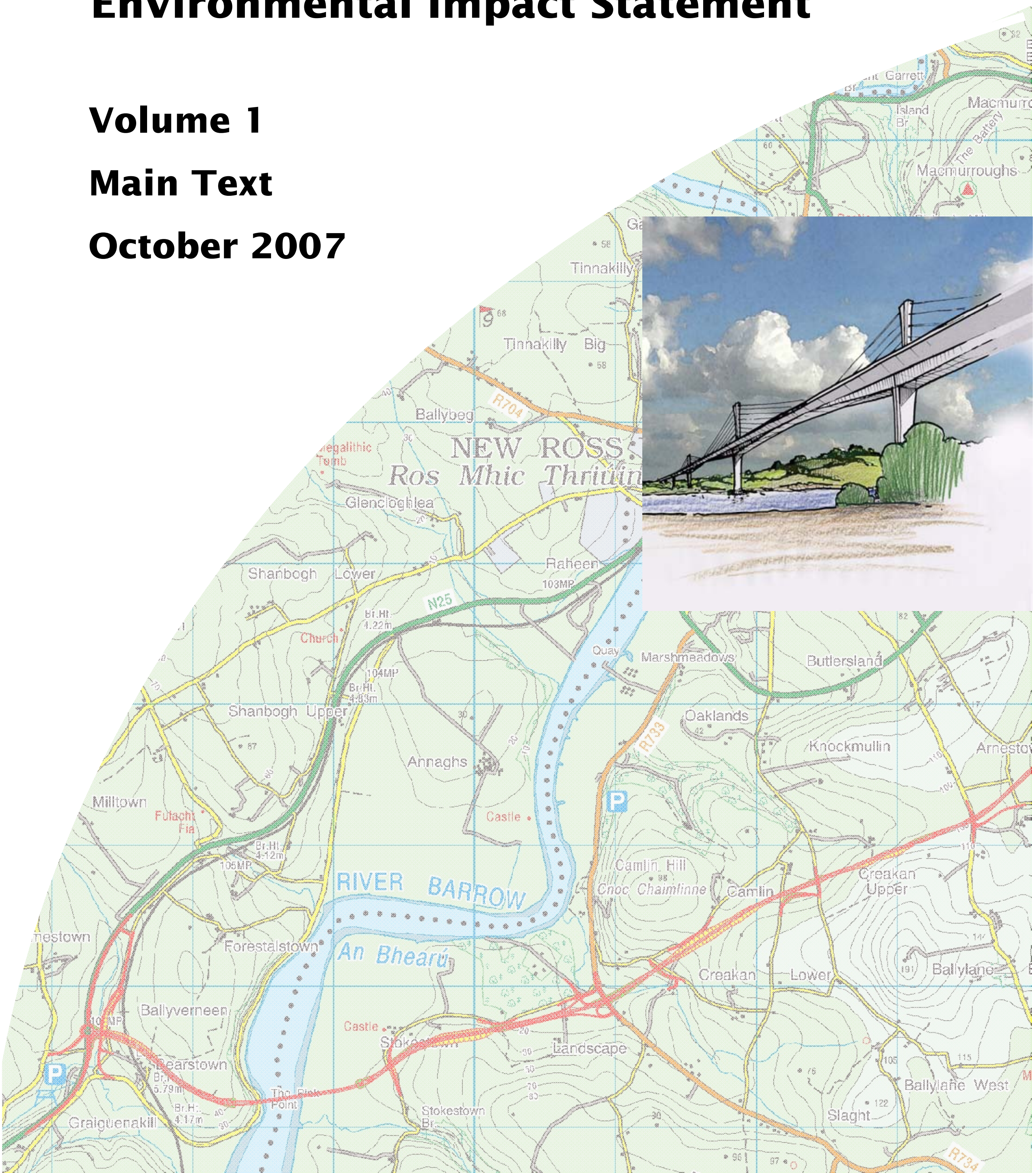
New Ross Bypass

Environmental Impact Statement

Volume 1

Main Text

October 2007



Kilkenny
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New Ross Bypass

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Mott MacDonald Pettit

Tramore House
Regional Design Office

ERM Ireland Ltd

New Ross Bypass

Environmental Impact Statement

Final

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Wexford County Council

New Ross Bypass:
Environmental Impact Statement

October 2007

Reference 0028699

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For and on behalf of
Environmental Resources Management

Approved by: **Bruce Davidson**

Signed:

Position: **Partner**

Date: **19th October 2007**

Preface to *Volume 1* of the New Ross Bypass Environmental Impact Statement

This Environmental Impact Statement (EIS) for the New Ross Bypass comprises the following volumes:

Volume 1 Non-Technical Summary (NTS) and Main Text

Volume 1 contains the following:

- NTS (also available as a separate booklet);
- List of Abbreviations Glossary of Terms;
- Main EIS Assessment Text (Chapters 1 to 19); and
- List of References.

A Table of Contents for Volume 1 page can be found at the front of Volume 1.

Volume 2 Drawings (containing engineering and environmental drawings)

Volume 2 contains a series of drawings and figures in A3 format. A full listing of all the figures in the EIS can be found in Volume 1 and Volume 2.

Volume 3 Annexes

Volume 3 contains four annexes to the EIS. These provide additional and supporting information to the chapters in Volume 1. The annexes are as follows:

- Annex A Landscape & visual;
- Annex B Ecology;
- Annex C Agronomy; and
- Annex D Archaeological heritage and Architectural, artistic, cultural & historic environment

The NTS is also available as a separate document.

This document is Volume 1 of the EIS.

Note on Stage of Design

All proposed road levels indicated in this Environmental Impact Statement or shown on drawings are based on preliminary stage designs and may be revised at detailed design stage. Modifications may be made to avail of opportunities to improve the design in the light of the experience of ground conditions or other innovations, provided this has no significant adverse environmental effect.

NTS 1 INTRODUCTION

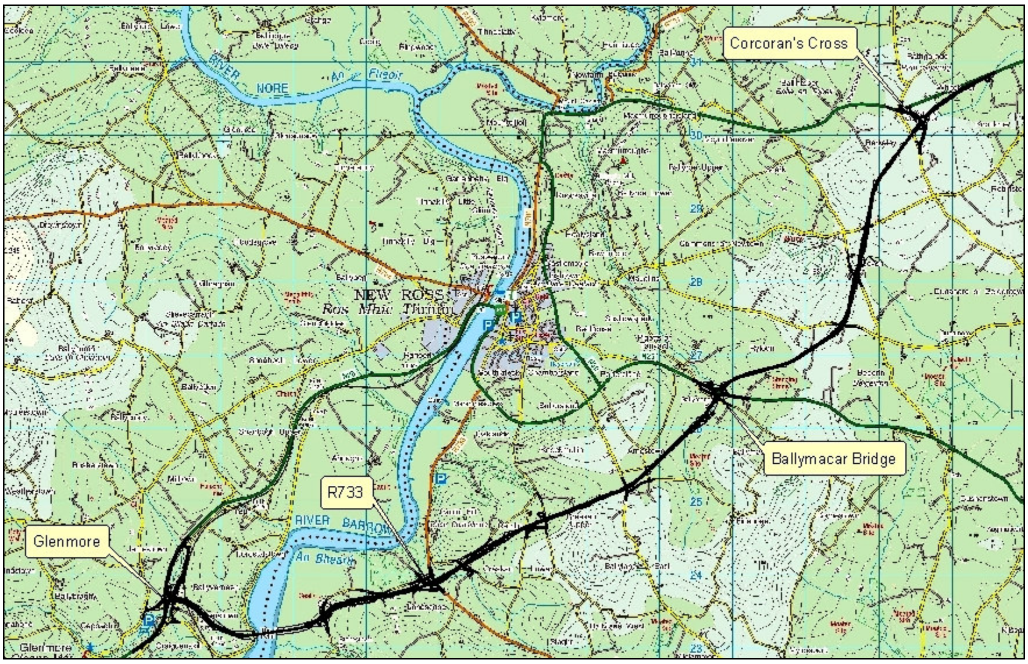
NTS 1.1 BACKGROUND TO THE PROPOSED BYPASS

Environmental Resources Management (ERM) was commissioned in January 2005 by *Mott MacDonald Pettit Limited* (MMP) to prepare an Environmental Impact Statement (EIS) for the proposed New Ross Bypass (the Bypass) on behalf of *Wexford County Council*.

This document is the Non-Technical Summary (NTS) of the Environmental Impact Statement (EIS), which is a statement of the likely significant effects, if any, that the proposed Bypass will have on the environment, if carried out. The EIS is the statement which is prepared as part of the Environmental Impact Assessment (EIA) process, which is a process for examining the environmental effects of a proposed development. The EIS will be submitted to An Bord Pleanala, whose approval is required before the proposed Bypass can be constructed.

The proposed Bypass is approximately 14.8km in length, starting at the eastern border of Kilkenny and crossing over the River Barrow via a new bridge into Wexford, as shown below in *Figure 1*.

Figure 1 ***General alignment of the proposed Bypass***



The concept of a Bypass for New Ross was first proposed in the National Road Needs Study, published in 1998 by the *National Roads Authority* (NRA), and in the National Development Plan (NDP) 2000 - 2006, published by the Government of Ireland in 1999. The latest version of the NDP (2007 - 2013) confirms the importance of the New Ross Bypass by designating the road scheme as a key project in the delivery of the Key National/Primary Routes.

NTS 1.2 *ROADS LEGISLATION*

The EIS has been prepared in accordance with Sections 50 and 51 of the Roads Act, 1993, as amended. Under Section 50 of the Roads Act, a road authority (e.g. a County Council) is required to prepare a statement (i.e. an EIS) of the likely effects on the environment of any proposed road development consisting of the construction of a motorway, a busway, or any prescribed type of proposed road development consisting of the construction of a proposed public road or the improvement of an existing public road.

The determination of the need to undertake the EIA process in relation to a proposed road development is called the EIA screening process. The need for a preparation of an EIS is either mandatory or discretionary, depending on the type and extent of the road development being proposed. The EIA screening process identified that the proposed Bypass falls into the mandatory EIA category because:

- there will be over 8 km of a new road of four or more lanes in a rural area; and
- the length of the bridge crossing the River Barrow is over 100m in length.

Furthermore, the road scheme crosses the River Barrow, a candidate Special Area of Conservation (cSAC), which is a European Protected Site under the Habitat Regulations. A potential significant effect on such sites usually requires the application of EIA.

NTS 2 PROPOSED BYPASS

NTS 2.1 GENERAL SCHEME

The new proposed bypass of New Ross will connect the N25 from Waterford on the Kilkenny side of the River Barrow, with the N25 to Rosslare and the N30 to Enniscorthy in Wexford east of New Ross town.

The Bypass commences at Glenmore in County Kilkenny with an At-Grade Roundabout and crosses over the River Barrow via a proposed Extrados type bridge between Pink Point in County Kilkenny and Stokestown in County Wexford. Continuing in a north easterly direction to Ballymacar Bridge, the Bypass interfaces with the R733 in Landscape by way of a Grade Separated Junction, and with the N25 at Ballymacar Bridge with an At-Grade Roundabout. From Ballymacar Bridge the Bypass continues to the northeast and interfaces with the existing N30 at Corcoran's Cross, finishing with an at-grade roundabout to the east of Corcoran's Cross with connecting roads to the existing N30 and severed Local Road L 4003-3.

The Bypass consists of:

- Approximately 4 km of Type 1 Dual Carriageway, which will link the existing N25 in Glenmore to the R733 in Landscape via the new River Barrow Bridge Crossing;
- Approximately 9.6 km of Type 2 Dual Carriageway, which links the R733 in Landscape to the existing N25 at Ballymacar Bridge and continues to the proposed junction southeast of Corcoran's Cross on the existing N30;
- Approximately 1.2 km of Standard Single Carriageway (S2), which links the roundabout southeast of Corcoran's Cross to the existing N30 to the east of Corcoran's Cross;
- Three at grade junctions, at Glenmore (N25), Ballymacar Bridge (N25) and Corcoran's Cross (N30);
- A grade separated junction, at Landscape (R733);
- River Barrow Crossing comprising an Extrados Type Bridge Crossing, connecting Pink Point in County Kilkenny and Stokestown in County Wexford;
- 10 local road bridges, 1 at Ballyverneen, 1 at Stokestown, 1 in Landscape (part of the grade separated junction), 1 in Camlin, 1 at Creakan Upper, 1 at Arnestown, 1 at Ballymacar and 3 at Lacken;
- A railway bridge at Ballyverneen (this proposed railway structure may be built as part of this scheme, or may be constructed in the future as a separate contract), where the Bypass intersects with a railway line that Iarnród Éireann has advised as having the status of being "closed but not abandoned";

- Retaining wall structures adjacent to the LS-7513 at Ballyverneen, and the R733 at Camlin;
- Various realignments and tie-ins of sections of National, Regional and Local roads affected by the proposed scheme; and
- Associated ancillary works.

NTS 2.2 *BARROW BRIDGE*

The Barrow Bridge will be an Extrados Type Bridge and is illustrated in *Figure 2* below. Three of the bridge piers will extend through the bridge deck, with the centre pier extending approximately 25m above the bridge deck and the two side piers extending approximately 15m above the bridge deck. Inclined stay cables will link these three piers to the centre of the bridge deck. The overall length of the bridge is approximately 900m with the two main central spans approximately 230m in length. The vertical alignment for the Barrow Bridge allows a 36m clearance envelope above Mean High Water Spring (MHWS) for the navigation channel of the river.

Figure 2 ***Visualisation of the proposed River Barrow 2nd crossing***

Image courtesy of Mott MacDonald Pettit

NTS 2.3 *CONSTRUCTION*

The construction of the Bypass is estimated to be 36 months. It is estimated that the Bypass will be open by 2013. It will result in the generation of construction traffic on the local and regional road network. Due to the nature of the construction work involved, a high percentage of this traffic will involve the movement of large volumes of HGVs, heavy machinery and plant. Typical plant and machinery to be used includes diggers and earth movers, concrete vehicles, small scale plant and machinery. Typical construction activities will include site clearance works; earth and spoil movement; cutting activities; construction of the various elements of the Bypass (Main line, bridges, underpasses, culverts etc.) and their associated sub-elements (e.g. sub-base, road surface, pavements, landscape elements etc.); and planting works.

Construction traffic data as provided by MMP indicates that the maximum construction movements could be 366 per day (which includes the maximum movements for earthworks, deliveries and internal movements, plus the maximum perceived amount of vehicles required for the delivery of concrete).

NTS 2.4 *TRAFFIC*

The Bypass will result in the removal of a significant volume of traffic from New Ross. An estimate of the extent of traffic removal is illustrated in *Tables 1* and *2* below. The road links for which traffic flows are provided are shown in *Figure 3*. The traffic flow data was provided by MMP. The Do-nothing column refers to the traffic conditions that are likely to arise if the Bypass is not built.

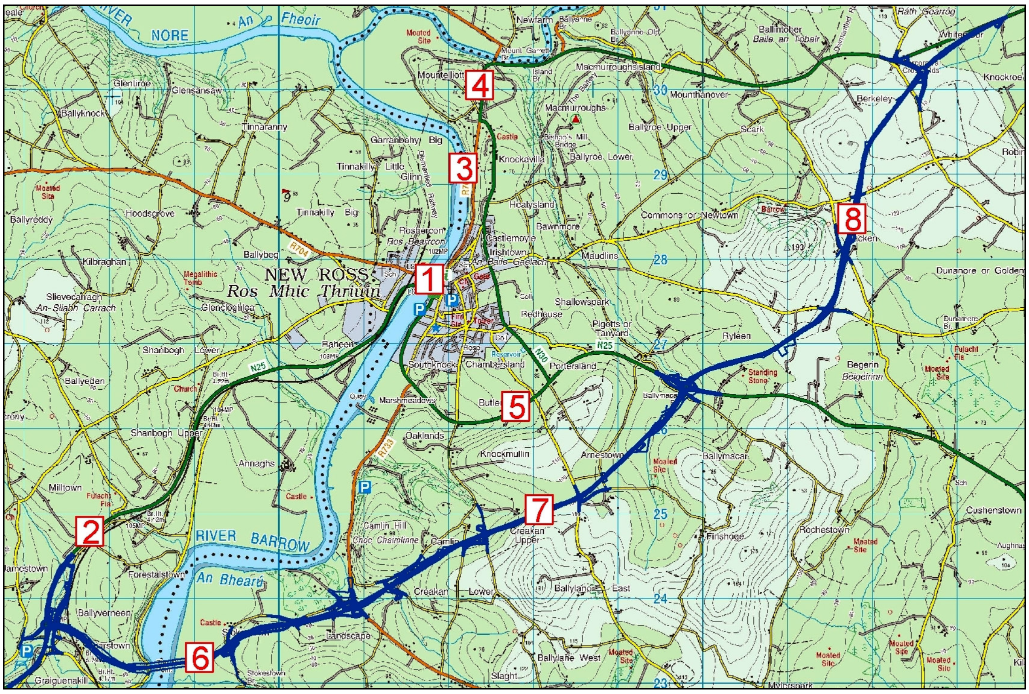
Table 1 ***Traffic flow projections for the Opening Year (2013)***

Road link	Do-nothing	With scheme	% Reduction
1. O'Hanrahan Bridge	22,175	10,158	54.19%
2. N25 Waterford Road	16,204	4,156	74.35%
3. R700 New Ross - N30	8,505	3,597	57.71%
4. N30 Enniscorthy Road	13,283	6,626	50.12%
5. N25/N30 Wexford Road	9,869	4,854	50.82%
6. New Bridge Crossing (Bypass)	0	12,048	n/a
7. R733 - Ballymacar (Bypass)	0	9,697	n/a
8. Ballymacar - Corcoran's Cross (Bypass)	0	6,658	n/a

Table 2 ***Traffic flow projections for the Design Year (2028)***

Road link	Do-nothing	With scheme	% Reduction
1. O'Hanrahan Bridge	27,909	12,746	54.33%
2. N25 Waterford Road	20,371	5,208	74.43%
3. R700 New Ross - N30	10,996	4,081	62.89%
4. N30 Enniscorthy Road	16,709	8,290	50.39%
5. N25/N30 Wexford Road	12,306	6,089	50.52%
6. New Bridge Crossing (Bypass)	0	15,173	n/a
7. R733 - Ballymacar (Bypass)	0	12,188	n/a
8. Ballymacar - Corcoran's Cross (Bypass)	0	8,419	n/a

Figure 3 *Road modelling links*



NTS 3 POLICY CONTEXT

NTS 3.1 INTRODUCTION

This section presents the policy context within which the road development is being proposed. There is policy guidance at a national, regional and local level that specifically relates to the road.

NTS 3.2 NATIONAL POLICY

The *National Development Plan (NDP)* set's out the Government's investment framework for the period 2007 to 2013. There are five main Investment Priorities of the NDP, one of which is Economic Infrastructure. The Economic Infrastructure Investment Priority includes funding for roads. The NDP specifically refers to the Bypass. It notes that investment priorities include "*completion by 2010 of the M/N9 Dublin - Waterford road and N25 Bypass*". In addition, The Road and Rail Network Map in the NDP include the Bypass as part of the Key National/Primary Routes.

The *National Spatial Strategy (NSS)* is the national planning framework for Ireland for the next 20 years. The NSS aims to achieve a better balance of social, economic and physical development across Ireland, supported by more effective planning. Although New Ross is not designated as a Gateway or Hub, the town is along the alignment of the National Transport corridor. The NSS notes that "*the critical mass of Waterford as a gateway, supported by Kilkenny and Wexford as hubs, will be complemented by development in surrounding and adjacent towns. The extensive network of county towns and other large towns in the South East provides a key resource, which, combined with the gateway and hub approach, provides a strong platform for balanced development throughout the region*".

"Towns such as Clonmel and Carrick-on-Suir in South Tipperary, Dungarvan and Tramore in Waterford, Carlow town, New Ross and Enniscorthy in Wexford provide good bases for population and services which will attract investment and employment activities additional to those that need to be located in or near a gateway".

The Bypass will assist with the growth and development of the Waterford Gateway in that it will greatly facilitate the faster, easier and greater movement of people, goods and services in the South East Region. Such movement is essential to achieving the stated NSS objectives of achieving a better balance of social, economic and physical development across Ireland.

NTS 3.3 REGIONAL POLICY

The South-East Regional Authority adopted its *Regional Planning Guidelines* (RPG) in May 2004. The RPG represents a planning framework for the period

2004 - 2020 designed to achieve a better spatial balance of social, economic and physical development throughout the South-East Region. The RPG specifically refers to the New Ross Bypass with regards to it being part of the "*east coast route from Dublin to the South-East*" and notes that the bypass is "*essential to the development of the eastern section of the region and would significantly improve access to the Rosslare Europort from the region and from the country as a whole*". The RPG goes on to state that the New Ross Bypass is one of the "*infrastructural development priorities in relation to roads*".

NTS 3.4 COUNTY POLICY

The *Draft Wexford County Development Plan 2007 - 2013* sets out Wexford County Council's intentions for the future development of land including measures for the conservation and improvement of the natural and physical environment and the provision of infrastructure. The County Development Plan fully supports the development of the New Ross Bypass. The County Development Plan lists the New Ross Bypass as one of seven Major Roads Proposals which Wexford County Council will support. The draft Plan states that it is the policy of the Council "*To facilitate and enable the development of major National Road proposals within the lifetime of the Plan*" and "*to provide a dual carriageway by-pass to the N25 at New Ross which will include an additional river crossing at New Ross*".

The *Kilkenny County Development Plan 2002* fully supports the development of the Bypass. Specific policy objectives include the completion of "*major road improvement projects over the plan period*" including "*the upgrading of the N25 route between Waterford and New Ross with a bypass for New Ross*".

NTS 3.5 LOCAL POLICY

The New Ross Town & Environs Development Plan 2004 fully supports the New Ross Bypass. The Development Plan lists a number of policy intentions of New Ross Town Council, one of which is to "*have a second river crossing to serve the town*".

To conclude, the proposed Bypass is supported by national, regional, county and local-level policy.

NTS 4 CONSULTATION

NTS 4.1 PUBLIC CONSULTATION

Public consultation has been undertaken since 1999. In September 1999, preliminary consultations were undertaken. A preliminary consultation brochure was prepared and distributed with local newspapers. The brochure requested submission and general views from the public. At the end of March 2000, a public exhibition event was held in New Ross and was facilitated by *Wexford County Council* and *Kilkenny County Council*. A presentation was also made to a joint meeting of the elected members of the two local authorities. Some one thousand people are estimated to have attended the public exhibition event.

A Public Consultation update meeting took place in New Ross in mid-July 2000. A presentation was made, updating the public on progress to date on the project. This was followed by a question and answer session. In excess of 2,500 responses were received. A second public consultation event was undertaken at the end of November 2001 and took place in New Ross. Display boards were used to present the preferred route for the Bypass. These boards were then placed in the New Ross Public Library after the second public consultation event and comments from the public were invited.

In addition to the public consultation events outlined above, consultation was also undertaken with landowners likely to be impacted during the route selection stage. Once the preferred route was identified, further consultation was undertaken with the landowners whose land will be acquired under the compulsory purchase order (CPO) process.

NTS 4.2 EIS SCOPING CONSULTATION

Scoping is a stage in the EIS process where the key issues of relevance to the EIS are identified. The process is usually assisted by consultation with various statutory and public organisations. ERM wrote to 23 public bodies and authorities (ranging from Local Authorities and Government Departments, to national and local organisations) in June 2005 and invited these consultees to input into the scope of the EIS. A number of submissions were received and these were considered in the scope of the EIS.

NTS 4.3 EIS CONSULTATION

Consultation was also undertaken in parallel with the preparation of the EIS. The form of the consultation ranged from written communications to on-site meetings. Organisations consulted include National Parks and Wildlife Service; Department of Environment, Heritage and Local Government; National Roads Authority (NRA); and Southern Regional Fisheries Board.

NTS 5 ALTERNATIVES

NTS 5.1 INTRODUCTION

The consideration of alternatives is a requirement of Section 50(2) of the Roads Act, 1993, which states that the EIS should provide *"the main alternatives studied by the road authority concerned and an indication of the main reasons for its choice, taking into account the environmental effects"*.

Considerable work has been undertaken on this topic. *Mott MacDonald Pettit* produced a Constraints Report in February 2001 and a Route Selection Report in October 2002.

NTS 5.2 CONSTRAINTS STUDY

The purpose of the Constraints Study was to determine the constraints (be they physical, procedural, legal or environmental) that currently exist and which may affect the design of the scheme,.

The issues considered in the Constraints Study included:

- ecology,
- water quality and fisheries
- archaeology and heritage,
- landscape,
- recreation/amenity,
- geology and hydrogeology,
- traffic,
- land ownership,
- planning,
- utilities, and
- preliminary site investigations.

All the identified issues and data collected were used in the identification of route options during the preparation of the Route Selection Report (*Section 5.2*).

NTS 5.3 ROUTE SELECTION REPORT

The Route Selection Report was prepared in October 2002 by MMP and was broken down into two phases. The first phase considered 46 scheme options (comprising various combinations of twelve different route corridors) and these were subject to an assessment with regards to:

- traffic performance;
- economic returns;
- cost estimates; and
- environmental factors.

This assessment resulted in the 46 options being reduced to five options. The majority of the scheme options were eliminated on the basis that they did not meet some or all of the requirements (traffic, economic and cost).

The second phase then focused on five emerging preferred routes (identified in the first phase), which, were examined in greater detail and resulted in two specific routes being taken forward to the second phase of the route selection study.

The two routes were split into two sub-sections to assist greater examination and all four sub-sections were subjected to assessment under the following criteria:

- Agriculture;
- Air quality;
- Alignment/engineering;
- Archaeology;
- Construction risk;
- Ecology;
- Economics;
- Geology/hydrogeology;
- Ground conditions;
- Human environment;
- Hydraulics;
- Journey length;
- Landscape;
- National Primary Route;
- Navigation;
- Noise;
- Traffic performance;
- Underwater archaeology;
- Water quality/fisheries; and
- Development of town.

On the basis of the assessment results, a decision was made by Wexford County Council to proceed with the scheme as shown in *Figure 1*.

NTS 5.4 BARROW BRIDGE ALTERNATIVES

Nine alternative bridge crossing options were considered with regards to the new crossing of the River Barrow. Following discussions with the Project Steering Committee, four bridge options were selected for more detailed consideration and these were:

1. box girder option;
2. three-arch bridge option;
3. single-arch bridge with approach viaduct option; and
4. three-tower extrados bridge option.

These four bridge options were then subjected to an examination against the following criteria:

- Geometry;
- Navigation clearance;
- Loading;
- Ground Conditions;
- No. of Piers;
- Environmental;
- Construction Programme;
- Construction complexity;
- Cost Comparisons;
- Whole Life Cost; and
- Architectural/Aesthetic Considerations.

The Extrados option was selected as it offered the best balance of overall performance across the criteria above.

NTS 6 ENVIRONMENTAL IMPACTS

NTS 6.1 INTRODUCTION

This section summarises the predicted impacts of the Bypass. Impacts have been summarised under the various environmental topic headings as used in the EIS. Both construction and operation impacts are described.

NTS 6.2 HUMAN BEINGS

For the duration of construction, the local economy will receive a positive impact of slight significance due to local spending by construction workers and indirect/spin-off, positive, economic impacts as a result of the construction of the scheme.

The residual impact of construction is a negative impact of moderate significance due to disruption and nuisance resulting from the construction of the scheme. While the various mitigation measures and the development of an Environmental Operating Plan by the contractor will reduce the significance of these impacts to slight, they will still remain for the duration of the construction phase, which will be 36 months.

The opening of the Bypass will result in positive impacts of moderate significance for New Ross due to traffic flow reductions of 50 - 57% for the Opening Year (2013) and positive impacts of moderate to major significance (50 - 62%) by the Design Year (2028). The reduction in traffic flows will result in reduced severance, visual impacts, noise and air quality emissions.

A COBA Cost Benefit appraisal has been carried out using COBA 11 (Release 6) in accordance with National Road Authority Guidelines for Cost Benefit Analysis (June 2005). This analysis has indicated a positive cost benefit ratio with saving to both travel time and fuel consumption. The scheme costs were Discounted to 2002 with a Discount Rate of 4.0% and have an Evaluation Period of 30 YEARS with the First Scheme Year (Opening Year) being 2013.

The opening of the scheme is likely to result in short-term negative impacts of slight significance regarding the economy of New Ross and the surrounding areas. However, in the medium to longer-term, positive impacts are likely to arise as a result of reduced traffic flows, which will benefit the town and its inhabitants, potentially resulting in greater economic activity in the town in the long-term due to overall improvements in the urban streetscape of the town and improved quality of life.

The provision of the Bypass will not result in any significant negative impacts for the majority of the various road users along the existing roads which will interact with the Bypass alignment. While these road users will be impacted during temporary road closures, once the scheme is completed the replacement structures will ensure that there is no significant impacts for the majority of roads. However, there are anticipated to be some negative impacts due to increased journey times and longer distances. These impacts are primarily confined to the key junctions on the alignment (Glenmore roundabout, R733 junction, Ballymacar Bridge roundabout and N-30 East tie-in at Corcoran's Cross) and along two of the local road realignments.

NTS 6.3 *AIR QUALITY AND CLIMATE*

Various mitigation measures have been identified to address potential negative air quality impacts during construction. These measures are focused on dust control to minimise dust generation during construction. The implementation of these measures will ensure that no significant air quality effects will arise during construction. These mitigation measures will be contained in the Environmental Operating Plan.

There will be a positive impact to air quality along the existing road network in the town of New Ross as a result of the Bypass. One road where PM_{10} concentrations are predicted to exceed the air quality limit value (without the Bypass) is brought within the limit values as a direct result of the Bypass removing traffic from New Ross.

There will be a small increase in pollutant concentrations adjacent to the proposed route. However, no air quality limit values are predicted to be exceeded. There will be no exceedance of the air quality limit value for NO_x for the protection of vegetation and sensitive habitat at the cSAC and NHA.

There will be a reduction in greenhouse gas emissions from the traffic network in the area as a result of the Bypass.

NTS 6.4 *NOISE AND VIBRATION*

The area along the Bypass is predominantly rural, agricultural land. Noise levels in these areas are typically very low with little or no man made noise sources. Baseline noise measurement was carried out at 17 locations along the proposed alignment. Parameters recorded during the baseline monitoring for the project were L_{Aeq}, L_{A90}, L_{A10}, L_{Amax} and L_{Amin}. A design goal of Day-evening-night 60 dB L_{den} (free field residential façade criterion), was developed by the NRA for which, "*all future national road schemes should be designed, where feasible*".

Noise and vibration impacts arising out of construction activities have been estimated to establish the likely impact on sensitive receptors during the construction period. In an effort to accurately estimate the noise levels likely to be experienced at noise sensitive receptors once the road is operational and taking into consideration guidance given within the NRA guidelines, a noise model was constructed of the Bypass.

Mitigation measures have been suggested where impacts were identified to exceed criteria. At two locations, it has been identified that the Noise Criteria may be exceeded by 8 dB which would be a significant impact but is likely to be short term. No significant residual vibration impacts from the construction phase are likely.

The design Noise Criteria for operational roads will be met at all noise sensitive locations, although it is noted that the change in the noise environment will result in significant impacts on some receptors along the Bypass. It is also noted that there would be a moderate and permanent positive impact for all the houses facing the roads where traffic flow will be reduced due to the Bypass. It is predicted that there will be no vibration impacts from the operation of the Bypass.

NTS 6.5 LANDSCAPE AND VISUAL

The impact of the proposed New Ross Bypass on both landscape character and visual amenity was assessed. The direct negative impacts on the receiving landscape include the loss of vegetation and localised changes to topography as a result of the scheme earthworks. The introduction of the Bypass together with proposed earthworks, junctions, structures and lighting will also indirectly, and in many cases negatively affect the character of the receiving landscape and the setting of particular designated landscape sites.

Mitigation measures are outlined and include ecologically sensitive integration of the road into the receiving environment together with the use of native species in the proposed planting and seeding of the scheme. The engineering design sought to route the proposals around significant hills in order to mitigate adverse effects on landscape character and visual amenity. A preliminary landscape design has been prepared and this illustrates, in conceptual format, many of the mitigation measures outlined.

The visual impact of the proposals was assessed with reference to a visual envelope which maps the area within which the proposals are likely to have an influence upon visual amenity. Visual impact was assessed from 205 selected viewpoint locations. Negative visual impacts will be experienced by viewers at many of these locations. The significance of the impact will generally be less at the post establishment stage than at the pre establishment stage. This reduction in visual impact significance is based on the successful establishment and growth of the landscape mitigation treatments which will contribute to the screening of the proposals.

NTS 6.6 TERRESTRIAL ECOLOGY

An assessment of the terrestrial ecological baseline associated with the New Ross Bypass was carried out by undertaking a review of desktop information relating to the site and ecological field surveys. The Bypass passes through a predominantly agricultural landscape characterised by pasture and arable farmland. Designated conservation areas and specific habitats of ecological value were identified throughout the proposed scheme. One candidate Special Area of Conservation (River Barrow and Nore cSAC – Site Code 002162) and proposed Natural Heritage Areas (Lower River Barrow pNHA – Site Code 000689) are intersected by the proposed scheme. Another pNHA (Oaklands Wood pNHA – Site Code 000744) is located within close proximity to the scheme. Eight Ecological Sites were identified along, or adjacent to, the Bypass, while a number of species, protected under national and EU Legislation, were also recorded.

There will be no significant permanent impacts to the terrestrial qualifying interests of the site. Impacts to Ecological Sites will range from permanent, moderate negative to permanent, major, negative. Impacts to terrestrial fauna identified along the proposed scheme will also range from permanent, moderate negative to permanent, major, negative.

Mitigation measures are outlined to reduce the impacts to the designated conservation areas, ecological sites and terrestrial fauna. Provided all mitigation measures are implemented, the proposed scheme will result in temporary moderate impacts to the designated conservation areas during construction. The recreation of habitats associated with the designated conservation areas with replacement planting will offset any long-term impacts associated with the loss of habitat to the landtake. As the replacement woodland planting will take a number of years to establish, there will be short to medium-term minor negative impacts.

One ecological site (Ecological Site 1 at Glenmore Junction) will experience permanent, major negative impacts while the remaining sites will undergo permanent minor negative impacts. The residual impacts to fauna movement will constitute a minor, permanent, negative impact. Once faunal species become habituated to mammal underpasses these residual impacts will be further reduced over time. Similarly, residual impacts arising from disturbance to fauna will also reduce over time, following habitualisation to the new road.

NTS 6.7 AQUATIC ECOLOGY

An assessment of the aquatic ecological baseline associated with the New Ross Bypass was carried out by undertaking a review of all desktop information relating to the site and ecological field surveys. While seven watercourses are located within the scheme study area (i.e. route corridor) only five are directly intersected by the proposed scheme, one of which is the River Barrow cSAC. The Camlin Stream, which forms part of the cSAC boundary is also directly impacted by the proposed scheme. The Graiguenakill River is another river, located within the scheme study area that forms part of the cSAC. Each stream occurring within the study area was evaluated and assigned an ecological quality rating. Of the seven streams assessed, two are of international conservation value, four are of high ecological value and one is of moderate ecological value. Species associated with each watercourse, some of which are protected under national and European legislation, were recorded during fieldwork.

An assessment of the potential of the Bypass to adversely impact upon the integrity of the qualifying interests of the cSAC was undertaken. Pre-mitigation impacts to the River Barrow and Nore cSAC and pNHA have the potential to constitute permanent, major negative impacts. Pre-mitigation impacts to other watercourses assessed throughout the scheme will range from neutral to permanent, major negative impacts. Permanent major negative impacts will also affect aquatic fauna if mitigation measures are not implemented.

Mitigation measures have been outlined to reduce and/or avoid potential impacts to the aquatic ecological resources. The implementation of specific mitigation measures within the cSAC will ensure that construction phase and operation phase impacts are reduced. On the basis of the information currently available and reviewed, and assuming the proposed mitigation measures are adopted it is not anticipated that there will be a significant impact on the qualifying interests of the cSAC.

Specific mitigation measures have been outlined for each watercourse affected by the scheme. Following implementation of these measures the impacts of the Bypass to watercourses located outside the designated conservation areas will range from neutral to moderate negative impacts. The implementation of mitigation measures will avoid significant impacts to fauna during the construction and operation phase of the Bypass.

NTS 6.8 WATER, SOILS AND GEOLOGY

An assessment was carried out of the potential impact of the Bypass on surface and ground waters, soils and bedrock geology with respect to quality and quantity. A comprehensive desk study to review relevant published and unpublished reports on the hydrology, geology and hydrogeology of the region was carried out. Ground conditions were investigated in the field by drilling boreholes and excavating trial pits. The findings of the field investigation were used to identify the soils and geology underlying the proposed route. This borehole and trial pit information was cross referenced with the data published by the *Geological Survey of Ireland* (GSI).

Construction of the Bypass, if not properly managed, could lead to major impacts on surface water quality. The main source of contamination is suspended sediment in runoff waters from the work site and accidental spillage of liquid cement, fuel oils and lubricants from construction. Operational impacts will constitute a major negative impact and will include changes to the existing hydrology, which may increase the potential for flooding in the area. They will also include the reduction of infiltration rates of rainfall to groundwater arising from the impermeable nature of the road surface. Impacts will also occur on surface water and groundwater quality due to the pollutants contained within the road drainage.

The Bypass drainage system will be collected and discharged to watercourses at eight proposed outfall sites, resulting in potential localised water quality impact at these outfall sites. The proposed development will increase the potential for: soil erosion during flooding events; and a reduction in the quality of groundwater locally, as a result of contaminated road runoff infiltration via proposed filter drains.

Mitigation measures have been identified to reduce the significance of the potential impacts to waters, soils and geology. The residual impacts of discharges from storm control areas to the water quality of local watercourses will be minor negative. The implementation of storm control measures will result in a minor to moderate local negative residual impact. Similarly the risk of flooding caused by the installation of culverts will be minimised by increasing the capacity of the culvert and providing a regular programme of inspection and maintenance.

The implementation of mitigation measures will ensure that the interference with groundwater by the Bypass will result in minor negative local residual impact to receiving groundwater quality and quantity. Finally, the risk of serious contamination of the soil and groundwater from accidental spillage will be low. A slight residual impact will remain to soils and water following the installation of oil/petrol interceptors at outfall locations.

NTS 6.9 AGRICULTURAL PROPERTIES

A total of 44 farms will be directly affected by the Bypass and approximately 117 hectares of agricultural land will be required to implement the scheme. The majority of farming along the proposed route is intensive and the majority of farmers work full–time on their farms. Of the 44 farms affected, 10 are dairy farmers, 13 are beef farmers, 3 mainly tillage, 17 are mixed crops and livestock farmers, 1 is categorised as other (horse rearing & dog rearing enterprise). The quality of the land for farming along the alignment of the scheme is generally very good.

Construction of the Bypass will impact on local farm operations. Construction traffic may impact on the movement of tractors, farming equipment and animal movements. Other temporary impacts will occur during the construction phase. The activity of earth moving machinery, transport lorries and other ancillary vehicles will generate noise and dust during construction. While farm animals may be sensitive to sudden unexpected noises they generally have a high tolerance to noise emissions from construction machinery.

Severance will affect 52% of the farms and will create 30 new land segments. The majority (73%) of farms are in the not significant to moderate impact categories (which is defined as the farm enterprise can be continued as before but with increased management or operational difficulties). However, 12 farms (27% of the total farm numbers) will be in the major and severe impact categories. These impacts are defined as the farm enterprise cannot be continued without considerable management or operational changes or where the farm enterprise cannot be continued as a result of the scheme. These farms comprise of approximately 418 hectares or 20% of the affected land studied.

The impacts from land loss and severance are permanent residual impacts and financial compensation will be necessary and this will be undertaken as part of the Compulsory Purchase Order process. There may be a gradual increase in the net worth of farmers affected by the new route due to proximity of the new route to other parts of their farm.

NTS 6.10 ARCHAEOLOGICAL HERITAGE

The aim of the archaeological heritage assessment was to identify all known archaeological and cultural heritage constraints within c. 50 metres of the Bypass, as well as to assess the likelihood of significant archaeology being uncovered. The National Roads Authority's Guidelines for the Assessment of Archaeological/Heritage Impacts of National Roads Schemes (2005) was used in the preparation of this assessment.

The Bypass will have a direct impact on six recorded archaeological monuments and places. The sites are as follows:

- a castle site in the townland of Lacken;
- the site of an earthwork in the townland of Lacken;
- a tower house in the townland of Stokestown;
- an enclosure in the townland of Lacken;
- the site of an enclosure in the townland of Rathgaroge; and
- a Fulacht Fiadh in the townland of Rathgaroge.

The Bypass will have an indirect impact on one recorded archaeological monument and place, an enclosure in the townland of Lacken.

The Bypass will have a direct impact on six sites of archaeological potential. The sites are as follows:

- a curving field boundary in the townland of Ballyverneen;
- two river crossing points in the townland of Ballyverneen and Stokestown
- a group of possible mounds in the townland of Arnestown; and
- two settlement locations at Ryleen and Lacken.

The proposed scheme will have an indirect impact on three sites of archaeological potential:

- an enclosure in the townland of Stokestown;
- a settlement site at Lacken, and
- possible mounds in the townland of Arnestown.

Furthermore, additional archaeological sites and features are likely to be encountered during further stages of the assessment.

Mitigation measures will involve either preservation by record or preservation in-situ. All mitigation measures will be carried out in accordance with current best practice. Methods of preservation by record will involve a combination of the following:

- archaeo-geophysical survey;
- aerial survey;
- site specific test excavations;
- centreline test excavation;
- townland boundaries survey;
- archaeological excavation; and
- archaeological monitoring.

It is not anticipated that any significant residual impacts will remain if the appropriate archaeological mitigation measures are put in place.

NTS 6.11 ARCHITECTURAL, ARTISTIC, CULTURAL AND HISTORIC ENVIRONMENT

The aim of the assessment was to identify all known architectural heritage constraints within c. 50m of the Bypass. Guidelines for the assessment of Architectural Heritage Impacts of National Roads Schemes (2005), prepared by the NRA, were used in the preparation of this study.

The alignment will have a direct impact on eight architectural heritage features (four significant impacts and four moderate) and will have an indirect impact on five architectural heritage features (one significant and four moderate) and will have no predicted impact on two architectural heritage features.

The significant direct and indirect impacts are predicted to arise for:

- Ballymacar Bridge (direct impact);
- Stokestown Estate (direct impact);
- Landscape Estate (direct impact) ;
- Arnestown Estate (direct impact); and
- A folly in Stokestown (indirect impact).

Mitigation measures will involve either preservation by record or preservation in-situ. All mitigation measures will be carried out in accordance with current best practice. Methods of preservation by record will involve a combination of the following:

- archaeo-geophysical survey; and
- archaeological recording.

It is not anticipated that any significant residual impacts will remain if the appropriate archaeological mitigation measures are put in place.

NTS 6.12 MATERIAL ASSETS

A total of four properties are to be acquired as part of the construction of the Bypass. Compensation will be provided through the CPO in the terms of the material assets affected. Nonetheless, it is recognised that the acquisition of property, particularly residential property, will cause disruption to those directly affected. Further measures to compensate affected parties due to land acquisition, drainage works, reinstatement of boundaries and loss of facilities are also part of the compensation under the CPO process.

Table 3 summarises the utility conflicts along the proposed Bypass.

Table 3 Utility conflicts with the proposed Bypass

Utility	**No. of conflicts**
10 kV overhead powerline (ESB)	28
38 kV overhead powerline (ESB)	1
220 kV overhead powerline (ESB)	1
Overhead Eircom lines	24
Underground Eircom cables	6

Consultation with Wexford County Council and Kilkenny County Council indicates that there is no known water services located along the proposed route or in the surrounding area.

The 10kV and 38 kV lines will be either diverted underground via ducting or carried over the Bypass. The 220kV line will require a major alteration.

NTL/Chorus has been contacted to confirm if any of their services are present in the area. At present no known services are conflicting with the proposed route.

BT Ireland (Formally Esat) has been contacted to confirm if any of their services are present in the area. At present no known services are conflicting with the proposed route.

The Eircom services will be either carried under or over the Bypass at the conflicts points.

All proposed diversion works will be agreed in advance with the appropriate utility provider.

With the undertaking of an appropriate utility diversity strategy, there is not predicted to be any significant impact on utilities during construction.

NTS 6.13 INTERRELATIONSHIPS AND INTERACTIONS OF THE PREDICTED IMPACTS

Effect interactions are predicted for the following environmental topics:

- Human beings and noise & vibration;
- Human beings and air quality & climate;
- Landscape & visual and terrestrial & aquatic ecology;
- Terrestrial ecology and aquatic ecology;
- Archaeological heritage & architectural heritage and human beings; and
- Water, soils & geology and aquatic ecology.

The consideration of such interactions has been assessed in the individual impact chapters.

There is the potential for cumulative impacts to arise during the construction and operation of the Bypass. However, given the rural location of the Bypass, cumulative impacts arising with another major construction project are unlikely.

Any expansion and growth of New Ross may potentially result in additional traffic flows. Furthermore, changes to commuting patterns to the larger towns in the region (which may arise as a result of the reduced journey times) may also increase flows on the Bypass.

NTS 7 WHAT HAPPENS NEXT

NTS 7.1 CONSULTATION ON THE EIS

The EIS will be on display and available for inspection/purchase for not less than one month at the locations as outlined in the published newspaper notices. A digital version of the EIS is available for purchase on CD.

NTS 7.2 CONSULTATION PROCESS

Written submissions in relation to the proposed Bypass and this EIS may be made to An Bord Pleanála (the Board) by the public or by prescribed bodies within the specified period.

An Oral Hearing maybe held, with the Board appointing an Inspector who will conduct and oversee the oral hearing. Following the conclusion of the hearing, the Inspector will prepare an Inspectors Report into the conduct of the oral hearing. Based on the EIS, submissions, and information received during the oral hearing, the Inspector will make a recommendation in relation to the proposed road development. The Board will then consider the Inspectors Report in making their decision (approval, approval with modifications or refusal) on the proposed road development. Approval from An Bord Pleanala is required before the proposed Bypass can be constructed.

All submissions in relation to the Bypass and EIS should be sent to the Board at the following address:

An Bord Pleanála
64 Marlborough Street,
Dublin 1.

CONTENTS

Figures list for the New Ross Bypass EIS (Volumes 1 & 2)

The drawings listed below can be found in Volume 1 of the EIS, unless stated.

LIST OF ABBREVIATIONS

Below is provided a list of abbreviations used in the EIS. The list is not exhaustive and the explanations and definitions provided should not be taken as comprehensive, but as an aid to the non-technical reader.

AADT Annual Average Daily Traffic (total annual flows divided by 365)

ABP An Bord Pleanála

AHC Archaeological & Architectural Heritage Constraint

Ch Chainage

CH_4 Methane

CIRIA Construction Industry Research and Information Association

CO Carbon Monoxide

CO_2 Carbon Dioxide

CPO Compulsory Purchase Order

cSAC candidate Special Area of Conservation

CSO Central Statistics Office

dB Decibel. The basic unit used for sound intensity. Decibels are measured on a linear scale which defines a logarithmic amplitude scale, thereby compressing a wide range of amplitude values into a small set of numbers.

dB (A) A frequency weighting applied to sound measurements which approximates to the frequency response of the human ear.

$dBL_{A10(18\ hour)}$ The A-weighted sound level exceeded for 10% of an 18hr period. This index is used in the UK for measurement of road traffic noise for which the period is taken from 06.00 to 24.00hrs. It is the parameter typically used in Ireland for the purposes of assessing traffic noise.

DCMNR Department of Communications, Marine and Natural Resources

DMRB Design Manual for Roads and Bridges, UK

DOEHLG Department of Environment, Heritage & Local Government

EC European Community

EcIA Ecological Impact Assessment

EIA Environmental Impact Assessment

EIS Environmental Impact Statement

EPA Environmental Protection Agency

ERM Environmental Resources Management

ESRI Economic and Social Research Institute

EU European Union

GAA Gaelic Athletics Association

GHGs Greenhouse Gases

g/km Grams per kilometre

GSI Geological Survey Ireland

ha Hectare

HA Highways Agency

HCV Heavy Commercial Vehicle

Hz (Hertz) The frequency of sound is the rate at which a sound wave oscillates.

IPCC Intergovernmental Panel on Climate Change

km Kilometres

L_{Aeq} The A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value.

L_{A90} The A-weighted sound level that is exceeded for 90% of the sample period, it's generally used to quantify background noise.

L_{A10} The A-weighted sound level that is exceeded for 10% of the sample period of one hour; this parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic.

$L_{A10(1\ hour)}$ This is the noise level exceeded for just 10% of the time over the period of one hour.

$L_{A10(18\ hour)}$ This is the arithmetic mean of the values of $L_{A10(1\ hour)}$ for each of the one hour periods between 06:00 and 24:00hrs. $L_{A10(18\ hour)}$ is the parameter typically used in Ireland for the purposes of assessing traffic noise.

L_{Amax} This is the maximum A-weighted sound pressure level recorded during the sample period.

L_{Amin} This is the minimum A-weighted sound pressure level recorded during the sample period.

m^2 Square metre

m^3 Cubic metre

mm/s Millimetres per second

mph Miles per hour

m/s Metres/second

Mt Million tonnes

MMP Mott MacDonald Pettit

MW Megawatt

NAAQS National Ambient Air Quality Standards

NCCS National Climate Change Strategy

NDP National Development Plan 2007 - 2013

NGR National Grid Reference

NHA National Heritage Area

NIAH National Inventory of Architectural Heritage

NMI National Museum of Ireland

NO_2 Nitrogen Dioxide

NO_x Oxides of Nitrogen

NPWS National Parks and Wildlife Service

NRA National Roads Authority

NSS National Spatial Strategy 2002

OPW Office of Public Works

OS Ordnance Survey

PM_{10} Fine Particles (airborne particles)

pNHA Proposed National Heritage Area

PPV Peak Particle Velocity

RMP Records of Monuments and Places

RPS Record of Protected Structures

SEHB South Eastern Health Board

SMR Site and Monuments Record

SRFB Southern Regional Fisheries Board

SO_2 Sulphur Dioxide

SPL Sound Pressure Level

SRFB Southern Regional Fisheries Board

WHO World Health Organisation

$\mu g/m_3$ Micro grams per metre cubed

GLOSSARY OF TERMS

Below is provided a glossary of terms used in the EIS. This glossary is not exhaustive and the definitions below are not to be taken as comprehensive, but solely as an aid to the non-technical reader.

0dB The threshold of hearing.

120dB The threshold of pain.

ACCOMMODATION WORKS Ancillary works carried out by the road authority to mitigate the effects of the construction of a development (such as a road to a property).

AIR QUALITY MODEL A computer model used to assist with the air quality assessment. For this EIS, the Design Manual for Roads and Bridges (DMRB) was the chosen model.

AMBIENT NOISE LEVEL This is characterised by the Equivalent Continuous Sound Level parameter (L_{Aeq}).

ANCILLARY ROAD DEVELOPMENTS Development works additional to but associated with the main project, similar to accommodation works.

ANTHROPOGENIC Made by people or resulting from human activities

AQUIFER A geological formation with sufficient interconnected porosity and permeability to store and transmit significant quantities of water under natural hydraulic gradients.

AT-GRADE ROUNDABOUT Roundabout where at least two roads converge at the same level.

At-GRADE JUNCTION Road junction at which at least one road connects to another.

BACKGROUND NOISE LEVEL This is characterised by the L_{A90} parameter; the noise level exceeded for 90% of a measurement period.

BARROW A barrow is a raised mound of earth. They tend to have outer features such as a fosse and bank outside the central mound, they were used for ritual burial and have been dated to the Prehistoric period from the Neolithic to the Iron Age.

BASELINE CONDITIONS The conditions, which prevail just prior to opening in the absence of the road development.

BERN CONVENTION The Convention on the Conservation of European Wildlife and Natural Habitats – also known as the Bern Convention. Adopted September 1979 in Bern (Switzerland) and came into force 1 June 1982.

BIOGENIC Describing changes in the environment resulting from the activities of living organisms

BUNKERING Refuelling of vessels used in the context of HCVs.

BURIAL Burial site is a track of land used for burials. Burials sites may date to any period. See also Cist burial, Barrow and Cairn.

CAIRN Mound composed of stones, sometimes with internal structures, usually a burial monument, but sometimes used as a memorial.

CANDIDATE SPECIAL AREA OF CONSERVATION Statutory designation that has legal basis in the EU Habitats Directive as transposed into Irish law through the European Communities (Natural Habitats) Regulations, 1997 (S.I. 94 of 1997). A candidate SAC is a site that has been transmitted to the EU Commission for designation but still awaits completion of the formal designation process.

CARBONIFEROUS A period in geological timescale of between 355-290 million years ago.

CARRIAGEWAY The particular part of the road used by vehicular traffic.

CHAINAGE (CH) Length in metres from the start of the road development (chainage 0m).

CROPMARK Where buried features such as ditches or walls affect the covering soil and alter the colour of the surface vegetation and/or crop.

CULVERT Structure or drain for the diversion of a stream or river.

CUTTING (CUT) Section of earthworks where the level of the proposed road is below the original ground level.

DELISTED SITES Sites that are no longer considered to be of archaeological importance i.e. non-archaeological in nature or post date 1700.

DEMESNE Lands held by a house or manor for its own use and occupation.

DO NOTHING SCENARIO This traffic scenario assumes that no improvements will be carried out on the existing road network other than a basic level of maintenance.

DÚN A ringfort, usually with earthen banks, but a name also given to prehistoric ceremonial enclosures.

EARTHWORK Any monument made entirely or largely of earth.

EIA The process of examining the environmental effects of development from consideration of environmental aspects at design stage, though to 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.

EIS A statement of the effects, if any, which the proposed development, if carried out, would have on the environment (EPA, 1995b).

EMBANKMENT Mounded earth on which the roadway runs.

ENCLOSURE This can be applied to any area that is defined by walls, banks or ditches.

EPA BIOLOGICAL INDEX ('Q' value) A standard technique for which the water quality of a watercourse is assessed.

EXCAVATION As an archaeological term, excavation means the manual and mechanical excavation by an archaeologist-led team with specific objectives as regards information, preservation, recording, etc. of archaeological information. Its purpose is to fully investigate archaeological deposits and features.

FARM A single farming enterprise. Some farms will comprise of just one holding but are made up of two or more holdings.

FAUNA A collective term for the animals of a region.

FIELD An area of land which is surrounded by a permanent boundary (fence, ditch, hedge wall, etc) and is not subdivided by any permanent boundary.

FIELD SYSTEM Pattern of fields, now no longer in use, sometimes visible as low earthworks and often associated with medieval or earlier settlements.

FILL Material used for the raising of the level of the ground.

FLORA A collective term for the plants of a region.

FUGITIVE DUST EMISSIONS Occur from the surface (e.g. soil surface, road etc.) if the winds are sufficiently strong and turbulent and the surface dry and loose enough to cause re-suspension from the ground and road surfaces.

FULACHT FIADH Fulachta fiadh tend to date from the mid to late Bronze Age (1500B. C. to 500 B.C. approximately). They are one of the most common field monuments in Ireland and are believed to have been used for cooking purposes.

GEOMETRICS Details of the various vertical and horizontal curves and straights used to make up the road alignment.

GEOPHYSICAL SURVEY A non-disturbance survey method involving one or more of the following: electrical resistivity, various types of magnetometry and ground penetrating radar.

GEOPHYSICS A non-disturbance survey method involving one or more of the following: electrical resistivity, various types of magnetometry and ground penetrating radar.

GEOTEXTILES MATERIALS Fleece lining providing a protection, separation or drainage layer used for example in road construction.

GRADE SEPARATED JUNCTION Road junction at which at least one road passes over another.

GRAVEYARD A graveyard is on consecrated ground with defined grave markers usually enclosed by a wall or bank and frequently associated with remains of a church.

GREENHOUSE GASES (GHG'S) Gases which absorb the longer wavelength radiation that would otherwise be lost in space thus leading to an increase in the temperature of the earth. So far about 30 greenhouse gases produced by human activity have been identified. The main gases identified are carbon dioxide (CO_2), methane (CH_4), chlorofluorocarbons (CFCs) and nitrous oxide (NO_x).

GROUNDWATER Water that occupies pores and crevices in rock and soil, below the surface and above a layer of impermeable material.

HABITAT The dwelling place of a species or community which provides a particular set of environmental conditions (e.g. forest floor).

HILLFORT Large Late Bronze Age/Iron Age defensive hilltop enclosure defined by one or more large ramparts and consisting of banks with external ditches.

HOLY WELL Holy wells were customarily visited for cures and are often associated with a local saint. The origins of their use are undateable but they were used throughout the early medieval period and many are still in use today.

IMPACT OF SIGNIFICANCE Depends on the nature of the environment affected, the duration of the impact and the probability of its occurrence.

IMPACT The degree of change in an environment resulting from a development.

IN-SITU In its original place, in relation to archaeology it refers to the preservation of archaeological sites/features without any disturbances.

INTERCHANGE Road junction, generally grade separated.

INVERT The lowest visible surface, the floor of a culvert, drain, sewer or tunnel.

IRON AGE Prehistoric period from c. 500 BC to c. 500 AD. Also described as the Celtic period, when influences from central Europe and Britain led to the adoption of the Celtic language and the development of an Irish style of Celtic art.

KERBING/KERBSTONES Large stones placed around the edge of a cairn or mound to define and consolidate the monument; a retaining wall; in passage tombs, they can be decorated with art.

KICK-SAMPLING Kick sampling is the method of collecting biological samples from the watercourses by kicking the watercourse substrate for a set period of time to disturb the invertebrates present and allow them to be caught in the net.

KYOTO PROTOCOL An international agreement reached in Kyoto at the Third Conference of the Parties to the U. N. Framework Convention on Climate Change (COP 3) in 1997. The Protocol established specific targets and timetables for reductions in greenhouse gas emissions to be achieved by the framework's signatories.

LAND HOLDING An integral undivided area of land comprising one or more fields that is in single ownership. Where an area of land is in single ownership but has a public road passing through it the public road is considered to have divided or split the area of land into two land holdings.

LIME KILN A stone and brick structure utilised for the burning of lime. Mostly built in the eighteenth and nineteenth centuries when the burning of lime as an agricultural fertiliser was widespread.

LIMIT VALUE Specified in European Union air quality Directives as a concentration of a pollutant, which must not be exceeded in order to protect health.

MEGALITHIC TOMB Literally 'large stone,' a Neolithic tomb.

MESOLITHIC Middle Stone Age (c. 10,000–4000 BC).

METHODOLOGY The specific approach or techniques use to analyse impacts or describe environments (EPA, 1995b).

MILLRACE A millrace is the current of water that drives a mill wheel.

MITIGATION To mitigate means to ease or soothe the effect of. Mitigation measures suggest ways to avoid or lesson the negative effects of a project on the environment.

MOATED SITE Generally a rectangular or square earthwork with a moat. Common in the southeast of the country and generally associated with the Anglo-Norman settlements. They tend to date to the late thirteenth and early fourteenth centuries.

MONTREAL PROTOCOL Treaty signed in 1987 by 24 nations to cut the emissions of chlorofluorocarbons (CFCs) into the atmosphere.

MOTTE A raised, flat topped mound of earth. They were the earliest earthwork defences of the Anglo Normans. They date to the late twelfth and thirteenth centuries.

MOUND The term "mound" is used when a site cannot be identified as a tumulus or barrow, due to usual morphology, or where the siting might indicate a possible modern origin. See burial and barrow.

MULTIVALLATE More than two sets of ramparts.

NEGATIVE IMPACT A change, which reduces the quality of the environment.

NEOLITHIC Pertaining to the New Stone Age c.4000–2500 BC, when agriculture and cattle husbandry was developed in Ireland.

NEUTRAL IMPACT A change, which does not affect the quality of the environment.

NEW SEVERANCE New road or increased traffic on an existing road forms a barrier between people and community facilities.

OCCUPATION SITE A settlement site; the term is usually used to indicate a prehistoric site.

OVERBURDEN Any non-lithified material that rests upon solid rock. Lithification is defined as the process, which results in the formation of massive rock from a loose sediment.

PASSAGE TOMB Megalithic tomb dating to the Neolithic period characterised by an oval or circular mound, kerbing, and a passage, often terminating with a chamber in which cremated burials were placed; often situated on hilltops.

PILING Process of placing into the ground a timber, steel or reinforced concrete post, usually vertical, to carry vertical or horizontal loads.

PIT Any artificially dug hole over a certain size may be described as a pit. They are a common feature in all periods of archaeology.

POLLUTION The direct or indirect alteration of the physical, chemical, thermal, biological, or radioactive properties of any part of the environment in such a way as to create a hazard or potential hazard to the health, safety or welfare of living species.

POSITIVE IMPACT A change, which improves the quality of the environment (for example, improving landscape diversity; removal of existing negatively impacting aspects; etc).

POST-ESTABLISHMENT IMPACT In relation to landscape, impact is assessed in the 15th year opening. At such stage proposed landscaping will have developed as effective mitigation.

POTENTIAL SITE This is the term given to any site that has archaeological potential. It may have been identified due to the presence of earthworks for example but no definitive dating evidence may be forthcoming form them. Potential sites could belong to any archaeological period.

PREDICTOR Sound Level Analyser, proprietary noise calculation package for computing noise levels in the vicinity of noise sources.

PRE-ESTABLISHMENT IMPACT In relation to landscape, impact is assessed in the opening year before proposed planting has matured and developed as effective mitigation.

PROPOSED NATURAL HERITAGE AREA This is a statutory designation that replaced the previous 'Area of Scientific Interest (ASI)', under the Wildlife (Amendment) Act, 2000. pNHAs are legally protected from damage from the date that they are formally proposed.

Q VALUE SYSTEM The 'Q value' system is based on the sensitivity or tolerance of various groups of invertebrates to pollution, and is used to evaluate water quality by identification of invertebrates.

RATH A ringfort, usually with earthen banks, or any circular enclosure.

REVEAL The side of an opening in a wall between the framework and the outer face of the wall.

RIBBON-TYPE DEVELOPMENT The development of single dwelling units along the roads, which radiate out of a town.

RING BARROW Barrow with raised or domed central area.

RING DITCH Barrow with flat or dished central area.

RINGFORT A ringfort is a roughly circular area enclosed by a bank and ditch. Their diameter varies greatly and it is believed that they were used as enclosed farmsteads or cattle enclosures. They date from the early Medieval period onwards.

RING-WORKS Ring-works comprised of slightly raised circular or near-circular area enclosed by a substantial inner bank and outer ditch and are thought to have been an alternative defensive structure to the motte.

RIPARIAN ECOLOGY Ecology adjacent to a river/ stream.

RUN-OFF The gravity flow of water over or from a surface.

SALMONID WATERS High quality waters suitable for the maintenance of viable self-sustaining populations of wild salmon and trout.

SCREENING AIR MODEL This model incorporates the screening spreadsheet given in the Design Manual for Roads and Bridges. Reference DMRB (2003) Volume 11 - Environmental Assessment, Section 3, Part 1

SENSITIVE RECEPTORS Any element in the environment, which is subject to impacts (EPA, 1995b).

SETASIDE Areas of arable land left uncultivated.

STANDING STONE A Standing Stone is simply an upright stone. They probably date to the Bronze Age.

STORM CONTROL AREAS Control areas used for the collection and slow release of road run-off.

SURROUND A frame, as of any architectural feature, like a door-surround.

TEST EXCAVATION A form of archaeological excavation where the purpose is to establish the nature and extent of archaeological deposits and features present in a location that is proposed for development. Its purpose is not to fully investigate those deposits or features.

TEST TRENCHING see Test Excavation.

THERMAL DESORPTION This is the process of removing an adsorbed material from the solid on which it is adsorbed by the use of heat.

TOGHER A Togher is a wooden trackway across a bog or marshy area. Excavated examples date from the Neolithic period up until the later Medieval period.

TOWER HOUSE Tower Houses date to the fifteenth or sixteenth centuries. They are usually rectangular in design and three to five stories in height.

TOWNLAND Townlands originally consisted of a number of sub-divisions such as gneeves and ploughlands but they are now recognised as the smallest administrative division in the country.

TRACKWAYS Trackways and routes through the landscape are known from the Neolithic to the post-Medieval periods. See also togher.

TUMULUS Burial mound composed of earth, sometimes with internal structures.

UNCONFINED AQUIFER An aquifer whose upper surface is at atmospheric pressure.

UNIVALLATE Single set of ramparts.

VISUAL INTRUSION The impact on a view without blocking.

VISUAL OBSTRUCTION The impact on a view involving blocking thereof.

ZONE OF ARCHAEOLOGICAL POTENTIAL An exclusion area around an archaeological site or monument where potential greatness exists for the recovery of archaeology associated with a site or monument.

1 *INTRODUCTION TO THE EIS*

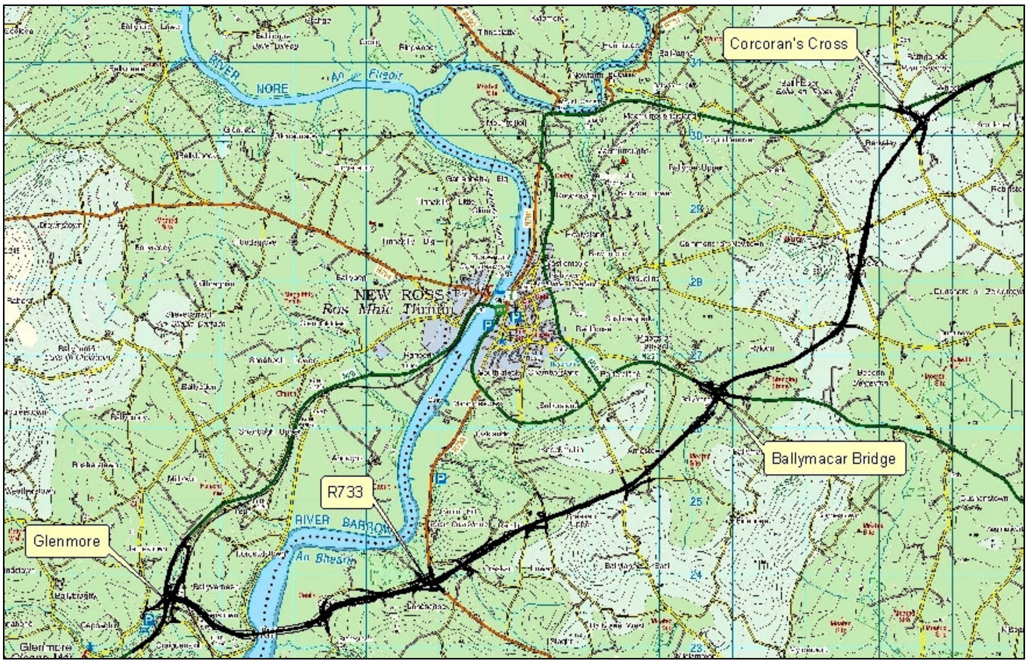
1.1 *BACKGROUND*

Environmental Resources Management Ireland Limited (ERM) was commissioned in January 2005 by *Mott MacDonald Pettit Limited* (MMP) to prepare an Environmental Impact Statement (EIS) for the proposed New Ross Bypass on behalf of *Wexford County Council*. MMP are the Consulting Engineers and were appointed by *Wexford County Council* in 1999 (and were then operating under the name *Ewbank Preece O hEocha*) to determine the needs for and the location of the road scheme. For clarity, the term MMP will be used throughout the EIS to represent the current and all previous names of the company.

The concept of a Bypass for New Ross was first promoted in the National Road Needs Study, published in 1998 by the *National Roads Authority* (NRA), and in the National Development Plan (NDP) 2000 - 2006, published by the Government of Ireland in 1999. The latest version of the NDP (2007 - 2013) confirms the importance of the New Ross Bypass, by designating the road scheme as a key project in the delivery of the Key National/Primary Routes. In addition, the Regional Planning Guidelines for the South-East (May 2004) support the proposed Bypass. A more detailed discussion of the planning context within which the road scheme has been developed can be found in *Section 1.4*.

The proposed road scheme is approximately 14.8 km in length, and will be generally constructed as a dual carriageway road type. A bridge crossing the River Barrow is part of the road scheme. The road scheme starts at the eastern border of Kilkenny and crosses over the River Barrow into Wexford, as shown in *Figure 1.1*.

Figure 1.1 General alignment of the Bypass



Since 1999, a number of activities have been undertaken to assist and facilitate the development of the proposed road scheme. These were:

- Preliminary Public Consultation (September 1999);
- First Public Consultation (March and July 2000);
- Constraints Study (February 2001);
- Second Public Consultation (November 2001);
- Route Selection Report (October 2002);
- Development of scheme alignment; and
- Development and evaluation of bridge options.

The Route Selection Report identified a preferred route, which was then taken forward for design development, upon which this EIS was prepared. A summary of key findings of the route selection study is provided in *Chapter 4: Alternatives*. The full Route Selection Report will be made available to interested parties at the Oral Hearing [(1)].

1.2 ROADS LEGISLATION

This EIS has been prepared as part of the development consent procedure for the New Ross Bypass. The EIS is required by European Community Environmental Assessment Directive 85/EEC/337(2) (as amended by Directive 97/11/EC(3)). The Directive was transposed into Irish law by The Roads Acts, 1993(4), as amended.

(1) The Oral Hearing process is described in *Section 1.3.4*.

The requirements of the Roads Act, 1993(4) (the Act), as amended, in relation to EIS, are summarised below. The sections of the Act applicable to the preparation and submission of an EIS are Sections 50 and 51. The Act defines an EIS as a statement of the effects, if any, which the proposed development, if carried out, would have on the environment.

Under Section 50 of the Act, a road authority is required to prepare a statement of the likely effects (i.e. an EIS) on the environment of any proposed road development consisting of the construction of a motorway, a busway, or any prescribed type of proposed road development consisting of the construction of a proposed public road or the improvement of an existing public road.

The prescribed type of proposed road developments is defined in the Roads Regulations (S.I. No. 119, 1994 (Art. 8)), as amended by European Communities (EIA) (Amendment) Regulations, 1999, and the Planning and Development Act, 2000, as:

"the construction of a new road, of four or more lanes or the realignment or widening of an existing road to provide four or more lanes, where such new, realigned or widened road would be 8 km or more in length in a rural area or 500m or more in an urban area and the construction of a new bridge or tunnel which would be 100m or more in length".

1.3 EIA PROCESS

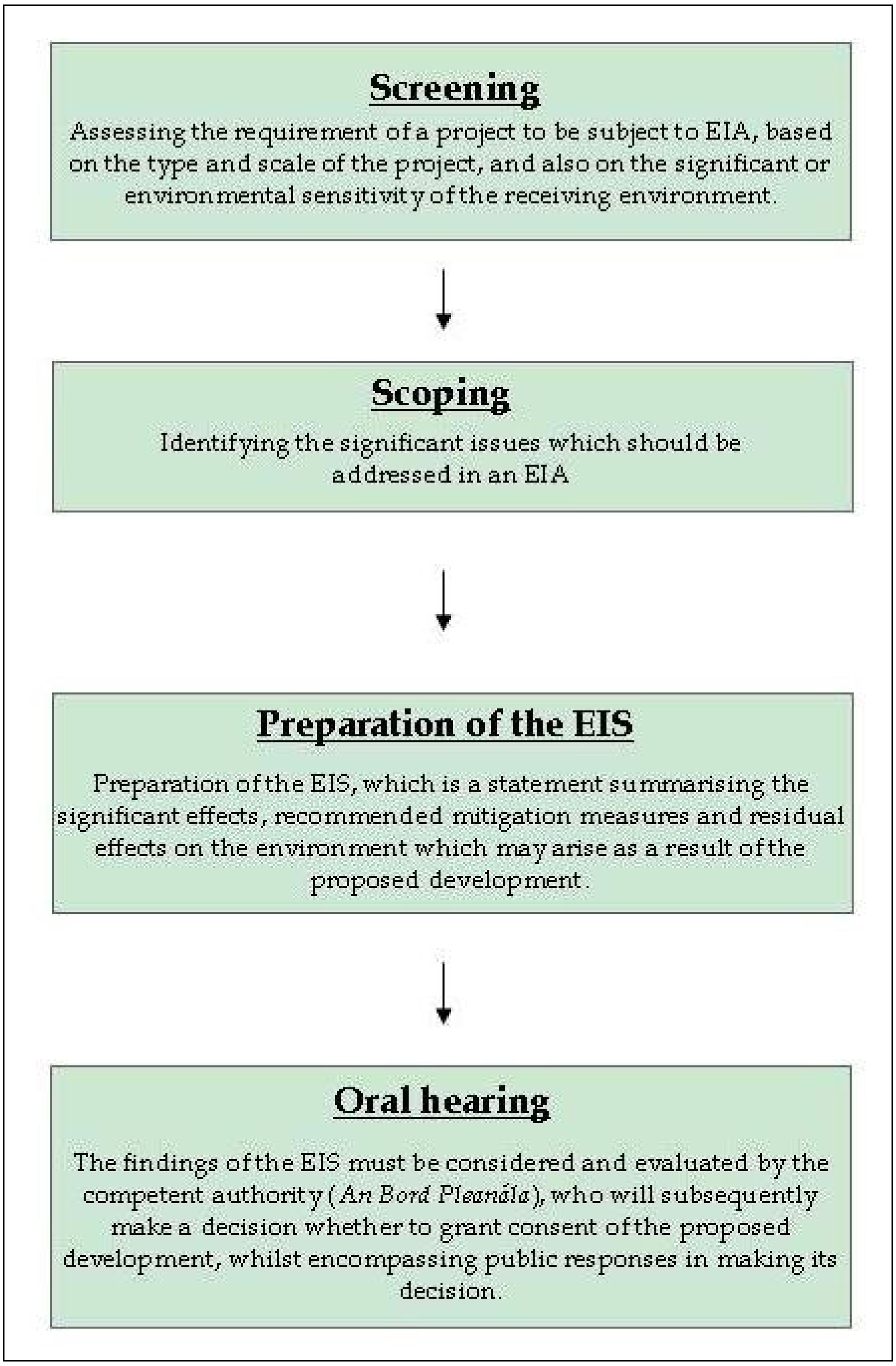
Environmental Impact Assessment (EIA) is defined as [(1)]:

"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 EIA process for a new road can be broken-up into a number of stages. These are summarised in *Figure 1.2* and described in *Sections 1.3.1* and *1.3.4*.

(1) p.3; Environmental Impact Assessment of National Road Schemes - A Practical Guide, National Roads Authority

Figure 1.2 Main stages in an EIA for a road scheme



1.3.1 Screening

Screening is the stage in the EIA process where the need for EIS regarding a road scheme is determined. The need for preparation of an EIS is either mandatory or discretionary, depending on the type and extent of the road development being proposed.

One of the key factors in making this decision is whether significant effects on the environment are likely to arise from the scheme. Such effects may arise due to the type of road scheme being proposed; the scale or extent of the road scheme; and the location of the road scheme in relation to sensitive environments.

Specific guidance on mandatory EIA thresholds (i.e. EIA is required) can be found in Section 2 of the NRA's *Environmental Impact Assessment of National Road Schemes - A Practical Guide*. Table 1 of that document is reproduced as *Table 1.1*, which summarises the legislative requirements for EIA screening in relation to road schemes.

Table 1.1 Summary of legislative requirements for EIS screening

Mandatory/discretionary EIA	**Regulatory reference**
Mandatory (EIA required)	
(1) Construction of a motorway.	S. 50 (1)(a) Roads Act, 1993
(2) 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 8km or more in length in a rural area or 500m or more in length in an urban area.	Art. 8 (a) Roads Regulations, 1994 (Road development prescribed for the purposes of S. 50 (1) (a) of the 1993 Act)
(3) Construction of a new bridge or tunnel which would be 100m or more in length.	Art. 8 (b) Roads Regulations, 1994 (Road development prescribed for the purposes of S. 50 (1) (a) of the 1993 Act)
Discretionary (EIA may/may not be required)	
(4) 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
(5) 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

Mandatory/discretionary EIA	Regulatory reference
(6) 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 Regulation 4 of the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997); - (iii) Special Protection Area; - (iv) A site where consultation has been initiated in accordance with Article 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; and - (vii) If the road authority considers that significant environmental effects are likely, it shall inform ABP in accordance with section 50(1)(c).	S. 50 (1)(d) Roads Act, 1993

Table taken from *Environmental Impact Assessment of National Road Schemes - A Practical Guide*, National Roads Authority

The proposed Bypass falls into the mandatory EIA category as:

- there will be over 8 km of a new road of four or more lanes in a rural area;
- the length of the bridge crossing the River Barrow is over 100m in length.

Furthermore, the road scheme crosses the River Barrow, a candidate Special Area of Conservation (cSAC), which is a European Protected Site under the Habitat Regulations. A potential significant effect on such sites usually requires the application of EIA.

1.3.2 Scoping

Scoping is the stage where the significant environmental issues to be examined in the EIA process are identified. Scoping involves reviewing existing sources of information, professional judgement and referencing guidance documents. Scoping also involves consultation with various organisations and statutory authorities that may have an interest in the preparation of the EIS, and that may also be able to assist in the determination of the scope of the EIA. Further detail on scoping is presented in *Section 2.1* below.

1.3.3 Preparation of the EIS

1.3.3.1 Minimum information requirements

The EIS is the key document in the EIA process.

The EIA Directive and the Roads Act, 1993, set out the general information required to be included in an EIS. Section 50(2) of the 1993 Act states that an EIS should contain descriptions of [respective section of the EIS where this information can be located]:

a description of the proposed road development, comprising information about the site, design, size, physical characteristics and land-use requirements of the development **[Chapter 3]***;*

A description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects **[Chapters 6 - 18]***;*

the data necessary to identify and assess the main effects which the proposed road development is likely to have on the environment **[Chapters 6 - 17]***;*

an outline of the main alternatives studied by the road authority concerned and an indication of the main reasons for its choice, taking into account the environmental effects **[Chapter 4]***;*

a summary in non-technical language of the above information **[NTS in the EIS]***.*

An EIS shall, in addition to and by way of explanation or amplification of the specified information referred to in subsection 50(2), contain further information on the following matters:

(i) a description of the physical characteristics of the whole proposed road development and the land-use requirements during the construction and operational phases **[Chapter 3]**;

(ii) an estimate, by type and quantity, of expected residues and emissions (including water, air and soil pollution, noise, vibration, light, heat and radiation) resulting from the operation of the proposed road development **[Chapter 3 and 6 - 17]**

a description of the aspects of the environment likely to be significantly affected by the proposed road, including in particular:

> *(i) human beings, fauna and flora* **[Chapter 6, 10 and 11]***;*
>
> *(ii) soil, water, air, climatic factors and the landscape* **[Chapters 7, 9 and 12]***;*
>
> *(iii) material assets* **[Chapter 16],** *including the architectural and archaeological heritage, and the cultural heritage* **[Chapters 14 and 15]***; and*
>
> *(iv) the inter-relationship between the above factors* **[Chapter 17]***.*

a description of the likely significant effects (including direct, indirect, secondary, cumulative, short, medium, and long term, permanent and temporary, positive and negative effects) of the proposed road development on the environment resulting from:

(i) and the existence of the proposed road development;

(ii) the use of natural resources;

(iii) the emission of pollutants, the creation of nuisance, and the elimination of waste.

*and a description of the forecasting methods used to assess any effects on the environment***[all Chapters 6 - 17]***;*

an indication of any difficulties (such as technical deficiencies or lack of know-how) encountered by the road authority in compiling the required information **[Chapters 6 - 17]***.*

*a summary in non-technical language of the above information***[NTS in the EIS]***.*

1.3.3.2 Guidance documents

A number of guidance documents have been considered in the preparation of the EIS. The titles and relevance of these documents are described in *Table 1.2*.

Table 1.2 Guidance Documents Considered in the Preparation of the EIS

Guidance	Relevance/Contribution
Environmental Impact Assessment of National Road Schemes - A Practical Guide, National Roads Authority	Used through out the preparation and drafting of this EIS.
Guidelines on Information to be Contained in Environmental Impact Statements, Environmental Protection Agency, 2002	Used through out the preparation and drafting of this EIS.
Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements), Environmental Protection Agency, 2003	Used through out the preparation and drafting of this EIS.
A Guide to Landscape Treatments for National Road Schemes in Ireland, National Roads Authority	Used in the preparation of Chapter 9 (Landscape and Visual)
Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of Habitats Directive 92/43/EEC	Used in the preparation of Chapters 10 and 11 (Terrestrial Ecology and Aquatic Ecology)
Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes, National Roads Authority	Used in the preparation of Chapter 10 (Terrestrial Ecology)
Guidelines for Assessment of Ecological Impacts of National Road Schemes, National Roads Authority	Used in the preparation of Chapters 10 and 11 (Terrestrial Ecology and Aquatic Ecology)
Guidelines for the Treatment of Badgers prior to the construction of National Road Schemes, National Roads Authority	Used in the preparation of Chapter 10 (Terrestrial Ecology)
Guidelines for the Treatment of Noise and Vibration in National Road Schemes - Revision 1, National Roads Authority, October 2004	Used in the preparation of Chapter 8 (Noise and Vibration)
Guidelines for the Assessment of Architectural Heritage and National Road Schemes, National Roads Authority	Used in the preparation of Chapter 15 (Architectural, Artistic, Cultural and Historic Environment)
Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes, National Roads Authority	Used in the preparation of Chapter 14 (Archaeological Heritage)
Design Manual for Roads and Bridges (DMRB): volume 11: Environmental Assessment, Department of Transport (UK) (1994)	Used in the preparation of Chapters 5 and 6 (Traffic and Human Beings)
Guidelines for Landscape and Visual Impact Assessment: Second Edition, Landscape Institute and Institute of Environmental Assessment (2002)	Used in the preparation of Chapter 9 (Landscape and Visual)

Following consideration of the guidance documents in *Table 1.2*, the EIS has been structured as shown in *Table 1.3*.

Table 1.3 Structure of the New Ross Bypass EIS

Volume 1 - Main text (this volume)

1 - Introduction to the EIS

2 – Approach to the EIA

3 - Scheme Description

4 - Alternatives

5 - Traffic

6 - Human Beings

7 - Air Quality & Climatic Factors

8 - Noise & Vibration

9 - Landscape Resources

10 - Terrestrial Ecology

11- Aquatic Ecology

12 - Water, Soils & Geology

13 - Agricultural Properties

14 - Archaeological Heritage

15 - Architectural Heritage

16 - Material Assets

17 - Interrelationships and Interactions of the Predicted Impacts

18 - Summary of Mitigation Measures

19 - Summary of Residual Impacts

References

Volume 2 - Drawings and Figures

Volume 3 - Annexes

A	Landscape & Visual
B	Ecology
C	Agronomy
D	Archaeology and Cultural Heritage

A Non-Technical summary (NTS) of the EIS has also been produced and can be found at the front of Volume 1. The NTS is also available as a separate, stand-alone document.

1.3.4 Oral Hearing

An Oral Hearing, if required, maybe held at a future date, following the publication of the EIS. The EIS will be made publicly available and submissions invited from any interested person(s). At the Oral Hearing, any persons(s) who made a submission can appear at the oral hearing and have their submission heard.

An Bord Pleanala will appoint an Inspector who will conduct the Oral Hearing. Following the conclusion of the hearing, the Inspector will prepare an Inspector's Report into the conduct of the Oral Hearing. Based on the EIS, submissions, and information received during the Oral Hearing, the Inspector will make a recommendation in relation to the proposed road development. An Bord Pleanala will then consider the Inspector's Report in making their decision (approval, approval with modifications or refusal) on the proposed road development. The proposed road development cannot proceed without the approval of An Bord Pleanala.

1.4 POLICY CONTEXT OF THE PROPOSED ROAD DEVELOPMENT

This section presents the policy context within which the road development is being proposed. There is policy guidance at a national, regional and local level that specifically relates to the proposals for the new road. A summary of compliance with the various levels of policy is described in the following sections.

1.4.1 National Development Plan 2007 - 2013

The National Development Plan (NDP) (2007 - 2013) sets out the Government's investment framework for the period 2007 to 2013. It builds on the NDP 1999 - 2006. There are five main Investment Priorities of the NDP. These are:

- economic infrastructure;
- enterprise, science and innovation;
- human capital;
- social infrastructure; and
- social inclusion.

The Economic Infrastructure Investment Priority includes funding for roads. Executive summary of the NDP [(1)] specifically refers to the N25 Bypass. It notes that investment priorities include:

> *"completion by 2010 of the M/N9 Dublin - Waterford road and N25 Bypass".*

In addition, The Road and Rail Network Map in the NDP includes the road scheme as part of the Key National/Primary Routes, as shown in *Figure 1.3*. *Figure 1.3* presents an extract from the Network Map in the NDP 2007 - 2013 of the national road and rail network.

(1) page 29.

Figure 1.3 ***Extract from the national road and rail network map in the NDP 2007 - 2013***

Source: National Development Plan 2007 - 2013

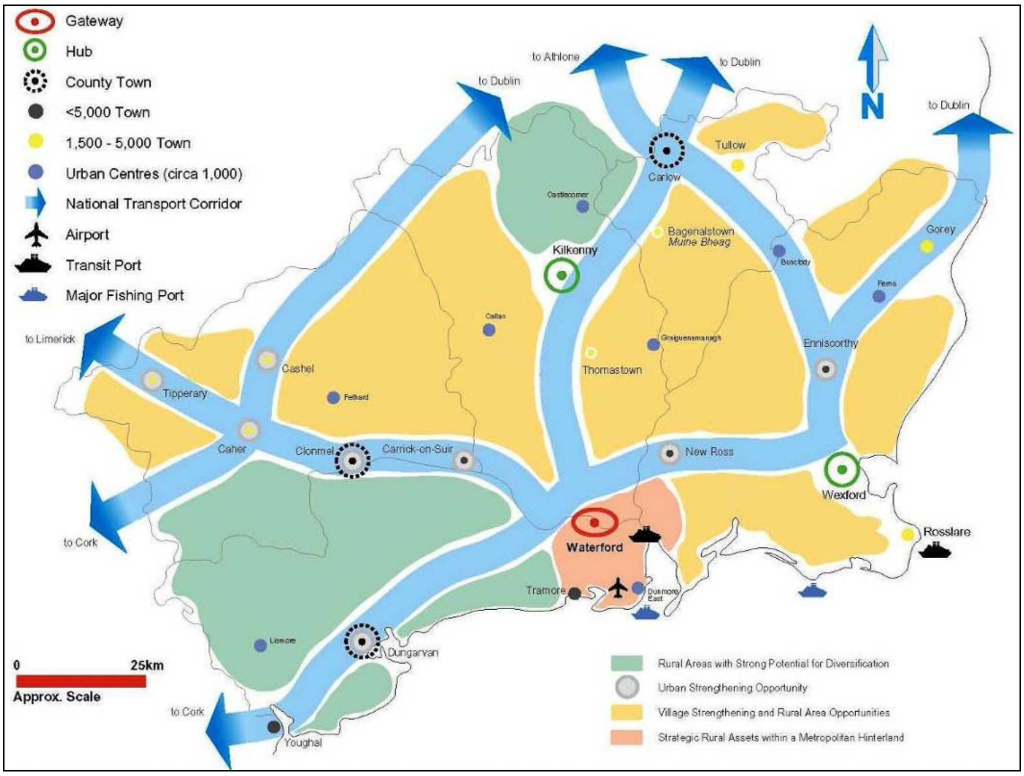
Figure 1.3 shows that the proposed Bypass forms an integral part of the NDP 2007 - 2013.

1.4.2 *National Spatial Strategy 2002*

The National Spatial Strategy (NSS) is the national planning framework for Ireland for the next 20 years. The NSS aims to achieve a better balance of social, economic and physical development across Ireland, supported by more effective planning. In order to drive development in the regions, the NSS proposes that areas of sufficient scale and critical mass will be built up through a network of gateways and hubs.

Although New Ross is not designated as a Gateway or Hub, the town is along the alignment of the National Transport corridor, as shown in *Figure 1.4*.

Figure 1.4 Map 8 (South East Region) of the National Spatial Strategy 2002



Source: National Spatial Strategy 2002

The NSS notes that:

> *"the critical mass of Waterford as a gateway, supported by Kilkenny and Wexford as hubs, will be complemented by development in surrounding and adjacent towns. The extensive network of county towns and other large towns in the South East provides a key resource, which, combined with the gateway and hub approach, provides a strong platform for balanced development throughout the region".*

> *"Towns such as Clonmel and Carrick-on-Suir in South Tipperary, Dungarvan and Tramore in Waterford, Carlow town, New Ross and Enniscorthy in Wexford provide good bases for population and services which will attract investment and employment activities additional to those that need to be located in or near a gateway".*

This demonstrates that the proposed Bypass will assist with the growth and development of the Waterford Gateway in that it will greatly facilitate the faster, easier and greater movement of people, goods and services in the South East Region. Such movement is essential to achieving the stated NSS objectives of achieving:

> *"a better balance of social, economic and physical development across Ireland".*

Thus, the proposed New Ross Bypass is supported by the NSS.

1.4.3 *The Atlantic Gateways Initiative 2006*

Launched in 2006, the Atlantic Gateways Initiative seeks to create a vision as to how the Gateways of Waterford, Cork, Limerick and Galway can become interconnected and developed into a network of co-operating and complementary cities, which can in turn enhance the development potential of each of the gateways and therefore stimulate development in a wider sub-regional context.

To develop the Atlantic Gateways as a new economic corridor, including the N15/N17/N18/N20/N25 Atlantic Corridor network, there is a definite need to create new development possibilities and priorities across and throughout the entire corridor. The Atlantic Gateway corridor has the potential to expand and include wider areas. There clearly needs to be a focus on accelerating the growth of the four city regions that make up the Atlantic Gateways. This needs, however, to be linked to the potential and vital roles of dominant rural and urban areas between the gateways, thus completing the economic viability that sustains strong, competitive and innovative regional economies.

The Atlantic Gateways Initiative suggests the creation of a new 'economic corridor' focused around the gateways and areas in between, but over time expanding outwards to adjacent areas. Here interaction between the Gateways stimulates an area of new economic linkages and trade. The rationale for the Atlantic Gateways is to counterbalance the development of Dublin in a regionally balanced manner.

The proposed Bypass will greatly assist Waterford, one of the four cities identified in the Atlantic Gateway Initiative, in meeting the stated objectives of the Atlantic Gateway Initiative 2006. Thus, the the proposed Bypass is in compliance with the Atlantic Gateway Initiative 2006.

1.4.4 *South-East Regional Authority - Regional Planning Guidelines*

The South-East Regional Authority adopted its Regional Planning Guidelines (RPG) in May 2004. The South-East Regional Authority is one of the eight regional authorities that were established in January 1994. The South-East Region covers Carlow, Kilkenny, South Tipperary, Waterford City, Waterford County and Wexford.

The RPG represents a planning framework for the period 2004 - 2020 designed to achieve a better spatial balance of social, economic and physical development throughout the South-East Region. The Guidelines address the following matters:

- employment and economic development;
- population growth and settlement strategy;
- transportation;
- environmental issues, water services and waste management;
- energy and telecommunications;

- education and health care;
- agriculture, marine and rural development;
- community development;
- recreation, amenity and culture;
- heritage and conservation; and
- inter-regional issues.

A planning authority must have regard to any regional guidelines in force for its area when making and adopting a development plan. Furthermore the Minister for the Environment, Heritage and Local Government may issue directions where necessary to ensure that planning authorities comply with the RPG.

The RPG specifically refers to the New Ross Bypass as part of the:

> "*east coast route from Dublin to the South-East*"

and notes that the bypass is

> "*essential to the development of the eastern section of the region and would significantly improve access to the Rosslare Europort from the region and from the country as a whole*".

The RPG [1] goes on to state that the New Ross Bypass is one of the:

> "*infrastructural development priorities in relation to roads*".

Thus, the proposed New Ross Bypass is supported by the South-East RPG.

1.4.5 *Wexford County Development Plan 2007 - 2013 and the Wexford Development Plan 2001*

The Wexford County Development Plan 2007 - 2013 sets out Wexford County Council's intentions for the future development of land including measures for the conservation and improvement of the natural and physical environment and the provision of infrastructure.

The County Development Plan fully supports the development of the New Ross Bypass. The County Development Plan lists the New Ross Bypass as one of seven Major Roads Proposals which Wexford County Council will support. Objective T10 states that it is the policy of the Council to:

> "*facilitate and enable the development of major National Road proposals within the lifetime of the Plan*".

The Wexford County Development Plan 2001 also supported the development of the Bypass. Paragraph 7.6.5 notes that:

(1)South-East Regional Authority, Regional Planning Guidelines. May 2004. **Table 5.1**.

"As part of the overall National Roads development programme, it is an objective to carry out a number of specific projects during the plan period: … to provide an additional Barrow River crossing and bypass of New Ross (N25)".

Paragraph 7.7.6 states that:

"it is an objective of the Council … to provide a dual carriageway bypass to the N25 at New Ross which will include an additional river crossing at New Ross".

Thus, the proposed New Ross Bypass is in compliance with the Wexford County Development Plan 2007 - 2013 and the Wexford Development Plan 2001.

1.4.6 Kilkenny County Development Plan 2002

The Kilkenny County Development Plan 2002 fully supports the development of the New Ross Bypass. Paragraph 6.1.5 (Specific Objectives) states that

"As part of the National Roads development programme it is an objective to complete the following major road improvement projects over the plan period".

The Plan then goes on to state (in Paragraph 6.1.5.1, National Primary Routes)

"e) The construction of the Waterford bypass and second river crossing along the N25 to dual carriageway standard …

g) The upgrading of the N25 route between Waterford and New Ross with a bypass for New Ross".

Thus, the proposed New Ross Bypass is supported by the Kilkenny County Development Plan 2002.

1.4.7 New Ross Town & Environs Development Plan 2004

The New Ross Town & Environs Development Plan 2004 fully supports the Bypass. A development plan sets out an overall strategy for the proper planning and sustainable development of the area to which it relates. It sets out the landuse, amenity and development objectives and policies of the planning authority, New Ross Town Council in this case. This development plan will be in place from 2004 - 2010.

Section 6.2 (Policy) of the Development Plan lists a number of policy intentions of New Ross Town Council, one of this is to:

"have a second river crossing to serve the town".

Section 6.3 (Objectives) of the Development Plan lists 30 objectives which the council intends to complete. TM26 notes that it is a Council objective

"To provide/facilitate the provision of/co-operate in the provision of a Second River Crossing".

Thus, the the proposed New Ross Bypass is supported by the New Ross Town & Environs Development Plan 2004.

1.4.8 Conclusion

The proposed New Ross Bypass is supported by national, regional and local policy.

2 APPROACH TO THE EIA

2.1 SCOPE OF THE EIS

2.1.1 *Scoping process*

ERM consulted a number of public bodies and authorities in June 2005 and invited these consultees to input into the scope of the New Ross Bypass EIS. *Table 2.1* below presents the list of consultees, and their response.

Table 2.1 Scoping Consultees and Summary of Responses Received

Consultee	Response	EIS chapter
An Taisce	Significant intervention will be required between Creakan Upper and the area to the south of Camlin Hill.	9
	Noted the potential for impacts to the Stokestown village cluster, the setting of the adjacent castle and the wider area of the SAC river valley flood plain.	9, 10, 11, 14 & 15
Badgerwatch Ireland	Main concern relates to badger activity throughout the length of the proposed route. Requests an extensive badger survey to be undertaken within 500m on either side of the route.	10
	Also concerned regarding the safety of otter habitats in the vicinity of the River Barrow.	10
	Notes that ameliorative measures will be necessary to minimise any impacts on resident badger populations.	10
Birdwatch Ireland	No response received.	
Department of Communications, Marine and Natural Resources	No response received.	
Department of Transport	No response received.	
Department of Environment, Heritage and Local Government	Acknowledgement received.	
Environmental Protection Agency	No response received.	
Fáilte Ireland	No response received.	
Geological Survey of Ireland	No response received.	
Irish Farmers Association	No response received.	
Irish Wildlife Trust	No response received.	

Consultee	Response	EIS chapter
Kilkenny County Council	No response received.	
National Parks and Wildlife Service	No response received.	
New Ross Chamber of Commerce	No response received.	
New Ross Port Company	Primary concern is that the 2nd Crossing does not have an adverse impact on navigation in the River Barrow.	3 & 12
	It is critical that the clearance under the bridge is not less than 36m above mean high water spring tides over the full width of the navigable channel.	3 & 12
	Any support structures must be located outside the navigable channel and they should also be protected against the possibility of a ship striking the structure.	3 & 12
	Support columns in the River Barrow will cause some disturbance to the existing patterns of siltation and erosion. The proposed development may lead to an increase in dredging activities.	12
New Ross Sea Angling Club	No response received.	
New Ross Town Council	No response received.	
National Roads Authority	No response received.	
Office of Public Works	Acknowledgement and a standard note regarding flood risk received.	12
South East Angling Ireland	No response received.	
Southern Regional Fisheries board	No response received.	
The Heritage Council	No response received.	
Wexford County Council	No response received.	

Please note that the *Table 2.1* above only covers consultation on the scope of the EIA. Additional consultation has taken place with many of the above authorities and organisations during the development and preparation of the EIS. A summary of these consultations is presented in the individual environmental topics (*Chapters 6 to 17*).

2.1.2 *Scoping Conclusions*

Following consideration of the scoping responses received, a review of the information in the Constraints Report and in the Route Selection Report, the topics identified in the following section were considered the areas where significant environmental effects could potentially occur in the absence of mitigation:

Ecology. The potential effect on the ecology of the River Barrow was identified as a key issue for assessment. The river is a candidate Special Area of Conservation (cSAC) (1) and contains protected species such as char, salmon and twaite shad. The terrestrial ecology along the alignment contains some areas of conservation value. Bats were found to be feeding and commuting along the alignment and badger setts are likely to be present.

Noise. The new road will pass through some very quiet, primarily rural areas where existing noise levels are very low and therefore noise from the proposed road may need to be minimised. The main noise receptors are single and small clusters of rural housing.

Landscape & visual. The road passes through a variable and rural terrain. The crossing of the Barrow requires sensitive treatment as the existing river valley presents a striking change in topography and landscape character in comparison to the land-based landscape adjacent to the River Barrow. Important views along the alignment include Camlin Hill, and the hill to the west of Ballylane.

Cultural heritage. The new road alignment passes through areas of known archaeological interest.

Human beings. The proposed Bypass will remove a significant volume of traffic from the town of New Ross, thereby improving the quality of life for its residents and for commuters who currently pass through the town. The Bypass may, however, also impact on a number of secondary and local roads, and thus local access, along the alignment. The scoping exercise determined that the EIA should examine the effects of the road scheme on local populations, economic activity, road users and effects on individual roads.

Agronomy. The majority of the alignment passes through agricultural land and, thus, the proposed road will impact on private agricultural holdings.

The topics listed above are those that were identified as potential key issues through the scoping exercise. It should be noted that the EIS considers all the environmental topics specified in the Road Act (1993).

2.2 *CONSULTATIONS*

Public consultation (as distinguished from EIS scoping consultation and other statutory consultation) has been undertaken at various times since March 1999. A brief summary of these consultation events is provided below.

(1) the River Barrow cSAC is a European Protected Site under the EU Habitats Directive. Further detail can be found in Chapters 10 and 11.

In September 1999, preliminary consultations were undertaken. A preliminary consultation brochure was prepared and distributed with local newspapers. The brochure requested submission and general views from the public.

At the end of March 2000, a public exhibition was held in New Ross, organised by *Wexford County Council* and *Kilkenny County Council*, in association with *Tramore House Regional Design Office* (THRDO) and MMP. In addition to the public exhibition, a presentation was made to a joint meeting of the elected members of the two local authorities. Some one thousand people are estimated to have attended the public exhibition event.

A Public Consultation update meeting took place in New Ross during mid-July 2000. A presentation was made, updating the public on progress to date on the project. This was followed by a question and answer session.

In excess of 2,500 responses were received. Concerns raised in the responses included:

- impact on farmlands,
- impact on cultural, archaeological and ecological heritage,
- impact on amenity and lifestyle,
- devaluation of property,
- economic impact on the town of New Ross and its environs,
- impact on landscape,
- noise and air quality impacts on residential areas and farmlands,
- impact on community, and
- existing HGV traffic in the town.

A second public consultation event was undertaken at the end of November 2001 and took place in New Ross. Display boards were used to present the horizontal and vertical alignments of the preferred route. A brochure was prepared outlining the key issues and also included a map showing the preferred route. Members of the design team were present to answer questions and provide further information on the road scheme. A set of public display boards were placed in the New Ross Public Library after the second public consultation event and comments from the public were invited.

In addition to the public consultation events outlined above, consultation was also undertaken with landowners likely to be impacted during the route selection stage.

Once the preferred route was identified (*Chapter 4: Alternatives*), further consultation was undertaken with the landowners whose land will be acquired under the compulsory purchase order (CPO) process.

In addition to consultation set out above, there was on-going technical liaison with statutory and non-statutory bodies. This liaison ranged from obtaining baseline data to discussing survey methods, potential impacts and mitigation measures. Such technical consultation is discussed under each of the environmental sections presented in *Chapters 6 to 17*.

2.3 EIS TEAM

A number of companies contributed to the preparation of this EIS and they are summarised in *Table 2.2* below.

Table 2.2 EIS team and technical responsibility

Technical area	Company
EIS management and preparation	ERM
Road scheme drawings (inc. Route Selection Report/Alternatives)	Mott MacDonald Pettit
Traffic modelling and data	Mott MacDonald Pettit
Human beings	ERM
Air quality and climate	ERM
Noise and vibration	ERM
Landscape and visual	ERM
Photomontages	ERA Maptec
Terrestrial ecology	ERM
Aquatic ecology	ERM
Water, soils and geology	Hydroenvironmental
Agricultural properties (agronomy)	Curtin Agricultural Consultants
Archaeological, architectural and cultural heritage	CRDS
Material assets	ERM & Mott MacDonald Pettit

2.4 STUDY AND INFORMATION LIMITATIONS

No major study and information limitations were encountered in preparing the EIS. Specific data and survey assumptions are addressed in the individual environmental topics chapters.

3 *SCHEME DESCRIPTION*

3.1 *INTRODUCTION*

This chapter introduces the individual elements of the proposed New Ross Bypass and should be read in conjunction with *Figures 3.1 a - k* in *Volume 2* of the EIS.

3.2 *GENERAL ROAD SCHEME*

The new proposed bypass of New Ross will connect the N25 from Waterford on the Kilkenny side of the River Barrow, with the N25 to Rosslare and the N30 to Enniscorthy in Wexford east of New Ross town.

The Bypass commences at Glenmore in County Kilkenny with an At-Grade Roundabout and crosses over the River Barrow via a proposed Extrados type bridge between Pink Point in County Kilkenny and Stokestown in County Wexford. Continuing in a north easterly direction to Ballymacar Bridge, the Bypass interfaces with the R733 in Landscape by way of a Grade Separated Junction, and with the N25 at Ballymacar Bridge with an At-Grade Roundabout. From Ballymacar Bridge the Bypass continues to the northeast and interfaces with the existing N30 at Corcoran's Cross, finishing with an at-grade roundabout to the east of Corcoran's Cross with connecting roads to the existing N30 and severed Local Road L 4003-3.

The overall road scheme consists of:

- Approximately 4 km of Type 1 Dual Carriageway, which will link the existing N25 in Glenmore to the R733 in Landscape via the new River Barrow Bridge Crossing;
- Approximately 9.6 km of Type 2 Dual Carriageway, which links the R733 in Landscape to the existing N25 at Ballymacar Bridge and continues to the proposed junction southeast of Corcoran's Cross on the existing N30;
- Approximately 1.2 km of Standard Single Carriageway (S2), which links the roundabout southeast of Corcoran's Cross to the existing N30 to the east of Corcoran's Cross;
- Three at grade junctions, at Glenmore (N25), Ballymacar Bridge (N25) and Corcoran's Cross (N30);
- A grade separated junction, at Landscape (R733);
- River Barrow Crossing comprising an Extrados Type Bridge Crossing, connecting Pink Point in County Kilkenny and Stokestown in County Wexford;

- 10 local road bridges, 1 at Ballyverneen, 1 at Stokestown, 1 in Landscape (part of the grade separated junction), 1 in Camlin, 1 at Creakan Upper, 1 at Arnestown, 1 at Ballymacar and 3 at Lacken;
- A railway bridge at Ballyverneen (this proposed railway structure may be built as part of this scheme, or may be constructed in the future as a separate contract), where the bypass intersects with a railway line that Iarnród Éireann has advised as having the status of being "closed but not abandoned";
- Retaining wall structures adjacent to the LS-7513 at Ballyverneen, and the R733 at Camlin;
- Various realignments and tie-ins of sections of National, Regional and Local roads affected by the proposed scheme; and
- Associated ancillary works.

3.3 *DESIGN CRITERIA*

The NRA DMRB (National Roads Authority Design Manual for Roads and Bridges) standards were used for the design of the scheme.

The mainline comprising approximately 4 km of Type 1 Dual Carriageway, 9.6 km of Type 2 Dual Carriageway and 1.2 km of Single Carriageway road has a design speed of 100 km per hour.

Geometry criteria in conjunction with other issues including traffic, topography, environment, structural design, drainage and interfaces with the existing road network; were used to develop the current road geometry and cross sections.

N25 Chainage 0 to 4000

Type 1 Dual Carriageway, the cross section consists of the following:

- 1 × 2.6m (min) central reserve (including 2 × 1.0m hard strips);
- 2 × 7.0m carriageway;
- 2 × 2.5m hard shoulders (reduced to 0.5m on the Barrow Bridge); and
- 2 × 2.0m verges (reduced to 1.5m min underbridges and to 0.6m on the Barrow Bridge).

The overall cross-sectional width is 25.6m.

N25 Chainage 4000 to 8650

Type 2 Dual Carriageway, the cross section consists of the following:

- 1 × 1.5m central reserve;
- 2 × 7.0m carriageway;
- 2 × 3.0m (min) verges (includes 0.5m hard strips and is reduced to 2m min on underbridges); and
- 2 x 1m hard standing in the verges for occasional cyclists and pedestrians use.

The overall cross-sectional width is 21.5m.

N30 Chainage 0 to 4950

Type 2 Dual Carriageway, the cross section consists of the following:

- 1 × 1.5m central reserve;
- 2 × 7.0m carriageway;
- 2 × 3.0m (min) verges (includes 0.5m hard strips and is reduced to 2m min on underbridges); and
- 2 x 1m hard standing in the verges for occasional cyclists and pedestrians use.

The overall cross-sectional width is 21.5m.

N30 East Tie-in Chainage 0 to 1200

Standard single carriageway (S2) the cross section consists of the following:

- 1 x 7.3m carriageway;
- 2 × 2.5m hard shoulders; and
- 2 × 3.0m verges.

The overall cross-sectional width is 18.30m.

Table 3.1 below details the interfaces between the new road alignment and the existing road networks.

Table 3.1 Interfaces with the existing road network

Road Name	Chainage	Road Type	Design Element
National Primary			
N25 New Ross Bypass	N25 0,000 to 4,100	Type 1 Dual Carriageway	New roadway
N25 New Ross Bypass	N25 4,100 to 8,650	Type 2 Dual Carriageway	New roadway
N25 South Tie-in	N25 0,000	Single carriageway with climbing lane	Tie-in to roundabout at Glenmore
N25 East Tie-in	N25 8,650	Single carriageway with climbing lane	Tie-in to roundabout at Ballymacar Bridge
N30 New Ross Bypass	N30 0 to 5,000	Type 2 dual carriageway	New roadway
N30 East Tie-in	N30 East Tie-in 0,000 to 1,200	Standard single carriageway (S2)	New roadway
Regional Roads			
N25 North Tie-in *(to be re-classified)*	N25 0,000	Single carriageway with climbing/right turn lane	Tie-in to roundabout at Glenmore
R733	N25 3,980	Single carriageway with right turn lanes	Road bridge
N25 West Tie-in (to be re-classified)	N25 8,650	Single carriageway	Tie-in to roundabout at Ballymacar Bridge
N30 West Tie-in *(to be re-classified)*	N30 5,000	Single carriageway	New roadway
Local Roads			
LS-7501 realignment	N25 0,000	Single carriageway	Road realignment and tie-in to roundabout
LS-7513 realignment	N25 0,100	Single carriageway	Road realignment and bridge
LS-7512 (existing)	N25 1,350	Single carriageway	Road bridge
L-4026-2 realignment	N25 2,350	Single carriageway	Road realignment and bridge
L-4026-1 realignment	N25 3,050 to 3,320	Single carriageway	Road Realignment
L-8049-1 realignment	N25 4,400	Single carriageway	Road realignment and bridge
L-8047-1 realignment	N25 4,500 to 4,900	Single carriageway	Road Realignment
L-8048-1 realignment	N25 5,400 to 5,700	Single carriageway	Extinguishment and road realignment to tie-in to L-8046-1 south of the bypass
L-8046-1	N25 5,700	Single carriageway	Road bridge
L-4021-2	N25 6,870	Single carriageway	Road bridge
L-80434 realignment	N25 6,870 to 7,250	Single carriageway	Extinguishment and road realignment to tie-in to L-4021-2 south of the Bypass
L-80561 realignment	N25 8,650	Single carriageway	Extinguishment and road realignment to tie-in to a section of the old Wexford road west of the Bypass

Road Name	Chainage	Road Type	Design Element
Old Wexford road at Ballymacar Bridge	N25 8,650	Single carriageway	Extinguishment and road realignment to tie-in to L-80561 realignment east of the Bypass
L-4008	N30 1,900	Single carriageway	Road bridge
L-4013-2 realignment	N30 2,600	Single carriageway	Road realignment and bridge
L-4007-3	N30 3,310	Single carriageway	Road bridge
L-4003-3 realignment	N30 4,600 to 5,000	Single carriageway	Extinguishment and road realignment to tie-in to roundabout at Corcoran's Cross.
L-4003-2 realignment	N30 4,900	Single carriageway	Extinguishment and road realignment to tie-in to the old N30 North of Corcoran's Cross Roundabout.
N30 North Tie-in *(to be re-classified)*	N30 5,000	Single carriageway	New roadway
Old N30 North of Corcoran's Cross Roundabout *(to be re-classified)*	N30 5,000 to N30 East Tie-in 1,200	Single carriageway	Extinguishment and tie-in to N30 North Tie-in and L-4003-2 realignment
Link Roads			
LS7513 West Tie-in	N25 0,100	Single carriageway	New roadway
LS7513 East Tie-in	N25 0,100 to 0,200	Single carriageway	New roadway
LS7513 South Tie-in	N25 0,150	Single carriageway	New roadway
LS7512 South Tie-in	N25 0,200	Single carriageway	New roadway
L-4026 West Tie-in	N25 3,600 to 3,750	Single carriageway	Tie-in to roundabout (R733) at Landscape
L-4026 East Tie-in	N25 3,800 to 3,930	Single carriageway	Tie-in to roundabout and R733 at Landscape.
Stokestown Port Access Road	N25 3,800	Single carriageway	Tie-in to roundabout (R733) at Landscape
L-8049-1 South Tie-in	N25 4,380 to 4,470	Single carriageway	Road realignment and tie-in to L-8049-1 realignment
L-4003-3 West Tie-in	N30 4,700	Single carriageway	Tie-in to realigned L-4003-3 west of the realignment

Merges and Diverges			
Glenmore Junction Free-flow Lane	N25 0,000 to 0,100	Free flow lane	New roadway
N25/R733 Junction Eastbound Diverge	N25 3,450 to 3,750	Diverge slip lane	New roadway
N25/R733 Junction Eastbound Merge	N25 3,800 to 3,930	Merge slip lane	New roadway
N25/R733 Junction Westbound Diverge	N25 3,880 to 4,010	Diverge slip lane	New roadway
N25/R733 Junction Westbound Merge	N25 3,550 to 3,980	Merge slip lane	New roadway
Ballymacar Bridge Junction Free-flow Lane	N25 8,500 to 8,700	Free flow lane	New roadway

3.4 *JUNCTIONS*

Three new at-grade junctions and one grade separated junction are proposed as part of the road scheme. Modifications will also be made to existing roads where the junctions tie-in to the network.

3.4.1 *Glenmore Junction*

At this junction the Bypass connects to the existing N25 in Glenmore County Kilkenny with an at-grade roundabout. The roundabout will connect the Bypass to the existing N25 Waterford to New Ross Road and to local road LS-7501. A dedicated freeflow slip lane, located on the south east side of the roundabout, is provided to facilitate traffic from the N25 Bypass travelling in an east to west direction.

3.4.2 *Ballymacar Bridge Junction*

At this junction the N25 and the N30 section of the Bypass connect to the existing N25 in Ballymacar County Wexford with an at-grade roundabout. A dedicated freeflow slip lane, located on the south east side of the roundabout, is provided to facilitate traffic travelling in an east to west direction from the existing N25. The level of the roundabout is lifted in order to facilitate a diversion to local road L-80561.

3.4.3 *Corcoran's Cross Junction*

At this junction the N30 section of the Bypass connects to the existing N30 and local road L-4003 in Knockroe (Corcoran's Cross), County Wexford with an at-grade roundabout.

3.4.4 *R733 Junction*

The proposed grade separated junction connects the Bypass with the regional road R733 and the local road network in County Wexford. The bypass mainline passes over the R733 with on/off ramps providing full connectivity with the R733. The north side of this junction is restricted due to an environmentally sensitive area to the north of the junction and to the west of the existing R733. The woodland and marsh area are part of River Barrow pNHA (proposed National Heritage Area) and the marsh is part of the River Barrow & River Nore cSAC (candidate Special Area of Conservation).

3.5 STRUCTURES

3.5.1 *Barrow Bridge*

The River Barrow Bridge is located between approximate N25 Ch. 1180m and 2080m. The design of the structure has been developed to provide a structurally efficient and cost-effective solution that provides the necessary clearances over the River Barrow, whilst fitting sympathetically within the surrounding landscape. The architectural design of the river crossing is considered to be important to the project, and the proposed extrados structure is considered to offer an elegant solution, ably exploiting the aesthetic potential offered by the surrounding topography.

The design issues associated with the structure include prevailing ground conditions, ship navigation on the River Barrow, wind effects, environmental considerations, the assumed construction methodology, and the structure's operation and maintenance.

The Barrow Bridge will be an Extrados Type Bridge. Three of the bridge piers will extend through the bridge deck, with the centre pier extending approximately 25m above the bridge deck and the two side piers extending approximately 15m above the bridge deck. Inclined stay cables will link these three piers to the centre of the bridge deck. Five addition piers are required: two to the west of the main spans and three to the east of the main spans. The overall length of the bridge is approximately 905m with the two main central spans approximately 230m in length. The vertical alignment for the Barrow Bridge allows a 36m clearance envelope above Mean High Water Spring tide (MHWS) for the navigation channel of the river. The median and raised verges at the bridge abutments vary due to sight distance requirements.

3.5.2 *Other Road Bridges*

Eleven bridges to facilitate the Bypass Mainline, Local Roads and a closed but not abandoned Railway (this proposed railway structure may be built as part of this scheme, or may be constructed in the future as a separate contract) are provided for in the design. Bridge location, obstacle crossed and span configurations are summarised in *Table 3.2* below.

Table 3.2 *Road Bridges (excluding Barrow Crossing)*

Bridge Reference	Approximate Mainline Chainage (m)	Bridge Title	Approx. Span of Bridge (m)
B01	Ch 0 +106 (N25)	LS-7513 Road & Stream bridge	20
B02*	Ch 0 +300 (N25)	Ballyverneen Railway bridge*	77
B03	Ch 2 +354 (N25)	L-4026-2 Road bridge	12
B04	Ch 3 +964 (N25)	R733 Road bridge	18
B05	Ch 4 +392 (N25)	L-8049-1 Road bridge	54
B06	Ch 5 +696 (N25)	L-8046-1 Road bridge	12
B07	Ch 6 +881 (N25)	L-4021-2 Road bridge	56
B08	Ch 8 +652 (N25)	L-8056-1 Road bridge	12
B09	Ch 1 +918 (N30)	L-4008-2 Road bridge	12
B10	Ch 2 +615 (N30)	L-4013-2 Road bridge	76
B11	Ch 3 +308 (N30)	L-4007-1 Road bridge	12

*: This proposed railway structure may be built as part of this scheme, or may be constructed in the future as a separate contract

3.5.3 *Retaining Structures*

Retained structures have been identified at the following locations (*Table 3.3*):

Table 3.3 *Retaining Structures*

Retaining Wall Reference	Approximate Mainline Chainage (m)	Location of Retaining Wall	Approx. Length of Structure (m)	Form of Retaining Wall
R01	Ch 0 +140 N25	Retaining wall to west of realigned local road LS-7513 between local road Ch. 200 to 280.	100m	Piled Wall or similar approved
R02	Ch 0 +150 N25	Retaining wall between railway line and LS-7513 South Tie-in.	45m	Piled Wall or similar approved
R03	Ch 3 +960 N25	Retaining wall adjacent to R733 regional road	150m	Piled Wall or similar approved

3.6 CONSTRUCTION

The construction period of the Bypass is estimated to be 36 months. It will result in the generation of construction traffic on the local and regional road network. Due to the nature of the construction work involved, a high percentage of this traffic will involve the movement of large volumes of HGVs, heavy machinery and plant. Typical plant and machinery to be used includes diggers and earth movers, concrete vehicles, small scale plant and machinery.

Typical construction activities will include site clearance works; earth and spoil movement; cutting activities; concrete pouring; construction of the various elements of the Bypass (Mainline, local road realignments, bridges, underpasses, culverts etc.) and their associated sub-elements (e.g. sub-base, road surface, pavements, landscape elements, retaining walls, drainage infrastructure and features etc.); landscaping features; and finish works (signage's, road markings etc.). The landtake required for the construction and operation of the Bypass is approximately 117 hectares.

Construction traffic data as provided by MMP indicates that the maximum construction movements could be 366 per day (which includes the maximum movements for earthworks, deliveries and internal movements, plus the maximum perceived amount of vehicles required for the delivery of concrete). Other construction materials to be used in the construction of the Bypass may include safety barriers, crushed stone and other sub-base material, concrete (in-site and pre-cast), PVC piping and ducting, environmental fencing and lighting columns and associated works.

The works to construct the Bypass will be undertaken along the line of the route and within the CPO boundary. Provision has been made in the design for a number of stock and machinery underpasses along the length of the Bypass to mitigate the effects of farm and other severance caused by the Bypass. Any additional lands required for accommodation works will be subject to agreement (and appropriate consent procedures) between Wexford County Council and individual Landowners.

Earthworks for the scheme comprise approximately 33 primary areas of excavation/embankment. The preliminary Land Based Ground Investigation Interpretative Report indicates that the majority of the material excavated is suitable for reuse with the exception of the materials excavated from the River Barrow and River Barrow floodplain.

The approximate earthworks volumes are shown in *Table 3.4* below. Excess spoil will be reused, where possible, across the scheme as part of the proposed earthworks. Excess topsoil will be reused, where possible, as part of the landscaping proposals. Further details regarding the removal, storage and reuse of topsoil can be found in *Section 9.6* of Volume 1.

Table 3.4 Approximate Earthworks Volumes

Section	Cut Volume (m^3)	Fill Volume (m^3)	Surplus (m^3)	Excavate Topsoil Volume (m^3)	Reinstate Topsoil Volume (m^3)	Topsoil surplus (m^3)
Section 1 - Glenmore to River Barrow	245,000	-90,000	155,000	24,000	20,000	4,000
Section 2 - River Barrow to R733	300,000	-175,000	125,000	38,000	25,000	13,000
Section 3 - R733 to Ballymacar	525,000	-380,000	145,000	61,000	45,000	16,000
Section 4 - Ballymacar to N30	190,000	-480,000	-290,000	60,000	35,000	25,000
Total	**1,260,000**	**-1,125,000**	**135,000**	**183,000**	**125,000**	**58,000**

4 *ALTERNATIVES*

4.1 *INTRODUCTION*

The consideration of alternatives is a requirement of Section 50(2) of the Roads Act, 1993, which states that the EIS should provide:

> *"the main alternatives studied by the road authority concerned and an indication of the main reasons for its choice, taking into account the environmental effects"*.

In relation to this road scheme, considerable work has been undertaken on this topic. *MMP* produced a Constraints Report in February 2001 and a Route Selection Report in October 2002. A summary of both reports is provided in *Sections 4.2* and *4.3*.

When the preferred route was chosen, there was further consideration of alternatives. Design option work was undertaken in relation to the Bridge Crossing. This is discussed in *Section 4.4* below.

4.2 *CONSTRAINTS REPORT*

The New Ross Bypass Constraints Study is the second of seven phases defined in the NRA's *National Roads Project Management Guidelines* (March 2000). The purpose of the Constraints Report was to determine the constraints (be they physical, procedural, legal or environmental) that currently exist and which may affect the design of the scheme, delay its progress or influence the scheme cost.

The environmental issues considered in the Constraints Study included:

- ecology,
- water quality and fisheries
- archaeology and heritage,
- landscape,
- recreation/amenity, and
- geology and hydrogeology.

Other non-environmental issues considered included:

- traffic,
- land ownership,
- planning,
- utilities, and
- preliminary site investigations.

All the identified issues and data collected were used in the identification of route options during the preparation of the Route Selection Report (*Section 4.3*).

4.3 *ROUTE SELECTION REPORT*

4.3.1 *Overview*

The Route Selection Report was prepared in October 2002 by MMP and describes the two phases of route selection. The first phase considered 46 scheme options (comprising of various combinations of twelve different route corridors; Routes A to L). The second phase then focused on emerging preferred routes (identified in the first phase).

4.3.2 *Route Selection - first phase*

This part of the route selection process identified 46 scheme options. Each scheme option comprised two or three sections (with one of the routes within each individual section):

- **Section 1** - Southern crossings: routes A, B and C;
- **Section 2** - Northern crossings: routes D, E, F, G and H; and
- **Section 3** - Eastern Link: routes I, J, K and L.

Routes A to L are illustrated in *Figure 4.1*.

Figure 4.1 Route combinations for the first phase of the Route Selection process

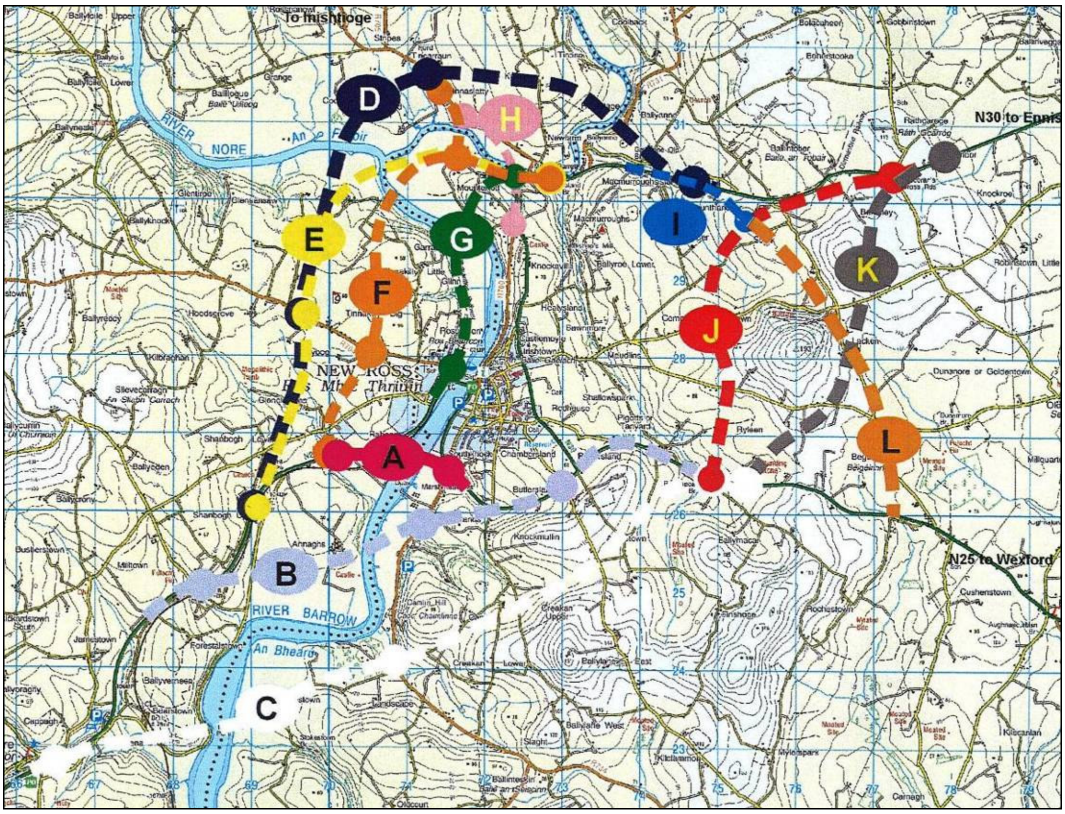


Figure taken from Figure 4.1 of the New Ross Second River Crossing & Bypass: Route Selection Report

Based on the various combinations of Sections 1 to 3, the 46 alternative scheme options were developed. The 46 scheme options were subject to an assessment with regards to:

- traffic performance;
- economic returns;
- cost estimates; and
- environmental factors.

This assessment is summarised in *Table 4.1* below and resulted in the 46 options being reduced to five options. The majority of the scheme options were eliminated on the basis that they did not meet some or all of the requirements (traffic, economic and cost).

Table 4.1 Evaluation of the 46 original scheme options

Option (Corridor combinations)	**Status**
0	'Do-Nothing' option
1 (A & D)	Eliminated: higher cost and a lower rate of internal return.
2 (A, E & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
3 (A & F)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
4 (A, G & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
5 (A & J)	Taken forward for more detailed assessment.
6A (B &D)	Eliminated: higher cost and a lower rate of internal return.
6B (B &D)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
6C (B/C &D)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
6D (B/C &D)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
7A (B, E & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
7B (B, E & H)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.

Option (Corridor combinations)	Status
7C (B/C, E & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
7D (B/C, E & H)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
8A (B & F)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
8B (B & F)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
8C (B/C & F)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
8D (B/C & F)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
9A (B, G & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
9B (B, G & H)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
9C (B/C, G & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
9D (B/C, G & H)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
10A (B & J)	Eliminated: engineering difficulties with vertical alignment and environmental issues (landscape).
10B (B & J)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
10C (B/C & J)	Eliminated: engineering difficulties with vertical alignment and environmental issues (landscape).
10D (B/C & J)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
11A (C & D)	Eliminated: higher cost and a lower rate of internal return.
11B (C & D)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
12A (C, E & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
12B (C, E & H)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.

Option (Corridor combinations)	Status
13A (C & F)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
13B (C & F)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
14A (C, G & H)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
14B (C, G & H)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
15A (C & J)	Taken forward for more detailed assessment.
15B (C & J)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
16 (D, I & L)	Taken forward for more detailed assessment.
17 (E, H, I & L)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
18 (F, I & L)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
19 (G, H, I & L)	Eliminated: traffic/connectivity issues, environmental difficulties (upstream River Barrow Crossing) and option does not offer a viable solution to the needs of New Ross town and the National Primary Route Network.
20A (C & K)	Taken forward for more detailed assessment.
20B (C & K)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
21A (B & K)	Eliminated: engineering difficulties with vertical alignment and environmental issues (landscape).
21B (B & K)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.
22 (A & K)	Taken forward for more detailed assessment.
23A (B/C & K)	Eliminated: engineering difficulties with vertical alignment and environmental issues (landscape).
23B (B/C & K)	Eliminated: no junction with R733 and poor connectivity with New Ross town and Port.

The remaining five scheme options (plus the 'Do-Nothing') are:

- Do-Nothing;
- Scheme option **5** (A & J);
- Scheme option 1**5** (C & J);

- Scheme option **16** (D, I & L);
- Scheme option **20** (C & K); and
- Scheme option **22** (A & K).

These remaining scheme options are illustrated in *Figure 4.2*. This figure shows the routes (A, C, D, I, J and K) which comprise the five remaining scheme options) and these were subject to more detailed examination.

Figure 4.2 ***Route combinations retained for further assessment***

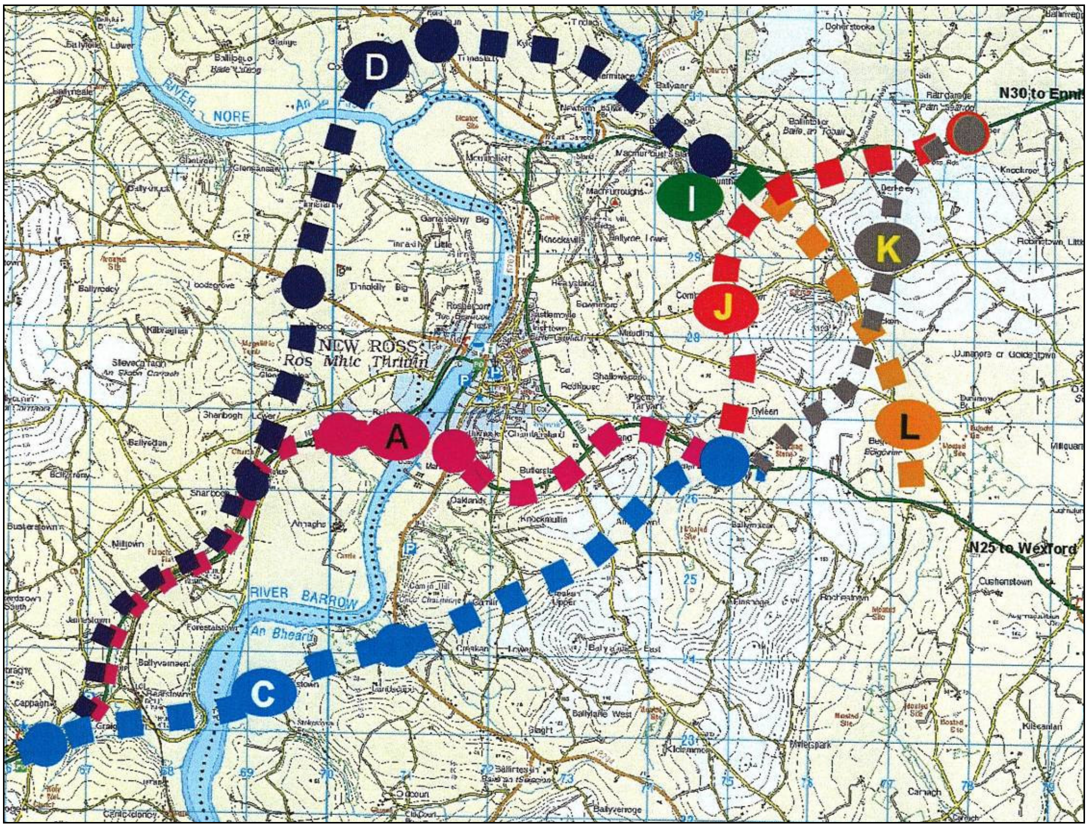


Figure taken from Figure 7.1 of the New Ross Second River Crossing & Bypass: Route Selection Report

This assessment process was based on the following factors:

- travel cost savings;
- increased travel opportunities;
- economic stimulation;
- positive environmental effects;
- capital costs;
- operating and maintenance costs;
- disruption to river barrow shipping traffic; and
- negative environmental effects.

During the course of the evaluation, it was apparent that corridor K was preferred to corridor J for the following reasons:

- **Cost:** €14M (K) vs. €25M (J);
- **Environmental:** J passes through a proposed NHA; and

- **Engineering:** K presents a better cut/fill balance.

Thus, options involving corridor J were eliminated from more detailed assessment. The remaining options thus comprised:

- Do-Nothing;
- Option **16** (D, I & L);
- Option **20** (C & K); and
- Option **22** (A & K).

A further traffic modelling exercise was subsequently undertaken for the remaining options. This modelling determined that the 'Do-Nothing' would result in a worsening of traffic and environmental conditions, while option 16 would carry significantly less traffic on the Bypass (and thus, result in significant volumes of traffic continuing to pass through New Ross after the Bypass was opened) in comparison to Options 20 and 22.

On the basis of this further modelling, Options 20 and 22 were taken forward to the second phase of the route selection process.

4.3.3 Route Selection - second phase

The two options examined in the second phase were sub-divided into two sub-sections:

1. from Glenmore (south-east of New Ross) to Ballymacar Bridge (east-south-east of New Ross); and
2. from Ballymacar Bridge to Corcoran's Cross (N30 tie-in; north-east of New Ross).

Table 4.2 below summarises the sub-divisions of the two sub-sections.

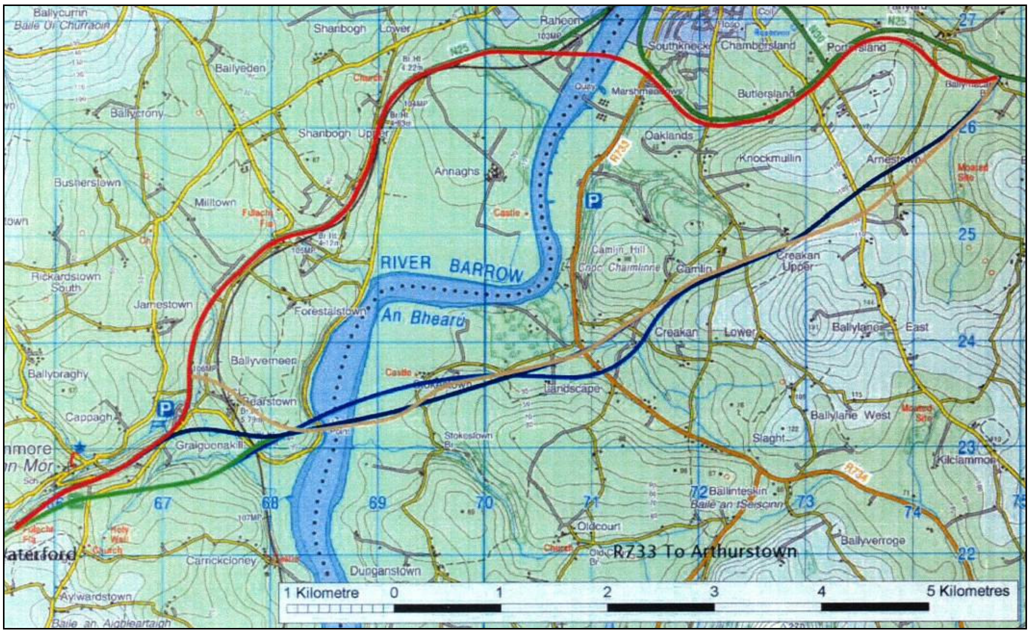
Table 4.2 Sub-corridor options for the sub-sections in the Route Selection - Phase 2

Sub-section	**Corridor**	**Sub-corridor**
1. from Glenmore to Ballymacar Bridge	A	A4
	C	C1, C3, C4 and C6
2. from Ballymacar Bridge to Corcoran's Cross	J	J4
	K	K4

For sub-section 1, there are two corridors; A and C (which has been further sub-divided into 4 sub-corridor options: C1, C3, C4 and C6). Corridor A considered three methods of crossing the River Barrow: High-level Bridge; Opening Span Bridge and a Tunnel. The 4 sub-corridor options for C considered a High Level Bridge crossing of the River Barrow.

All five corridor options (i.e. A and the four sub-corridor options for C) were compared against each other to determine the preferred route corridor between Glenmore and Ballymacar Bridge. All five corridor options are shown in *Figure 4.3*. The sub-corridors are as follows: A4 - red; C1 - green; C3 - dark blue; C4 - light blue; C6 - light brown.

Figure 4.3 Sub-corridor options within Sub-section 1



Source: Figure 11.1 of the New Ross Second River Crossing & Bypass: Route Selection Report

Regarding the C sub-corridor options, C6 was chosen as the preferred C sub-corridor on the basis that it performed the best for agriculture, construction risk, ecology, economics and water quality/fisheries and was tied with the other three sub-options for archaeology, development of the town, geology & hydrogeology, ground conditions, human environment, hydraulics, journey length, landscape, National Primary Route, navigation, noise, traffic performance and underwater archaeology.

Thus C6 was compared to A4 to determine the preferred route from Glenmore to Ballymacar Bridge (sub-section 1).

Regarding sub-section 2, two corridors (J4 and K4) were compared to determine the preferred route corridor between Ballymacar Bridge and Corcoran's Cross (sub-section 2). These are shown in *Figure 4.4* with red indicating the J4 sub-corridor and dark blue indicating the K4 sub-corridor.

Figure 4.4 Sub-corridor options within Sub-section 2

Source: Figure 11.7 of the New Ross Second River Crossing & Bypass: Route Selection Report

Table 4.3 summarises the comparisons of A4 with C6 (sub-section 1) and J4 with K4 (sub-section 2). 20 criteria were used in this comparison and these ranged from environmental and engineering, to economics and traffic performance.

Table 4.3 Comparison of the four route corridor options

Topic	Sub-section 1 (Fig. 4.3)		Sub-section 2 (Fig. 4.4)	
	A4	C6	J4	K4
Agriculture	=	=		+
Air quality		+		+
Alignment/engineering		+++		++
Archaeology	+		+	
Construction risk		+++	=	=
Ecology	+			+
Economics		+++		++
Geology/hydrogeology	=	=	=	=
Ground conditions	=	=	=	=
Human environment		+		+
Hydraulics	=	=	n/a	n/a
Journey length		++		+
Landscape	++			+
National Primary Route		+++		+
Navigation	=	=	n/a	n/a
Noise		+		+
Traffic performance	=	=	=	=
Underwater archaeology	=	=	n/a	n/a
Water quality/fisheries	+			+
Development of town		++	=	=

n/a	Not applicable
=	Equal
+	Slightly better
++	Better
+++	Much better

Source: Table 30.3 of New Ross Second River Crossing & Bypass: Route Selection Report, Document Two (Appendices & Figures) October 2002.

The results in *Table 4.3* show that the preferred route from Glenmore to Ballymacar Bridge (sub-section 1) is C6 as this route shows considerable advantages over A4 for alignment/engineering, construction risk, economics and the National Primary Route. C6 is also advantageous over A4 for air quality, human environment, journey length, noise and the development of New Ross town.

The preferred route from Ballymacar Bridge to Corcoran's Cross (sub-section 2) is K4. This route option demonstrates advantages over J4 under agriculture, air quality, alignment/engineering, ecology, economics, human environment, journey length, landscape, National Primary Route, noise and water quality/fisheries.

4.4 *BRIDGE CROSSING OPTIONS*

Nine alternative bridge crossing options were considered with regards to the new crossing of the River Barrow. Following discussions with the Project Steering Committee, four bridge options were selected for more detailed consideration. The four options were:

1. box girder option (*figure 4.5a*);
2. three-arch bridge option (*figure 4.5b*);
3. single-arch bridge with approach viaduct option (*figure 4.6a*); and
4. three-tower extrados bridge option (*figure 4.6b*).

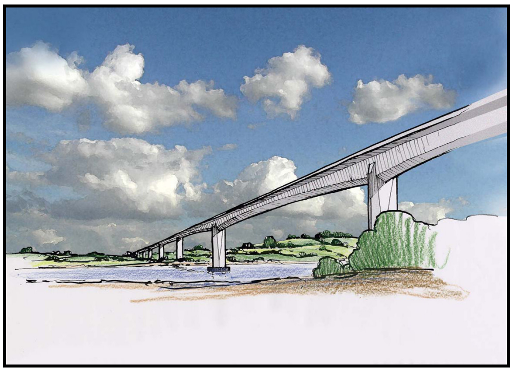
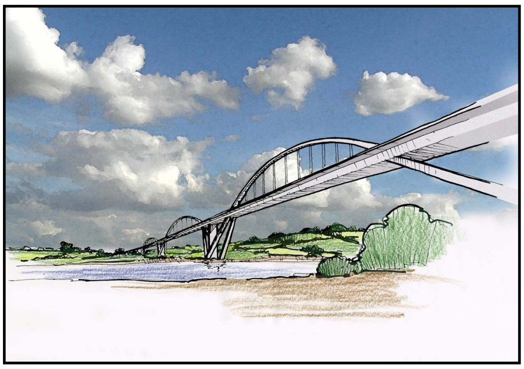



Figure 4.5a & b: Box girder bridge option and Three-arch bridge option (sketches courtesy of Mott MacDonald Pettit).


Figure 4.6a & b: Single-arch bridge option and Three-tower extrados bridge option (sketches courtesy of Mott MacDonald Pettit).

In relation to aquatic ecology, the key receptor is the River Barrow, a candidate Special Area of Conservation (cSAC) and a salmonid river. As with underwater archaeology, potential ecological issues are broadly similar for each bridge option.

The options with vertical elements (all options, with the exception of the Box girder option) present a risk in relation to bird strikes. This risk can be reduced through the use of visible cables of an adequate thickness.

Ground conditions and the risk of encountering contamination are broadly similar for each bridge option.

Ship navigation to/from the Port of New Ross has been considered in all four options with the agreed provision of a 36m high clearance above the Mean High Water Mark Spring tide (MHWS) and also by locating the main span river piers outside of the navigation channel.

A key consideration is landscape and visual effects of the bridge options. All four options broadly adopt a similar design concept which is the use of strong horizontal elements which consider the nature of the surrounding topography and River Barrow valley. All four options do not have dramatically high structures nor are the vertical elements significantly taller than the surrounding landscape.

The alternative bridge types were considered under a variety of headings which are summarised in *Table 4.4*.

Having regard to all of the considerations, the Extrados option was selected on the basis that it had a small increase in cost over the Box Girder bridge but it was considered to be significantly better from an aesthetic viewpoint and had a lower alignment with a slightly shorter overall length.

Table 4.4 Summary of comparison of bridge options

	Box Girder Bridge	Three Arch Bridge	Single Arch Bridge	Extrados Bridge
Geometry	Deeper deck - higher road alignment over navigation clearance - longer bridge	Shallower deck - lower alignment	Shallower deck - lower alignment	Shallower deck - lower alignment
Navigation clearance	No Difference	No Difference	No Difference	No Difference
Loading	No Difference	No Difference	No Difference	No Difference
Ground Conditions	No Significant Difference	No Significant Difference	No Significant Difference	No Significant Difference
No. of Piers	10	5	7	8
Environmental Considerations	No Significant Difference	No Significant Difference	No Significant Difference	No Significant Difference
Approximate Construction Programme (months)	29	42	40	30
Construction Method Complexity	Normal	Most complex	Complex	Normal
Cost Comparisons	100.00%	153.41%	123.66%	105.61%
Whole Life Cost Comparison	100.00%	126.47%	101.86%	101.73%
Architectural/Aesthetic Considerations	standard	visually striking	visually striking	visually striking

5 TRAFFIC

5.1 INTRODUCTION

This chapter provides a summary of the traffic conditions and effects of the road scheme. Traffic modelling data is provided by MMP and is presented for the key road links around New Ross and the route of the road scheme. Data is provided for an Opening Year (2013) and a Design Year, which is defined as the opening year plus 15 years (i.e. 2028). Traffic flow figures are provided with and without the road scheme (i.e. the Do-Nothing).

Please note that this chapter only presents a summary of the future traffic flows both with and without the Bypass. The assessment of environmental impacts, both positive and negative, which are predicted to arise as a result of the proposed Bypass can be found in the individual environmental chapters.

5.2 TRAFFIC MODEL BACKGROUND

The original traffic modelling for New Ross was based on traffic survey information gathered in 1998 but updated to reflect actual growth to 2000. This was reported in detail in the Route Selection Report, published in October 2002. Reviews of traffic and traffic growth were undertaken in subsequent years.

In early July 2007, a data collection exercise was undertaken which included classified traffic counts and number-plate registration surveys on the major links into New Ross. This provided up-to-date O&D information which enabled a detailed update of the model.

A total of 35,913 vehicles were counted by manual classified counts at 5 locations illustrated in *Figure 5.1*. 97% of these were registered by the plate recognition software and 84% of the trips were matched at another site (or at the same site returning in the opposite direction).

The detailed 2007 O&D data from the number plate registration survey were used to create a 2007 trip matrix. Some movements which were not recorded by the plate registration survey were derived from the original O&D survey and present day traffic counts. The model was run for the Do-Nothing case for 2007 and the results compared with actual recorded traffic counts. The comparison showed good correlation with a maximum difference between modelled flows and recorded flows of 9%.

The 2007 trip matrix was then grown using the NRA document entitled "Future Traffic Forecasts 2002 – 2040 to yield trip matrices for 2013 and 2028 which were considered to be the "year of opening" and the "design year" respectively. The model was run for the Do-Nothing and Do-Something networks for these years.

5.3 TRAFFIC FLOW DATA

Figure 5.1 shows traffic flows for key links in the network (5 existing locations and one location on each section of the proposed bypass). *Table 5.1* below summarises the Annual Average Daily Traffic (AADT) for the Opening Year and *Table 5.2* summarises the AADT for the Design Year. *Tables 5.1* and *5.2* have the link names and road references as per *Figure 5.1.*

Figure 5.1 Road modelling links

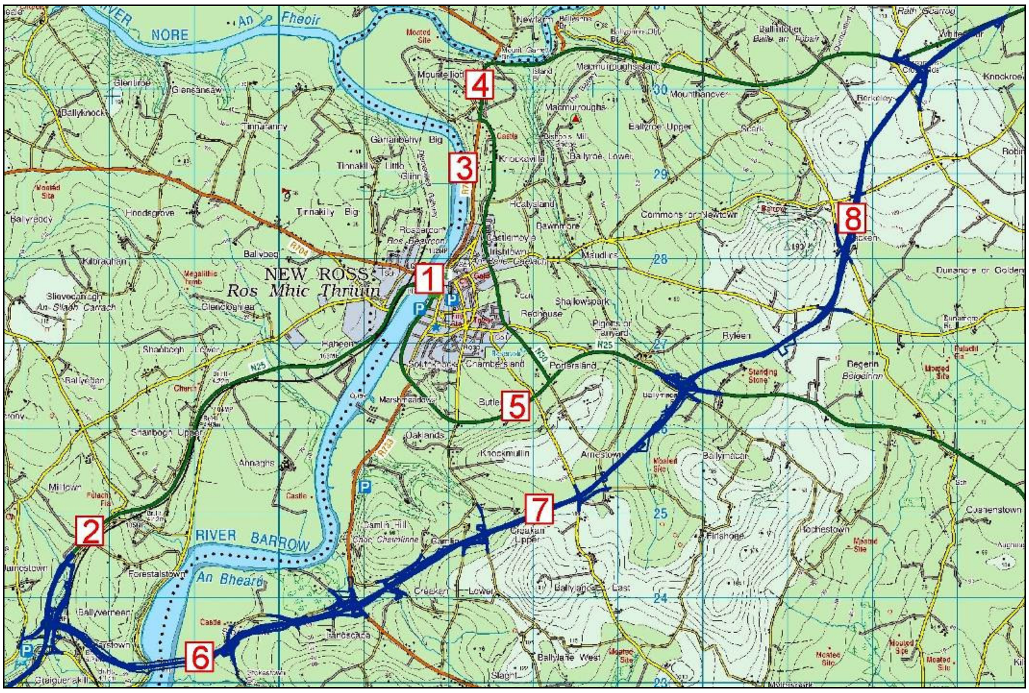


Table 5.1 Traffic flow projections for the Opening Year

Road link	Do-nothing	With scheme	% Reduction
1. O'Hanrahan Bridge	22,175	10,158	54.19%
2. N25 Waterford Road	16,204	4,156	74.35%
3. R700 New Ross - N30	8,505	3,597	57.71%
4. N30 Enniscorthy Road	13,283	6,626	50.12%
5. N25/N30 Wexford Road	9,869	4,854	50.82%
6. New Bridge Crossing (proposed scheme)	0	12,048	n/a
7. R733 - Ballymacar (proposed scheme)	0	9,697	n/a
8. Ballymacar - Corcoran's Cross (proposed scheme)	0	6,658	n/a

Table 5.2 *Traffic flow projections for the Design Year*

Road link	Do-nothing	With scheme	% Reduction
1. O'Hanrahan Bridge	27,909	12,746	54.33%
2. N25 Waterford Road	20,371	5,208	74.43%
3. R700 New Ross - N30	10,996	4,081	62.89%
4. N30 Enniscorthy Road	16,709	8,290	50.39%
5. N25/N30 Wexford Road	12,306	6,089	50.52%
6. New Bridge Crossing (proposed scheme)	0	15,173	n/a
7. R733 - Ballymacar (proposed scheme)	0	12,188	n/a
8. Ballymacar - Corcoran's Cross (proposed scheme)	0	8,419	n/a

6 HUMAN BEINGS

6.1 INTRODUCTION

Human beings are an important consideration under the environmental topics being considered in the EIA process. This chapter examines the socio-economic effects on human beings, e.g. population levels, occupational data, economic effects, as well as residential access & severance impacts. Other effects on human beings are examined in the following chapters: *Chapter 7: Air Quality and Climatic Factors*; *Chapter 8: Noise and Vibration*; *Chapter 9: Landscape Resources*; *Chapter 13: Agricultural Properties*; and *Chapter 17: Interrelationships and Interactions of Predicted Impacts*.

6.2 METHODOLOGY

The examination of socio-economic effects involved desk-based research and visits to the areas along the proposed alignment during August 2005. Baseline data regarding population, occupation and other socio-economic indicators was obtained from the following sources:

- Census 2002;
- Census 2006 data (where available);
- Draft Wexford County Development Plans 2007 - 2013; and
- Kilkenny County Development Plan.

The prediction of impacts on road users was undertaken using assessment methodologies in the *Design Manual for Roads and Bridges (DMRB): Volume 11: Environmental Assessment.*

An assessment of the impacts of the change in traffic flows on the existing and future road network was undertaken using traffic data from *Chapter 5* and assessed using methodologies in the *Design Manual for Roads and Bridges (DMRB): Volume 11: Environmental Assessment.*

6.3 BASELINE ENVIRONMENT

6.3.1 *Overview*

The new road alignment will pass through two counties. It begins in County Kilkenny, to the west of the River Barrow. The alignment then crosses the River Barrow and enters County Wexford. New Ross is the closest urban settlement to the road scheme and lies to the north of the proposed alignment (*Figure 1.1*).

To determine the social and community impacts of the Bypass, census data was obtained on the level of Electoral Division (EDs). The EDs of relevance are:

- Shanbogh (Kilkenny),
- Kilmakevoge (Kilkenny),
- Kilbride (Kilkenny),
- Old Court (Wexford),
- New Ross Rural (Wexford),
- Rochestown (Wexford), and
- Whitemoor (Wexford).

6.3.2 *Population*

6.3.2.1 *New Ross and Surrounding Area*

Table 6.1 shows population data for the years 1996, 2000 and 2006. It can be seen that all the EDs have undergone population increases from 1996 to 2006. The large increase for New Ross Rural represents both an expansion of the town urban population as well as the general expansion of the town.

Table 6.1 Relevant 1996, 2002 and 2006 Census population data

DED	1996	2002	2006	% change ('96-'02)	% change ('02-'06)	% change ('96-'06)
Shanbogh	431	421	475	- 2.3	+ 12.8	+ 10.2
Kilmakevoge	374	391	425	+ 4.5	+ 8.7	+ 13.6
Kilbride	290	332	348	+ 14.5	+ 4.8	+ 20.0
Old Court	510	595	670	+ 16.7	+ 12.6	+ 31.4
New Ross Rural	1,408	2,052	3,367	+ 45.7	+ 64.1	+ 139.1
Rochestown	175	192	233	+ 9.7	+ 21.4	+ 33.1
Whitemoor	468	522	507	+ 11.5	- 2.9	+ 8.3

Source: CSO Census data 2006, 2002 & 1996

The Draft Wexford County Development Plan 2007 - 2013 notes (p.17 - 18) that preliminary data from the Census 2006 shows that the population of Co. Wexford grew to 131,615 persons, an increase of 12.9% since 2002. It also notes that the population of the New Ross Electoral Area (within which all of the above EDs are located) grew from 24,233 (2002) to 26,911 (2006), an 11.1% increase.

The EDs in Kilkenny also show a broadly similar overall population growth from 1996 to 2006.

Overall, the population adjacent to the road scheme is growing and future trends indicate that this will continue.

6.3.2.2 *Adjacent to the New Road Alignment*

Based on the information contained in *Annex A* (*Landscape & Visual*), there are approximately 160 dwellings or clusters of dwellings within 500m of either side of the alignment. Approximately 70 dwellings are within 100m of the alignment. The majority of these dwellings are single, isolated residential units adjacent to the various local roads that adjoin the Bypass alignment. *Figure 9.5* (*Volume 2: Drawings and figures*) shows the location of these dwellings and clusters of dwellings adjacent to the alignment.

6.3.3 *Socio-economic Profile*

New Ross is recognised as an important urban centre in the National Spatial Strategy. The town provides services (such as banking and professional services) and amenities (retail, restaurants etc.). Waterford is approximately 24km away to the south-west. The town is Ireland's only inland port and is approximately 32km away from the Irish Sea, to the south of the town.

The surrounding hinterland is predominately in agricultural use. This is seen in the relative proportion which agricultural activity provides in employment terms. The 2002 Census notes that agriculture provided 10.5% employment in County Wexford, against a national average of 1.2%.

Employment data from the 2002 Census show that New Ross had an unemployment rate of 13.7% against an average of 10.5% for County Wexford and a national average of 8.8%. Census 2006 data shows a similar unemployment rate of 13.1%.

Table 6.2 presents occupation data (in percentages) for New Ross town and rural area. Comparison data is presented for Wexford County and Dublin city and county. All data is taken from Census 2002 (the data is not yet available from Census 2006).

Table 6.2 ***Occupation data (%) for New Ross area, Wexford County and Dublin (Census 2002 data)***

Area	Employers and managers	Higher professional	Lower professional	Non-manual	Manual skilled	Semi-skilled	Unskilled	Own account workers	Farmers	Agricultural workers	All others gainfully occupied and unknown
New Ross town	11.7	2.6	6.0	16.7	13.9	11.5	9.0	5.0	0.3	0.5	22.9
New Ross rural area	14.2	2.3	8.1	13.5	11.4	7.6	5.7	6.1	15.2	2.1	13.8
Wexford County	14.3	2.9	8.1	16.4	11.5	8.8	6.2	6.0	8.8	2.1	14.9
Dublin city & county	18.4	7.3	10.5	19.7	8.9	6.6	4.0	4.2	0.3	0.1	20.0

The data in *Table 6.2* indicates that a New Ross rural area has a relatively high (15.2%) proportion of employment in agricultural and related-employment. New Ross town has, as expected, a much lower proportion (0.3%) of agricultural and related-employment, a similar level to Dublin city and county. New Ross town and rural area, and Wexford County, all have a lower proportion of professional and managerial employment, in comparison to Dublin city and county.

6.3.4 Accommodation

Table 6.3 shows that the majority of housing in the relevant EDs comprise houses, with very minor amounts of apartments, bed-sits or caravans. This is expected as apartment and bed-sit accommodation is typically more prevalent in larger cities, such as Dublin, Cork and Galway.

Table 6.3 ***Relevant accommodation classification data***

DED	House	Apartment	Bed-sit	Caravan	Not stated	Total
Shanbogh	145	2	0	7	3	157
Kilmakevoge	132	1	0	0	3	136
Kilbride	108	0	0	0	1	109
Old Court	183	1	0	6	5	195
New Ross Rural	1,081	29	7	5	33	1,155
Rochestown	65	0	0	4	4	73
Whitemoor	159	1	0	0	6	166
Wexford County	42,374	1,932	113	470	704	45,566

Source: CSO Census data 2006

6.3.5 *Facilities and Amenities*

There are four Primary Schools and five Secondary Schools in New Ross. Sporting organisations amenities in the town and surrounding area include Geraldine O'Hanrahans GAA Club, New Ross Rugby Club, New Ross Celtic Soccer Club, New Ross Town Soccer Club, New Ross Boat Club, New Ross Badminton Club, New Ross Swimming Club and New Ross Golf Club.

New Ross contains the Dunbrody replica famine ship which is moored on the Quay (east of O'Hanrahan Bridge). The original Dunbrody ship was a three-masted barque built in Quebec, Canada, for the Graves family of New Ross, Co. Wexford in 1845. The original ship carried many emigrants to the new world from 1845-1870.

The town of Dunganstown, approximately 6km south of New Ross is the ancestral home of the Kennedy family which includes John F. Kennedy, the 35th President of the USA, and other members of the Kennedy family. Their great-grandfather, Patrick Kennedy, emigrated to America from there.

6.3.6 *Infrastructure*

The existing road infrastructure is illustrated in *Figure 1.1*. The N25 is the main National Primary Road for New Ross and the surrounding areas. The N25 (west of the town) connects New Ross to Waterford, Dungarvan and Cork. The N25 (east of the town) links the town to Wexford and Rosslare Harbour. The N30 spurs off the N25 (east of the town) and connects New Ross to Enniscorthy, Gorey and Dublin.

The R704 links the town to the western hinterland; the R700 links the town to Kilkenny and to the northern hinterland and the R733 provides access to villages in South West Wexford and access to areas south of the town. There are also numerous local roads providing local access to New Ross.

Traffic congestion is a major problem for New Ross. The New Ross Town & Environs Development Plan 2004 notes (p.21) that

> *"traffic congestion is one of the most significant threats facing New Ross over the period of the development Plan which, if left unchecked, will impact on the economic vitality of the town's commercial life and the attractiveness of the town as a place to live".*

New Ross Town Council commissioned a Traffic Management Study for the town and found that 60% of traffic using the bridge (N25) was using the N25 to access areas outside the town and its environs.

The proposed Bypass impacts on a number of public roads and private accessways (such as private roads, tracks and farming paths). These are listed in *Table 6.8* below.

6.4 *CONSTRUCTION IMPACTS AND MITIGATION MEASURES*

6.4.1 *Overview*

Construction impacts will arise during the construction of the scheme. This section considers socio-economic impacts on the local community and issues such as disruption to road users and severance issues. Please note that the Noise & Vibration, Landscape Resources, and Air Quality and Climatic Factors chapters (*Chapters 8, 9 and 7* respectively) address other aspects of impacts to arise during the construction process.

6.4.2 *Disruption to Local Communities*

Construction of the scheme will take approximately 36 months. During this time, existing roads crossed by the scheme will be temporarily impacted by the construction process, primarily due to the movements of construction traffic as well as nuisance impacts from construction activities. Movements through New Ross town will also be required during the construction process. Receptors impacted by the disruption include local road users (pedestrians, cyclists and vehicle users) and local residential populations along both local roads and in New Ross town.

Construction traffic will use the existing road network to access the construction site. The estimated volume (reasonable worst-case) of heavy goods vehicles (HGV) on the road network is approximately 366 movements per day. The majority of these construction movements will be 'internal' or within the Bypass site, to move excavated material from areas of surplus to those where fill is required.

The presence of construction traffic is likely to temporarily impact on all road users and populations living close to the construction site and along construction traffic routes. As construction progresses, it is likely that temporary road closures and temporary diversions will be required to facilitate construction of the scheme.

The majority of the Scheme is being constructed off-line (i.e. is not being built over an active road) and thus, the majority of impacts for road users will arise where the construction process interacts with an existing and open road. Approximately 28 temporary public road closures are anticipated during the construction of the Bypass. Such temporary closures are required to facilitate the construction of the scheme. It is intended to minimise the temporary closure of all such roads. Where such temporary closures are required, advanced notice will be given to the public and an alternative/diversion route made available. While the diversion route may be longer, the route will provide an alternative means of completing the journey. These diversions will facilitate all road users; pedestrians, cyclists and vehicle drivers.

Soiling of local roads (e.g. mud carried on the wheels of HGVs, material falling from HGVs, etc.) during the construction process will also impact on local road users and residential dwellings. The construction process will also generate dust and other airborne material which may soil properties and other buildings. These issues are examined in *Chapter 7* (*Air Quality and Climatic Factors*).

Construction activities will generate temporary noise and vibration impacts. Construction road traffic will also generate noise along haulage and movement routes. These impacts are examined in *Chapter 8* (*Noise and vibration*).

The construction site will have a temporary impact on the existing landscape setting along the alignment and will also impact on particular views of the construction site. These issues are examined in *Chapter 9* (*Landscape Resources*).

Some private properties will be acquired to facilitate construction of the road development. This issue is examined in *Chapter 16* (*Material assets*).

6.4.3 Economic Effects

The construction of the Scheme will generally result in positive, if temporary, economic effects of the New Ross area. It is likely that some of the demand for construction employment will be met locally. Given the higher level of unemployment in the area, this is likely to be a benefit for the area's socio-economic profile. In addition, over the 36 month construction phase, the construction workers will spend some of their income in the local economy. The demand for local goods and services will increase during the construction phase. This is a positive effect of slight to moderate significance for the economy of New Ross and the surrounding areas.

6.5 OPERATIONAL IMPACTS

6.5.1 Traffic Reductions

The road scheme will result in the redirection of approximately 54% of AADT traffic volumes away from O'Hanrahan Bridge both in the Opening and the Design years. This represents a positive impact of moderate significance for the population of New Ross town, according to the criteria presented in the *Design Manual for Roads and Bridges (DMRB): Volume 11: Environmental Assessment*, which provides guidance on evaluating the effects of changes in traffic volumes on roads. *Table 6.4* presents these criteria.

Table 6.4 ***Guidelines for evaluating the effects of changes in traffic volumes (AADT) on roads*** (1)

Area type	Minor benefit	Moderate benefit	Major benefit
Built-up/urban areas	c. 30% reduction	37 - 60% reduction	>60% reduction
Rural areas	60 - 75% reduction	75 - 90% reduction	> 90% reduction

Table 6.5 applies the criteria in *Table 6.4* to the key road links in and around the town of New Ross for the Opening year (2013). *Table 6.6* presents similar data for the Design year (2028).

Table 6.5 ***Effects of the operation of the Road scheme during the Opening year (2013)***

Road link (road classification)	Do-nothing	With scheme	% reduction	Significance
1. O'Hanrahan Bridge (urban)	22,175	10,158	54.19%	Moderate benefit
2. N25 Waterford Rd (rural)	16,204	4,156	74.35%	Minor benefit
3. R700 New Ross - N30 (urban)	8,505	3,597	57.71%	Moderate benefit
4. N30 Enniscorthy Rd (rural)	13,283	6,626	50.12%	Not significant
5. N25/N30 Wexford Rd (urban)	9,869	4,854	50.82%	Moderate benefit

Table 6.6 ***Effects of the operation of the Road scheme during the Design year (2028)***

Road link	Do-nothing	With scheme	% reduction	Significance
1. O'Hanrahan Bridge (urban)	27,909	12,746	54.33%	Moderate benefit
2. N25 Waterford Rd (rural)	20,371	5,208	74.43%	Moderate benefit
3. R700 New Ross - N30 (urban)	10,996	4,081	62.89%	Major benefit
4. N30 Enniscorthy Rd (rural)	16,709	8,290	50.39%	Not significant
5. N25/N30 Wexford Rd (urban)	12,306	6,089	50.52%	Moderate benefit

Both *Tables 6.5* and *6.6* show that the road scheme will result in positive impact along the various five road links. Regarding the urban population of New Ross town (represented by road links 1, 3 and 5), positive impacts of moderate significance will arise during the Opening and Design years, with positive impacts of major significance arising for link 3 during by the Design year. The secondary and local roads within the town will also have a commensurate reduction in traffic flows, with similar benefits for the town's population. The reduction in traffic flows will result in reduced severance, visual impacts, noise and traffic emissions. The benefits of reductions in air pollution and noise emissions are covered in *Chapters 7* and *8*, respectively.

(1) These guidelines do not apply to roads where traffic flows are relatively low and, thus, do not apply to roads where the AADT is less than 8,000 vehicles.

6.5.2 *Road users*

While the population in New Ross and its hinterland of the road scheme will benefit, specific residents adjacent to the alignment will be negatively impacted by changes to the existing local road network. These negative impacts are covered later in *Chapters 7* (*Air Quality and Climatic Factors*), *8* (*Noise and Vibration*) and *9* (*Landscape Resources*).

Table 6.7 below presents the criteria that will be used to assess the effects on the local roads (and the road users). The criteria are based on those found in the *DMRB: Volume 11: Environmental Assessment*.

Table 6.8 lists the roads affected by the road scheme. *Table 6.7* also covers any mitigation (e.g. replacement structures) and an assessment of the residual impact significance for each of the affected roads.

Table 6.7 Criteria for assessing the effects on road and road users

Impact significance	Road users	Guideline criteria
Not significant	P, C, V	No appreciable change in journey distance
Minor negative	P	Increase in journey length by 100 - 250m, ***or***
		Grade-separated junction or roundabout to be negotiated, or at-grade crossing of a new major road (AADT >8,000)
	C	Increase in journey length by 400 - 1,000m, ***or***
		New roundabout or major junction to be negotiated
	V	Journeys increased by up to 5 minutes
Moderate negative	P	Increase in journey length by 100 - 250m, *plus* grade-separated junction or roundabout or at-grade crossing of a new major road to be negotiated, ***or***
		Journeys increased by 250 - 500m
	C	Increase in journey length by 400 - 1,000m, *plus* new roundabout or major junction to be negotiated, ***or***
		Journeys increased by 1,000 - 2,000m
	V	Journeys increased by to 5 - 10 minutes
Major negative	P	Increase in journey length by 250 - 500m, *plus* grade-separated junction or roundabout or at-grade crossing of a new major road to be negotiated, ***or***
		Journeys increased by over 500m
	C	Increase in journey length by 1,000 - 2,000m, *plus* new roundabout or major junction to be negotiated, ***or***
		Journeys increased by over 2,000m
	V	Journeys increased by more than 10 minutes

P = pedestrian road users
C = cyclists road users
V = vehicle road users

Table 6.8 *Elements of the existing road network affected by the New Ross Bypass*

Road Name	Chainage	Road Type	Design Element	Impact on road users
Regional Roads				
N25 North Tie-in *(to be re-classified)*	N25 0,000	Single carriageway with climbing/right turn lane	Tie-in to roundabout at Glenmore Junction	Minor negative for P and C; Not significant for V
R733	N25 3,980	Single carriageway with right turn lanes	Road bridge (B04)	Not significant for P, C and V
N25 West Tie-in (to be re-classified)	N25 8,650	Single carriageway	Tie-in to roundabout at Ballymacar Bridge	Minor negative for P and C; Not significant for V
Local Roads				
LS-7501 realignment	N25 0,000	Single carriageway	Road realignment and tie-in to roundabout	Minor negative for P and C; Not significant for V
LS-7513 realignment	N25 0,100	Single carriageway	Road realignment and bridge (B01)	Not significant for P, C and V
LS-7512 (existing)	N25 1,350	Single carriageway	Road bridge (Barrow Bridge)	Not significant for P, C and V
L-4026-2 realignment	N25 2,350	Single carriageway	Road realignment and bridge (B03)	Not significant for P, C and V
L-4026-1 realignment	N25 3,050 to 3,320	Single carriageway	Road Realignment	Not significant for P, C and V
L-8049-1 realignment	N25 4,400	Single carriageway	Road realignment and bridge (B05)	Not significant for P, C and V
L-8047-1 realignment	N25 4,500 to 4,900	Single carriageway	Road Realignment	Not significant for P, C and V
L-8048-1 realignment	N25 5,400 to 5,700	Single carriageway	Extinguishment and road realignment to tie-in to L-8046-1 south of the bypass	Moderate negative for V and C; Major negative for P
L-8046-1	N25 5,700	Single carriageway	Road bridge (B06)	Not significant for P, C and V
L-4021-2	N25 6,870	Single carriageway	Road bridge (B07)	Not significant for P, C and V
L-80434 realignment	N25 6,870 to 7,250	Single carriageway	Extinguishment and road realignment to tie-in to L-4021-2 south of the bypass	Not significant for P, C and V
L-80561 realignment	N25 8,650	Single carriageway	Extinguishment and road realignment to tie-in to a section of the Old Wexford road west of the bypass	Not significant for P, C and V

Road Name	Chainage	Road Type	Design Element	Impact on road users
Old Wexford road at Ballymacar Bridge	N25 8,650	Single carriageway	Extinguishment and road realignment to tie-in to L-80561 realignment east of the bypass (B08)	Not significant for P, C and V
L-4008	N30 1,900	Single carriageway	Road bridge (B09)	Not significant for P, C and V
L-4013-2 realignment	N30 2,600	Single carriageway	Road realignment and bridge (B10)	Not significant for P, C and V
L-4007-3	N30 3,310	Single carriageway	Road bridge (B11)	Not significant for P, C and V
L-4003-3 realignment	N30 4,600 to 5,000	Single carriageway	Extinguishment and road realignment to tie-in to roundabout at Corcoran's Cross.	Moderate negative for P; Minor negative for C; Minor negative for V.
L-4003-2 realignment	N30 4,900	Single carriageway	Extinguishment and road realignment to tie-in to the old N30 North of Corcoran's Cross Roundabout.	Not significant for P, C and V
Old N30 North of Corcoran's Cross Roundabout *(to be re-classified)*	N30 5,000 to N30 East Tie-in 1,200	Single carriageway	Extinguishment and tie-in to N30 North Tie-in and L-4003-2 realignment	Not significant for P, C and V
Link Roads				
LS7513 West Tie-in	N25 0,100	Single carriageway	New roadway	Not significant for P, C and V
LS7513 East Tie-in	N25 0,100 to 0,200	Single carriageway	New roadway	Not significant for P, C and V
LS7513 South Tie-in	N25 0,150	Single carriageway	New roadway	Not significant for P, C and V
LS7512 South Tie-in	N25 0,200	Single carriageway	New roadway	Not significant for P, C and V
L-4026 West Tie-in	N25 3,600 to 3,750	Single carriageway	Tie-in to roundabout (R733) at Landscape	Minor negative for P and C; Not significant for V.
L-4026 East Tie-in	N25 3,800 to 3,930	Single carriageway	Tie-in to roundabout and R733 at Landscape.	Not significant for P, C and V
Stokestown Port Access Road	N25 3,800	Single carriageway	Tie-in to roundabout (R733) at Landscape	Minor negative for P and C; Not significant for V.
L-8049-1 South Tie-in	N25 4,380 to 4,470	Single carriageway	Road realignment and tie-in to L-8049-1 realignment	Not significant for P, C and V

Table 6.8 shows that for the majority of road users (pedestrians, cyclists and vehicles), the road scheme will not have any impact on their respective use of the existing road network. This is because the proposed road scheme is not significantly increasing journey lengths for populations residing along the local road network. However there will be some negative impacts and these are discussed in the following section.

A major negative impact is predicted for pedestrian users of the local road L-8048-1. This minor road is being extinguished and the road being realigned to tie-in to the L-8046 to the south of the Bypass. This new road geometry will result in an increase in journey length of over 500 m for pedestrians. Moderate negative impacts are also predicted for vehicle and cyclists of this road.

A moderate negative impact is predicted for pedestrian users of the eastern end of the alignment (L-4003-3). This minor road is being replaced by the Corcoran's Cross junction and the associated L-4003-3 realignment and the N30 West Tie-in. Minor negative impacts are predicted for cyclists and for vehicle users of the L-4003-3.

Minor negative impacts are predicted for both pedestrian and cyclists using the existing N25 Kilkenny side (Glenmore junction), LS-7501 realignment, Stokestown Port Access Road, L-4026 West Tie-in (R733 junction) and the N25 Wexford side (Ballymacar Bridge junction).

6.5.3 Economic Effects

6.5.3.1 Cost-benefit

A COBA Cost Benefit appraisal has been carried out using COBA 11 (Release 6) in accordance with National Road Authority Guidelines for Cost Benefit Analysis (June 2005). The analysis was carried out using both Low and High traffic growth rate.

This analysis has indicated a positive cost benefit ratio with saving to both travel time and fuel consumption. The scheme costs were Discounted to 2002 with a Discount Rate of 4.0% and have an Evaluation Period of 30 YEARS with the First Scheme Year (Opening Year) being 2013.

6.5.3.2 Economics effects on New Ross

The proposed Bypass will be removing approximately 54% of traffic volumes from New Ross. There exists, therefore, the potential for negative economic impacts to arise to local towns and businesses due to the significant reduction in passing traffic, and thus, potential business.

Chase and Gustavson (2004), in their report prepared for the Department of Transportation and Public Works (Province of Nova Scotia) titled *'Economic Impacts of Highway Bypass Development on Communities'*, reviewed existing literature on the subject of the economic effects on bypassed towns. They note that:

"The key findings indicate that the development of a highway bypass results in short-term [negative] impacts, primarily to drive through traffic-dependent businesses, but little or no significant long-term economic effects overall. In addition, the magnitude of negative impacts is lessened with a pre-existing strong economic base within the community, or history of being a trade centre for the region…"

In a research project by the Wisconsin Department of Transportation (1998) titled '*The Economic Impacts of Highway Bypasses on Communities*' specifically studied the economic effects of 17 bypassed towns and communities in Wisconsin, USA. The size of the communities studied ranged in population size from 304 and up to 28,089. The studied used a number of methodologies and techniques, such as existing data analysis using GIS, focus group interviews and original route travel surveys.

The study reached four main findings:

1. There is little evidence that bypasses adversely impact the overall economies of most communities. Smaller communities have a greater potential to be impacted economically by a bypass.

2. Over the long term, average traffic levels on 'old [original] routes' in medium and larger communities are close to pre-bypass levels, indicating continued economic activity in those communities, and the opportunity for all kinds of retail trade to flourish, including traffic dependent businesses.

3. 'Retail flight' in Wisconsin bypass communities is not apparent, meaning there are very few retail businesses that are newly developed or relocated from town centres to near bypass facilities.

4. Communities consider their bypasses to be beneficial overall, while understanding that a bypass brings a number of changes for a community and individual businesses that need to be addressed proactively to ensure the maximum benefits and minimal adverse impacts.

Given the regional economic and retail importance of New Ross and its relatively large population size, it is unlikely that the town will suffer significant short-term negative economic effects, although a down-turn in passing traffic volumes is likely to result in some negative economic effects in the town.

In the longer-term, it is likely that the reduction in traffic flows will result in economic benefits because of reduced congestion, improved quality of life and townscape, and reduced journey times (specifically for those travelling to the town).

6.6 MITIGATION MEASURES

6.6.1 *Construction*

Mitigation measures regarding construction will be undertaken and will comprise implementation of good practice construction management and control. These measures are covered in *Sections 7.4.2* (Air Quality and Climatic Factors), *8.4.1* (Noise and Vibration) and *9.5* (Landscape Resources).

In addition, the contractor will be required to develop and implement an Environmental Operating Plan (EOP) with the local authority and the NRA in advance of any construction works. The contractor will have regards to the *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan* (National Roads Authority, 2007).

Any temporary road closures will be notified in advance. Diversion and alternative routes will be agreed with the local authority in advance. Adequate road and directional signage, informing all road users of the diversion and alternative routing, will be put in place in advance of the temporary road closure. Appropriate reductions in speed limits, if applicable, will apply to all temporary diversions and alternative routes.

Other mitigation measures of relevance to Human Beings are covered in the Air Quality and Climatic Factors; Noise and Vibration and the Landscape Resources chapters.

6.6.2 *Operation*

To address potential short-term and long-term socio-economic impacts when the Bypass opens, signage will be put in place in accordance with the NRA Policy on the Provision of Tourist & Leisure Signage on National Roads to notify all road users of the facilities available in New Ross. Specific signage will be put in place which encourages cyclists and pedestrians to use the old national primary route, rather than the Bypass route.

Mitigation has also been considered in the form of replacement structures (B01 - B11) to facilitate access along the local roads. Such structures will maintain the original access route following the opening of the Bypass.

6.7 RESIDUAL IMPACTS

The residual impact of construction is a negative impact of moderate significance due to disruption and nuisance resulting from the construction of the scheme. While the various mitigation measures and the development of an Environmental Operating Plan will reduce the significance of these impacts to slight, they will still remain for the duration of the construction phase, which will be approximately 36 months.

For the duration of construction, the local economy will receive a positive impact of slight significance due to local spending by construction workers and indirect/spin-off, positive, economic impacts as a result of the construction of the scheme.

A Cost Benefit analysis has indicated a positive cost benefit ratio for the Bypass, with savings to both travel time and fuel consumption. The scheme costs were Discounted to 2002 with a Discount Rate of 4.0% and have an Evaluation Period of 30 years with the First Scheme Year (Opening Year) being 2013.

The opening of the Bypass will result in positive impacts of moderate significance for New Ross due to traffic flow reductions of approximately 54% for the Opening year and positive impacts of moderate to major significance (approximately 54%) by the Design year. The reduction in traffic flows will result in reduced severance, visual impacts, noise and traffic emissions.

The opening of the scheme is likely to result in short-term negative impacts of slight significance regarding the economy of New Ross and the surrounding areas. However, in the medium to longer-term, positive economic benefits are likely to arise through reduced congestion, improved quality of life and townscape, and reduced journey times (specifically for those travelling to the town).

The provision of the Bypass will not result in any significant negative impacts for the majority of the various road users along the existing roads which will interact with the Bypass alignment. While these road users will be impacted during temporary road closures, once the scheme is completed the replacement structures (*Table 6.8*) will ensure that there is no significant impact for the majority of roads.

However, for some road users, negative impacts will arise, essentially due to increased journey times and longer distances. Minor negative impacts arise for pedestrians and cyclists at the key junctions along the alignment (Glenmore, R733, Ballymacar Bridge and Corcoran's Cross), and also at the local road LS-7501 (will be realigned to connect to the Glenmore junction).

The realignment of L 8048-1 will result in moderate negative impacts for vehicles and cyclists and major negative impacts for pedestrians. The reason for these impacts is that the extinguishment and realignment of the L 8048-1 will increase journey times and distances for all road users.

The extinguishment and realignment of the L-4003-3 will result in moderate negative impacts for pedestrians and minor negative impacts for other road users. L-4026-1 West tie in and Stokestown Port local road proposals will result in minor negative for pedestrians and cyclists.

7 AIR QUALITY AND CLIMATIC FACTORS

7.1 INTRODUCTION

This chapter examines effects on local air quality and emissions of greenhouse gases. Aspects considered are construction effects, the effects of the reduction in vehicle flows in the town of New Ross and climate change related emissions. The NRA has issued "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*", and these have been referred to during the completion of this assessment.

7.2 METHODOLOGY

7.2.1 Overview

The baseline environment has been described with reference to the air monitoring data that is collected at the air monitoring stations around Ireland operated by the *Environmental Protection Agency* (EPA). Air monitoring data is not available for the New Ross area and therefore data has been extrapolated from the nearest monitoring areas, taking into account the similarities and differences of the relevant areas.

Potential sources of air emissions have been identified for both the construction phase and the operational phase. During the operational phase the source of the air emissions is related to traffic, whilst the key issues during the construction phase are considered to be potential emissions from construction dust and construction traffic.

7.2.2 Construction Impacts

7.2.2.1 Construction Traffic

Construction traffic data as provided by MMP indicates that the maximum construction movements could be 366 per day (which includes the maximum movements for earthworks, deliveries and internal movements, plus the maximum perceived amount of vehicles required for the delivery of concrete).

The construction of the scheme will take place progressively along the length of the proposed road. It is anticipated that construction traffic will arrive and leave through the N25 Waterford Road and the N30 Enniscorthy Road, where it will result in an increase in traffic flows of approximately 3 and 3.6% respectively. The predicted construction traffic movements are relatively low in air quality terms and will be short term in nature. On this basis, the impacts from construction traffic travelling along the route of the proposed scheme have therefore been scoped out of this assessment.

7.2.2.2 *Construction Dust*

There are no established criteria for the assessment of dust deposition arising from construction sites. A risk-based approach has therefore been developed to identify construction activities with the potential to generate significant quantities of dust near to sensitive receptors. Construction sites are a temporary operation and some degree of nuisance would normally be tolerated if the activity lasts for no more than a few months. Studies highlighted by the Building Research Establishment also suggest that nuisance is unlikely to occur at distances greater than 50 metres from a construction site boundary (1). One of these has also shown that at least half the people living within 50 metres of the site boundary of a road construction scheme were seriously bothered by construction nuisance due to dust, but that beyond 100 metres less than 20 percent of the people were seriously bothered.

On this basis, a risk evaluation matrix has been devised and is presented in *Table 7.1* below. This has been used to determine the significance of effects arising from construction dust deposition without mitigation.

Table 7.1 Evaluation of Potential Significant Effects of Dust Deposition

Duration of on-site dust raising activity	Distance from Site Boundary to Sensitive [(a)] Receptors (m)		
	< 50 m	50 – 100 m	> 100 m
> 12 months	Significant	Significant	Potentially Significant
6 – 12 months	Significant	Potentially Significant	Not Significant
< 6 months	Potentially Significant	Not Significant	Not Significant

(a) Sensitive receptors defined as: residential, commercial office, hospital, surgery etc

7.2.3 *Operational Impacts*

For the operational phase of this project the impact of the air emissions is modelled using the methodology described in the Design Manual for Roads and Bridges (DMRB) *(Version 1.3c, Highways Agency, July 2007)*. Traffic modelling data was used to indicate any changes in traffic flow for operational phase of the project.

The operational phase of the project is assessed by comparison of modelled predictions of pollutant concentrations in two scenarios; *Do Nothing* and *Do Something.* The *Do Nothing* scenario represents the existing situation whilst the *Do Something* represents the proposals for the new road links and the changes to the existing road network. These scenarios have been assessed for both the Opening year (2013) and the Design year (2028), which is approximately fifteen years after the scheme is planned to have opened. Air quality impacts can therefore be identified and evaluated for each of these scenarios. Any impacts are then evaluated in terms of significance through comparison with appropriate air quality standards.

(1) Buildings Research Establishment (BRE) (2003). Control of dust from construction and demolition activities. Kukadia, V., Upton, S. and Hall, D. BRE Bookshop, London. February 2003.

Annual Average Daily Traffic (AADT) flows for 2013 and 2028 are provided in *Tables 5.1* and *5.2* for the three sections of the proposed road and the existing road network that will be affected by the proposals. This data has been used within the DMRB air quality assessment model. A heavy goods vehicle percentage of 14% has been assumed (based on the Route Selection Report) and an average speed of 100 km/hr has been assumed for the new road and 60 km/hr for existing roads.

Representative background pollutant concentrations for 2013 have been estimated based on values for 2005. This methodology only allows pollutant concentrations to be predicted to 2020; therefore, the modelling for 2028 is based on estimated background concentrations for 2020. This is a worst case scenario, as it is predicted that baseline pollutant concentrations will fall over time due to future improvements in fuel/engine technology.

7.2.4 *Criteria*

Air quality standards have been developed for Ireland within a framework of extensive European Legislation. These air quality standards are enshrined in S.I. No. 271 of 2002 Air Quality Standards Regulations, 2002.

The legislation defines limit values for various airborne pollutants such as nitrogen dioxide (NO_2), oxides of nitrogen (NO_x) and particulate matter with a diameter of less than 10 microns (PM_{10}). For several of the pollutants, limit values were set to be achieved by 2005, with new tighter limits applicable from 2010 and reducing margins of tolerance between these two dates. Pollutants and their limit values, associated with the protection of human health from traffic emissions, have been defined and given in *Table 7.2* below. *Table 7.3* refers to vegetation-related protection limits for NO_x.

Table 7.2 ***Limit Values Relating to the Protection of Human Health***

Pollutant	Limit Concentration	Measured as
	To be achieved by 2010 (1)	
Nitrogen Dioxide (NO_2)	200µg/m³ not to be exceeded more than 18 times per calendar year	1 hour mean
	40 µg/m³	Annual mean
PM_{10}	50 µg/m³ not to be exceeded >7 times per calendar year	24 hour mean
	20 µg/m³	Annual mean

(1) 2007 limits have to be reduced each and every year to reach this amount by 2010

Table 7.3 *Limit Values Relating to the Protection Of Ecosystems And Vegetation*

Pollutant	Limit Concentration	Measured as
Nitrogen Oxides (NO_x)	30 µg/m³	Annual mean

7.2.5 *Greenhouse Gas Emissions*

The DMRB air quality model was also used to estimate the change in carbon emissions as a result of the scheme. Data on the daily vehicle kilometres travelled on the modelled network were provided for the 2013 and 2028 Do Nothing and Do Something scenarios, so that CO_2 emissions could be calculated in each case.

7.3 *BASELINE ENVIRONMENT*

7.3.1 *Current Air Quality*

The EPA does not have any monitoring stations in this area. The closest EPA monitoring stations to the development are shown in *Figure 7.1,* described and listed in *Table 7.4*. In addition to monitoring data, the EPA has classified Ireland into four main categories with regards to air quality. The four zones (A, B, C and D) are defined in the Air Quality Regulations (2002) as follows:

Zone A: Dublin Conurbation

Zone B: Cork Conurbation

Zone C: Other Cities and Large Towns comprising Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee and Dundalk

Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C. New Ross town and environs falls into this zone.

Figure 7.1 ***EPA monitoring stations in the vicinity of the development***

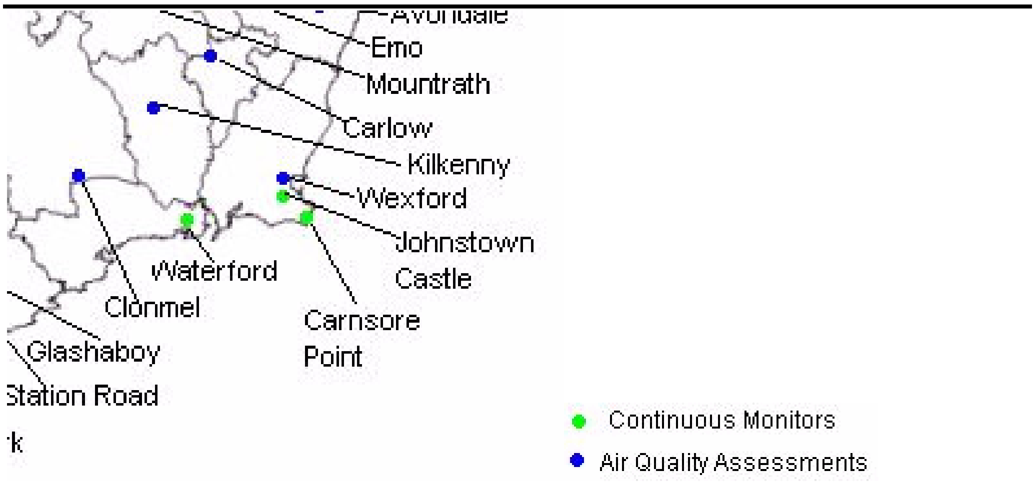


Table 7.4 ***EPA monitoring stations closest to the development***

Location	Zone	Type of station	Pollutants Monitored
Waterford	C	Continuous	NO_x, SO_2, PM_{10}, CO, Benzene & Metals
Wexford	C	Air Quality Assessments	NO_x, SO_2 & PM_{10}
Johnstown Castle	D	Continuous	Ozone
Carnsore Point	D	Continuous	PM_{10}

The Carnsore Point site is located at a remote coastal location in Co. Wexford. It is operated by the EPA's Environmental Research Centre. PM_{10} measurements at this site became part of the National Network on 1 January 2006. None of the results have been made available to date. Analysis of the PM_{10} measured at Carnsore Point has shown that typically over half of it is sea salt and not traffic related. Relevant data could not therefore be obtained from this site.

The Wexford site is located to one side of the EPA headquarters in the grounds of Johnstown Castle outside Wexford town. Monitoring is done using a continuous analyser for ozone. Data is available from 1999 to the current year. All of the results recorded at the station in 2005 (the most recent year for which the EPA have published a '*Air Quality in Ireland*' report) showed concentrations were within the current legal limit values and limit values defined for 2010.

The EPA has classified the Johnstown Castle site as '*Good*' in terms of air quality. This classification is made on the basis of comparison of the recorded ozone concentrations with the index shown in *Table 7.5* below. This index also shows the typical values that one would expect to record for other air pollutants in areas classified as having 'Good' air quality.

As New Ross is designated as Zone D, the monitoring results from Waterford and Wexford (both Zone C) are not comparable. The pollutants monitored at the Johnstown Castle and Carnsore Point monitoring sites are not directly relevant to this assessment. Consequently, the National average for Zone D areas has been used in the assessment. These data are presented below.

7.3.1.1 EPA Air Quality in Ireland 2005

Other Zone D areas in which relevant parameters were recorded include Mountrath, Drogheda, Castlebar, Glashboy and Kilkitt. The average result for Zone D for the relevant parameters is presented in *Table 7.5.*

Table 7.5 Zone D average air quality results

	SO_2 µg/m³ Annual Mean	NO_2 µg/m³ Annual Mean	O_3 µg/m³ Annual Mean	CO mg/m³ Annual Mean	PM_{10} µg/m³ Annual Mean	Benzene µg/m³ Annual Mean
Zone D average results	3.33	7.66	58.66	0.3	18	0.03

Comparing these results with the Index of classification in *Table 7.6* below would suggest that the air quality in Zone D areas could be classified as 'Very Good'. Therefore, for the basis of this assessment, it is assumed that the air quality in the New Ross area is similar to other Zone D areas and can be classified as 'Very Good'. This is consistent with a rural area unaffected by roads or industry. The average figures were used in the DMRB air quality model to represent background pollutant concentrations in the area.

Table 7.6 EPA Index for classification of Air Quality

	SO_2 µg/m³ (1 hr. avg.)	NO_2 µg/m³ (1 hr. avg.)	O_3 µg/m³ (1 hr. avg.)	PM_{10} µg/m³ (24 hr. avg.)
Very Good	0 - 49	0 - 36	0 - 39	0 - 19
Good	50 - 129	37 - 94	40 - 119	20 - 49
Fair	130 - 209	95 - 139	120 - 179	50 - 74
Poor	210 - 349	140 - 199	180 - 239	75 - 99
Very Poor	≥ 350	≥ 200	≥ 240	≥ 100

Additional baseline monitoring for PM_{10} and NO_2, has not been carried out, as the area is classified as Zone D and the route corridor is through a very rural setting with little or no anthropogenic inputs. Based upon this information it has been assumed that the pollutant concentrations are currently well below the air quality standards. A dedicated monitoring programme in and around the area of the new road would be highly unlikely to reveal concentrations of the key pollutants in excess of those found in other parts of rural Ireland. The

DMRB air quality modelling predicts pollutant concentrations beside the existing road network based on the traffic data provided.

7.3.2 *Climate*

The nearest and most relevant *Met Eireann* meteorological station to the site is the station in Kilkenny. The most recent 30-year average report on climate factors for this location relates to the years 1961 – 1990. The annual mean values for climate factors for this period are shown in the *Table 7.7*. There are no major obstructions or natural barriers (e.g. mountains) between the proposed site and the meteorological station. Therefore, the wind and weather patterns recorded at Kilkenny are likely to be similar to that experienced along the proposed route.

Table 7.7 ***Annual mean values for 1961 - 1990***

	Parameter	**Units**	**Annual Mean Value 1961 - 1990**
Temperature	Mean Daily Max.	°C	13.4
	Mean Daily Min.		5.2
	Mean		9.3
Relative Humidity	Mean at 0900UTC	%	84
	Mean at 1500UTC		71
Sunshine	Mean daily duration	Hours	3.51
	Mean no. of days with no sun		65
Rainfall	Mean monthly total	mm	822.8
	Greatest daily total		66.4
Wind	Mean monthly speed	knots	6.5
	Mean no. of days with gales		1.4
Weather – mean number of days with:	Snow or sleet	days	17.3
	Snow lying at 0900UTC		4.1
	Hail		10.4
	Thunder		5
	Fog		44.4

7.3.3 *Greenhouse Gas Emissions* (1) (2)

The main greenhouse gas emitted in Ireland is carbon dioxide (CO_2), mainly arising from the burning of fossil fuel in transport, heating and electricity generation.

(1) Irelands Environment 2004 - the State of our Environment, EPA, April 2004
(2) Environment in Focus 2006 - Environmental Indicators for Ireland, EPA, 2006

It is estimated that private vehicles contribute 60% of all transport sector greenhouse gas emissions and freight vehicles contribute 35%. In 1990, the transport sector contributed approximately 15.7% of Ireland's CO_2 emissions and 9.5% of base year greenhouse gas emissions. However, transport sector greenhouse gas emissions are forecast to increase by almost 180% in the period from 1990 to 2010.

7.4 CONSTRUCTION IMPACTS AND MITIGATION MEASURES

7.4.1 Sources of Potential Air Pollutants

The construction of the Bypass is predicted to take 36 months to complete, during which time there is the potential to impact on air quality in the vicinity of the project. There are two main categories of air pollutants that can arise from the construction of a road – dust (nuisance dust (1)) and non-dust pollutants. Dust emissions are typically but not exclusively associated with the physical operations on site, eg crushing, driving on paved roads, earth moving etc. whereas the non-dust emissions are associated with the mechanical operations, eg generators, engines. The extent to which these sources cause nuisance or air quality impacts is dependent upon the effectiveness of control measures and the proximity of people and residences to the source. Effective on-site management can significantly control the emissions of these substances on-site.

Construction traffic and equipment also has the potential to cause and impact on local air quality.

7.4.2 Dust Emissions

Dust emissions have been highlighted as possible factors influencing local air quality. Areas on the proposed site likely to be sources of dust have been identified and are listed below:

- stockpiles of earth for landscaping and building;
- stripping;
- demolition of any existing structures;
- traffic on haul roads; and
- soiling of main roads.

As the road construction progresses it is standard construction practice to lay a hardcore layer as soon as the landscaping of the alignment has been completed and services (drainage and underpasses) have been installed. This will assist in reducing the potential for dust to arise. Therefore the period of activity with the greatest potential for dust impact is during the earlier phases of the project.

(1) Dust is a generic term used to describe particles of varying size that can become airborne due to wind or mechanical abrasion and includes PM10 particles as mentioned in the baseline section.

Impacts caused by dust arising from the construction phase of the project are likely to be experienced within 100 m [1] of the site boundary. The ability of a particle to remain suspended in the air depends on its size, shape and density. The largest particles (i.e. greater 100 µm diameter) are likely to settle within 6m to 10 m of their source and particles between 30 µm and 100 µm diameter within 100m of the source, under a typical mean wind speed of 4 ms^{-1}. Smaller particles, particularly those below 10 µm in diameter, are more likely to have their settling rate retarded by atmospheric turbulence and to be transported further. Typical wind speeds in the area are reported to be 3.3 ms^{-1}.

One study [2] has shown that at least half the people living within 50m of the boundary of a road construction site were seriously bothered by noise, vibration, dust or loss of amenity due to the presence of heavy construction traffic but that beyond 100m less than 20% of the people were seriously bothered. The impact of dust, as a nuisance, will also be partially dependent on existing deposition rates. An increase will be more noticeable in areas with low background deposition rates. There is nothing to suggest that existing local dust deposition rates are unusually high or low for a rural area. It should be noted that the landscape is dominated by pasture which would reduce the level of naturally occurring dust arising from agricultural activities. On this basis it is considered that construction dust is likely to cause an impact at sensitive receptors within 100m of the source.

There are no national standards outlining the acceptable levels of deposited dust and evaluation of impacts has therefore been based on the matrix presented in *Table 7.1*.

The prevailing wind in the area of the development is from the south-west with an average strength of 3.3 ms^{-1}. The concentration of houses within 100 m of the development is low (approximately 78). In the absence of mitigation measures the impact at these properties within 100m of the development is likely to be 'potentially significant' for construction activities greater than 12 months in duration and insignificant for activities of less than 6 months in duration.

7.4.3 Non-Dust Emissions

Non-dust emissions, e.g. NO_x, SO_2, CO_2, are less likely to be an issue given the short duration of the construction phase, the phased basis of the construction and the comparatively lower vehicle activity. Sources of non-dust pollutants on the proposed site have been identified and are listed below:

- vehicles; and
- generators/motors.

(1) Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England, Office of the Deputy Prime Minister, London, March 2005.
(2) Baughan CJ (1980) Nuisance from road construction: a study at the A31 Poulner Lane Diversion. Ringwood: TRRL Supplementary Report 562. From: Design Manual for Roads and Bridges, 1994.

It is predicted that construction traffic will result in a small increase in traffic along the N25 Waterford Road and the N30 Enniscorthy Road (3 and 3.6% respectively). This small increase in traffic flows is not significant enough to cause an impact on air quality (increases greater than 10% require assessment) and as such the impact of construction traffic on the surrounding road network has been scoped out of this assessment.

7.4.4 *Mitigation Measures*

Management of the activities on site can effectively reduce the potential for dust to arise and cause a nuisance at nearby receptors. By identifying any on-site practices and activities that might be especially liable to generate dust (e.g. excavation, stockpiles), control measures can be put in place and therefore reduce potential impacts to a minimum. The main mitigation measure for both dust and non-dust emissions will be through the implementation of appropriate management programmes and the Contractor's Environmental Operating Plan.

The effectiveness of the mitigation measures can be assessed through continual monitoring of emissions during the construction phase. The Contractor's Environmental Operating Plan will include dust deposition monitoring in areas close to where construction activities are being carried out. The Environmental Operating Plan will take into consideration best practice [(1)] and the NRA *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*.

7.5 *OPERATIONAL IMPACTS AND MITIGATION MEASURES*

7.5.1 *Overview*

Once the scheme is operational, the flow of traffic in and around New Ross will be significantly altered. The most obvious effect of the scheme will be to divert a significant number of vehicles from the N25 between the Glenmore Junction to Ballymacar Bridge and from the N30 between Corcoran's Cross and its current junction with the N25, onto the Bypass and therefore out of the centre of New Ross. *Chapter 5* on *Traffic* indicates that the reduction in traffic volumes through New Ross and the regional roads will be approximately 50% - 74% in the Opening and Design years of the Bypass. A qualitative assessment of this would suggest that the diversion of traffic from O'Hanrahan Bridge and New Ross town centre will improve the general environs of New Ross and the air quality in the town centre. These assumptions have been based on the fact that the Bypass will be removing approximately of 18,000 vehicles per day from New Ross. Congestion will be reduced within the town, which in turn will reduce air quality emissions,

(1) For example: Building Research Establishment (2003) Guidance on the control of dust from Construction and Demolition Activities, February; V Kukadia, S Upton, C Grimwood, C Yu (2003) Controlling particles, vapour and noise pollution from construction sites, Part 1-5.

travel times and distances. The air quality modelling results presented in this chapter form the qualitative assessment of this impact.

7.5.2 *Modelling Results*

During operation the emissions from the vehicles using the Bypass will be the main source of pollution. Pollutants associated with vehicle emissions that are of concern for human health are principally nitrogen dioxide (NO_2) and particulate matter (PM_{10}). Nitrogen oxides (NO_x) also have the potential to impact on sensitive vegetation and ecosystems.

The modelled results for the Opening year (2013) and Design year (2028) for each of the road links in the current network are presented in *Tables 7.8-7.10* and for the Bypass in *Tables 7.11-7.13*. Three receptor distances have been modelled: 10, 20 and 30m back from the source line, which the DMRB air quality model assumes to be the middle (centre-line) of the Bypass. Therefore the 10m band would be at the edge of the road in the case of the dual carriageway and approximately 6m out from the edge of the road in the case of a standard road (assuming 3.5m wide road and 0.5m hard shoulder).

Table 7.8 ***Summary of the Results of the DMRB Assessment for 2013 & 2028 Traffic Flows at Theoretical Residential Properties Located Ten Metres from the Centre of the Carriageway (Annual Average Concentrations in μg m^{-3})***

Scenario / Pollutant	**NO_X**		**NO_2**		**PM_{10}**	
	2013	*2028*	*2013*	*2028*	*2013*	*2028*
Road Link 1 O' Hanrahan Bridge						
Do Nothing	**37.0**	**32.7**	14.1	13.1	17.9	17.7
Do Something	25.6	24.8	11.2	11.0	17.0	17.1
Difference	*-11.4*	*-7.9*	*-2.9*	*-2.1*	*-0.9*	*-0.6*
Change as % of criterion	*-38.0*	*-26.3*	*-7.3*	*-5.3*	*-2.3*	*-1.5*
Road Link 2 N25 Waterford Road						
Do Nothing	**33.8**	29.9	13.3	12.4	17.6	17.5
Do Something	16.3	15.5	8.6	8.4	16.3	16.4
Difference	*-17.5*	*-14.4*	*-4.7*	*-4.0*	*-1.3*	*-1.1*
Change as % of criterion	*-58.3*	*-48.0*	*-11.8*	*-10.0*	*-3.3*	*-2.8*
Road Link 3 R700 New Ross to N30						
Do Nothing	23.1	22.6	10.6	10.5	16.8	16.9
Do Something	15.5	14.2	8.3	7.9	16.3	16.3
Difference	*-7.6*	*-8.4*	*-2.3*	*-2.6*	*-0.5*	*-0.6*
Change as % of criterion	*-25.3*	*-28.0*	*-5.8*	*-6.5*	*-1.3*	*-1.5*
Road Link 4 N30 Enniscorthy Road						
Do Nothing	**30.4**	28.3	12.5	12.0	17.4	20.2
Do Something	20.1	19.3	9.7	9.5	16.6	19.1
Difference	*-10.3*	*-9.0*	*-2.8*	*-2.5*	*-0.8*	*-1.1*
Change as % of criterion	*-34.3*	*-30.0*	*-7.0*	*-6.3*	*-2.0*	*-2.7*
Road Link 5 N25/N30 Wexford Road						
Do Nothing	25.2	24.2	11.1	10.9	17.0	17.0
Do Something	17.4	16.6	8.9	8.7	16.4	16.5
Difference	*-7.8*	*-7.6*	*-2.2*	*-2.2*	*-0.6*	*-0.5*
Change as % of criterion	*-26.0*	*-25.3*	*-5.5*	*-5.5*	*-1.5*	*-1.3*
Assessment Criterion	**30**		**40**		**40**	

Table 7.9 Summary of the Results of the DMRB Assessment for 2013 & 2028 Traffic Flows at Theoretical Residential Properties Located Twenty Metres from the Centre of the Carriageway (Annual Average Concentrations in µg m^{-3})

Scenario / Pollutant	**NO_X**		**NO_2**		**PM_{10}**	
	2013	*2028*	*2013*	*2028*	*2013*	*2028*
Road Link 1 O' Hanrahan Bridge						
Do Nothing	**30.4**	27.0	12.5	11.6	17.4	17.2
Do Something	21.8	21.0	10.2	10.0	16.7	16.8
Difference	*-8.6*	*-6.0*	*-2.3*	*-1.6*	*-0.7*	*-0.4*
Change as % of criterion	*-28.7*	*-20.0*	*-5.8*	*-4.0*	*-1.8*	*-1.0*
Road Link 2 N25 Waterford Road						
Do Nothing	28.0	24.9	11.9	11.1	17.2	17.1
Do Something	14.8	14.0	8.1	7.9	16.2	16.3
Difference	*-13.2*	*-10.9*	*-3.8*	*-3.2*	*-1.0*	*-0.8*
Change as % of criterion	*-44.0*	*-36.3*	*-9.5*	*-8.0*	*-2.5*	*-2.0*
Road Link 3 R700 New Ross to N30						
Do Nothing	19.9	19.4	9.6	9.5	16.6	16.7
Do Something	14.1	13.0	7.9	7.5	16.2	16.2
Difference	*-5.8*	*-6.4*	*-1.7*	*-2.0*	*-0.4*	*-0.5*
Change as % of criterion	*-19.3*	*-21.3*	*-4.3*	*-5.0*	*-1.0*	*-1.3*
Road Link 4 N30 Enniscorthy Road						
Do Nothing	25.5	23.7	11.2	10.8	17.0	19.7
Do Something	17.7	16.9	9.0	8.8	16.4	18.8
Difference	*-7.8*	*-6.8*	*-2.2*	*-2.0*	*-0.6*	*-0.9*
Change as % of criterion	*-26.0*	*-22.7*	*-5.5*	*-5.0*	*-1.5*	*-2.3*
Road Link 5 N25/N30 Wexford Road						
Do Nothing	21.5	20.6	10.1	9.9	16.7	16.8
Do Something	15.6	14.8	8.3	8.2	16.3	16.4
Difference	*-5.9*	*-5.8*	*-1.8*	*-1.7*	*-0.4*	*-0.4*
Change as % of criterion	*-19.7*	*-19.3*	*-4.5*	*-4.3*	*-1.0*	*-1.0*
Assessment Criterion	**30**		**40**		**40**	

Table 7.10 ***Summary of the Results of the DMRB Assessment for 2013 & 2028 Traffic Flows at Theoretical Residential Properties Located Thirty Metres from the Centre of the Carriageway (Annual Average Concentrations in μg m^{-3})***

Scenario / Pollutant	**NO_X**		**NO_2**		**PM_{10}**	
	2013	*2028*	*2013*	*2028*	*2013*	*2028*
Road Link 1 O' Hanrahan Bridge						
Do Nothing	25.7	22.8	11.3	10.5	17.0	16.9
Do Something	19.0	18.2	9.4	9.2	16.5	16.6
Difference	*-6.7*	*-4.6*	*-1.9*	*-1.3*	*-0.5*	*-0.3*
Change as % of criterion	*-22.3*	*-15.3*	*-4.8*	*-3.3*	*-1.3*	*-0.7*
Road Link 2 N25 Waterford Road						
Do Nothing	23.8	21.2	10.8	10.1	16.9	16.8
Do Something	13.6	12.9	7.7	7.5	16.1	16.2
Difference	*-10.2*	*-8.3*	*-3.1*	*-2.6*	*-0.8*	*-0.6*
Change as % of criterion	*-34.0*	*-27.7*	*-7.8*	*-6.5*	*-2.0*	*-1.5*
Road Link 3 R700 New Ross to N30						
Do Nothing	17.5	17.0	9.0	8.8	16.4	16.5
Do Something	13.1	12.1	7.5	7.2	16.1	16.2
Difference	*-4.4*	*-4.9*	*-1.5*	*-1.6*	*-0.3*	*-0.3*
Change as % of criterion	*-14.7*	*-16.3*	*-3.8*	*-4.0*	*-0.7*	*-0.8*
Road Link 4 N30 Enniscorthy Road						
Do Nothing	21.8	20.3	10.2	9.8	16.7	19.3
Do Something	15.9	15.1	8.4	8.2	16.3	18.6
Difference	*-5.9*	*-5.2*	*-1.8*	*-1.6*	*-0.4*	*-0.7*
Change as % of criterion	*-19.7*	*-17.3*	*-4.5*	*-4.0*	*-1.0*	*-1.8*
Road Link 5 N25/N30 Wexford Road						
Do Nothing	18.8	17.9	9.3	9.1	16.5	16.6
Do Something	14.3	13.5	7.9	7.7	16.2	16.3
Difference	*-4.5*	*-4.4*	*-1.4*	*-1.4*	*-0.3*	*-0.3*
Change as % of criterion	*-15.0*	*-14.7*	*-3.5*	*-3.5*	*-0.8*	*-0.8*
Assessment Criterion	**30**		**40**		**40**	

Overall, the 2028 baseline concentrations are lower than the 2013 baseline concentrations because of the predicted improvements in engine design and efficiency which mean that each car is emitting less pollution per kilometre between the two assessment years. Pollutant concentrations decay with distance from the centre of the road. This can be seen in the results for distances of 10 m, 20 m and 30 m where the results at 10m are greater than those at 20m, which are in turn greater than those at 30m.

The results indicate a decrease in pollutant concentrations along the existing roads in New Ross as a result of the proposed new road. This was predicted in the qualitative assessment, because of the significant drop in traffic numbers on the N25 and N30.

The greatest decrease in NO_2 concentrations is 4.7 µg m^{-3}, which occurs on Road Link 2 N25 Waterford Road. This decrease represents 11.8% of the NO_2 criterion. The corresponding largest decrease in PM_{10} concentrations is 1.3 µg m^{-3}, which also occurs on N25 Waterford Road and which represents 3.3% of the PM_{10} criterion. These decreases in pollutant concentrations can be considered significant positive impacts as they represent a decrease of greater than 1% of the relevant criterion.

There is no exceedance of the air quality limit values for the protection of human health in the *Do Something* scenario. The one place where there is an exceedance of the air quality limit value, predicted to occur within 10m of *Link 4, N30 Enniscorthy Road* in 2028 *Do Nothing*, is predicted to meet the limit value in the *Do Something* scenario, as a result of the introduction of the Bypass.

Therefore, the Bypass can be seen to have a positive impact on the air quality within the town of New Ross.

Table 7.11-7.13 below presents the results of the *Do Something* scenario for the road links that make up the Bypass. These results can only be compared to the background concentrations for the relevant years as there is no *Do Nothing* scenario for direct comparison.

Table 7.11 Summary of the Results of the DMRB Assessment for 2013 & 2028 Traffic Flows at Theoretical Residential Properties Located Ten Metres from the Centre of the Proposed Carriageway (Annual Average Concentrations in μg m-3)

Scenario / Pollutant	NO_X		NO_2		PM_{10}	
	2013	*2028*	*2013*	*2028*	*2013*	*2028*
Link 6 New Barrow Bridge						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	**31.4**	**30.7**	12.7	12.6	17.7	17.9
Difference	*+21.5*	*+21.5*	*+6.3*	*+6.4*	*+1.9*	*+2.0*
Change as % of criterion	*+71.7*	*+71.8*	*+15.8*	*+16.0*	*+4.7*	*+4.9*
Link 7 R733 to Ballymacar						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	21.2	26.6	11.7	21.2	17.4	17.5
Difference	*+11.3*	*+17.4*	*+5.3*	*+15.0*	*+1.6*	*+1.6*
Change as % of criterion	*+37.7*	*+58.1*	*+13.3*	*+37.5*	*+3.9*	*+3.9*
Link 8 Ballymacar Bridge to Corcoran's Cross 2013						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	21.8	21.2	10.2	10.1	16.9	17.1
Difference	*+11.9*	*+12.0*	*+3.8*	*+3.9*	*+1.1*	*+1.2*
Change as % of criterion	*+39.7*	*+40.1*	*+9.5*	*+9.8*	*+2.7*	*+2.9*
Assessment Criteria	**30**		**40**		**40**	

Table 7.12 Summary of the Results of the DMRB Assessment for 2013 & 2028 Traffic Flows at Theoretical Residential Properties Located Twenty Metres from the Centre of the Proposed Carriageway (Annual Average Concentrations in μg m-3)

Scenario / Pollutant	NO_X		NO_2		PM_{10}	
	2013	*2028*	*2013*	*2028*	*2013*	*2028*
Link 6 New Barrow Bridge						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	26.2	25.5	11.4	11.2	17.3	17.4
Difference	*+16.3*	*+16.3*	*+5.0*	*+5.0*	*+1.5*	*+1.5*
Change as % of criterion	*+54.4*	*+54.4*	*+12.5*	*+12.5*	*+3.7*	*+3.6*
Link 7 R733 to Ballymacar						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	23.0	22.4	10.5	10.4	17.0	17.2
Difference	*+13.1*	*+13.2*	*+4.1*	*+4.2*	*+1.2*	*+1.3*
Change as % of criterion	*+43.7*	*+44.1*	*+10.3*	*+10.5*	*+2.9*	*+3.1*
Link 8 Ballymacar Bridge to Corcoran's Cross 2013						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	18.9	18.3	9.4	9.2	16.6	16.8
Difference	*+9.0*	*+9.1*	*+3.0*	*+3.0*	*+0.8*	*+0.9*
Change as % of criterion	*+30.0*	*+30.4*	*+7.5*	*+7.5*	*+1.9*	*+2.1*
Assessment Criteria	**30**		**40**		**40**	

Table 7.13 Summary of the Results of the DMRB Assessment for 2013 & 2028 Traffic Flows at Theoretical Residential Properties Located Thirty Metres from the Centre of the Proposed Carriageway (Annual average concentrations in μg m-3)

Scenario / Pollutant	**NO_X**		**NO_2**		**PM_{10}**	
	2013	*2028*	*2013*	*2028*	*2013*	*2028*
Link 6 New Barrow Bridge						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	22.4	21.7	10.4	10.2	16.9	17.1
Difference	*+12.5*	*+12.5*	*+4.0*	*+4.0*	*+1.1*	*+1.2*
Change as % of criterion	*+41.7*	*+41.8*	*+10.0*	*+10.0*	*+2.7*	*+2.9*
Link 7 R733 to Ballymacar						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	20.0	19.3	9.7	9.5	16.7	16.9
Difference	*+10.1*	*+10.1*	*+3.3*	*+3.3*	*+0.9*	*+0.9*
Change as % of criterion	*+33.7*	*+33.8*	*+8.3*	*+8.3*	*+2.2*	*+2.4*
Link 8 Ballymacar Bridge to Corcoran's Cross 2013						
Background Concentration	9.89	9.17	6.4	6.2	15.84	15.95
Do Something	16.8	16.2	8.7	8.6	16.5	16.6
Difference	*+6.9*	*+7.0*	*+2.3*	*+2.4*	*+0.7*	*+0.7*
Change as % of criterion	*+23.0*	*+23.4*	*+5.8*	*+6.0*	*+1.7*	*+1.6*
Assessment Criteria	**30**		**40**		**40**	

As with the assessment of the existing road links, overall the 2028 baseline concentrations are lower than the 2013 baseline concentrations because of the predicted improvements in engine design and efficiency which means that each car is emitting less pollution per kilometre between the two assessment years. Pollutant concentrations decay with distance from the centre of the road. This can be seen in the results for distances of 10 m, 20 m and 30 m where the results at 10m are greater than those at 20m, which are in turn greater than those at 30m.

There is a small to medium increase in pollutant concentrations as a result of the new road. The greatest increase in NO_2 concentrations is 15.0 μg m^{-3} in 2028, which occurs on Link 7 R733 to Ballymacar and which represents 37.5% of the NO_2 criterion. The corresponding largest increase in PM_{10} concentrations is 2.0 μg m^{-3} in 2028, which occurs on Link 6 of the Bypass and which represents 4.9% of the PM_{10} criterion. These increases are significant, but there is no exceedance of the air quality limit values for the protection of human health as a result of the proposed new road.

There are no residential properties within 30 m of the central alignment of the new road, the closest property being approximately 32 m and the next closest is approximately 55 m from the central alignment. The pollutant concentrations at the façade of the nearest residential properties will therefore be lower than those presented in *Tables 7.11-7.13*, as pollutant concentrations decay with distance from the road. There will be no exceedances of the air quality limit values at these residential properties.

The proposed road will be carried over the River Barrow cSAC by an open bridge which is 36m above the River Barrow.

The maximum predicted NO_x concentration 10m from the centre carriageway along the bridge is 31.4 µg m^{-3}, which is predicted to occur in 2013. This is a large increase in NO_x concentrations over those currently experienced and is above the criterion of 30 µg m^{-3}. At a distance of 20m and 30m the concentration is predicted to be within the criterion, at 26.2 µg m^{-3} and 22.4 µg m^{-3} respectively. The bridge will be 22m wide, so the concentration at the cSAC would be lower in fact than the 26.2 µg m^{-3} predicted at 20m from the road centre and it is likely that there will be some added dispersion due to the height of the bridge above the cSAC, reducing concentration further.

The new road also goes through the River Barrow pNHA. The NO_x concentrations predicted are within the air quality limit value for the protection of vegetation and sensitive habitats.

7.5.3 Impacts to Emissions of Greenhouse Gases

The results of the DMRB air quality modelling are presented in *Table 7.14* below. An average speed across the traffic network of 60 km h^{-1} and an HVG fraction of 14% was assumed. Traffic data for 2028 were included as 2025 in the DMRB air quality model, as this is the latest year that can be included.

Table 7.14 Predicted Carbon and CO_2 Emissions With and Without the Scheme

Scenario	Daily Vehicle Kilometres	Annual Carbon Emissions (tonnes/year)	Annual CO_2 Emissions (tonnes/year) [a]
2013 Do Nothing	500,691	10,755	39,434
2013 Do Something	464,626	9,980	36,594
Change	**-36,065**	**-775**	**- 2,840**
2028 Do Nothing	629,908	12,875	47,209
2028 Do Something	584,870	11,955	43,833
Change	**-45,038**	**-921**	**- 3,375**

(a) Based on a ratio of 12:44 Carbon to Carbon Dioxide

The results indicate that the introduction of the scheme in 2013 will reduce the vehicle kilometres travelled on the network, and therefore reduce the associated emissions of carbon and CO_2. The decrease in emissions is greater in the design year 2028.

7.6 RESIDUAL IMPACTS

7.6.1 Construction

With the implementation of the mitigation measures outlined in *Section 7.4.2* it is anticipated that the impact during this phase of the project can be reduced to 'moderate' and 'short-term'.

There will be no significant impacts from construction traffic.

7.6.2 Operational

There will be a positive impact to air quality along the existing road network in the town of New Ross as a result of the proposed scheme. One road where PM_{10} concentrations are predicted to exceed the air quality limit value in the baseline situation is brought within the limit values as a direct result of the new road.

There will be a small increase in pollutant concentrations adjacent to the proposed route. However, no air quality limit values are predicted to be exceeded.

There will be no exceedance of the air quality limit value for NO_x for the protection of vegetation and sensitive habitat at the cSAC and NHA.

There will be a reduction in greenhouse gas emissions from the traffic network in the area as a result of the introduction of this scheme.

8 NOISE & VIBRATION

8.1 INTRODUCTION

Noise is a feature in the natural environment to varying degrees due to both natural factors and the influence of mankind. The introduction of a new noise source has the potential to impact on people's exposure to noise and the enjoyment of their environment. How people perceive a new noise source is dependant on several factors, including:

- the current noise levels in the environment;
- the source of the noise (road, rail, industry, etc);
- the proximity of the noise source to the receiver;
- the duration of exposure (intermittent versus constant); and
- the use of the noise sensitive receptor (office versus residence).

Not all noise or noise sources cause "*annoyance*", which has been defined by the EPA as, "*… a feeling of displeasure evoked by a noise or any feeling of resentment, displeasure, discomfort, and irritation when a noise intrudes into someone's thoughts and moods or interferes with activity*"[(1)].

Noise is caused by air pressure changes in the atmosphere, and these pressure changes are picked up by the eardrum. Pressure changes that result in noise are usually measured on the decibel (dB) scale, which is a logarithmic scale, based on a ratio to a reference pressure level (20 micropascals (µPa)). In an effort to mimic the human ear, this scale is corrected for the natural characteristics of the human ear, which has varying sensitivities to the range of frequencies in noise. A weighting system is applied to the measurements and is called the A-weighting and is indicated by a capital "A" – dB(A). This weighting is added to the frequency bands of measurements and predictions to represent the response of the human ear to noise, which is typically more sensitive to noise at some frequencies (500 – 2k Hz) than others.

Noise levels experienced by people depend significantly on where they are in relation to the noise source and what they are doing. *Table 8.1* gives an indication of the range of noise levels, and how they are perceived, in the environment.

(1) EPA, Guidance Note for Noise In Relation to Scheduled Activities, 2006

Table 8.1 Perception of Noise Levels in the Environment

Sound level in decibels dB(A)	Description
0	Absolute silence
25	Very quiet room
35	Rural night-time setting with no wind
55	Day-time, busy roadway 0.5km away
70	Busy restaurant
85	Very busy pub, voice has to be raised to be heard
100	Disco or rock concert
120	Uncomfortably loud, conversation impossible
140	Noise causes pain in ears

In an effort to minimise the impact of road development on the environment the NRA published a series of guidelines on environmental topics. Of relevance to this section are the "*Guidelines for the Treatment of Noise and Vibration in National Road Schemes*" (1). Guidance is given in relation to route selection, environmental impact assessment and design goals. The guidelines cover both the construction and operational phases of a proposed road scheme.

Vibration arising from the operation of a road maintained in good condition is unlikely to be a source of perceptible structural vibration in properties located close to these roads. Given the location of potential sensitive receptors in relation to the road, the distance from the road and the quality of the new road surface, the potential for there to be a significant vibration impact on these locations has been scoped out of the impact assessment.

Vibration from the construction phase of the project has the potential to cause an impact at the closest residential properties. Typically, the main sources of vibration during construction arise from piling and blasting. Both of these techniques are likely to be used during the construction of the road.

8.2 METHODOLOGY

8.2.1 Baseline

The area along the proposed route is predominantly rural, agricultural land. Noise levels in these areas are typically very low with little or no man made noise sources. The EPA has issued a document entitled "*Environmental Quality Objectives – Noise in Quiet Areas*"(2) which address the issues around how to assess noise in these areas and what level of protection is required. It recommends that background noise levels that are found to be below 35 dB L_{A90} indicate that an area should be considered to be very quiet.

(1) National Roads Authority, Guidelines for the Treatment of Noise and Vibration in National Road Schemes, NRA, October 2004.
(2) EPA (Environmental Protection Agency) 2003, Environmental Quality Objectives – Noise in Quiet Areas (2000-MS-14-M1), 2003, Environmental RTDI Programme 2000 - 2006. (Authors Waugh, D., Durucan, et. Al.)

Figure 8.1 (Volume 2: Drawings and figures) shows the locations of noise monitoring locations. Background/baseline monitoring was carried out taking into consideration guidance given by the EPA in relation to Noise from Scheduled Activities [(1)], the NRA guidelines in relation to national road schemes [(2)], and ISO 1996 [(3)]. The numerical identification for all locations in this chapter corresponds with those in *Figure 9.5* of the Landscape and Visual Chapter.

Parameters recorded during the baseline monitoring for the project were L_{Aeq}, L_{A90}, L_{A10}, L_{Amax} and L_{Amin}. Descriptions of these parameters can be found in the List of Abbreviations at the start of this document. Samples were taken at each location over fifteen or five minute periods during the day and night respectively. Monitoring periods were chosen based upon the observations that the noise environment, particularly at locations away from the main roads, was very constant during the survey. This situation occurs because the noise was influenced by sources that were either constant (e.g. the distant hum of traffic from the N25 and N30), or they were very infrequent (occasional car along a country road).

Detailed notes were taken describing the location and activities that were taking place during the measurements and that were contributing to the observed noise levels. Measurements were only carried out during appropriate weather conditions. This precludes the influence of rain or wind on measured baseline noise levels. The noise meter was located on a tripod at 1.5 m above the ground and more than 3 m away from reflective surfaces, to allow free-field noise measurements to be taken. The meter was protected using an outdoor weather protection kit. The results of the baseline monitoring are outlined in *Section 8.3*.

Since no significant sources of perceptible environmental vibration were identified in the area of the proposed development, no baseline vibration monitoring has been carried out.

8.2.2 Assessment Criteria

There are no applicable legal standards in relation to environmental noise assessment in Ireland. The European Union Directive 2002/49/EC relating to the assessment and management of environmental noise has been enacted into Irish law through S.I. No 140, Environmental Noise Regulations 2006. This has placed a requirement on specific national agencies to develop strategic noise maps in certain situations and highlights the need for action plans to protect areas of low noise levels and to reduce noise in areas where noise levels are high. However, this does not affect the assessment of individual roads. The NRA guidelines set out design goals for new roads and the EPA has developed guidelines for the sectors controlled by them.

(1) EPA, Guidance Note for Noise In Relation to Scheduled Activities, 2006
(2) National Roads Authority, Guidelines for the Treatment of Noise and Vibration in National Road Schemes, NRA, 2004
(3) ISO 1996. Acoustics - Description and Measurement of Environmental Noise:- International Standards Organisation, Geneva (1982 - 1987).

8.2.3 Construction Noise

8.2.3.1 Guidelines for the Treatment of Noise and Vibration in National Road Schemes

The NRA issued a guidance document in 2004 with the aim of assisting in the handling of noise and vibration issues during the planning and design phases of national road schemes. Prior to the NRA guidance there were no published national guidelines in relation to acceptable noise levels during the construction phase of a development. The NRA has put forward what they consider to be typically acceptable noise levels during construction and these are show in *Table 8.2*.

Table 8.2 Maximum Permissible Noise Levels at the Facade of Dwellings during Construction (NRA Guidelines)

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

[1] Construction activity at these times, other than that required in respect of emergency works, will normally require the explicit permission of the relevant local authority

The noise levels set out in the NRA guidance are not aimed at providing legislative noise limits for construction activities, but can be used as criteria for the assessment of the significance of noise impacts associated with the construction programme.

8.2.4 Operational Noise

8.2.4.1 Guidelines for the Treatment of Noise and Vibration in National Road Schemes

The NRA engaged in a prolonged consultation period in the development of these guidelines. Consideration was taken not only of previous and current international practice but also proposed developments in the area of noise mapping (now enacted in the Noise Regulations 2006). A design goal was developed for which, "*all future national road schemes should be designed, where feasible*", and which is based on the L_{den} parameter:

- Day-evening-night 60 dB L_{den} (free field residential façade criterion).

Prior to this a design goal of 68 dB(A) $L_{10,\ 18-hour}$, was employed which was based upon UK [1] guidance. The original intention of the NRA was to reduce the criterion by 3 dB to a level of 65 dB(A) $L_{10,\ 18-hour}$, which was believed to be equivalent to 60 dB L_{den}. Upon validation of this assumption for Irish conditions it was found that 60 dB L_{den} actually equated to 62.5 dB(A) $L_{10,\ 18-hour}$, which is an overall reduction of 5.5 dB. Although it was accepted that this was a "significantly more onerous" design goal the NRA felt it appropriate to keep the design goal at 60 dB L_{den}. For this EIS and noise assessment, this means that the 60 dB L_{den} design goal is to be applied to all existing sensitive receptors in respect of both the year of opening and the Design year i.e. 15 years after the projected year of opening, which in this case is 2028.

The design goal is attainable at all the noise sensitive locations along the proposed route, although it is also recognised that there is likely to be a residual impact on receptors due to the change in noise levels in the area. In order to assess the potential residual impact on the receiving environment the following guidelines from the Institute of Environmental Management and Institute of Acoustics will be referred to.

8.2.4.2 *Institute of Environmental Management and Institute of Acoustics Guidelines*

The Institute of Environmental Management and Institute of Acoustics *Consultation Draft Guidelines for Noise Impacts Assessment* (April 2002) give guidance on how to describe and evaluate noise impacts arising from changes in noise levels, as summarised in *Table 8.3*. It is generally accepted that human perception of changes in environmental noise levels is limited to those of 3 dBA or greater. For this reason, only those increases of 3 dB or greater in the table below are classified as significant.

Table 8.3 Significance of Noise Level above Impact Assessment Criterion

Amount by Which Noise Criterion is Exceeded dB(A)	Impact	Significance
0	None	Not Significant
0 to 3	Slight	Not Significant
3 to 5	Moderate	Significant
5 to 10	Substantial	Significant
10 and above	Severe	Significant

8.2.5 *Vibration*

There is no standard predictive method for calculating vibration levels due to construction works. Guidance relevant to acceptable vibration levels at the foundation of buildings is contained within British Standard (BS) 7385 (1993): Evaluation and Measurement of Vibration in Buildings Part 2: Guide to Damage Levels from Ground-Borne Vibration. The NRA have considered these standards and other international standards (including the German

(1) UK Department of the Environment, The Noise Insulation Regulations 1975, SI No 1763 of 1975

standard DIN4150) in deriving the guidance levels to ensure that there is little or no risk of even cosmetic damage to buildings indicated in, *Table 8.4*.

Table 8.4 Allowable Vibration Velocity (Peak Particle Velocity) at the Closest Part of any Sensitive Property to the Source of Vibration

Frequency	**<10Hz**	**10 to 50Hz**	**50 to 100Hz (and above)**
Peak Particle Velocity	8 mm/s	12.5 mm/s	20 mm/s

The NRA guidance also discusses the issue of disturbance or annoyance due to vibration. Typical operations that are carried out during the construction of roads include blasting and piling. The NRA suggests that a level of 12 mm/s and 2.5 mm/s respectively would typically be accepted for short periods of time, during day-time hours.

8.3 DESCRIPTION OF EXISTING NOISE ENVIRONMENT

The results of the baseline monitoring are presented in *Table 8.5*. The noise monitoring location numbering system is the same as that used in the Landscape Resources Chapter (*Figure 9.5 Volume 2*). Except for localised areas where the proposed route intersects with the N25, N30 and R733, the areas along the route can be described as being quiet. In the areas around the existing roads, traffic noise dominates and the influence is noticeable for some distance away from the road (due to the fact that there are no other dominant sources of noise in the area or natural obstructions to prevent the noise from carrying). As one moves away from the existing roads, the noise levels drop significantly and background noise levels ($L_{A90,\ 15\text{-minutes}}$) drop to approximately 35 dB or less. Even at these levels faint noise from the roads can on occasion be heard and does add to the background noise levels, to some degree. The $L_{Aeq,\ 15\text{-minutes}}$ during the same periods has a wider range from 40-45 dB(A) to 50-55 dB(A).

Areas like Lacken, Ryleen, Arnestown, Creakan (Upper and Lower), and Landscape can be described as rural areas, dominated by agricultural activities, with little or no anthropogenic sources of noise, other than those associated with agricultural activities.

Typical noise sources in the areas mentioned above include dogs barking, birds, cattle grazing, tractors and other distant agricultural activities. At night these activities cease, to a greater or lesser degree and noise levels ($L_{A90,\ 5\text{-minutes}}$) typically drop to approximately L_{A90} 25 dB or less. It was also noted that the levels of traffic (number of vehicles) on the existing main roads (N25 and N30) drops significantly.

Table 8.5 *Baseline Noise Survey Results*

Noise Monitoring Location		Date	Time	Duration	Sound Pressure Level (dB)					Comment
					L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	L_{Amin}	
4	Intersection with N30	29/01/2007	00:44:38	05:00	48	20	43	68	19	Night
		29/01/2007	00:50:48	05:00	60	23	55	78	19	Night
19		03/11/2006	16:36:44	15:00	42	33	46	58	29	
		29/01/2007	00:33:00	05:00	22	19	21	45	19	Night
30		03/11/2006	17:06:53	15:00	43	40	44	71	38	
		29/01/2007	00:22:49	05:00	26	19	23	54	18	Night
		29/01/2007	14:27:56	15:00	49	32	46	77	30	
64	Intersection with N25	03/11/2006	16:05:01	15:00	62	55	65	80	48	
		29/01/2007	23:53:14	05:00	64	BR	61	83	BR	Night
		29/01/2007	23:58:35	05:00	62	28	56	84	28	Night
74		03/11/2006	15:32:00	15:00	43	38	46	59	33	
		29/01/2007	23:38:45	05:00	35	27	38	59	26	Night
		29/01/2007	13:54:01	15:00	47	35	49	69	30	
94		03/11/2006	14:18:30	15:00	43	26	47	59	23	
		29/01/2007	23:22:26	05:00	47	25	43	72	22	Night – Noise from cattle shed
		29/01/2007	13:23:15	15:00	41	36	44	65	33	
103		03/11/2006	13:43:52	15:00	29	26	31	45	24	
		29/01/2007	23:01:41	15:00	30	19	25	60	19	Night - One car pass
		30/01/2007	12:50:25	15:00	37	32	41	55	BR	
118		03/11/2006	11:40:22	15:00	42	38	44	55	34	
		14/11/2006	22:57:12	15:00	37	24	41	55	22	
127		03/11/2006	12:14:01	15:00	42	40	43	58	38	
132	Intersection with R733	03/11/2006	12:41:10	15:00	60	44	65	72	39	
135	Near R733	03/11/2006	13:16:10	15:00	50	42	54	61	36	
		14/11/2006	23:18:37	15:00	36	27	40	52	25	Night
		29/01/2007	22:29:55	15:00	49	45	50	51	38	
		29/01/2007	01:13:56	05:00	31	23	31	56	22	Night
		29/01/2007	12:29:30	15:00	46	41	49	58	35	
147		03/11/2006	11:10:36	15:00	44	37	44	69	35	
150		03/11/2006	10:40:50	15:00	45	43	47	54	41	
		14/11/2006	22:28:14	15:00	35	29	36	60	25	
160		03/11/2006	09:07:08	15:00	58	53	61	63	47	
		14/11/2006	21:38:26	15:00	55	43	58	72	38	
		29/01/2007	01:35:24	05:00	43	20	49	55	20	Night
		29/01/2007	11:56:14	15:00	58	51	60	79	45	
161		03/11/2006	08:46:58	15:00	52	48	54	73	45	

Noise Monitoring Location	Date	Time	Duration	Sound Pressure Level (dB)					Comment
				L_{Aeq}	L_{A90}	L_{A10}	L_{Amax}	L_{Amin}	
	14/11/2006	21:56:36	15:00	47	39	50	66	30	
180	03/11/2006	09:37:04	15:00	50	46	51	71	42	
200	03/11/2006	14:47:59	15:00	33	30	36	54	29	

BR – Below Range

To allow for a comparison of the baseline noise level measurements above, with predicted future noise levels with the proposed scheme, which are presented in L_{den}, a baseline L_{den} figure has been calculated for each location. The baseline L_{den} figures are presented in *Table 8.6*. In terms of baseline noise environments along the alignment there are two distinct groupings: those influenced by traffic noise on the main roads; and those that are remote from the main roads and have little or no anthropogenic influences.

8.3.1 *Rural Setting Away from Main Roads*

For the locations away from the existing main roads in the area (N25 and N30), it is assumed that the baseline will not change significantly over time, and the existing noise measurements can therefore be used to represent the baseline noise levels in 2028. Locations 19, 23, 30, 31, 45, 47, 50, 71, 73, 74, 94, 103,110, 118, 127, 147, 150, 151 and 200, from the baseline monitoring locations, are considered not to be significantly influenced by traffic flows on the existing main roads. In *Section 8.5.1* these baseline noise levels are used to calculate the 2028 Do-something noise levels from the proposed New Ross Bypass, by combining them with the predicted noise levels due to traffic on the new road.

8.3.1.1 *Calculation of Baseline L_{den} levels in Rural Settings*

The L_{den} has been calculated using the formula below:

$$L_{den} = 10\lg\frac{1}{24}\left(12*10^{\frac{L_{day}}{10}} + 4*10^{\frac{L_{evening}+5}{10}} + 8*10^{\frac{L_{night}+10}{10}}\right)$$

An average L_{Aeq} was calculated for the Day, Evening and Night periods combining the monitoring results at the following locations: 19, 30, 74, 94, 103, 118, 127, 147 and 150. This was done on the basis of observations during the monitoring, which indicated that the noise environments in these areas were very similar i.e. any one of the sites could represent the area. By doing this we have sufficient samples within specific time-frames to use the NRA calculation methods as described in Sections 3.1 and 6.3.4 of the NRA guidance document. The calculated L_{den} from this process was L_{den} 43 dB(A).

8.3.2 *Locations Influenced by Main Roads*

For the areas close to the current main roads i.e. the remainder of the baseline monitoring locations 1, 63, 64, 160, 161 and 180, road traffic flows are considered the greatest influence on baseline noise levels. Therefore, the software modelling package *Soundplan* was used to calculate the current baseline noise levels at locations 1, 63, 64 and 160 as traffic data is available for these locations. Locations 116, 132, and 135 are also influenced by traffic flows on the R733. However, traffic flow information is not available and baseline monitoring information is therefore used to calculate the L_{den} noise levels at these locations.

The measured baseline noise levels at location 160 was higher than the calculated values due to localised noise sources temporarily present in the area i.e. building work on a site near-by and some agricultural activities in the fields near-by. Both the measured and predicted results are shown in *Table 8.6*. The combined noise levels in (2028) are based on modelling of traffic flows rather than using the measured baseline levels for locations 160, 161 or 180.

8.3.2.1 *Calculation of Baseline L_{den} levels Influenced by Main Roads*

The monitoring results at location 160 were used to calculate the L_{den} as outlined in the NRA guidelines. The $L_{10(18\text{-hour})}$ was calculated from monitoring results at the location and then converted into the L_{den} for that point. The three $L_{A10\ (15\text{-minute})}$ measurements, 58, 60 and 61 dB(A) were used to calculate the $L_{10(18\text{-hour})}$ noise level using the following formula:

$$L_{10(18hour)} = (X1 + X2 + X3) \div 3 - 1 = XdB(A)$$

This gave an $L_{10(18\text{-hour})}$ of 59dB(A). The L_{den} was then calculated by using the formula:

$$L_{den} = 0.86 \text{ x } L_{A10(18hr)} + 9.86 \text{ dB}$$

Which gave an L_{den} of 61 dB(A).

The average L_{Aeq} for location 160 was compared with the average L_{Aeq} of locations 161 and 180 to establish the difference in noise levels between the locations. From the baseline monitoring data, the average day-time L_{Aeq} at location 160 was calculated to be 57 dB(A) and this was compared with the average at location 161 and 180 of L_{Aeq} 50 dB(A), a difference of 7 dB(A). Therefore an assumption was made that the baseline L_{den} at these locations would also be 7 dB(A) less. Based upon this assumption 7 dB was subtracted from the 61 dB (A) L_{den} at location 160 to give a baseline L_{den} 54 dB(A) for location 161 and 180.

The L_{den} for location 135 was calculated in a similar manner as that for 160. This resulted in a calculated $L_{10(18\text{-hour})}$ of 50 dB(A) and an L_{den} of 53 dB(A). The difference in the average L_{Aeq} at locations 135 and 132 is +11 dB(A) and the L_{den} at location 132 is therefore assumed to be 64 dB(A). Location 116 is a similar distance back from the R733 as location 132 and is assumed to experience similar or the same noise environment. In *Section 8.5.1* the baseline noise levels are similarly added to the predicted noise levels from the New Ross Bypass to give the combined future noise level.

8.4 CONSTRUCTION IMPACTS AND MITIGATION MEASURES

8.4.1 Noise

Construction impacts are temporary in comparison to the operational phase of the road scheme. The general public are typically more accepting of higher construction noise levels due to the fact that they are considered to be of a temporary duration. However, where the impact from the construction phase will be significant, and if the road scheme is not generally seen as being beneficial to the local area, the likelihood of there being complaints and the noise levels causing annoyance is high. Due to the rural nature of the majority of the proposed route and the low background noise levels in the area, construction noise is likely to have a significant, but short term, impact on some noise sensitive locations along the route alignment.

NRA guidelines indicate that a noise level of 70 dB $L_{Aeq\ 1-hour}$, is considered to be an acceptable level at the façade of dwellings during construction. Best practical means will be used to minimise construction noise by adopting the recommendations set out in BS 5228. In particular, the following noise control (mitigation) measures will be implemented:

1. Proper use of plant with respect to minimising noise emissions and regular maintenance will be required. All vehicles and mechanical plant will be fitted with effective exhaust silencers and will be maintained in good efficient order;

2. The use of inherently quiet plant where appropriate - all major compressors and generators will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;

3. Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum;

4. All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance, and if necessary, acoustic enclosures will be provided; and

5. The construction contractors will be obliged to adhere to the relevant codes of practice for construction working and the guidance given therein to minimise noise emissions from the site.

Additionally, all contractors will be required to comply with S.I. No 632 of 2001 European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001, amended by S.I. No 241 of 2006. Where feasible, earth works or noise barriers will be installed at an early stage to help mitigate the impact of construction noise.

Typical operations associated with road construction include earth moving and excavation, pilling, blasting, earth levelling, tipping and site clearing. BS 5228 provides sound pressure levels for these operations, which can be used to predict noise levels at noise sensitive receptors. The predictions assume continuous noise levels which do not necessarily reflect the real life situation. However, the worst case scenario is assumed. With several plant items working at the same time excavating, tipping and levelling earth, a noise level of $L_{Aeq\ 1\text{-}hour}$ of up to 95 dB(A) at 10m from the noise source could be experienced.

No mitigation due to the natural topography and absorptive nature of the land or the fact that some of this work will be carried out in cut, the noise would reach the guide value of 70 dB(A) approximately 180m from the source. It is noted that this would be the worst case scenario and unlikely to arise. Noise levels would drop by approximately 3 dB(A) if the equipment only operated for half the time, and noise levels would then drop to 70 dB(A) within approximately 100m of the alignment. There are approximately 70 properties that are within this distance of the road. Given that there will be further attenuation due to natural features and the fact that some of the work will be in cut, it is considered unlikely that the criteria of 70 dB(A) will be exceeded at all but the closest receptors. Therefore, the general alignment works are expected to result in significant, but short-term noise impacts at fewer than 70 receptors. Locations 118 and 127 are typical of the worst affected of these as they are located within 40 m of the alignment and are close to a major junction development. There is a potential that these locations may experience impacts for a longer period than other locations and that noise levels may be as high as 78 dB(A) on occasion.

8.4.2 Vibration

Sources of vibration arising from the construction of roads typically include piling and blasting. These activities are frequently centred on activities such as earthworks and bridge or culvert construction. Other activities, with the potential to be a source of vibration, include compaction of the road base materials using vibrating rollers and breaking of rock using pneumatic breakers. The most effective form of attenuation is distance as the earth naturally attenuates the vibration wave as it moves through the soil.

The closest properties to the central alignment of the road are approximately 40 m back from the central line, and there are three properties approximately this far from the alignment. Of these two are 30m back from the central line of slip roads. The low density of housing along the alignment helps to reduce the potential for impacts arising from vibration. The contractor will be required to assess the impact of their activities against the criteria set down in the NRA guidelines.

Measured vibration levels from an impact pilling rig indicated that, at 30m from the source the PPV would be 2.57mm/s. This would be within acceptable limits for building damage as set out in *Table 8.4*. Therefore, no damage is likely as a result of the works. The vibration is also within 0.07 mm/s of the NRA disturbance standards for piling. Since this is a marginal exceedance of the standard suggested by the NRA for piling, significant disturbance is unlikely.

Detailed information on blasting is not available at this stage of the project, but trial blasting will be used to quantify vibration from piling during the construction programme, and will be used to ensure blasting procedures meet the suggested NRA guidance limit of 12 mm/s at occupied buildings to avoid significant disturbance or building damage.

8.5 *OPERATIONAL IMPACTS AND MITIGATION MEASURES*

8.5.1 *Noise*

In an effort to accurately estimate the noise levels likely to be experienced at noise sensitive receptors adjacent to the operational Bypass and taking into consideration guidance given within the NRA guidelines, a model was constructed for the Bypass. The proprietary software package *Soundplan 6.4* was used to undertake this predictive modelling. Information including traffic data (please refer to *Chapter 5*), geodetic survey information, Ordinance Survey Ireland mapping information and 3D digital data of the route alignment was used to construct the noise model, making the following additional assumptions:

- speed on the entire length of the road is 100km/hr;
- the percentage of heavy goods vehicles (HGVs) on the road is 14%;
- the central reservation is 2.6m wide;
- both lanes are 7m wide;
- traffic levels provided were AADT for the year 2028 and were subdivided into L_{den} flows using the diurnal profiles given in Appendix 1 of the NRA guidance document; and
- traffic flow on roads intersecting the main alignment was modelled using traffic flow information.

As an initial step, to identify potential noise sensitive receptors, the highest AADT was used to calculate the distance back from the road edge at which a noise level of 63 dB $L_{A10,\ 18\text{-hour noise}}$ (which is equivalent to 60 dB L_{den} in the Irish situation) would be achieved. The calculation assumed that the terrain was flat and did not take into consideration the beneficial mitigating effects arising when the alignment is in cut. The area identified is therefore the maximum area likely to be impacted and represents a precautionary approach. The alignment was reviewed to identify potential noise sensitive locations within this area, which was estimated to be 90m back from the nearest carriageway edge. This indicative line can be seen on *Figure 8.1*. Modelling was then carried out to predict the noise levels at the noise sensitive locations due to the operation of the new road in 2028. Predicted free-field noise results were calculated for the L_{den} at the noise sensitive receptors as listed in *Section 8.3* above, and the results are presented in *Table 8.6 and 8.7* below.

To calculate the combined noise levels from the road and the existing environment, the predicted road noise levels have to be added to the general environmental noise levels in the area. For areas away from the main roads an assumption has been made that there will be no change in the background noise levels with time. As outlined in *Section 8.3* the baseline noise levels for these areas is 43 L_{den} dB(A). Therefore, this figure is used as the baseline in the calculation of the combined L_{den} dB(A) for 2028.

Table 8.6 **Single Point Source Receivers, Free-field Results with no Mitigation for Rural Locations Calculated and Predicted Baseline L_{den} Levels based upon 2028 Traffic Flows and Predicted L_{den} Levels with the Proposed Road**

Name	Floor	Baseline L_{den} dB(A) Do Minimum*	Predicted L_{den} dB(A) with Bypass 2028	Combined noise level L_{den} dB(A)	Change in noise level from baseline dB(A)
19	1	43	57	57	14
19	2	43	54	54	11
23	1	43	55	55	12
30	1	43	48	49	6
31	1	43	50	51	8
31	2	43	53	53	10
45	1	43	46	48	5
47	1	43	47	48	5
50	1	43	51	52	9
71	1	43	54	54	11
73	1	43	52	53	10
74	1	43	**62**	**62**	19
94	1	43	52	53	10
94	2	43	54	54	11
103	1	43	50	51	8
110	1	43	55	55	12
118	1	43	**62**	**62**	19
127	1	43	59	59	16
147	1	43	57	57	14
147	2	43	58	58	15
150	1	43	49	50	7
151	1	43	53	53	10
200	1	43	55	55	12

* As discussed in Section 8.3 the baseline L_{den} figures for Rural Areas are calculated using the methodology set out in the NRA Guidance Document and have been assumed not to change and is therefore used in the calculation of the 2028 combined noise level.
Figures in **BOLD** represent noise levels above the NRA Design Goal of 60 dB L_{den}.

Table 8.7 presents the baseline noise levels, as described in *Section 8.3*, the predicted noise level arising only from the New Ross Bypass in 2028 and the combined noise levels. For locations 1, 63, 64, 160, 161 and 180, the baseline noise level was calculated by modelling traffic flows on the nearby main roads. The combined noise levels for these locations takes into consideration the change in traffic flows on these roads which is modelled in the software package *Soundplan*. Since the approach differs to that in *Table 8.6*, figures for the bypass alone have not been shown in *Table 8.7*.

For locations 116, 132 and 135 baseline noise levels were calculated from measured data as set out in *Section 8.3*, as traffic data for the R733 was not available. Predicted noise levels for these locations are the predicted noise levels based upon traffic on the New Ross Bypass in 2028. The Bypass may affect traffic flow on the R733, which could affect the noise from this road. However, predicted traffic flow data are not available for this road, and it has been necessary to assume that the changes in traffic on this road are not significant for the purposes of this assessment.

Table 8.7 Single Point Source Receivers, Free-field Results with no Mitigation for Locations influenced by Main Roads

Name	Floor	Baseline L_{den} dB(A) Do Minimum	Predicted L_{den} dB(A) with Bypass 2028	Combined noise level L_{den} dB(A) 2028	Change in noise level from baseline dB(A)
1 west	1	46	*	57	11
1 east	1	46	*	59	13
1 east	2	55	*	60	5
63	1	58	*	59	1
63 main house	1	**62**	*	**61**	-1
64 (north)	1	59	*	60	1
64 (west)	1	53	*	60	7
160	1	**61** (49)**	*	55	-6 (6)
160	2	**61** (50) **	*	57	-4 (7)
161	1	54	*	57	3
180	1	54	*	55	1
116	1	**64**	54	**64**	0
132	1	**64**	58	**65**	1
135	1	53	55	57	4

* The noise level from the new road is included in the combined noise level column, and is not shown individually.

** The modelled figures were lower than the measured figures. The measured figures were higher due to other activities in the area – agriculture. Modelled noise levels were used as these provide a more reliable means of assessing noise levels changes.
Figures in **BOLD** represent noise levels above the NRA Design Goal of 60 dB L_{den}.

From the results, five locations were identified as exceeding the NRA target design goal noise level of 60 dB L_{den}. However, two of these properties are to be acquired as part of the CPO process and will therefore remove the necessity for mitigation (Locations 63 and 74), two locations do not meet all the criteria set out in Section 2.3.1 of the NRA guidance documents and are therefore not eligible for mitigation (116 and 132), which leaves one location (118) potentially requiring mitigation.

Preliminary design of noise mitigation at location 118 was therefore included to ensure that the design of the road will meet the goals set within the NRA guidance document. This location was assessed to determine what form of barrier would be most appropriate and effective, taking into consideration the proximity of the receptor to the road and the visual impact guidance, *Chapter 9*, which states that, where possible, earth berms should be used.

8.5.2 Vibration

The NRA guidance document and research on the topic indicates that, vibration from well maintained operational roads is unlikely to cause perceptible vibration in, or structural damage to, properties located close to the road. As indicated there is only one property which is located approximately 30m of the central alignment of the road and this property is already located along the existing N25. Given the distance to the properties from the proposed road alignment it is considered unlikely that vibration from the operational road will be perceptible or cause annoyance. Structural damage would require vibration levels above those that cause annoyance and, so, structural damage will not occur. Therefore, no significant impacts due to vibration are predicted.

8.6 *RESIDUAL IMPACTS*

8.6.1 *Construction*

Noise and vibration impacts from the construction phase can be effectively mitigated through good management practices. Based on a worst-case assessment noise impacts from the construction phase will be significant but short-term at approximately 70 properties. The overall project is scheduled to take approximately 36 months to construct, and impacts are likely over a small period of this time. As highlighted in *Section 8.4.1* there are a number of locations within 100m of the alignment that may experience more prolonged impacts. Through monitoring and management of the construction phase these can be minimised. At two locations it has been identified that the Criteria may be exceeded by 8 dB which would be a significant impact but is likely to be short term.

No significant residual vibration impacts from the construction phase are likely.

8.6.2 *Operational*

The one location that has been identified in *Table 8.6* as requiring noise mitigation measures was reassessed taking into account the impact of noise barriers (or berms, if possible) on the area. The model showed that, the impacts arising from the road can be mitigated to ensure that the noise levels experienced at all the noise sensitive receptors meets the design criteria outlined in the NRA guidance documents. *Table 8.8* below shows the results of the modelling once a noise barrier has been put in place. While it is possible for noise levels to be mitigated to meet the NRA design criteria it is accepted that the overall noise environment along the route will change.

Proposed noise mitigation highlighted in *Figure 8.1* and *Table 8.8* below details indicative design specifications. Detailed design will have to be carried out prior to the construction phase of the project.

Table 8.8 Indicative Noise Barrier and Dimensions

Noise Sensitive Receptors	Approximate Chainage	Barrier type	Height (m)	Length (m)
118	3600 – 3700	Fence or berm	3.0	140

Table 8.9 ***Predicted Mitigated Operational Noise Level at Receptor 118***

Name	Usage	Floor	Baseline L_{den} dB(A) Do Minimum	Mitigated L_{den} dB(A)	Change in noise level dB(A)	Residual Impact
118	Residential	Ground	43	56	13	Severe

Table 8.10 ***Change in Noise Levels Following Mitigation and Meeting the NRA Guide Level 2025***

Change is noise levels	Impact	Location
0 or reduction	None	63.
0 to 3	Slight	63, 64, 161, 180, 116, 132, 135.
3 to 5	Moderate	1 east, 45, 47.
5 to 10	Substantial	64 west, 160, 30, 31, 50, 73, 94, 103, 150
10 and above	Severe	1 west, 1 east, 19, 23, 71, 74, 94, 110, 118, 127, 147, 151, 200.

The results shown in *Table 8.10* are used in the assessment of residual noise impacts. As described in *Section 8.2*, the project will be mitigated to a level that meets the NRA design goals and the contractor will be required to adhere to this. In undertaking assessment of residual environmental noise impacts, it is also considered reasonable to take into consideration the change in noise levels that are likely to be experienced in areas that both do and do not require mitigation.

Baseline monitoring has been used to calculate L_{den} figures as set out in *Section 8.3* and presented in *Table 8.6 and 8.7*. *Table 8.9* shows the noise level change that will be experienced at the specific location where mitigation will need to be installed.

Table 8.10 indicates the change in noise levels along the alignment at the other locations that were modelled. Although all these locations meet or are below the design criteria for national roads, the change in noise levels remains significant and the impact of this magnitude is considered to be 'substantial to severe' and 'permanent'. It should be stated that the impact is greater in this area due to the fact that, as outlined in the baseline above, noise levels along the alignment are particularly low due to the rural setting.

Significant residual operational noise impacts are thus predicted at all receptors listed in the lower 3 rows of *Table 8.10.*

8.6.2.1 *Changes in Noise on the Wider Road Network*

EIS *Chapter 5,* Traffic, highlights the predicted traffic flow levels in the "Do Nothing" and "Do Something" scenarios for the opening year (2013) and design year (2028). As can be seen from the figures the "Do Something" scenario results in a 50 – 60% reduction in the traffic flow on 5 assessed road links through and around New Ross. The change in noise levels for these 5 links for the 2028 scenario has been predicted using guidance found in

CRTN [1] (specified in NRA guidelines as an appropriate method), and in accordance with webTAG methodology for strategic assessment of road schemes.

These predictions are only indicative however, because, unlike the detailed modelling undertaken for noise from the proposed Bypass, distance of residences from the roads assessed and influence of any potential screening is not taken into account. They do provide a guide as to the potential benefit to be gained in noise terms on the wider network as a result of implementation of the proposed scheme. *Table 8.11* below summarises the predicted changes in traffic noise levels on the 5 road links on the existing road network assessed (*Figure 5.1*).

Table 8.11 Predicted Changes in Road Traffic Noise Levels on the Wider Road Network

Road Link	**Predicted Change in Road Traffic Noise Level**	**Significance of Impact**
O' Hanrahan Bridge	- 3	Slight Benefit
N25 Waterford Road	- 6	Substantial Benefit
R700 New Ross to N30	- 4	Moderate Benefit
N30 Enniscorthy Road	- 3	Slight Benefit
N25/N30 Wexford Road	- 3	Slight Benefit

A reduction in traffic flows of this magnitude will result in a reduction of noise levels within the town of approximately 3 to 4 dB(A). This would be a "moderate" and "permanent" positive impact for all the houses facing the roads where traffic flow will be reduced due to the Bypass.

(1) Calculation of Road Traffic Noise, Department of Transport, Welsh Office, HMSO, 1988

9 LANDSCAPE RESOURCES

9.1 INTRODUCTION

The impacts resulting from the proposed New Ross Bypass on both the landscape resources and character, and upon visual amenity are presented in this chapter. The assessment was conducted using methodologies sourced from the following references:

1. Environmental Impact Assessment of National Road Schemes – A Practical Guide, National Roads Authority;

2. Guidelines for Landscape and Visual Impact Assessment: Second Edition, Landscape Institute and Institute of Environmental Assessment (2002); and

3. A Guide to Landscape Treatments for National Road Schemes in Ireland, National Roads Authority.

Sources of information used to conduct this study included the following:

1. Ordnance Survey Mapping at scale 1: 50,000, Discovery Sheet 76;
2. Scheme proposals at scale 1:5000;
3. Wexford County Development Plan 2007-2013;
4. Kilkenny County Development Plan 2002; and
5. New Ross Second River Crossing and Bypass Route Selection Report, October 2002.

9.2 METHODOLOGY

9.2.1 Key Steps

A description of the receiving baseline landscape is presented and includes reference to specific designations, together with a description of landscape character. This is followed by an assessment of the impact of the proposed scheme on landscape elements, character and on visual amenity. The assessment of impacts considers both the construction phase and the operating phase of the development.

Landscape impacts relate to the effect of the proposed development on the physical elements or fabric that comprises landscape and landscape character. Impacts can range from physical or direct changes to a particular landscape (*direct impacts)* to indirect changes which are concerned with the effects of the proposals on a particular landscape setting and which are inextricably linked with views *(indirect impacts)*.

Visual impacts relate to the extent to which the proposals will cause a change in the existing view gained by those individuals who will be able to see the proposed development.

Residual landscape and visual impacts are recorded in respect of the proposals together with mitigating landscape treatment in place.

9.2.2 *Key Definitions*

9.2.3 *Overview*

Landscape and Visual impacts may be either:

- *Positive* : a change, which improves the quality of the environment (for example, improving landscape diversity; removal of existing negatively impacting aspect etc.); or
- *Neutral*: a change, which does not affect the quality of the environment; or
- *Negative:* a change, which reduces the quality of the environment (for example, impact on broadleaved woodland; obstructing an existing view; etc).

They may also be:

- ***Permanent*****:** permanent loss of landscape resources or impacts upon character; or
- ***Temporary*****:** short-term impacts confined to the construction period, and the period taken for new planting to become established; or
- ***Operational*****:** effects due to traffic, lighting (noise, dust, light pollution).

9.2.4 *Landscape and Visual Impacts*

9.2.4.1 *Landscape Impacts - Definitions Used*

Landscape Sensitivity refers to the extent to which a landscape can accept change of a particular type and scale without unacceptable adverse effects on its character and this is graded according to either one of the following:

- **High -** existing landscape qualities and resources would be susceptible to relatively small changes; or
- **Medium** – this landscape would be capable of absorbing some change; or

- **Low** – relatively robust landscape which could readily accept change or which would benefit from it.

Magnitude of Change in landscape elements and character caused by the proposals is defined as the scale, physical extent and duration of the change caused by the proposals and this is graded as either one of the following:

- **Large** – notable change in landscape features or character over an extensive area or a very intense change over a limited area; or

- **Medium** – notable changes in landscape features or character over a limited area or clearly perceptible changes over a large area; or

- **Small** – small changes in landscape features or character.

9.2.4.2 *Visual Impacts - Definitions Used*

Viewer Sensitivity is graded as either one of the following;

- **High** – viewers who have a high sensitivity to their environment, such as residential or recreational viewers and those who may be exposed to a view for long periods of time; or

- **Medium** – viewers of intermediate sensitivity or those who pass through areas at moderate speeds (walkers and cyclists); or

- **Low** – viewers of low sensitivity or who are only exposed to views for short periods of time (workers, drivers in cars, passengers in trains).

Magnitude of Visual Change is graded as either one of the following:

- **Large** – where the magnitude of the change in view is major; or

- **Medium** – where the magnitude of the change in view is noticeable; or

- **Small** – where the magnitude of the change in view is slight; or

- **No Perceptible Change** – no noticeable change in views.

Impact significance levels are graded from slight to substantial and are derived by combining *Landscape/Visual Sensitivity* with *Magnitude of Change* caused by the proposals, as outlined in the matrix shown in *Table 9.1*.

Table 9.1 Significance of Impact

Landscape/Visual Sensitivity	**Magnitude of Change**			
	Large	Medium	Small	No Perceptible Change
High	Substantial	Moderate to Substantial	Slight to Moderate	No significant impact
Medium	Moderate to Substantial	Moderate	Slight	No significant impact
Low	Slight to Moderate	Slight	Slight / No significant impact	No significant impact

Impacts are considered both without mitigation (*Impact pre-establishment)*, on the year of opening and with mitigation 15 years after opening (*Impact post-establishment)*. Consideration is given to both summer and winter conditions (with and without vegetation).

Professional judgement by qualified, experienced landscape architects is used to combine the various contributors to landscape effects, and to assign a grade of change from the implementation of the proposals. However, landscape assessment is subjective and reflects the professional judgement of the assessors. Grades of impacts are therefore supported with text as appropriate to help explain the impacts predicted. *Guidelines for Landscape and Visual Impact Assessment* provides further advice on accepted methodology. Slight, moderate and substantial changes are deemed to be above the threshold of significance, and where such effects are predicted mitigation is proposed.

9.2.5 Photomontage Production

Details of the photomontage methodology are set out below.

9.2.5.1 Site Photography, Panorama Stitching and Perspective Matching

Photographs were taken by ERA Maptec with a APS-C sized digital camera and 50mm equivalent lens. A sequence of 3 frames in a panorama were taken at each viewpoint site. The individual frames had a 20 degree overlap. The exposure was kept constant for all three frames. The positions of the camera was recorded using differential GPS (accurate to 0.5m). The exposure, view angle and weather conditions were also recorded for each viewpoint site. For each viewpoint, ACD Photostitcher was used to combine the individual photographic frames into panoramas. Matching computer-generated panoramas were constructed using the Visual Nature Studio programme. The parameters for these computer generated wireframes were based upon the recorded viewpoint and camera details. A perspective match was achieved between the computer-generated panoramas and the photographs by iteratively adjusting the perspective parameters (particularly viewcone and azimuth) until all major features in the image were aligned satisfactorily. These panoramas showed the surrounding landform based on a digital terrain model derived from the Ordnance Survey of Ireland 20m DTM data. Where appropriate, objects in the landscape such as gate posts and electricity pylons were used as additional markers.

9.2.5.2 *Rendering and Output*

Once accurate perspective parameters were known, these were fed into the rendering of Visual Nature Studio. A full model at the scale of the proposals was built within this package. Surface materials and colours were chosen to match those intended when the proposals are constructed. For each viewpoint, the date and approximate time of photography was used to calculate sun azimuth and elevation to ensure a correct lighting model. The final photomontages were composited using Adobe Photoshop.

In interpreting the photomontages, two important issues must be considered.

- There is an element of professional judgement inherent in the representation of changes shown in a photomontage. While the data sources are largely factual, or based on the judgement of professionals, the finished image is ultimately what the professional believes to be a reasonable imitation of a photograph of the completed proposal taken in similar conditions.

- Each photomontage incorporates the lighting seen in the base photograph. It therefore only truly represents the appearance of the proposed development as it would have appeared at that time, and on that day. The perceptibility of the changes and the visual character of elements of the scheme will be different under different weather or lighting conditions.

9.3 DESCRIPTION OF EXISTING LANDSCAPE AND VISUAL ENVIRONMENT

9.3.1 Overview

A review of policy in respect of landscape protection as derived from both the Wexford County Development Plan 2007-2013 and the Kilkenny County Development Plan 2002 is outlined and illustrated on *Figure 9.1 (Volume 2)*.

9.3.2 Landscape Designations, Policy and Guidance - Wexford County Development Plan 2007-2013

9.3.2.1 *Policy objectives for landscape and landscape elements*

Within this development plan, policy relating to landscape and landscape elements is set out as follows:

Policy NH 1: The Council shall encourage the conservation and maintenance of features important to local landscapes including trees, hedgerows, stone walls, woodlands, ponds, streams and wetlands.

Policy NH 2: The Council shall protect trees and woodlands of particular amenity and nature conservation value and make Tree Preservation Orders where appropriate.

Policy NH 3: The Council shall encourage woodland management and participating in tree and hedgerow planting schemes by community groups and others.

Policy NH 6: The Council shall resist development proposals which would result in the loss of trees which make a valuable contribution to the character of the landscape, a settlement or its setting.

9.3.2.2 *Landscape Character Assessment*

Policy in respect of the County Landscape Character assessment is quoted below;

Policy L1: In assessing developments the Council will have regard to the guidance contained in the Landscape Character Assessment. Proposed developments should reflect the guidance contained in the Landscape Character Assessment and seek to minimise the visual impact, particularly in areas designated as Sensitive and Vulnerable Landscapes.

The proposals are located in the following two character units as referenced in the County Landscape Character Assessment. These are *'Barrow River Corridor'* and *'Policy Area 3 South Hills'*. Description and policy objectives are quoted below abstracted from the landscape character assessment.

'Within the Lowlands there are a number of important sub-divisions – and 'landscape within landscape' – as follows;- There are two areas of elevated lands – the North and South Hills – which contain concentrations of elevated areas that enclose or visually dominate the local countryside. Within these areas there are higher than normal concentrations of potentially conspicuous sites where additional vigilance will be required when evaluating planning applications. In contrast to the elevated areas there are two highly scenic major River Corridors – The Slaney and the Barrow – than transect the lowlands of the County. Of these the Slaney is the most exceptional on account of its extent, its centrality to the county and its unspoilt character. This is another area where additional vigilance will be required when evaluating planning applications.

- *Recognise that these areas are made up of a variety of working landscapes and contain the vast proportion of the Counties population within principle towns and on rural holdings. These also incorporate all of the major national primary and regional roads, and railways.*

- *Continue to permit development that can utilise existing infrastructure, whilst taking account of absorption opportunities provided by the landscape and prevailing vegetation.*

- *Encourage development that will not unduly result in detrimental impacts on the landscape at a local or micro level as viewed from areas of the public realm.*

- *Consider development on steep slopes, ensuring that it will not have a disproportionate or dominating visual impact on the surrounding environment as seen from areas of the public realm.*

- *Recognise the substantial pockets of residential and rural landuses in some locations and the emerging pressures for differing landuses of industry, wind energy and residential development in this policy area.*

- *Continue to facilitate appropriate development in a progressive manner that respects the scale character and sensitivities of the landscape.*

- *Recognise that in this low lying open environment, tall and bulky development sometimes can have a disproportionate impact against the landscape particularly when viewed from the predominantly low lying areas of the public realm.*

- *Encourage development that will not have a disproportionate effect on the existing character of the landscape in terms of location, design, and visual prominence.'*

In terms of landscape sensitivity (mapping not provided in the County Plan), large rivers are classed as vulnerable (score of 5 in the Landscape Character Assessment) and this is understood to include the *'Barrow River Corridor'*. This category is described as follows, *'Very distinctive features with a very low capacity to absorb new development without significant alterations of existing character over an extended area'.*

The ridgelines of mountains and hills are also referenced under this category and locally dominant ridgelines are also located in the receiving landscape within the context of the *'Policy Area 3 South Hills'* identified in the landscape character assessment.

This landscape also contains agricultural land with significant areas of natural vegetation which is classed as being sensitive (score of 4). This category is described as follows, *'Distinctive character with some capacity to absorb a limited range of appropriate new developments while sustaining its existing character'.*

9.3.2.3 Record of Protected Structures

The protected structures which may have a landscape setting which in turn may be affected by the proposals include the following and are illustrated in *Figure 9.1 (Vol. 2).*

1. Stokestown Castle, Stokestown lodge, Stokestown House and Stokestown Folly;
2. Berkeley House and wooded estate ; and
3. Arnestown House and Demesne.

9.3.3 *Landscape Designations, Policy and Guidance – Kilkenny County Development Plan 2002*

9.4 *OVERVIEW*

Part of the proposed road alignment lies within Co Kilkenny, specifically a 1.5km length of alignment extending from the western side of the River Barrow to the existing N25 road north east of the village of Glenmore. Policy in regard to landscape protection of this area is outlined and illustrated on *Figure 9.1 (Vol. 2).*

9.4.1.1 *Areas of High Amenity*

These are areas of the County which are deemed to have outstanding natural beauty. Policy for development stipulates that a high standard of design and siting will be required for all development in these areas. In addition, development which would be seriously injurious to the visual amenity is not to be encouraged.

The landscape setting for the proposed road north of the village of Glenmore is part of a wider landscape corridor located between the line of the existing N25 road route and the western banks of the River Barrow (including the waterway), all of which carry this designation.

9.4.1.2 *Protected Views*

Scheduled protected views within the study area include the following:

1. Views north from hilly ground at Ballyverneen on the western bank of the River Barrow.

9.4.2 *Receiving Landscape Character*

A description of the receiving environment for the proposals is provided in the context of local landscape character areas or LLCAs as defined by ERM. Each LLCA is deemed to have a unique and site specific landscape character. The LLCAs are reviewed below, including their quality and sensitivity to change, which may be defined [(1)] as follows.

9.4.2.1 *Landscape Quality*

Landscape quality refers to the physical state of the landscape, and its intactness, from visual, functional and ecological perspectives. It also reflects the state of repair of individual features and elements which make up the character in any one place. The quality of the landscapes in the study area are assessed and categorised as either one of the following:

(1) Grades developed from Landscape Institute and Institute of Environmental Assessment (2002) Guidelines for Landscape and Visual Impact Assessment. Second Edition E and FN Spon.

- *High*: a landscape of nationally or locally recognised importance; or
- *Moderate:* an attractive and intact landscape, but which is not designated; or
- *Low*: a degraded landscape which would benefit from enhancement.

Sensitivity to change of the landscape is categorised as either one of the following:

- *High:* existing qualities and attributes would be threatened by the proposed change; or

- *Moderate:* the landscape would be capable of absorbing some of the proposed change; or

- *Low*: a landscape which can readily accept change or which would benefit from the proposed change.

There are 4 identified LLCAs and their boundaries are illustrated on *Figure 9.2 (Vol. 2).*

9.4.2.2 New Ross Urban Centre LLCA

The commercial centre of New Ross has developed as a concentrated settlement around the banks of the River Barrow. This townscape is variable in terms of the condition and quality of the buildings that comprise the urban fabric. The sensitivity of this LLCA to the proposed change is judged to be *low*.

9.4.2.3 River Barrow and Floodplain LLCA

This character area comprises the waterway corridor associated with the River Barrow and the adjacent floodplain land. Key characteristics are as follows:

1. broad river corridor is a dominant physical and visual element;

2. adjacent floodplain is a broad flat landscape margin to the river;

3. large scale field sizes are typical of farmland in this area. Farming types include pasture and tillage;

4. pockets of mature deciduous woodland scattered throughout; and

5. large clumps of mature woodland in the townlands of Stokestown, Landscape and Oaklands.

The condition and quality of this landscape is judged to be *high*. The sensitivity of this LLCA to the proposed change is judged to be *high*.

9.4.2.4 Flat to Undulating Farmland to the North East of New Ross LLCA

1. relatively flat farmed landscape setting;

2. open exposed landscape with medium to long ranging views;

3. occasional big houses dating back to the 18th century (sites of former estates);

4. large scale field pattern defined by hedgerows with occasional mature trees in hedges;

5. pasture and tillage are the principal land uses;

6. minor roads are relatively straight, well surfaced and in good condition;

7. treelines and tall hedgerows line these roads;

8. scattered farm buildings are present, some of which are very large and visually detract from this landscape;

9. large scale factory site south of Lacken townland detracts from the local area; and

10. occasional low hills are present, the most prominent being located in Lacken townland, somewhat scarred by the clear-felling of forestry.

The condition and quality of this landscape is judged to be *moderate*. The sensitivity of this LLCA to the proposed change is judged to be *moderate*.

9.4.2.5 Farmed Hills South of New Ross LLCA

1. a landscape of undulating topography and small locally distinctive hills;

2. pasture is the principal land use;

3. small scale field pattern defined by hedgerows with some hedge trees;

4. narrow winding roads, some in poor condition;

5. hedgerows typically line these roads, occasional beech tree lines occur on these roads;

6. occasional pockets of scrub and woodland located throughout;

7. enclosed landscape with very short range views as determined by the more pronounced topography. Occasional long range panoramic views from hilltops; and

8. traditional farmhouses rendered white or built of stone are present.

9. Many scenic views available towards the summits of the local hills and Slieve Coltair (Slievecoiltia) located further a field.

The condition and quality of this landscape is judged to be *high*. The sensitivity of this LLCA to the proposed change is judged to be *high*.

9.5 RESIDUAL LANDSCAPE AND VISUAL IMPACTS

9.5.1 Introduction

The proposals cross a scenic agricultural landscape which includes the River Barrow which has an overall rural and tranquil quality and contains residential dwellings which are scattered throughout, in clusters or as individual houses. The proposals will have significant negative impacts on both landscape and visual amenity. These impacts will be greatest at both the construction stage and the early operational stages (after road opening) when the mitigation landscape works is either not in place or of limited effect owing to the juvenile stage of the planted nursery stock.

Permanent landscape and visual impacts will be derived from the introduction of new road infrastructure comprising a range of elements described in *Chapter 3* of this EIS. The particular elements of the scheme, which have potential for landscape and visual impact, include the following:

1. scheme earthworks, principally as embankments and cuttings together with the changes caused by these elements in terms of land take and localised changes of topography;

2. structures, including grade separated junctions, overbridges and proposed at grade crossings including roundabout structures;

3. severance of watercourses;

4. River Barrow crossing at Pink Point;

5. loss of vegetation, including hedgerows, trees, tree groups and areas of woodland;

6. presence of traffic on the proposed road;

7. road illumination and signage; and

8. structures associated with noise attenuation.

9.5.2 *The Permanent Landscape Impacts of the Scheme*

9.5.2.1 *Overview*

The majority of impacts upon landscape are permanent and are described below and illustrated in *Figure 9.3 a-f*. Temporary effects as a result of construction are dealt with in *Section 9.6*.

At worst all vegetation together with existing fences will be removed for a strip of land of variable width from the centreline of both the mainline and associated side roads. Topsoil will be stripped and some of the current farmland with hedgerows will be replaced with a road surface of no landscape value. Areas of farmland will also be permanently lost to the proposals which will generally receive topsoil and landscape treatment in the form of planting or seeding. The three sections of the proposed scheme are thus described in terms of their predicted effect on the receiving landscape.

9.5.2.2 *N25 Bypass*

The N25 Bypass will commence at a proposed roundabout junction and lighting at the existing N25 at Glenmore the construction of which will involve the removal of some mature woodland. The realigned local road LS 7501 on the south western approach to the roundabout will cross two fields involving severance of hedgerow vegetation. The southern and northern approaches to this roundabout are expected to be confined within the existing road thereby resulting in no particular loss of landscape elements.

The mainline will extend east and the proposed bridge crossing (B01 in *Figure 9.3 a-f, Volume 2*), local road realignment (LS7513) together with associated earthworks will result in the removal of considerable sections of native woodland adjacent to a watercourse in the area. The mainline will intersect with the rail crossing by means of structure (B02) involving vegetation losses. The topography is such that the cutting will be visible as a distinct notch in the landscape when viewed from particular locations in the townland of Jamestown.

The mainline will extend further east over relatively flat farmland which is visually exposed. The route will cross the River Barrow by means of a bridge designed to be a new landmark feature in the landscape. Views of the alignment and indeed the new bridge will be gained from locations further a field particularly on the western side of the river. Vegetation losses that will arise include sections of native species woodland on the western bank of the River Barrow together with hedgerows containing mature trees. The proposed earthworks embankments associated with the river crossing will contrast with the gentle flat landscape of the floodplain and will adversely affect the character of this area.

Further east at Stokestown, the mainline will result in removal of hedgerow vegetation. The structure (B03) and road realignment (L4026-2) together with storm control areas is predicted to have an adverse effect on the rural and intimate character of the immediate area in which it will be located. Further east, the proposed mainline will be substantially concealed from view in a cutting although loss of vegetation will still arise, particularly sections of woodland at the proposed local road realignment (L-4026-1) near Ch 3,200. A large complex junction with lighting is proposed to integrate the bypass with the R733 and the access road to Stokestown Port. The impacts, apart from the loss of woodland amount to a reduction in rural character together with short range visual impacts as will be experienced by residents of dwellings located to the south and north of this junction.

Further to the north east, residents of dwellings located on elevated ground at the southern slopes of Camlin Hill will experience significant visual impacts as the proposed interchange will be clearly visible. Further east, the proposed mainline on embankment will result in the severance and removal of hedgerow vegetation. Changes in landscape character caused by the proposals will also be clearly visible from the dwellings located on the southern slopes of Camlin Hill.

The route extends uphill in an easterly direction on fill over farmland. The proposed structure (B05) and local road realignments (L-8049-1 and L8047-1) together with the proposed mainline cutting Ch 4,500-5,300 will extend eastward uphill resulting in permanent loss of farmland and removal of sections of many hedgerows. Visual impacts in these locations will arise from the structures and in part the edge of the cutting, the road surface and traffic being screened from view in many locations by the proposed earthworks.

The local road realignment (L8048-1) in Creakan Upper together with the mainline and Structure (B06) and earthworks embankments are likely to be visually conspicuous at a localised level being located on embankments. Impacts on the landscape include loss of hedgerow vegetation, permanent loss of farmland and a reduction in rural character.

The mainline progresses further east for which sections of hedgerows and mature trees will be removed. The receiving landscape here between Creakan and Knockmullin is well wooded and features hedgerows comprising mostly mature trees. The existing retained vegetation is likely to contribute to a reduction in the potential visual impact of the proposals in summertime. The realignment of the local road (L-80434) will result in the removal of a section of mature hedgerow trees and substantial visual impacts will arise for residents of nearby dwellings. The mainline, as it progresses east uphill from this location will also result in the severance and removal of sections of hedgerow containing mature trees.

The mainline continues downhill in an easterly direction towards the proposed Ballymacar Bridge Junction. It together with the proposed earthworks and lighting will result in permanent reduction of the rural character of the immediate area, vegetation losses and significant visual impacts for residents of dwellings located nearby.

9.5.2.3 *N30 Bypass*

The proposed N30 bypass will extend eastward, in relatively shallow cut or near the 'at grade' level across farmland severing many hedgerows. Residents of scattered dwellings throughout will be affected visually.

The proposed bridge over the local road L4008 at structure B09 together with the earthworks embankments will become prominent features at a localised level in this relatively flat farmland. Thereafter the mainline will continue in a cutting under the local road L 4013-2 by means of bridge structure B10. Whilst visual impacts will apply to a lesser extent, as a result of the proposed alignment being in a cutting, sections of hedgerow vegetation will be lost.

The mainline will extend uphill due north on an earthworks embankment, bridging over the local road L4007-3 by means of structure B11. Significant mature vegetation will be lost and visual impacts will arise at short range principally as a result of the embankment which will obstruct views across the wider landscape. This structure will be screened from view from the far west by the intervening Lacken Hill.

Thereafter the mainline progresses north either at grade or in shallow cut or shallow fill. Many hedgerows will be severed and visual impacts will arise for residents of scattered dwellings throughout. The proposed roundabout at Corcoran's Cross together with lighting and associated tie in roads will permanently alter the rural and tranquil character of this area in addition to permanent land take and loss of hedgerow vegetation. In regard to nearby residents of dwellings, visual impacts will arise and these will be mostly caused by the proposed earthworks embankments.

9.5.2.4 *N30 East Tie In*

The mainline extends from the proposed roundabout gently downhill in an easterly direction on an embankment, severing many hedgerows thereafter linking in with the existing N30. Visual impacts will arise for residents of dwellings and these will arise mainly as a result of the proposed embankment.

The direct impacts of the scheme on landscape elements and features are listed in the table below and illustrated in *Figure 9.3 (Vol. 2)*.

Table 9.2 Impacts on Landscape Elements and Features

Location or chainage (*Figure 9.3*)	Description
N25 Bypass approximate location or chainage	
Glenmore Junction and LS 7501 realignment	This part of the proposals will result in the following vegetation losses: • Sections of at least two hedgerows; and • Some mature trees will have to be removed to facilitate the roundabout junction.
Chainage 0-200 and LS 7513 realignment and LS 7512 tie in	This part of the proposals will result in the following vegetation losses and direct landscape impacts: • The Graiguenakill Stream will be affected where it crosses the proposed bypass and will have to be realigned. • A linear section of mature woodland associated with the stream will have to be removed; and • Sections of hedgerows that currently line the local roads will have to be removed.
200-1200.	This part of the proposals will result in the following vegetation losses: • Sections of hedgerows associated with field boundaries will be affected to facilitate the alignment in deep cut; and • Other hedgerow vegetation including mature trees (usually native species) located at chainage 500, 700 and 1000.
N25 Bypass (River Barrow Bridge) approximate location or chainage	
1200-2100	Partial loss of some woodland comprising native species, mainly Oak (*Quercus spp*), may arise at Pink Point on the west side of the river. The proposed bridge will cross two field drains for which direct impacts may not arise. Some vegetation losses on the eastern banks of the river may arise.
N25 Bypass approximate location or chainage	
2100-3400	This part of the proposals will result in the following vegetation losses: • At chainage 2100, a section of hedgerow containing mature trees; • The proposed bridge crossing and local road realignment at chainage 2300-2400 will result in the removal of mature roadside hedgerows containing some large trees; • A section of hedgerow comprising mature trees at chainage 2700; • An area of scrub woodland between chainage 3050-3200 in order to accommodate the mainline in cut and proposed bridge structure; and • Some mature trees associated with the designated sensitive woodland in Landscape in order to facilitate the proposed local road realignment at chainage 3300. • Stokestown Folly which is a protected structure will be retained south of the mainline earthworks at N25 Ch 2800.
3400-4200	The proposed junction with the R733 will result in the following vegetation losses and direct landscape impacts: • Line of mature trees containing native species associated with an existing hedgerow at chainage 3650; • Vegetation associated with the designated sensitive woodland at Landscape at chainage 3600 – 4000; • The Landscape / Camlin Stream will be crossed at chainage 4000; • Mature roadside trees on the R733 north and south of the proposed junction; and • Sections of two hedgerows containing mature trees at chainage 4100-4200.

Location or chainage (*Figure 9.3*)	Description
4200-5800	This part of the proposals will result in the following vegetation losses: • Sections of hedgerows associated with field boundaries and along the line of local roads between chainage 4300 and 4500 will be affected to facilitate the proposed bridge crossing and local road realignment together with some mature trees to the south of the proposed mainline; • Hedgerow vegetation and mature trees to facilitate the mainline in cut and the local road realignment north of the mainline between chainage 4500and 4900; • Sections of hedgerows containing mature trees to facilitate the mainline and earthworks cutting between chainage 5000 and 5100 and between chainage 5200 and 5400; and • Sections of roadside hedgerows and field boundary hedgerows will be affected by the proposed mainline and bridge structure and local road realignment.
5800-7300	This part of the proposals will result in the following vegetation losses: • Sections of hedgerows comprising mostly mature trees in order to facilitate the mainline and earthworks between chainage 5900 and 6400; • Hedgerows at chainage 6500 and 6650; • Roadside hedgerow vegetation at the location of the proposed structure at between chainage 6800 and 6900. • Mature hedgerow trees within the estate will be affected in order to accommodate the local road realignment and access track. This also constitutes a direct impact on the landscape associated with this estate; and • Hedgerows containing mature trees at chainage 7300 to facilitate the proposed mainline.
7300-8700	This part of the proposals will result in the following vegetation losses and direct landscape impacts: • Sections of hedgerows, many of which contain mature trees at chainage 7500, 7600, 7700 and 7900; • Sections of woodland and scrub vegetation associated with the Maudlin Stream at chainage 8000, 8300-8500 and 8600-8700, the latter to accommodate the proposed Ballymacar Roundabout; • The Maudlin Stream will be crossed in three locations indicated above and will be realigned; and • Hedgerow vegetation associated with the local road realignment to the south of the proposed roundabout at Ballymacar.
N30 Bypass approximate location or chainage	
0-2000	This part of the proposals will result in the following vegetation losses: • Section of hedgerows containing mature trees at chainage 100; • Sections of at least ten field boundary hedgerows between chainage 150 to 1300; • An area of scrub and sections of hedgerows at chainage 1400-1450; • Section of a hedgerow at chainage 1550; and • Sections of roadside hedgerows and some mature trees at chainage 1900-2000 to facilitate the proposed structure.
2000-3500	This part of the proposals will result in the following vegetation losses: • Sections of hedgerows at chainage 2050 containing mature trees and chainages 2300, 2400-2500 and 2700, the latter of which contains mature trees; • Mature roadside trees to facilitate the proposed structure and local road realignment at chainage 2600;and • Areas of scrub vegetation located between chainage 2900-3000 and 3300-3400 together with roadside hedgerows.

Location or chainage (*Figure 9.3)*	Description
3500-5000	This part of the proposals will result in the following vegetation losses and direct landscape impacts: • Sections of at least twelve hedgerows associated with field boundaries as a result of the mainline proposals across this farmland; and • Existing field drain will be crossed by the proposed roundabout junction at chainage 5000.
N30 East Tie-in	
L4003 realignment	This part of the proposals will result in the following vegetation losses: • Roadside hedgerows and some mature trees associated with the north tie in at Rathgaroge; and • Potential mature tree losses associated with the south tie-in at Knockroe.
0-1100	This part of the proposals will result in the following vegetation losses: • Sections of at least seven hedgerows associated with field boundaries; and • Sections of roadside hedgerows between chainage 800 and 1100.

9.5.2.5 *Impacts Arising from Proposed Earthworks*

The proposed earthworks will have a *direct negative* impact on the landscape in which these structures are located. In addition, *indirect negative* impacts will affect the local character of the landscape surrounding these structures because of their visibility in the wider landscape setting. In general, the proposed embankments are predicted to result in impacts of greater significance than the earthworks cuttings as they will generally be more visually prominent physical features above ground level. They will be seen from particular locations in the wider area and they are also likely to obstruct views across the local landscape settings in which they will be placed.

Table 9.3 Impacts of Earthworks Embankments

Location or chainage (*Figure 9.3)*	Description
N25 Bypass approximate location or chainage	
0 - 100	The proposed embankment in Glenmore will reach a maximum height of approximately 4.5 m.
600 – 850	The proposed embankment in the townland of Ballyverneen will reach a maximum height of approximately 3 m. This embankment is likely to partially obstruct views across the landscape at a localised level, in particular views to the south.
1050-1200 and 2050-2300	The embankments on either side of the proposed River Barrow bridge crossing are expected to reach a maximum height of approximately 9 m thereby altering the open flat character of the riverbank landscape.
2300-2650	The proposed embankment in the townland of Stokestown will reach a maximum height of approximately 4 m.
3100-3500	In the townland of Stokestown this proposed embankment will reach a maximum height of approximately 7-8 m. This will be visible at a very localised level owing to the screening effect of vegetation.
3900-4400	The embankment on the eastern side of the R733 junction is designed to reach approximately 9 m in height and is predicted to result in indirect impacts on the local landscape as perceived from the southern slopes of Camlin Hill and from Creakan. Partial obstruction of views across the landscape are likely to result. The embankment will be situated in a localised hollow topographically and thus the extent of the impact is likely to be confined by the higher ground associated with Camlin Hill.
5300-5950 6400-6700	In the Creakan townland, two sections of the mainline route will be located on embankment. These will reach an approximate height of up to 8 m and 5 m respectively. The impacts of these will be confined to a localised area owing to the screening effect of higher ground at Knockmullin.
7200-8000	In the Creakan townland this embankment is expected to reach an approximate height of 4 m. The scale of this is relatively small and is predicted to result in partial obstruction of views across the wider landscape at a localised level.
8200-8400 8550-8700	The proposed embankment will reach an approximate height of 4-5 m. The proposed embankment will reach an approximate height of 9 m.
N30 Bypass approximate location or chainage	
0-200	The proposed embankment in the townland of Ballymacar is expected to reach a height of approximately 9m.
1600-2100	The proposed embankment in the townland of Lacken is associated with structure B9 and will reach a maximum height of approximately 7 m.
2800-3650	The proposed embankment in the townland of Lacken is associated with structure B11 and will reach a maximum height of approximately 9 m. It is expected to cause obstruction of views across the wider landscape, in particular to the east. Views in a westerly direction are currently somewhat limited by Lacken hill and associated woodland.

Location or chainage (*Figure 9.3*)	Description
4000-4400 4700-5000	The proposed embankments are expected to reach a height of approximately 4 m.
N30 East Tie-in	
0-1000	The embankment associated with the N30 east tie in which is approximately 1 km length will reach an approximate height of 6 m.
Sideroads and local road realignments	
In Ballyverneen	Earthworks associated with the proposed roundabout junction and N25 South tie in.
In Stokestown	Earthworks associated with the L-4026-1 tie in and the access road to the port.
In Camlin	Earthworks associated with the L-8049-1 and the L-8048-1 realignment.
In Knockmullin	Earthworks associated with the L-4021-2 realignment and the L-80434 route.
In Ballymacar	Earthworks associated with the N25 west tie in.
In Rathgaroge	Earthworks associated with the N30 west tie in and the L-4003-3 realignment.

Table 9.4 Impacts of Earthworks Cuttings

Location or chainage (*Figure 9.3*)	Description
N25 Bypass approximate location or chainage	
100-850	Located east of the proposed Glenmore roundabout, this cutting will reach a maximum depth of approximately 8-9m. The indirect effects of this structure on the wider landscape setting will be particularly relevant in the townlands of Cappagh and Jamestown where the cutting is expected to be visible as a distinct notch in the landscape against the backdrop of Slieve Coltair in the distance.
800-1050	Located on the west of the proposed River Barrow crossing this cutting will reach a maximum depth of approximately 4 m. As this structure is not designed to intrude upon or visually obstruct the open landscape setting of the river, this landscape will not be compromised to the same extent as will be the case with embankment structures.
2600-3100	Located on the east of the proposed River Barrow Crossing reaching a maximum depth of approximately 13 m. This is among the deepest of the cuttings and is expected to be visible from selected locations as a prominent notch in the landscape. Some visual screening provided by existing woodland is likely to reduce the degree of this impact.
4400-5350	Located in the townland of Creakan this cutting will reach a maximum depth of approximately 13-14 m. This is predicted to be visible as a prominent notch in the landscape from localised areas.
5850-6450	Located in the townland of Creakan this cutting will a maximum depth of approximately 5 m.

Location or chainage (*Figure 9.3)*	Description
6750-7100	In the townland of Arnestown this cutting will reach a maximum depth of approximately 3 m.
8000-8260 8350-8550	In the townland of Ballymacar these cuttings will reach a maximum depth of approximately 7 m and 3m respectively. This is predicted to be visible as a prominent notch in the landscape from some locations.
N30 Bypass approximate location or chainage	
380-880	In the townland of Ryleen this cutting will reach a maximum depth of approximately 4 m.
1100-1600	In the townland of Ryleen this cutting will reach a maximum depth of approximately 2 m.
2150-2800	In the townland of Lacken this cutting will reach a maximum depth of approximately 8 m. This is predicted to be visible from some locations as a prominent notch in the landscape from particular localised areas.
3650-4000	In the townland of Lacken this cutting will reach a maximum depth of approximately 2 m.
4400-4700	In the townland of Berkeley this cutting will reach a maximum depth of approximately 1-2m.
Sideroads and local road realignments	
In Ballyverneen	Earthworks associated with the LS 7501 and LS 7503 local roads.
In Stokestown	Earthworks associated with the L 4026-1 and L 4026-2 local roads
In Ballymacar	Earthworks associated with the L 80561 local road.
In Lacken	Earthworks associated with the L 4008 local road.

9.5.2.6 *Impacts Arising from Proposed Junctions, Structures and Road Realignments*

The larger and more complex structures that are proposed as part of the scheme are predicted to significantly alter the landscape character of the local area in which each is located.

These indirect impacts are generally judged to be negative except in the case of the proposed Barrow Bridge crossing. This has been designed to appeal aesthetically to the viewer and could give rise to a positive impact on landscape character. Some indirect negative impacts may also arise as a result of the predicted reduction in rural character of the receiving landscape caused by its presence, together with moving traffic and lighting.

In the case of all structures, direct negative impacts are likely to apply and will include the loss of vegetation, localised changes in topography together with the introduction of new built elements into areas formerly relatively undeveloped. These structures are listed as follows:

1. group of structures located at Glenmore. This includes roundabout junction and structures B01 and B02 together with local road realignments LS 7501 and LS 7513 and LS 7512. All of these structures are closely grouped spatially and therefore will result in a significant impact owing to their collective scale;
2. River Barrow Bridge Crossing;
3. R733 junction including structure B04 at Landscape and associated road realignments including the L4026-1 and access to Stokestown Port;
4. group of structures located at Ballymacar. This includes the roundabout junction and structure B08 together with the tie in to N25 and N30 routes and the L80561 realignment;
5. roundabout Junction at Corcoran's Cross together with the N30 tie in and realignment of the L4003-3.

Further bridge structures (not listed above) proposed together with local road realignments are listed below. These are predicted to cause direct negative impacts arising from the removal of vegetation, localised changes in topography and the introduction of built elements into a predominantly rural or relatively undeveloped area. Indirect impacts are also predicted to be negative and are associated with the reduction of rural character in the receiving landscape. These structures are listed below:

1. B3 structure and realignment of L4026-2 at Stokestown (N25 Ch 2330);
2. L-4026-1 realignment (N25 Ch 2900-3300);
3. B4 structure at Landscape (N25 Ch 4000);
4. B5 structure and realignment of L8049-1 at Creakan (N25 Ch 4400);
5. L-8047-1 realignment (N25 Ch 4500-4900);
6. B6 structure and realignment of L8048-1 at Creakan Upper (N25 Ch 5700);
7. B7 structure and realignment of L4021-2 and L8043-4 at Arnestown (N25 Ch 6880);
8. B9 structure and realignment of L4008 at Ryleen (N30 Ch 1920);
9. B10 structure and realignment of L4013-2 (N30 Ch 2615);
10. B11 structure and realignment of L4007-3 (N30 Ch 3300); and

9.5.3 Impacts on Local Landscape Character Areas

9.5.3.1 Overview

The following assessment of the impact of the scheme on the local landscape character takes account of the mitigation measures as outlined in *Section 9.5*

Both *direct* and *indirect* impacts will apply to the local landscape character areas (LLCAs) and these are discussed below.

9.5.3.2 New Ross Urban Centre LLCA

The road proposals are located approximately 2-4 km distance to the south and east of this urban area and will not be *directly* affected by the proposals.

The proposals are likely be substantially screened from view from this LLCA by intervening vegetation and topography. The proposed second river crossing is also expected to be screened from view owing to the sinuous course of the River Barrow located directly south of the town of New Ross. The proposals are assessed to cause an *imperceptible* magnitude of change on the LLCA of *low* sensitivity resulting in an impact of *no significance.* Some positive impacts on character may arise from the potential reduction in through traffic in the town as a result of the proposals.

9.5.3.3 River Barrow and Floodplain LLCA

This LLCA will be *directly* affected by the proposals, in particular the second river crossing between chainage 1350 to 2500 which will pass through this LLCA. The *direct* effects will be *negative* and these amount to vegetation losses and stark changes in the local relatively flat topography that will arise from the proposed earthworks embankments. In addition the physical presence of the proposals is expected to cause a reduction in the rural character of the area. *Indirect* impacts will also occur to this landscape as a result of the visibility of the proposals and these are assessed to cause a *high* magnitude of change to this LLCA of *high sensitivity* thereby resulting in a *substantial* impact. It is worth noting that whilst the direct impact of the proposed road and earthworks is considered to be *negative*, the impact of the proposed bridge structure that is expected to span the river could be regarded as *negative* or *positive* depending on the viewer. The bridge design could be viewed by some as a new and attractive landmark feature.

9.5.3.4 Flat to Undulating Farmland to the North East of New Ross LLCA.

This LLCA will be directly affected by the proposals, specifically the N30 Bypass and the N30 east tie in which will pass through this landscape. The direct effects will be negative and will include vegetation losses, changes in local topography due to the proposed earthworks together with the introduction of new infrastructure to this landscape which is expected to reduce its rural character. Indirect effects are also predicted to arise as a result of the visibility of the proposals from particular locations including the townlands of Ryleen, Lacken and Berkeley and the southern slopes of Lacken Hill. The proposals are thus assessed to cause a *high* magnitude of change in this landscape of *moderate* sensitivity resulting in a *moderate* to *substantial* impact.

9.5.3.5 Farmed Hills South of New Ross LLCA

This LLCA will be directly affected by the proposals, specifically the N25 Bypass between chainage 0 and 1350 and chainage 2500 and 8700 which will pass through this landscape. The direct effects will be negative and will include vegetation losses, changes in local topography due to the proposed earthworks together with the introduction of new infrastructure to this landscape which is expected to reduce its rural character. Indirect effects are also predicted to arise as a result of the visibility of the proposals from particular elevated locations in the townlands of Jamestown, Ballyverneen, Arnestown and Lacken and the southern slopes of Camlin Hill. The characteristics of the landscape, in particular the hilly topography and the presence of areas of dense mature woodland play a role in reducing the visibility of the proposals in particular locations. The proposals are thus assessed to cause a *high* magnitude of change in this landscape of *high* sensitivity resulting in a *substantial* impact.

9.5.4 Impacts on Landscape Designations

9.5.4.1 Landscape Character Assessment – Landscape Sensitivity

The following assessment of the impact of the scheme on the landscapes which are assumed to be designated as vulnerable or sensitive in the County Landscape Character Assessment (in the absence of mapping which precisely defines same) is set out below and takes account of the mitigation measures as outlined in *Section 9.5*.

- The River Barrow together with its banks will be *directly* affected by the proposals, in particular the proposed second river crossing and the N25 bypass from chainage 1300-1800. The *indirect* effects on this River, which will also apply are described in the context of the impact on that character area.

The proposals are assessed to cause *indirect negative* impacts on various ridgelines which could be assumed to be designated as vulnerable. The significance of the impact is described below:

- Slieve Coltair was visited and the assessment predicts that views of the proposals are expected to be gained from the summit of this mountain. Views of the second river crossing and parts of the alignment on both sides of the river are expected to be gained. Further north in the townlands of Camlin and Creakan and beyond, the proposals are expected to be screened by intervening topography. The proposals are expected to be viewed as relatively small but clearly identifiable elements in the panoramic view of the wider landscape resulting in a *slight* to *moderate* impact. In the case of the proposed river crossing, the impact could be seen as either *positive* or *negative* depending on the viewer.

- The ridgeline between Finshoge and Rochestown, may in particular locations afford views of the proposals. In locations where parts of the proposals are expected to be visible (areas without woodland cover), these are likely to be viewed as relatively small elements in the wider landscape setting resulting in a *slight* or *not significant* impact.

- The ridgelines associated with both Ballylane Hill and Lacken Hill may in particular locations (areas without woodland cover) afford views of a part of the proposals as relatively small elements in a wider landscape setting resulting in a *slight to moderate* impact.

9.5.4.2 *Areas Designated as Sensitive in Wexford County*

The agricultural landscapes that contain significant areas of natural woodland are classed as being sensitive could include the following for which impacts are outlined:

- The mixed species woodlands located on Lacken Hill and Slieve Coltair Hill will, as landscape elements or features, not be *directly* affected by the proposals.

- The John F Kennedy Arboretum, as a landscape element or feature will not be *directly* affected by the proposals. In addition, this arboretum is located some distance from the proposals and indirect effects on this landscape as experienced by viewers visiting the arboretum are not expected to arise.

- Broadleaf woodlands located on the banks of the River Barrow to the north and south of Camlin Hill will, as a landscape element, be directly affected by the proposals. The proposed N25 Bypass at chainage 3800 is likely to result in some vegetation losses.

- Mixed species woodland in the townland of Stokestown which, as a landscape element will not be *directly* affected by the proposals.

9.5.4.3 *Record of Protected Structures in Wexford County*

Protected structures which have a physical aboveground presence in the landscape and contribute to landscape character at a localised level are discussed below in terms of the predicted *negative* impact of the proposals on the setting of each site.

- *Indirect* impacts on the setting of Stokestown folly are predicted to arise and these are assessed as being *substantial* owing to its location immediately south of the mainline at chainage N25 Ch 2800.

- *Indirect* impacts on the setting of Stokestown Castle are predicted to arise due to the partial visibility of the proposed mainline and junction at chainage N25 2400 involving the realignment of the local road. Partial screening of the proposals will be provided by existing vegetation and the long term impact (with mitigation measures in place) is assessed as being of *moderate* significance.

- Both Stokestown House and the site of Stokestown Lodge are visually screened from the proposals by woodland and are thus expected to be *unaffected* by the proposals.

- Views of the proposals from Berkeley House and wooded estate are expected to be screened by intervening topography and mature hedgerow vegetation and therefore this site is expected to be *unaffected* by the proposals.

- *Direct negative* impacts are predicted to arise on the site associated with Arnestown House and Demesne. The *direct* effects include vegetation losses (mature trees) and loss of land associated with the local road realignment. This direct impact is assessed as being *substantial*. *Indirect* effects on this site will also arise because of the visibility of the proposals and these are expected to be of *moderate* significance in the long term (with mitigation measures in place).

9.5.4.4 *Areas of High Amenity in Kilkenny County*

- The proposed junction and road realignments at Glenmore and the N25 bypass from chainage 0 to 1,400 will have a *direct negative* impact on the Area of High Amenity located on the western side of the River Barrow. In addition *indirect negative* effects are predicted to apply to a part of this designated landscape. Views of the proposals are expected to be gained from particular elevated areas in the townland of Jamestown and from farmed hilltops in Ballyverneen and Carrickcloney. The overall significance of the impact is assessed as being *moderate.*

9.5.4.5 *Protected Views in Kilkenny County*

- The protected views north from hilly ground at Ballyverneen on the western bank of the River Barrow are not expected to be intruded upon by any part of the proposals.

9.6 *MITIGATION MEASURES*

The implementation of landscape design including land forming and planting will have, as a principal objective, the mitigation of landscape and visual impacts and this is illustrated in *Figure 9.6a-h and j-m (Vol. 2)* Preliminary Landscape Design. The scheme has been developed, taking into account the following broad design objectives:

1. ecologically sensitive integration of the road into the receiving environment. The proposed landscape treatments will complement the surrounding ecological network and will counter the potential barrier and fragmentation effect of the proposed bypass as well as compensate for the loss of habitat;

2. consideration of the landscape character and context of the road in the preparation of the landscape design which will also consider the road user. The scheme will aim to retain and reinforce regional identity;

3. use of landscape treatments that require minimal long term maintenance;

4. a range of different habitats will be created to enhance local biodiversity including grasslands, scrub, woodland planting and hedgerows;

5. a soil management plan will be prepared to address procedures to take place during site clearance and for the construction phase. Particular mitigation measures addressed in the soil management plan will cover the following:

    a. Topsoil to be stripped will be stored near the location from which it was taken and stockpiles will not exceed 2m in height in order to preserve soil structure.

    b. Replacement topsoil will be placed in the area from which it was originally taken.

    c. In the event that proposed earthworks embankments or cuttings are required to be reinforced, thereby prohibiting the planting of tree or shrub plant material, these areas, being deemed unsuitable for planting will be located, where possible, in parts of the scheme for which minimal visual impact will arise.

6. species chosen will seek to enhance local biodiversity through providing food for birds and animals, increased species diversity etc. Berried and other fruiting species as well as evergreens will be included in the design;

7. use of native species throughout the scheme is encouraged. The guide to landscape treatments for national road schemes in Ireland stipulates the following in regard to the use of native species *'The plant species mixes reflect native plant communities adjacent to or in the vicinity of the road scheme. Therefore only planting stock that complies with the sourcing conditions of the Native Woodland Scheme should be considered for landscape treatments on national road schemes. In such cases, deliveries must be accompanied by an approved Provenance Declaration Form/Suppliers Document incorporating the appropriate Certificate of Provenance number.'* Use of non native species may be acceptable in particular locations where non native planting species are present and are a part of local landscape character; and

8. a landscape and habitat maintenance plan will be required from the contractor to address the establishment maintenance period (usually 3 years post planting) and long term maintenance.

9.6.1 Landscape Mitigation Measures related to engineered elements

1. the engineering design sought to route the road around significant prominent hills such as Camlin Hill, Lacken Hill and other ridgelines located in the townlands of Ballymacar and Creakan thereby reducing the potential visibility of the proposals;

2. earthwork slopes will be designed where space allows to mimic naturalistic profiles, and to match in with the existing landform;

3. new signs will be positioned wherever safety allows to avoid new significant visual intrusion to nearby properties and to avoid the loss of established vegetation;

4. fencing or other built elements, for example boundary walls or structures for noise attenuation will be of a colour to blend in with the surrounding landscape. In regard to noise attenuation, the use of earthworks bunds or mounds as noise screens is preferable to the use of fences or similar built structures. Post and rail style of fencing is predicted to be most suited to the receiving landscape; and

5. existing redundant roadside clutter such as signs which are no longer needed and broken fences will be removed, thus improving the visual environment.

9.6.2 Landscape Design Mitigation Measures (Principles for the Preliminary Landscape Design)

9.6.2.1 Overview

In order to achieve the quality of design and the degree of mitigation of landscape and visual impacts which has been identified as being required, design principles reflected in the preliminary landscape design which will have to be addressed in more detail in the detailed landscape design were evolved and are summarised in the table below. Specific locations where these mitigation measures are to apply are indicated in the preliminary landscape design in *Figure 9.6a-h and j-m*.

Table 9.5 Landscape Design Mitigation Measure

General Landscape Mitigation measures indicated on Figures 9.6 a-h & j-m	Description and purpose
GLM 1	As much existing planting as possible will be retained within and adjacent to the road corridor. Vegetation to be retained will be protected in accordance with British Standard 5837. Where any woodland is removed for essential safety reasons the potential effects of wind-throw will be assessed and appropriate measures included in the design to mitigate any effects. This mitigation measure will typically but not exclusively apply in locations where the proposals are designed to tie into an existing local road.
GLM 2	Boundary hedgerow to be introduced to mitigate hedgerow habitat loss and fragmentation and contribute or reinstate local landscape character.
GLM 3	Landscape treatment (planting and or seeding) to be introduced to integrate proposed road tie in to existing local road in a manner that recognises local landscape character.
GLM 4	Storm control areas will be designed to have a natural rather than geometric plan profile and the banks of these ponds will be profiled in a manner that will accommodate the growth of suitable wetland planting in order that these become viable wetland habitats and serve as new and attractive features of the landscape.
GLM 5	Planting will be introduced to compensate for the loss of areas of woodland or scrub required to construct the road.
GLM 6	Possible requirement for landscape accommodation works, for example, boundary treatment to existing dwelling or premises may be required.
GLM 7	Hedgerow planting and boundary fencing to be set out in accordance with standards for the design of mammal crossings.

In addition to the above mentioned mitigation measures which occur on a frequent repeated basis throughout the scheme, particular and specific mitigation measures that are to apply to particular locations along the scheme.

9.6.2.2 Specific Landscape and Ecological Mitigation Measures

These are described with reference to chainage location of the proposals.

Table 9.6 Specific Landscape Mitigation Measures (the principal mitigation measures are described with reference to chainage location of the proposals) Refer also to the preliminary landscape design figures 9.6a-9.6m

Location (indicated on Figures 9.6 a-h & j-m)	**Description and purpose**
N25 Bypass approximate location or chainage	
0 - 100	Planting to areas within the road boundary surrounding the realigned Graiguenakill Stream will comprise wetland plant species for the purpose of enhancing the stream habitat.
100	Proposed planting (hedgerow) will be designed to facilitate mammal crossing.
600 - 800	Hedgerow vegetation will include transplants and some standard trees for the purpose of providing a line of planting of variable height to facilitate bat activity.
1000 - 1200 and 2050 - 2200	Low thicket of shrub planting designed to mitigate the adverse impact of the proposed earthworks embankment on the adjacent landscape character.
1200 and 2050	Planting is to comprise species designed to facilitate movement of badgers across the alignment, specifically underneath the proposed bridge crossing.
1200	Replacement native species woody planting to be introduced to compensate for woodland losses in this area.
2350 (L4026-2 side road north)	Hedgerow planting to include transplants and standard trees for the purpose of providing a line of planting of variable height to facilitate bats.
2600 - 3100	Proposed native species woodland mix is expected to enhance ecologically this area specifically the existing woodland habitat north of the mainline at this location. Proposed boundary hedgerow on the north side of the mainline will include transplants and standard trees to provide variable height planting to suit bat activity.
3100 - 3200	Proposed planting (hedgerow) will be designed to facilitate mammal crossing.
4000 – 4100	Planting to areas within the road boundary surrounding the realigned Landscape / Camlin Stream will comprise wetland species to enhance adjacent wetland habitats.
4700 west side	Existing woodland inside road boundary to be retained as far as is practicable and safe from the risk of windthrow.

Location (indicated on Figures 9.6 a-h & j-m)	Description and purpose
6000 - 6300	Proposed hedgerow on the north side of the mainline will include transplants and standard trees in order to provide variable height planting to suit bat activity. On the south side of the mainline cutting, proposed woodland planting will compensate for vegetation losses in this area and will replace to some extent the former woodland habitat in this location.
7200	Proposed planting (hedgerow) will be designed to facilitate mammal crossing.
7600 - 8000	Proposed landscape treatment (seeding) will be designed to afford views of the wider landscape setting.
7950 – 8400	Planting to areas within the road boundary surrounding the realigned culverted Maudlin Stream will comprise wetland species.
8250 and 8550	Proposed planting (hedgerow) will be designed to facilitate mammal crossings in both of these locations.
8600	Planting proposed to boundary hedgerows on the south western side of the junction will include transplants and standard trees in order to establish a line of planting of variable height to facilitate bat activity.
N30 Bypass approximate location or chainage	
1000-1200	Planting proposed to boundary hedgerows on the south western side of the junction will include transplants and standard trees in order to establish a line of planting of variable height to facilitate bat activity.
1350 - 1450	Proposed planting will include a species mix designed to match the species content of the adjacent scrub habitat. The mosaic like layout of the existing habitat will be mimicked in the setting out of the proposed road planting. Planting will also be designed to facilitate bat activity.
1350 - 1450	Lines of vegetation are to be established within the proposed planting to support the movement of bats in this area.
2900 - 3000	Proposed landscape treatment in this location will include wetland species to match adjacent habitat. Proposed landscape works could be set out in mosaic like pattern to mimic the adjacent habitat.
3450	Proposed planting (hedgerow) will be designed to facilitate mammal crossing.
3980	Proposed planting (hedgerow) will be designed to facilitate mammal crossing.
N30 East Tie-in	
100	Proposed planting (hedgerow) will be designed to facilitate mammal crossing.

Table 9.7 Specific Visual Impact Mitigation Measures (the principal mitigation measures are described with reference to chainage location of the proposals) Refer also to the preliminary landscape design figures 9.6a-9.6m.

Location (indicated on Figures 9.6 a-h & j-m)	**Description and purpose**
N25 Bypass approximate location or chainage	
150 - 600	Landscape design treatment will include planting to integrate earthworks cutting into receiving landscape and reduce visual impact for viewers located in Ballyverneen and Forestalstown.
LS 7513 realignment	Planting to earthworks embankment associated with this tie in will include a species mix designed to screen views of the embankment in particular from viewpoints 160, 210 and 211.
Glenmore roundabout junction	Planting to roundabout junction will include a species mix designed to screen views of this junction and associated lighting in particular from viewpoints 161and 162.
600 - 1000	The proposed woodland planting will be designed to assist in the integration of the mainline into the receiving landscape and screen views of this part of the proposals from viewers in Ballyverneen and Forestalstown.
1000 – 1200 and 2000 – 2200.	Landscape treatment will be designed to comprise seeded areas and areas of mixed native shrub species to form a low thicket of planting to the proposed embankment in a manner that affords views of the wider landscape setting by the road user whilst assisting integration of same into the receiving environment.
Second River Crossing	Bridge structure is designed as a visually open structure thereby giving the road user access to views of the wider landscape. The form of the structure is distinctive and will be present in the receiving river landscape as a landmark feature. There will be minimal navigation lighting underneath the bridge. Road deck lighting is not envisaged. Possibility that feature lighting of the cables and towers may be a requirement. Feature lighting is likely to use LEDs.
2100 - 2200	Proposed planting mixes will be designed to afford views of Stokestown Castle from the road thereby enhancing the sense of place or local identity for the road user.
2200 - 2600	Proposed woodland planting will be designed to assist in integration of the proposed earthworks embankment and junction with local road into the receiving landscape. The proposed planting will include species designed to assist in the screening of these structures from view particularly from viewpoints 144 and 145 and 151, 152 and 153.
2600 - 3100	The proposed woodland planting will be designed to assist in the integration of the proposed earthworks cutting into the receiving landscape and provide visual screening of the proposals in particular from viewpoints 149 and 150.
3150 - 3350	Planting to earthworks embankment will include a species mix designed to screen views of the embankment and local road realignment in particular from viewpoints 119, 121 and 147.

Location (indicated on Figures 9.6 a-h & j-m)	Description and purpose
3300 - 3600	Proposed planting to the main line will include woodland species designed to reflect adjacent local landscape character and provide visual screening especially from viewpoints 118, 119, 121 and 127.
3600 – 4000	Planting to proposed junction and lighting will include a species mix designed to screen views of this junction in particular from viewpoints 118, 119, 121 and 127.
4000 - 4400	Planting to earthworks embankment will include a species mix designed to screen views of the embankment, in particular from viewpoints 132, 116, 117, 135, 136, 137, 138 and 232.
4450	Planting to proposed junction will include species designed to provide visual screening of this structure in particular from viewpoints 109, 110 and 230.
4450 - 5300	The proposed woodland planting will be designed to assist the integration of the proposed earthworks cutting into the receiving landscape. The propose planting will also be designed to assist in the screening of the proposed local road realignment. These landscape design proposals are expected to benefit viewers particularly from viewpoints 101, 102 and 103.
5300 - 5900	Planting to earthworks embankment and proposed local road realignment will include a species mix designed to screen views of the embankment and road realignment in particular from viewpoints 94,95 and 202.
5900 - 6450	The proposed woodland planting mix will be designed to assist in the integration of the proposed cutting into the receiving landscape. This is expected to provide visual screening, in particular from viewpoint 200.
6400 - 7500	Planting to earthworks embankment, bridge structure and proposed local road realignment will include a species mix designed to screen views of these structures in particular from viewpoints 71, 72, 73 , 75, 76, 185 and 186.
7500 - 7900	The proposed landscape treatment features boundary hedgerow and largely seeded areas. These will be designed in detail to afford views of the local landscape from the future road user.
7900 - 8600	The proposed woodland planting will be designed to assist integration of proposed mainline and earthworks into the receiving landscape.
8600 – 150 (N30 Bypass)	Planting to earthworks embankment, bridge structure, roundabout junction and proposed local road realignments together with lighting will include a species mix designed to screen views of these structures in particular from viewpoints 61 and 66.
N30 Bypass approximate location or chainage	
150 - 350	Proposed hedgerow planting together with proposed woodland planting will be designed to integrate the proposals into the receiving landscape.
350 - 800	Planting to earthworks embankment will include a species mix designed to screen views of this structure in particular from viewpoints 49, 50 and 51.

Location (indicated on Figures 9.6 a-h & j-m)	Description and purpose
800 - 1700	Proposed hedgerow planting together with proposed woodland planting will be designed to integrate the proposals into the receiving landscape.
1700 - 2150	Planting to earthworks embankment and bridge structure together with lighting will include a species mix designed to screen views of these structures in particular from viewpoints 36, 37, 41 and 45.
2150 - 2800	Proposed planting will include species mixes designed to integrate the proposed cutting into the receiving landscape.
2500 – 2700	Planting to proposed bridge structure to include a species mix designed to screen this junction from view in particular from viewpoints 30, 31, 32, 33 and 222.
2800 - 3650	Planting to earthworks embankment will include a species mix designed to screen views of this structure in particular from viewpoints 22, 23 and 31.
3300	Planting to proposed bridge structure to include a species mix designed to screen this structure from view in particular from viewpoints 19 and 15.
3650 - 4700	Proposed planting will include species mixes designed to integrate the proposals including cuttings and embankments into the receiving landscape.
Corcoran's Cross junction – N30 West Tie in and L-4003-3 realignment	Planting to earthworks embankment and road realignments to include species mix designed to screen views of these structures in particular from viewpoints 2, 3 and 4.
Proposed Roundabout Junction at Corcoran's Cross	Planting to junction to include species mix designed to screen views of this structure in particular from viewpoints 213 and 218.
N30 East tie in	
0 - 1100	Planting to earthworks embankment to include species mix designed to screen views of this structure in particular from viewpoints 1, 214 and 216.

9.7 *THE PERMANENT VISUAL IMPACTS OF THE SCHEME*

9.7.1 *Overview*

Visual impacts will arise primarily due to tree and hedgerow screening loss, alteration of ground levels and the introduction of new structures and earthworks associated with the scheme.

9.7.2 *Visual Envelope Map (VEM)*

The visual envelope is illustrated on *Figure 9.4 (Vol. 2)*. It maps the areas within which the proposals are likely to have an influence or effect upon visual amenity and is used as a tool to select sensitive viewpoints for more detailed assessment. The visual envelope was identified manually by site survey, this assessment being conducted from publically accessible locations.

9.7.3 *Impacts on Viewers*

The predicted visual impacts are outlined below and presented in detail in *Annex A (Assessment of Visual Impacts at Selected Viewpoint Locations)* and the summary significance of impact is illustrated in *Figure 9.5 a-f (Vol. 2)*. For each viewpoint, the visual baseline is presented as a brief description of the main components in the existing view. The predicted view is also described together with the significance of visual impact both at pre and post establishment stages. A total of 211 viewpoint locations were assessed and these mostly represented residents of dwellings identified as having potential for some degree of visual impact.

Of the 211 viewpoint locations, four represent properties are expected to be acquired to facilitate the construction works (nos. 128, 74, 64, 63) and a further two viewpoints represent properties identified as being abandoned (nos. 35 and 65). In the case of all of these, no visual impact assessment was conducted, thereby leaving a total of 205 viewpoint locations for which visual impact significance was assessed and these are summarised below.

9.7.4 *Predicted Visual Impacts – Pre Establishment Stage*

At this stage, the construction works will be complete and the impacts associated with these are expected to cease. The visual impacts are predicted to be derived from the infrastructure of the completed scheme which is likely to be exposed visually as the planting (implemented as part of the landscape design) will be in an immature state. Adverse visual impacts are predicted to affect viewers (largely residents of dwellings) at many of the viewpoints assessed. The significance of the impact is estimated to be *substantial* at 44 viewpoint locations.

Visual impacts of a *moderate to substantial* significance are predicted to apply at 13 viewpoint locations. Visual impacts of a *moderate* significance are predicted to apply at 23 viewpoint locations. Visual impacts of a *moderate to slight* significance are predicted to affect 14 viewpoint locations. Visual impacts of a *slight* significance are predicted to affect 24 viewpoint locations. Visual impacts in the range of slight to not significant are predicted to affect 87 viewpoint locations.

9.7.5 *Predicted Visual Impacts – Post Establishment Stage*

Visual impacts at this stage are assessed based on the assumption that all planting will be established successfully and good growth and development will have taken place over a 15 year period since implementation of the planting. The planting is therefore assumed to be effective in providing visual screening of the scheme during the summer months and hence the visual impact of the road works is expected to be significantly less than that predicted for the pre establishment stage. The screening effect of the vegetation will be particularly effective in reducing visual impact significance for residents of dwellings located some distance from the proposals.

For those located close to the road, the visual impact of the road is also predicted to be reduced however the proposed planting is also likely to become a source of visual impact in itself by obstructing longer range views across the landscape and hence long term visual impacts of some degree of significance will continue to apply. Adverse visual impacts are predicted to affect viewers (largely residents of dwellings) at some of the viewpoints assessed. The significance of the impact is estimated to be *moderate to substantial* at 26 viewpoint locations. Visual impacts of a *moderate* significance are predicted to arise at 27 viewpoint locations. Visual impacts of a *moderate to slight* significance are predicted to arise at 1 viewpoint location. Visual impacts of a *slight* significance are predicted to arise at 37 viewpoint locations. Visual impacts in the range of slight to not significant are predicted to arise at 114 viewpoint locations.

In regard to visual impacts of a *moderate to substantial* significance, these are further discussed by townland location.

1. In Ballyverneen, visual receptors located at 160, 161 and 211 are predicted to gain very short range views of the proposed woodland planting and hedgerow associated with the scheme. At viewpoint 210, short range views of the proposed local road realignment are expected to be gained.

2. In Carrickcloney receptors located at 175 are likely to gain views of the proposed bridge crossing which is expected to significantly alter the existing view and perception of landscape character.

3. In Stokestown, viewers at viewpoint 147 are likely to see the proposed planting associated with the scheme embankment and local road.

4. In Landscape, receptors located at 118 and 127 are likely to gain short range views of the boundary planting associated with the proposed mainline and junction with the R733. The proposed planting is also likely to be visible at short range for receptors located at 132. In the case of receptors located at 119, 135 and 138, views of the proposed interchange are likely to be gained from elevated ground, albeit with substantial screening by proposed planting.

5. In Camlin, short range views of both the mainline boundary planting and planted embankment associated with the bridge crossing are likely to be gained by receptors located at 110 and 230. In the case of receptors located at 109 views are likely to be gained of the same interchange from an

elevated location albeit partly filtered by the well established planting. At viewpoints 116 and 117 the proposed planting and junction with the R733 and associated earthworks and storm control areas is likely to be visible at short range.

6. Near Camlin, short range views are likely to be gained of proposed planted earthworks embankment and planting associated with the proposed storm control areas by viewers located at 94.

7. In Creakan Upper, receptors located at 73 are expected to gain short range views of the boundary planting associated with the local road realignment tie-in.

8. In Ballymacar, the proposed interchange and associated planted embankments will be visible at short range to receptors located at viewpoint 61.

9. In Ryleen, receptors located at viewpoints 45 are expected to be able to see the planted embankments associated with the mainline and the bridge crossing structure.

10. In and near Lacken, receptors located at 30 and 31 are expected to gain short range views of the planted proposals, including the mainline and proposed bridge structure. At viewpoint 222, short range views of the local road realignment and planting are expected to be gained. At viewpoint 19 and 36, the proposed mainline is expected to be visible together with planting. The proposed bridge crossings at chainage 3300 (for viewpoint 19) and chainage 1900 (for viewpoint 36) are expected to be visible.

Visual impacts that are likely to be experienced by the users (drivers) of the proposed river crossing and road route are likely to be variable. Sections of the route located on embankments of significant height will afford views over farmed landscape setting which will be experienced by drivers. In locations set in deep cutting, the driver view is expected to be confined to the immediate road environment and side slopes associated with the cutting. The journey over the second river crossing is likely to afford dramatic and extended views in a north/south direction along the course of the River Barrow.

9.8 CONSTRUCTION IMPACTS AND MITIGATION MEASURES

Negative impacts on landscape, landscape character and visual amenity will be generally more pronounced at the construction stage. The temporary sources of these impacts will be derived from the following:

1. presence of construction plant and machinery including possibly tall cranes;

2. movement of construction traffic;

3. temporary fences and hoardings;

4. temporary lighting;

5. construction related signage;

6. temporary stockpiles of earthworks materials including topsoil;

7. movement of earthworks material;

8. site compounds which are expected to be sited at more than one location along the length of the scheme

9. works associated with the Barrow River crossing including temporary jetty or causeway, storage areas for goods and materials and barges or vessels that are expected to carry the pre cast segments of the structure by river; and

10. the presence of dust or mud.

Measures to mitigate landscape and visual impacts during construction will include, as appropriate:

1. design and construction process to be conducted to minimise land take;

2. design and construction process to be conducted to minimise tree removal or encroachment on valued habitats and landscape resources;

3. protection of valued habitats and wooded areas by means of the introduction of temporary protective fencing during the construction stage;

4. control of after dark construction lighting in the interest of visual amenity;

5. maintenance of tidy and contained site compounds;

6. use of irrigation system to control the evacuation of dust from the construction site;

7. the storage of topsoil in heaps of a height not exceeding 2m in the interest of visual amenity and indeed to protect soil structure;

8. the spreading of topsoil, reseeding and replanting as soon as possible after sections of the work are complete; and

9. protection of newly restored areas during early establishment stage whilst other construction activities are taking place.

9.9 SUMMARY

Permanent and direct impacts upon the landscape will result from the scheme, in particular the proposed structures, earthworks, mainline alignment and side roads. Impacts include the loss of vegetation and localised changes to topography arising from earthworks cuttings and embankments.

Indirect impacts on landscape character will apply in terms of the effect of the proposals on the setting of a given landscape character area as perceived by the viewer. In this regard four local landscape character areas were identified and the significance of the indirect impact was assessed as follows.

- New Ross Urban Centre – *Not Significant.*
- River Barrow and Floodplain – *Substantial Impact.*
- Flat to undulating farmland to the north east of new Ross – *Moderate to Substantial Impact.*
- Farmed Hills South of New Ross - *Substantial Impact.*

With regard to visual impacts, a total of 205 viewpoint locations were assessed. The visual impact significance is predicted to be greater during the construction and pre establishment phases of the scheme. In the pre establishment phase, construction works will be completed and planting will have just been implemented and will be in a very immature stage of growth. The planting will not therefore be adequately developed for the purpose of providing visual filtering of the road proposals. The significance of the impact is estimated to be *substantial* at 42 viewpoint locations. Visual impacts of a *moderate to substantial* significance are predicted to arise at 12 viewpoint locations. Visual impacts of a *moderate* significance are predicted to arise at 24 viewpoint locations. Visual impacts of a *moderate to slight* significance are predicted to arise at 14 viewpoint locations. Visual impacts of a *slight* significance are predicted to arise at 25 viewpoint locations. Visual impacts in the range of slight to not significant are predicted to arise at 88 viewpoint locations.

The post establishment phase of the project is defined as 15 years post implementation of the landscape design scheme and assumes that planting and seeding has established and developed appropriately. The significance of the visual impact of the proposals is expected to be less that that assessed at the pre establishment phase for the majority of the viewpoint locations assessed. In this regard, the significance of the impact is estimated to be *moderate to substantial* at 23 viewpoint locations. Visual impacts of a *moderate* significance are predicted to arise at 27 viewpoint locations. Visual impacts of a *moderate to slight* significance are predicted to arise at 1 viewpoint location. Visual impacts of a *slight* significance are predicted to arise at 39 viewpoint locations. Visual impacts in the range of slight to not significant are predicted to arise at 115 viewpoint locations.

10 TERRESTRIAL ECOLOGY

10.1 INTRODUCTION

The purpose of this assessment is to identify the potential impact of the proposed development of the New Ross Bypass on the terrestrial ecological resources. In order to assess potential impacts upon ecological resources, the assessment has focused upon the following aspects:

- flora growing in the area to be affected by the development;
- fauna (insects, mammals, birds, and herpetofauna);
- ecosystem functionality; and
- relationship with abiotic factors (*e.g.* moisture, light).

The geographical scope of the assessment comprised the area occupied by the proposed route and the lands two hundred and fifty metres either side of the centre line of the road, resulting in a 600m route corridor (to be referred to as the route corridor).

10.2 LEGAL CONTEXT

A number of international, national and local legal instruments have been devised to protect and conserve flora and fauna in Ireland. These instruments are outlined below.

10.2.1 International and EU

- **The Convention on the Conservation of Migratory Species of Wild Animals** (Bonn Convention, 1979, enacted 1983). This Convention seeks to harmonise laws across national boundaries to protect migratory species.

- **The Convention on the Conservation of European Wildlife and Natural Habitats** (Bern Convention, 1982). This Convention requires governments to take into account the conservation needs of species during the formulation of planning and development policies. It also seeks the protection of endangered species and stipulates that protected species and their habitats are conserved.

- **Convention on Wetlands of International Importance (Ramsar Convention).** This convention requires the State to recognise and preserve internationally important wetlands, especially as waterfowl habitat. Ramsar sites are included in existing Nature Reserves. Ramsar sites have no formal legal status unless objectives for their conservation are included in statutory environmental management plans (especially development plans) or they are included in statutory nature designations.

- **EU Freshwater Fish Directive (78/659/EEC)** The Directive aims to protect and preserve fish species and freshwater aquatic habitats. This Directive has been transposed into Irish Law by the European Communities (Quality of Salmonid Waters) Regulations of 1988 (S.I. No. 293, 1988).

- **Birds Directive (Council Directive 79/409/EEC**). This Directive, as amended by the Habitats Directive requires member states to classify Special Protection Areas (SPAs) within their geographical area of remit. The most suitable territories for the conservation of Annex I species of the Directive will be designated as SPAs. The Member States must ensure the conservation status of all SPAs and avoid pollution or deterioration of habitats or any significant disturbance affecting birds in SPAs.

- **Habitats Directive (Council Directive 92/43/EEC)** The European Community Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora ('EC Habitats Directive') is the means by which the European Union meets its obligations as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention'). The Directive requires Member States to introduce a range of measures including the protection of species listed in the Annexes; to undertake surveillance of habitats and species and to produce a report every six years on the implementation of the Directive. The 189 habitats listed in Annex I of the Directive and the 788 species listed in Annex II, are to be protected by means of a network of sites. These sites will eventually be designated by Member States as Special Areas of Conservation (SACs), and along with Special Protection Areas (SPAs) classified under the EC Birds Directive, these will form a network of protected areas known as Natura 2000. The Directive has been transposed into Irish legislation primarily by the European Communities (Natural Habitats) Regulations 1997 – 2005.

- **Water Framework Directive (2000/60/EC),** The Water Framework Directive aims to establish a "framework for community action in the field of water policy". The Water Framework Directive promotes an integrated approach to the protection of inland surface waters, transitional waters, coastal waters and groundwater within river basins. The most significant requirement of the Directive is the identification of River Basin Districts (RBD) and the preparation of River Basin Management Plans (RBMP), with the aim of achieving "good ecological status" for all waters by 2015.

10.2.2 National

- **Wildlife Act 1976 and Wildlife (Amendment) Act 2000,** The primary legislative instruments in Ireland for the protection of habitats and wildlife are the Wildlife Act, 1976 and the Wildlife (Amendment) Act, 2000. These acts allow for the creation of Nature Reserves and Natural Heritage Areas (NHAs), which are designated under similar procedures to SACs. The acts also afford statutory protection to wildlife and their habitats listed in Schedule 3 of the act.

- **The Planning and Development Act, 2000** requires local authorities to set out strategies within their development plan to conserve and protect natural heritage and European sites.

10.2.3 *Local*

Other plans, at national and county level, which contain policies that aim to conserve habitats and wildlife include:

- National Biodiversity Plan 2002;
- National Heritage Plan;
- Wexford County Development Plan 2007-2013; and
- New Ross Town and Environs Development Plan 2004.

10.3 *METHODOLOGY*

10.3.1 *Introduction*

The scope and methodology used for this assessment are based upon the National Roads Authority's *Guidelines for Assessment of Ecological Impacts of National Road Schemes*, with additional guidance taken from the UK Highways Authority's *Design Manual for Roads and Bridges* and the Institute of Ecology and Environmental Management's (IEEM) *Guidelines for Ecological Impact Assessment.* The methodology used throughout this assessment satisfies the requirements of the Environmental Protection Agency's (EPA) *Guidelines on the Information to be Contained in Environmental Impact Statements*.

The basis for the assessment was an initial Phase I habitat survey of the entire route corridor, supplemented by a detailed desktop review of all relevant literature and consultations with relevant organisations and specialists. Targeted specialist surveys for flora and fauna were also undertaken to further quantify the route corridors ecological resource.

10.3.2 *Desktop Review and Consultations*

ERM undertook an extensive desktop review in order to establish baseline conditions along the proposed route corridor. The principal sources of information that were referred to included:

- a review of existing published ecological information and, where possible, any unpublished accessible sources;
- a review of the National Parks and Wildlife Service (NPWS) database;
- identification of any protected species, habitats or Red Data Book species; and
- A review of high resolution aerial photography was carried out to identify and map habitats.

Consultations were undertaken with the following statutory and non-statutory bodies during the ecological impact assessment:

- appropriate representatives of the National Parks and Wildlife Service;
- appropriate representatives of the Southern Regional Fisheries Board;
- BSBI County Recorder for County Kilkenny and Co. Wexford;
- Bat Conservation Ireland;
- BadgerWatch Ireland;
- BirdWatch Ireland; and
- National Roads Authority.

10.3.3 Scope of the Ecological Assessment

In response to scoping consultations with the above listed agencies the ecological field assessment undertook surveys of the habitats, and the flora and fauna supported by these habitats so that the impacts of the proposed development, with particular emphasis placed on the potential impacts to protected species, could be identified.

10.3.4 Field Surveys

The methods and timing of field surveys carried out to inform the ecological baseline are set out below. These surveys were undertaken in order to verify the information gathered during the desktop and consultation exercises and to identify, map and evaluate the habitats located within the route corridor.

10.3.5 Habitats & Flora

10.3.5.1 Field Survey

A Phase I Habitat Survey was undertaken for the entire route corridor. A 600m wide corridor was surveyed to allow for the assessment of indirect impacts such as habitat fragmentation. The Phase I Habitat Survey was undertaken in line with the *Heritage Councils Draft Habitat Survey Guidelines, 2002*. The Phase I survey examined the ecological baseline of the route corridor with emphasis placed upon identifying the habitats occurring within the corridor according to the Heritage Councils *A Guide to Habitats in Ireland*, 2000 (1) . This guide classifies habitats according to a hierarchical framework with Level 1 habitats representing broad habitat groups, Level 2 representing habitat sub-groups and Level 3 representing individual habitats. The field surveys were focused at identifying Level 3 habitats. The Phase I Habitat Survey was undertaken by ERM ecological staff during March, April and May 2005.

(1) Fossit, J. 2000. A Guide to Habitats in Ireland. The Heritage Council – An Chomhairle Oidhreachta. Dublin.

Conditions during the Phase I survey allowed ERM's ecologist to successfully identify and map the habitats occurring within the study area. 1:5,000 scale field maps were used during the survey. GPS records were taken during the survey to allow for the accurate GIS mapping of habitats. Habitat maps were produced at a scale of 1:10,000 using GIS Arc View 9.2. The Habitat Maps are shown in *Figure 10.1a-f (Volume 2).*

Habitats of ecological value are outlined in the habitat maps. A detailed flora survey of these habitats was undertaken using a Joint Nature Conservation Committee (JNCC) National Vegetation Classification (NVC) walk over approach. The results of the floral survey of specific habitats of ecological value are described with reference to the appropriate Level 3 Habitat of the Guide to Habitats in Ireland. Plant identification follows Webb et al [(1)] for higher plants and Smith [(2)] for mosses.

10.3.6 Fauna

10.3.6.1 Mammals

The fieldwork included a survey for the signs of mammal species. Detailed locations of those species that are considered to be common, such as fox, rabbit and brown rat were not made, except when their presence was noted in setts/holts of protected species.

The potential for habitats to support protected mammal species was identified during the Phase I Habitat Assessment. Locations of faunal activity are also outlined in the habitat maps. To ensure the continued protection of fauna, no grid reference are provided for the locations of their breeding / resting places of protected species (i.e. badger setts, otter holts etc). Approximate alignment chainages and the associated approximate distances of habitats or fauna from the centre line of the proposed alignment are used to identify marker locations on the Habitat Maps.

Following the results of the Phase I Habitat Survey, more detailed mammal surveys were undertaken, which focused on identifying field signs for the presence badgers (*Meles meles*), otters (*Lutra lutra*), pine marten (*Martes martes*), Irish stoat (*Mustela erminea*) and bat species. In addition signs of other mammal species such as Irish hares (*Lepus timidus hibernicus*), red squirrels (*Sciurus carolinensis*) and hedgehogs (*Erinaceus europaeus*) were recorded. All of the above species are protected in Ireland under relevant EU and National legislation.

ERM staff gathered evidence of mammalian activity within and adjacent to the site between the months of April to October during, 2005, 2006 and 2007. The proposed route was surveyed for terrestrial mammals by walking a 600m wide corridor centred on the centre-line of the proposed Bypass. This involved

(1) Webb, D.A., Parnell, J. and Doogue, D., 1996. 'An Irish Flora', Dundalgan Press (W. Tempest) Ltd., Dundalk.
(2) Smith, A.J.E., 1991. The Moss Flora of Britain and Ireland. Cambridge University Press.

walking either side of hedgerows, along drainage ditches and through woodland/scrub areas recording any field signs of mammal activity. These field signs, as described in Neal & Cheeseman [(1)] and Bang & Dahlstrom [(2)], include:

- mammal breeding and resting places, such as setts, holts, lairs;
- pathways;
- prints;
- faecal deposits;
- latrines (and dung pits used as territorial markers);
- feeding signs (snuffle holes);
- hair; and
- scratch marks.

Any badger setts, otter holts, pine marten lairs and stoat dens recorded were appraised for activity levels. Badger setts are divided into "main", "annexe" and "outlier" setts with activities levels recorded as "active", "inactive" or "occasional use". Main setts support the badger population within a given territory, and are generally active for most of the year. Setts, holts and lairs were recorded as active where there was clear evidence of occupation by the relevant mammal species. Some resting places were recorded as "occasional use" due to intermittent occupation by the relevant mammal species. The survey for badgers, otters, pine martens and Irish stoats was carried out in the spring of 2005, between the 11th and 20th of April. Conditions were dry and mild during the extent of the survey with temperatures ranging from 13°C to 17°C.

In addition to the above methodology, the following publications were also used to guide the terrestrial mammal surveys:

- NRA's *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Scheme* and the UK Highways Agency's *Design Manual for Roads & Bridges; and*

- DMRB's *Nature Conservation in relation to Otters HA81/99*. The assessment of otters was also informed by Grogan et al. [(3)], particularly with reference to the recording of otter field signs such as spraints, prints, tracks etc.

The methodology adopted for the assessment of bats along the route corridor was guided by the NRA's *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes* [(4)] . The details and timing of the bat surveys undertaken as part of the assessment are outlined in *Table 10.1* below.

(1) Neal, E., & Cheeseman, C., (1996). 'Badgers'. Poyser Natural History, London.

(2) Bang, P., & Dahlstrom, P., 'Animal Tracks and Signs'. Oxford University Press, Oxford,

(3) Grogan, A., Philcox, C. & MacDonald, D. (2001). Nature Conservation and Roads: Advice in Relation to Otters. University of Oxford.

(4) National Roads Authoirty. Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes. Dublin

Day, dusk and dawn surveys were undertaken during the bat assessment. Structures that were identified as having the potential to support roosting bats were inspected during the day for evidence of bat activity. Such evidence included bat droppings, grease marks, and urine staining.
Following the results of the day survey, activity surveys were undertaken to identify whether bat species were roosting within the identified structures, and if so, what species were present. The activity surveys were undertaken by two field ecologists using bat detectors (Peterssons & Bat Box) set at the heterodyne function. Dusk and pre-dawn bat detector surveys were undertaken at each structure and tree identified as having potential to support roosting bats. Dusk surveys commenced 20 minutes after sunset and lasted for at least two hours. Pre-dawn surveys commenced over one hour before dawn.

To identify the range of species present the frequency at which the bat detector was set was altered during the survey. The peak frequency of bats likely to occur within the route corridor ranges from 26.9 khz (for Leisler's bats to 55.5khz (Soprano pipistrelle bats) (1). Therefore the frequency range surveyed was from 25khz to 70khz, with the detector set to the optimum frequency for each bat species known to occur in the area, for a duration of five minutes. The range of bat species considered likely to be present within the survey areas was informed by a review of historical records.

Table 10.1 Bat Survey Schedule - Buildings

Date	Type of Survey	Locations
30/08/05	Day Survey	Pink Point Quarry, N25 Ch. 1,350*; Cottage, 30m east N25 Ch. 8,600; Ballymacar Bridge, N25 Ch. 8,650; and Derelict house, 300m south N30 Ch. 1,100.
	Dusk survey	Cottage, 30m east N25 Ch. 8,600; Ballymacar Bridge, N25 Ch. 8,650; and Derelict house, 300m south N30 Ch. 1,100.
01/09/05	Dawn Survey	Cottage, 30m east N25 Ch. 8,600; and Ballymacar Bridge, N25 Ch. 8,650.
	Day Survey	Stokestown Castle, 200m north N25 Ch. 2,350; Stokestown Gate Lodge, 150m north N25 Ch. 2,800; Stokestown Quarry, 100m north N25 Ch. 2,900; and Stokestown Folly, N25 Ch. 2,800;
	Dusk Survey	Stokestown Castle, 200m north N25 Ch. 2,350; Stokestown Gate Lodge, 150m north N25 Ch. 2,800; Stokestown Quarry, 100m north N25 Ch. 2,900; and Stokestown Folly, N25 Ch. 2,800;

(1) Jones, K. & Walsh, A. 2001. A Guide to British Bats. Field Studies Council/The Mammal Society. London.

Date	Type of Survey	Locations
02/09/05	Dawn Survey	Stokestown Castle, 200m north N25 Ch. 2,350; Stokestown Gate Lodge, 150m north N25 Ch. 2,800; and Stokestown Quarry, 100m north N25 Ch. 2,900.
10/10/05	Day Survey	Residential farm house, 250m south and farm out-buildings 200m south N25 Ch. 3,500.
	Dusk Survey	Residential farm house, 250m south and farm out-buildings 200m south N25 Ch. 3,500; Along lane intersecting alignment at N25 Ch. 3,650; and Along L-4026-1 north of the alignment from N25 Ch. 3,100 to 3,650.
11/10/05	Dawn Survey	Residential farm house, 250m south and farm out-buildings 200m south N25 Ch. 3,500; Along lane intersecting alignment at N25 Ch. 3,650.
	Day Survey	Bearstown Bridge, 300m south N25 Ch. 100
	Dusk Survey	Bearstown Bridge, 300m south N25 Ch. 100
12/10/05	Dawn Survey	Bearstown Bridge, 300m south N25 Ch. 100
31/07/06	Day Survey	Cottage, 30m east N25 Ch. 8,600; Ballymacar Bridge, N25 Ch. 8,650;
	Dusk Survey	Cottage, 30m east N25 Ch. 8,600; Ballymacar Bridge, N25 Ch. 8,650; and Along Ballymacar River upstream of Ballymacar Bridge.
01/08/06	Dawn Survey	Cottage, 30m east N25 Ch. 8,600; Ballymacar Bridge, N25 Ch. 8,650; and Along Ballymacar River upstream of Ballymacar Bridge.
	Day Survey	Residential farm house, 250m south and farm out-buildings 200m south N25 Ch. 3,500.
	Dusk Survey	Residential farm house, 250m south and farm out-buildings 200m south N25 Ch. 3,500; Restored outhouse 50m south N25 Ch. 3,650; Along lane-way intersecting alignment N25 Ch. 3,650.
02/08/06	Dawn Survey	Residential farm house, 250m south and farm out-buildings 200m south N25 Ch. 3,500; Restored outhouse 50m south N25 Ch. 3,650; Along lane-way intersecting alignment N25 Ch. 3,650.
	Day Survey	Farm out-houses, 100m southwest N25 Ch. 600
	Dusk Survey	Farm out-houses, 100m southwest N25 Ch. 600

Date	Type of Survey	Locations
03/08/06	Dawn Survey	Farm out-houses, 100m southwest N25 Ch. 600
	Day Survey	Bearstown Bridge, 300m south N25 Ch. 100
	Dusk Survey	Bearstown Bridge, 300m south N25 Ch. 100
04/08/06	Dusk Survey	Stokestown Folly, N25 Ch. 2,800; and Stokestown Castle 200m north N25 Ch. 2,350.
18/04/07	Dusk Survey	Cottage, 30m east N25 Ch. 8,600; and Ballymacar Bridge, N25 Ch. 8,650;
19/04/07	Dawn Survey	Cottage, 30m east N25 Ch. 8,600; and Ballymacar Bridge, N25 Ch. 8,650.
	Dusk Survey	Farm out-houses, 100m southwest N25 Ch. 600.
20/04/07	Dawn Survey	Farm out-houses, 100m southwest N25 Ch. 600.
08/08/07 – 12/08/07	Day Surveys	Bat tree surveys undertaken throughout the alignment; Ballymacar Bridge, N25 Ch. 8,650; Farm out-houses, 100m southwest N25 Ch. 600; and Farm out-houses 80m north N25 Ch. 6,150.
	Dusk Survey	Bat tree surveys undertaken throughout the alignment; Farm out-houses, 100m southwest N25 Ch. 600; Farm out-houses 80m north N25 Ch. 6,150; and Ballymacar Bridge, N25 Ch. 8,650.
	Dawn Surveys	Bat tree surveys undertaken throughout the alignment; Ballymacar Bridge, N25 Ch. 8,650; Farm out-houses, 100m southwest N25 Ch. 600; and Farm out-houses 80m north N25 Ch. 6,150.

* All distances and chainages listed in *Table 10.1* are approximate

A survey for bat trees was undertaken during late summer/early autumn, 2007. This survey was guided by the NRA's *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes.* While no winter roosting survey of bat trees were undertaken, the potential of the trees identified along the alignment to support winter roosting sites was assessed.

10.3.6.2 *Birds*

ERM staff recorded observations of ornithological activity within and adjacent to the route corridor during all field surveys undertaken throughout the assessment process.

As riparian habitats associated with the River Barrow are known to support a diverse range of bird species [(1)], some of which are protected under Annex I of the EU Birds Directive a specific bird survey was undertaken along the river. This survey involved recording all bird species identified within a 1km corridor, upstream and downstream from the centre line of the proposed bridge crossing. Where it was possible to do so, a walkover survey of this stretch of the river was also undertaken. This survey focused on recording bird species and nesting sites along the river, with emphasis placed upon the identification of potential nesting sites for protected bird species.

10.3.6.3 *Invertebrates*

No specific invertebrate survey was undertaken during the assessment for the following reasons:

- the majority of the habitats encountered along the Bypass are improved grassland and arable field systems and the evidence; and
- the evidence recorded during the desktop review and Phase 1 Habitat Survey did not indicate that a invertebrate survey based on the criteria set out in the Guidelines for Baseline Ecology [(2)] was required.

A review of historical records was undertaken and records of all terrestrial invertebrates recorded during the field surveys were noted. The historical records referred to include the *Atlas of Land and Freshwater Molluscs of Britain and Ireland* [(3)], *the Natural History of Irelands Dragonflies* [(4)], and *a Guide to Butterflies in Ireland* [(5)].

10.3.6.4 *Herpetofauna*

Three species of amphibians occur in Ireland; the Natterjack Toad (*Bufo calamita*), Common Frog (*Rana temporaria*) and Smooth Newt (*Triturus vulgaris*). The common frog and the smooth newt are widely distributed throughout Ireland. The common lizard (*Lacerta vivipara*), which is widely distributed throughout Ireland, is the only native lizard species occurring in the country.

The potential for habitats to support these species was assessed during the Phase 1 Habitat Survey. As outlined in the Herpetofauna Workers Manual [(6)] habitats considered likely to support such species include wetland habitats with high water tables or open water bodies. Any observations of these species were recorded during further field surveys.

(1) BirdWatch Ireland IWeBS Records
(2) Spon. E.M., 1995. Guidelines for Baseline Ecological Assessments. Institute of Environmental Assessment. United Kingdom.
(3) Kerney, M. (1999). Atlas of the Land and Freshwater Molluscs of Britain and Ireland. Harley Books. England
(4) Nelson, B. & Thompson, R. (2000). The Natural History of Ireland's Dragonflies.
(5) Dublin Naturalist Field Club, 2004. A Guide to Butterflies in Ireland – see http://www.butterflyireland.com.
(6) Gent, T. & Gibson, S., 2003. Herpetofauna Workers' Manual. Joint Nature Conservation Committee (JNCC). Peterborough

10.3.7 *Ecological Evaluation*

The evaluation of the ecological resource was assessed according the NRA's Site Evaluation Scheme as described in the NRA's *Guidelines for Assessment of Ecological Impacts of National Road Scheme* and outlined in *Table 10.2* below. These criteria evaluate the significance of an ecological resource within a defined geographical context. The IEEM's Guidelines for Ecological Impact Assessment, which also evaluate ecological resources according to a defined geographical context and the Ratcliffe Criteria were also taken into account during the baseline ecological evaluation. Any habitats or ecological sites of moderate value or greater are described in *Table 10.3* and illustrated on the habitat maps.

Table 10.2 Site Evaluation Scheme

Rating	Qualifying Criteria
A	**Internationally Important** Site designated (or qualifying for designation) as Special Area of Conservation (SAC) or Special Protection Area (SPA) under the EU Habitats or Birds Directives. Undesignated sites containing good examples of Annex I priority habitats under the EU Habitats Directive. Major salmon river fisheries. Major salmonid (salmon, trout or char) lake fisheries.
B	**Nationally Important** Sites or waters designated or proposed as an Natural Heritage Area (NHA) or statutory Nature Reserves. Undesignated sites containing good examples of Annex I habitats (under EU Habitats Directive). Undesignated sites containing significant numbers of resident or regularly occurring populations of Annex II species under the EU Habitats Directive or Annex I species under the EU Birds Directive or species protected under the Wildlife (Amendment) Act 2000. Major trout river fisheries. Water bodies with major amenity fishery value. Commercially important coarse fisheries.
C	**High Value, locally important** Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or significant populations of locally rare species. Small water bodies with known salmonid populations or with good potential salmonid habitat. Sites containing any resident or regularly occurring populations of Annex II species under the EU Habitats Directive or Annex I species under the EU Birds Directive. Large water bodies with some coarse fisheries value.
D	**Moderate Value, locally important** Sites containing some semi-natural habitat or locally important for wildlife. Small water bodies with some coarse fisheries value or some potential salmonid habitat. Any water body with unpolluted water (Q-value rating 4-5).
E	**Low Value, locally important** Artificial or highly modified habitats with low species diversity and low wildlife value. Water bodies with no current fisheries value and no significant potential fisheries value

Source: NRA's *Guidelines for Assessment of Ecological Impacts of National Road Scheme*

10.3.8 General Ecological Context

The proposed New Ross Bypass passes through undulating countryside with many prominent hills adjacent to the route. The proposed alignment utilises the natural form of the landscape and is generally restricted to flat lands and valley areas. The majority of the land crossed by the alignment is highly modified by human activity and agriculture is the predominant land use. The agricultural land is characterised by good quality farmland which is mainly given over to pasture grassland for grazing. A substantial amount of arable land was identified throughout the route and in some localised areas arable farming becomes the dominant land use.

Habitats of moderate ecological value, or greater, are sparsely spread throughout the alignment. A number of linear habitats are intersected by the route alignment. These include hedgerows, treelines and watercourses. The River Barrow, which is a watercourse of international importance for its conservation value is intersected by the proposed alignment. Details of aquatic habitats and the potential impacts caused by the Bypass are outlined in *Chapter 11*.

10.3.9 Designated Sites within or Adjacent to the site

10.3.9.1 River Barrow and River Nore cSAC (002162)

This site (to be referred to as the River Barrow cSAC) consists of the freshwater stretches of the Barrow/Nore River catchments as far upstream as the Slieve Bloom Mountains. It also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The site passes through eight counties – Offaly, Kildare, Laois, Carlow, Kilkenny, Tipperary, Wexford and Waterford.

The site is a candidate Special Area of Conservation (cSAC) selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. Old oak woodlands, floating river vegetation, estuarine habitats including tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, as well as dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive, also occur within the site. The site supports the following qualifying species, all listed on Annex II of the Directive:

- sea lamprey (*Petromyzon marinus*)
- river lamprey (*Lamptera fluviatilis*),
- brook lamprey (*Lamptera planeri*),
- freshwater pearl mussel (*Margaritifera margaritifera*),
- Nore freshwater pearl mussel (*Margaritifera durrovensis*),
- white-clawed crayfish (*Austropotamobius pallipes*),
- twaite shad (*Alosa fallax lcae*),
- Atlantic Salmon (*Salmo salar*),
- otter (*Lutra lutra*),
- *Vertigo Moulinsiana;* and
- Killarney Fern (*Trichomanes speciosum*).

The cSAC is bridged by the bypass between N25 Ch. 1,350 and 1,650, while the realignment of the L-4026-1 East Tie-in crosses the southern boundary of the cSAC adjacent to N25 Ch. 3,850 – 3,900. The Annex I habitats associated with the cSAC occurring with the route corridor include old oak woodland

and tidal mudflats. Other habitats associated with the L-4026-1 realignment include wet grassland with stands of wet woodland and marsh.

All of the above qualifying species with the exception of otters, *Vertigo Moulinsiana* and Killarney fern are restricted to aquatic habitats. The otter is the only qualifying species not restricted to aquatic habitats that occurs within the area of the cSAC associated with the bypass.

10.3.9.2 Barrow River Estuary pNHA (000689)

This proposed Natural Heritage Area (pNHA) comprises the lower and upper tidal reaches of the river Barrow before it enters Waterford Harbour. It extends from St. Mullins in Co. Carlow to Cheek Point in Co. Waterford (approximately 20-25 kilometres) and includes both sides of the river. This pNHA includes the land bridged by the bypass between N25 Ch. 1,350 – 2,000. It also includes lands to the north of the L-4026-1 tertiary road (which forms the southern boundary of the site) adjacent to N25 Ch. 3,300 – 3,950. The habitats associated with the pNHA bridge crossing include those associated with the cSAC i.e. old oak woodlands and tidal mudflats, as well as drainage ditches and improved grassland further to the east of the river. The area of the pNHA adjacent to the L-4026-1 is dominated by native woodland while the habitats associated with the L-4026-1 realignment described above are also associated with this site.

10.3.9.3 Oaklands Wood pNHA (000774)

Oaklands Wood pNHA is located to the east of the River Barrow. This comprises a narrow strip of woodland extending north of the main body of woodland, on the hillside above the R733. This section of woodland is dominated by Oaks (*Quercus spp*.) and Beech (*Fagus sylvatica*), with some Ash (*Fraxinus excelsior*) and Sycamore (*Acer pseudoplantanus*) and an understorey of Holly (*Ulex europeae*). The ground flora includes Bluebell (*Hyacintoides non-scripta*), Lesser Celandine (*Ranunculus ficaria*), Honeysuckle (*Lonicera periclymenum*), Ivy (*Hedera helix*), Soft Shield-fern (*Polystichum setiferum*), Soft-grass (*Holcus mollis*), Lords-and-Ladies (*Arum maculatum*), Polypody (*Polypodium vulgare*), Navelwort (*Umbilicus rupestris*), Bramble (*Rubus fruticosus*), Wood Anemone (*Anemone nemorosa*), Harts-tongue (*Phylllitis scolopendrium*) and Hogweed (*Heracelum sphondylium*). To the north, Spruce (*Picea* spp.) has been extensively planted in the woodland.

10.3.10 Survey Findings

The terrestrial habitats recorded along the route corridor are shown on the Phase I Habitat Maps (*Figure 10.1a-f*). Four broad (Level 1) habitat groups were identified along the route corridor. These broad habitats are outlined below in order of dominance along the route corridor:

1. Grassland;
2. Cultivated & Built Land;
3. Woodland & Scrub;

4. Exposed Rock & Disturbed Ground; and
5. Freshwater (included here to describe swamp (FS) habitats).

The majority of the habitats recorded have been modified by human activity and do not represent natural or semi-natural habitats. Each of the broad habitats and the individual habitats (Level 3 habitats) making up these broad groups are described below.

10.3.10.1 *Grassland Habitats*

The grasslands within and adjacent to the proposed route have been classified as:

- *GA1, Improved agricultural grassland;*
- *GS4, Wet grassland; and*
- *GM1, Marsh.*

The dominant grassland habitat along the proposed route is improved agricultural grassland. This category of grassland is dominated by perennial ryegrass (*Lolium perennia*.) with meadow-grasses (*Poa* spp.), nettle (*Urtica dioica*) and thistles (*Cirsium arvense, C. vulgare*) also frequent. Other occasional species recorded include docks (*Rumex* spp.), Yorkshire-fog (*Holcus lanatus),* and plantains (*Plantago* spp.).

These grasslands are highly modified by human activities for livestock grazing. They are intensively managed, with frequent mowing and fertiliser application. As a result this habitat is of low diversity and of low ecological importance.

A number of areas dominated by species-poor wet grassland ("rush pasture") occur throughout the route corridor and are typically dominated by dense tussocks of soft rush (*Juncus effusus*) with the occasional docks (*Rumex acetosa*) and silverweed (*Potentilla anserina*). The poor species diversity of these areas may indicate localised nutrient enrichment of the wet grassland sward. In general such areas of wet grassland are of low ecological value. More species-rich wet grassland occurs at two locations along the route corridor:

- N25 Ch. 8,550. A discrete area of wet grassland (Ecological Site 6) characterised by abundant rushes and/or sedges along with a variety of grasses occurs at this location. The area consists of a wet grassland field situated adjacent to the Maudlin Stream, which flows north and then west towards New Ross town. It is characterised by a wet field fed from water from a slope to the east, which drains gradually into the Maudlin Stream. A range of grass and herbaceous species were recorded at this site. This site is of moderate ecological value.
- N30 Ch 2,900. The wet grassland occurring at this location (Ecological Site 7) forms part of a larger ecological mosaic.

Both these areas are described in full in *Table 10.3.*

- Marsh (GM1) habitats occur at two locations along the route corridor, at N25 Ch. 100 to the north of Glenmore Junction (Ecological Site 1) and N30 Ch. 2,900 (Ecological Site 7).

- N25 Ch. 100. The marsh habitat at this location is undisturbed and species-rich with floating vegetation and wet woodland tree species interspersed throughout the habitat. This area of marsh forms part of a large habitat mosaic and is considered to be of high ecological value.

- N30 Ch. 2,900. This marsh habitat represents the dominant habitat within a larger habitat mosaic which includes wet grassland (GS4), willow scrub (WN6), along with non-calcareous springs (FP2). This habitat mosaic is of high ecological value

These marsh habitats are described in detail in *Table 10.3.*

10.3.10.2 Cultivated &Built Land

The cultivated and built land identified along the proposed route is as follows:

- BC1 Arable crops
- BL1 Stonewalls and other stone structures
- BL2 Earth Banks

Both arable land and stonewalls and other stone structures do not represent significant ecological resources along the proposed route. The arable land is dominant along certain stretches of the proposed route. Much of the crops being cultivated within these areas include cereals such as corn, wheat and barley. Plant species supported within arable habitats include many weed species such as Common poppy (*Papaver rhoeas*), Common field-speedwell (*Veronica persica*), Knotgrasses (*Polygonum spp.*) and Wild carrot (*Daucus carota*).

Stonewalls in Wexford in general and along the proposed route in particular are associated with hedgerows. Many stonewalls along the alignment have been colonised by vegetation which has formed a humic layer over the stonewall feature so that it now resembles an earth-bank. However the stonewalls frequently supported the following plant species:

- ivy (*Hedera helix*);
- herb robert (*Geranium robertianum*);
- red valerian (*Centranthus rubber*);
- hart's-tongue (*Phyllitis scolopendrium*); and
- navelwort (*Umbilicus rupestris*).

Only one purpose built embankment (BL2), located along the eastern shoreline of the River Barrow was encountered along the route of the alignment. The embankment (Ecological Site 3*)* occurs with a number of drainage ditches on the eastern side and a belt of common reeds (*Phragmites Australis*) on the western side banking the River Barrow. This site is of moderate ecological value. Further details of this site are provided in *Table 10.3.*

10.3.10.3 *Woodland & Scrub Habitat*

The woodland and scrub habitats encountered along the proposed route have been classified as;

- *WN 1* Oak-birch-holly woodland
- *WN2* Oak-ash-hazel woodland
- *WN 6* Wet ash, alder willow woodland
- *WD 2* Mixed broadleaved/conifer woodland
- *WS 2* Immature woodland
- *WL 1* Hedgerows
- *WL 2* Treelines

A linear strip of woodland is located to the north of the Glenmore Roundabout, adjacent to the LS-7513 realignment. Even though this woodland is not entirely representative of oak-ash-hazel woodland (WN2), this code is deemed to provide the closest description of this woodland. While non-native tree species, particularly beech (*Fagus. sylvatica*) and sycamore (*Acer pseudoplatanus*) occur and are actively regenerating within this woodland, it still retains features of native woodland and supports a diverse range of tree and herbaceous species. However, the continued regeneration of beech and sycamore will, over time, decrease the naturalness of this habitat. A detailed description of this woodland is outlined in *Table 10.3* – see Ecological Site 1. This woodland is of high ecological value and local nature conservation importance.

The high ground at Pink Point (N25 Ch. 1,350) is fringed by oakwood (Ecological Site 2) which has been augmented by planting but retains features of native woodland. This woodland is located within the River Barrow cSAC, which is a site of international conservation importance. This woodland has been designated as Oak-birch-holly woodland (WN1). Similar to the WN2 woodland described above, this designation is not entirely representative of the site. However, it was deemed to provide the most suitable description of the site from the *Guide to Habitats in Ireland*. The woodland retains features of native woodland and supports a diverse range of tree and herbaceous species. A detailed description of this woodland is outlined in *Table 10.3* below.

A discrete area of wet woodland, WN6, is located to the south of the junction between the R733 and the L-4026-1 tertiary road. The L-4026-1 separates this site (Ecological Site 5) from the River Barrow cSAC. The Camlin Stream flows through the woodland. The woodland is dominated by ash, with alder and willow less frequent. A visible water layer was recorded along with a small pond, smothered by a vigorous layer of water starwort (*Callitriches stagnalis*) and fool's watercress (*Apium nodifolium*) indicating enrichment within the wood. A range of herb species was identified recorded within this woodland. While this woodland is representative of a natural wet woodland and displays similar characteristics to the wet woodland habitats within the cSAC, the small size and nutrient enrichment have decreased the ecological value of this site. This habitat is considered to be of moderate ecological value and locally important. A detailed description of this habitat is outlined in *Table 10.3* below.

A mixed broadleaved/conifer woodland (WD2) habitat was identified within the route corridor at N25 Ch. 3,100 (Ecological Site 4). This habitat type comprised a mixed stand of broadleaved and conifer trees with broadleaved tree representing 75% of the cover and conifers representing circa 25%. Beech (*F.* sylvatica) is the dominant species occurring at this site. Other species recorded include sycamore (*Acer pseudoplatanus*), holly (*Ilex aquifolium*) and sweet chestnut (*Castanea sativa*). Patches of sitka spruce (*Picea sitchensis*) also occur within this woodland. The site is of moderate ecological value.

An immature woodland (WS 2) area of deciduous trees was recorded at Ecological Site 8. This habitat type includes areas that are dominated by young saplings that have not reached threshold heights. This woodland is of moderate ecological value.

Hedgerows (WL1) and treelines (WL2) are a significant features of the New Ross hinterland. They are an important ecological resource as they provide connectivity between larger habitats as well as breeding habitats and shelter for a range of mammal and bird species. The hedgerows along the route alignment range in density and form, with the denser hedgerows providing a greater ecological resource. The typical tree and shrub species occurring in the hedgerows along the proposed route are as follows:

- ash (*F. excelsior*)
- blackthorn (*Prunus spinosa*)
- hawthorn (*Crataegus monogyna*)
- hazel (*Corylus avellana*)
- gorse (*Ulex europaeus*)

Herbaceous species associated with hedgerows include:

- bramble (*R. fruticosus*)
- nettle (*U. dioica*)
- honeysuckle (*L. periclymenum*)
- hedge bindweed (*Calystegia sepium*)
- hart's-tongue (*P. scolopendrium*)
- ivy (*H. helix*)

The majority of the hedgerows identified along the route corridor are of moderate to high ecological value. The hedgerows of high ecological value are more prevalent along the New Ross Bypass from N25 Ch. 0 – 8,500.

While many mature treelines are generally associated with hedgerows throughout the route alignment, they also occur independently of them. The majority of the treelines consist of mature tree species such as oaks (*Quercus* *spp.*), beech (*F. sylvatica*), ash (*F. excelsior*), sycamore (*A. pseudoplatanus*), poplar (*Populus spp.*), horse chestnut (*Aesculus hippocastanum*) and limes (*Tilia spp.*). The treelines are of moderate ecological value, but where they occur within a greater ecological complex they are of high ecological value.

10.3.10.4 Exposed Rock & Disturbed Ground

Exposed siliceous rock (ER1) occurs at Ecological Site 2. This habitat represents all natural and artificial exposures of siliceous rock, thus the disused Pink Point quarry is included within this habitat. A suite of acid tolerant plants occur here: ling (*Calluna vulgaris*), fraochan (*Vaccinium myrtillus*), greater woodrush (*Luzula sylvatica*), shining St John's wort (*Hypericum pulchrum*), heath pea (*Lathyrus linifolius*), goldenrod (*Solidago virgaurea*) and a hawkweed (*Hieracium cf sabaudum*). This site is discussed further in *Table 10.3*.

A further area of exposed siliceous rocks occurs within Ecological Site 4, represented by a disused quarry. This quarry is associated with mixed broadleaved/coniferous woodland

An area of recolonising bare ground occurs at the proposed location of Glenmore roundabout. This area has been colonised by largely ruderal species, such as common ragwort (*Senecio jacobaea*), ox-eye daisy (*Leucanthemum vulgare*), sorrel (*Rumex acetosa*), gorse (*Ulex europaeus*), creeping thistle (*Cirsium arvense*), nettle (*Urtica dioica*), knapweed (*Centaurea nigra*), clover (*Trifolium repens*), great willowherb (*Epilobium montanum*), silverweed (*Potentilla anserina*), dandelion (*Taraxacum spp.*) and bindweed (*Convolvulus arvensis*).

10.3.10.5 Freshwater Habitats

An area of swamp (FS1) dominated by dense stands of reed sweet-grass (*Glyceria maxima*) occurs to the south of the Glenmore roundabout. The swamp (FS1) occurs on wet or waterlogged mineral or organic soils that are poorly drained and subject to flooding.

Table 10.3 Ecological Sites Identified within the Route corridor (see Habitat Map, Figure 10.1a-f, Vol. 2)

Site No.	Location	Description	Evaluatio
1	North and south of N25 Ch. 0 to Ch. 100	This site represents a mosaic of habitats including native woodland (WN2), wet grassland (GS4), marsh (GM1), reed and large sedge swamps (FS1) and a lowland river (FW2). Smaller areas of scrub (WS1) and tree species indicative of wet woodland also occur within this site. The site forms a rectangular area orientated in a north south direction. Woodland is located on slopes to the east and west of the site. The portion of woodland to the east of the site is divided from the swamp and marsh habitats by the Graiguenakill Stream, while a drainage ditch separates the woodland and swamp/marsh habitats to the west. The woodland to the east of the site is indicative of natural woodland, dominated by oak species (*Quercus spp.*), with ash (*Fraxinus excelsior*) less dominant but more frequent towards the base of the wooded slope. While this woodland has been designated as WN2, it is not entirely representative of this classification. However, due to the lack of any suitable alternative within the *Guide to Habitats*, and the presence of native woodland vegetation this classification has been used. The woodland also supports a frequent distribution of beech (*Fagus sylvatica*) and sycamore (*Acer pseudoplatanus*). Regeneration of the above species was noted throughout the woodland, with sycamore regeneration dominating the upper slopes of the woodland. The sub-canopy tree-layer includes hawthorn (*Crataegus monogyna*) and holly (*Ilex aquifolium*) with grey willow (*Salix cineria*) and eared willow (*Salix aurita*) recorded at the base of the woodland slope adjacent to the river. The herb layer is dominated by dense ivy (*Helix hedera*) cover, with bramble (*Rubus fruticosa*) dominant in patches. Other species recorded include: • Herb robert (*Geranium robertianum*); • Hogweed (*Heracleum sphondylium*); • Honeysuckle (*Lonicera periclymenum*); • Hart's tongue (*Phyllitis scolopendrium*); • Bracken (*Pteridium aquilinium*); • Wood avens (*Geum urbanum*); • Wood sage (*Teucrium scorodonia*); • Bluebell (*Hyacinthoides non-scripta*); and • Great brome (*Bromopsis ramose*). The swamp habitat (FS1) to the south of the site is dominated by dense reed sweet-grass (*Glyceria maxima*). The species diversity is very low in this portion of the site. At the edges of the swamp habitat, bordering the drainage ditch to the west and the river to the east, a number of other species were recorded, including bulrush (*Typha latifolia*), great willowherb (*Epilobium hirsutum*),	C

Site No.	Location	Description	Evaluation
		field bindweed (*Convolvulus arvensis*) and meadowsweet (*Filipendula ulmaria*). An additional area of swamp habitat occurs to the north of this area. Both areas of swamp are separated by an area of scrub (WS1) and waste ground (ED3). The swamp areas to the north of the scrub/waste ground habitats are also dominated by reed sweet-grass. However, the site becomes progressively drier to the north so that this portion of swamp habitat grades into more species-rich marsh which in turn grades into species-poor wet grassland. The marsh habitat supports a more diverse assemblage of herbaceous flora which includes: • Meadowsweet (*Filipendula ulmaria*); • Water horsetail (*Equisetum aquatica*); • Water mint (*Menthe aquatica*); • Marsh pennywort (*Hydrocotyl vulgaris*); • Fools watercress (A*pium nodifolium*); • Mouse-ear (*Cerastium fontanum*); • Cuckoo plant (*Cardimine pratensis*); • Cocksfoot (*Dactylis glomerata*); • Creeping Bent (*Agrostis stolonifera*); • Soft rush (*Juncus effusus*); • Yellow iris (*Iris pseudocarus*); • Great willowherb (*Epilobium hirsutum*); • Marsh willowherb (*Epilobium palustre*); • Marsh bedstraw (*Galium palustre*); • Marsh cinquefoil (*Potentilla palustris*); and • Common sedge (*Carex nigra*). The wet grassland area to the north of the site is heavily disturbed with extensive areas of this habitat poached by bovine activity. The Graiguenakill Stream, which flows through the site, displayed indicative evidence of good water-quality. Riparian vegetation consisted of native tree species such as ash, grey willow and hawthorn. Upstream from the site coniferous woodland borders the river to the east. Aquatic invertebrates included caddis fly species, ephemeroptera and baetis mayfly and the river limpet A*ncylus fluviatilis*. A diverse range of instream habitats were recorded with well oxygenated riffle habitats occurring over a gravely river bed, lateral moraines, glides and pools. The intact native riparian vegetation to the east of the river also provides	

Site No.	Location	Description	Evaluation
		shelter and foraging material for instream fauna. This site supports a range of fauna. The woodland, swamp and grassland habitats provide ideal foraging habitat for bat species. Common pipistrelle and Leisler's bats were recorded foraging within, and adjacent to, the site. While no field sign of otter activity was recorded in this site, the presence of an otter footprint approximately 400m to the southeast of the site and the direct watercourse link to this area suggests that otters forage within this site. Similarly, while no amphibians were recorded, the habitats present have the potential to support populations of common frog. A number of butterfly species, including the peacock (*Inachis io*), red admiral (*Vanessa atalanta*) and large white (*Pieris brassicae*) were recorded during the field survey. The site is also likely to support a diverse range of Odonata species. A large population of the large amber snail (*Succinea putris*) was noted throughout the swamp habitats.	
2	N25 Ch. 1,350, adjacent to Pink Point	The high ground at Pink Point (N25 Ch. 1350) is fringed by oakwood which has been augmented by planting but retains features of native woodland. This woodland is located within the River Barrow cSAC and is representative of old oak woodland, which is a qualifying habitat of this site. While this woodland has been designated as Oak-birch-holly woodland (WN1), this is not entirely representative of the site but was deemed the most suitable description of it from the Guide to Habitats. Pedunculate oak (*Quercus robur*) grows with Wych elm (*Ulmus glabra*) and Wild cherry (*Prunus avium*) but there is some Scot's pine (*Pinus sylvestris*) above the quarry as well as Bramble (*Rubus fruticosus*), Gorse (*Ulex europaeus*) and Field rose (*Rosa arvensis*) in more open ground. Irish Whitebeam (*Sorbus hibernica*) also occurs within the woodland at Pink Point. This *Sorbus* species is endemic to Ireland and has been recommended for inclusion in the next revision of the Irish Red Data Book (1). A diverse flora occurs with ferns rather prominent beneath the trees - Shield fern (*Polystichum setiferum*), Male fern (*Dryopteris filix-mas*) and Hart's tongue (*Phyllitis scolopendrium*) are frequent. The herb species consist of; • False brome (*Brachypodium sylvaticum*); • Wood sage (*Teucrium scorodonia);* • Wall pennywort (*Umbilicus rupestris*); • Great brome (*Bromopsis ramose*); • Common violet (*Viola riviniana*); • Bugle (*Ajuga reptans*); • Bluebell (*Hyacinthoides non-scripta*); • Wood avens (*Geum urbanum*); • Herb robert (*Geranium robertianum*); • Wild strawberry (*Fragaria vesca*); • Barren strawberry (*Potentilla sterilis*);	A

(1) Rich, T, Lochton, A.J. & Parnell, J.,. (2005). Distribution of the Irish Whitebeam,*Sorbus hibernica* E. F. Warb. (Rosaceae). Watsonia, 25 (369 – 380).

Site No.	Location	Description	Evaluation
		• Greater stitchwort (*Stellaria holostea*); and • Primrose (*Primula vulgaris*). Exposed rock (ER1) occurs in the wood on the northern side of the quarry. A suite of acid plants occur here: ling (*Calluna vulgaris*), Fraochan (*Vaccinium myrtillus*), Greater woodrush (*Luzula sylvatica*), Shining St John's wort (*Hypericum pulchrum*), Heath pea (*Lathyrus linifolius*), Goldenrod (*Solidago virgaurea*) and a hawkweed (*Hieracium* cf *sabaudum*). This site supports a significant badger population. High levels of activity observed at this site. Leisler bat activity was also recorded at this site. As this site is located within the boundary of the River Barrow cSAC it is considered to be of international importance	
3	N25 Ch. 1,650	The route crosses the eastern shore of the estuary through a narrow (5m) belt of reeds below the shoreline embankment. Sea clubrush (*Bolboschoenus maritimus*) occurs at the river margin, then common reed (*Phragmites australis*) with some hemlock water dropwort *Oenanthe crocata*, curled dock (*Rumex crispus*) and English scurvygrass (*Cochlearia anglica*). Bindweed (*Calystegia* cf *sylvatica*) grows out from the embankment which is otherwise covered by false oat (*Arrhenatherum elatius*), teasel (*Dipsacus fullonum*), bittersweet (*Solanum dulcamara*) and meadowsweet (*Filipendula ulmaria*). Contiguous to the reed belt on the river side are intertidal mud flats which are representative of exposed mudflats listed in Annex I of the EU Habitats Directive and a qualifying habitat of the cSAC. The riverside portion of this site is located within the River Barrow cSAC while the landward side of the embankment is located within the River Barrow pNHA. A triangular grazing field with cattle is found on the landward side of the embankment and is edged by two drains, the western with such plants as water starwort (*Callitriche* cf *stagnalis*), floating sweet grass (*Glyceria fluitans*) and great willowherb (*Epilobium hirsutum*). It is overhung by tall fescue (*Festuca arundinacea*), fox sedge (*Carex otrubae*) and Yorkshire fog (*Holcus lanatus*) into which woody species are spreading, both elder (*Sambucus nigra*) and bramble (*Rubus fruticosus*). The eastern (inner) drain is more stable and has more open water, in which grows: • water plantain (*Alisma plantago-aquatica*); • small pondweed (*Potamogeton berchtoldii;*) • bur reed (*Sparganium erectum*); • greater pond sedge (*Carex riparia*); • common reed (*Phragmites australis*); • marsh bedstraw (*Galium palustre*); and • water figwort (*Scrophularia auriculata*). Meadowsweet (*Filipendula ulmaria*) is again frequent on the edge where a little crow garlic (*Allium vineale*) also grows. The fauna at this site is characteristic with numbers of sedge warbler (*Acrocephalus schoenabaenus*) in the drains, a few reed bunting (*Emberiza schoeniculus*) and skylarks (*Alauda arvensis*) in the fields behind. Frogs were also recorded here.	A
4	Immediately north of N25	A mixed broadleaved/conifer woodland (WD2) belt is crossed at N25 Ch. 3100, situated at the side of a shallow valley. It is north-facing and consists mainly of Sitka spruce (*Picea sitchensis*) and beech (*Fagus sylvatica*) with some sycamore (*Acer*	D

Site No.	Location	Description	Evaluation
	Ch. 3,100	*pseudoplatanus*), Holly (*Ilex aquifolium*) and Sweet chestnut (*Castanea sativa*). The ground flora is relatively open as the site is dry and on shallow soil. The slatey Ordovician rock is exposed in a few places and often has wall pennywort *Umbilicus rupestris* growing on it. Elsewhere ferns characterise the surface; Shield fern (*Polystichum setiferum*), Buckler fern (*Dryopteris dilatata*) and Scaly male fern (*D.affinis*). There is also: • Ivy (*Hedera helix*); • Honeysuckle (*Lonicera periclymenum*); • Great woodrush (*Luzula sylvatica*); • Wood sorrel (*Oxalis acetosella*); • Bluebell (*Hyacinthoides non-scripta*); • Foxglove (*Digitalis purpurea*); • Great stitchwort (*Stellaria holostea*); • Enchanter' s nightshade (*Circaea lutetiana*); • Tutsan (*Hypericum androsaemum*); and • A moss (*Mnium hornum*). Goldcrests were particularly prominent in the canopy during the site visit but there was also coal tit, treecreeper and chiffchaff. Woodpigeon, hooded crow and magpie were the larger species noted and there was evidence too of sparrowhawk. This woodland also supports badgers, while foraging common pipistrelle bats were recorded immediately adjacent to it along the L-4026-1 and along the southern edge of the woodland. This woodland site is severed from a much larger area of woodland by the L-4026-1. The larger area of woodland, which supports a more diverse range of flora and fauna is located within the River Barrow pNHA.	
5	N25 Ch. 3,900	This site is characterised by a high water level, with areas of low-lying muddy substrate. The Camlin Stream, an eroding river (FW1) flows through the eastern section of the site. Woodland, consisting of ash (*F. excelsior*), beech (*F. sylvatica*) and oak (*Quercus spp.*) dominates the site. The eastern bank of the stream slopes steeply to the sites boundary. The dryer slope of this area (as well as the dryer area to the west of the site) is reflected by the flora associated with it, which includes: • Blue bell (*Hyacinthoides non-scripta*); • Primrose (*Primula vulgaris*); • Lords and ladies (*Arum maculatum*); • Hart's tongue (*Phyllitis scolopendrium*); • Hard fern (*Blechnum spicants*);	D

Site No.	Location	Description	Evaluation
		• Bracken (*Pteridium aquilinium*); • Common dog-violet (*Viola riviniana*); • Greater stitchwort (*Stellaria holostea*); • Creeping buttercup (*R. repens);* • Common sorrel (*R. acetosa*); • Nettle (*U. dioica*); • Bush vetch (*Vicia sepium*); and • Lesser Celandine (*Ranunculus ficaria*). The herb layer associated with the wetter area of the site include: • Meadowsweet (*F. ulmiara);* • Water forget-me-not (*Myosotis scorpioides*); • Opposite-leaved saxifrage (*Chrysosplenium oppositifolium*); • Water mint (*M. aquatica*); • Water plantain (*Alisma Plantago-aquatica*); • Brooklime (*V. beccabunga*); and • Cuckoo plant (*C. pratensis*). A small pond, choked by aquatic vegetation, such as common water-starwort (*C. stagnalis*) and fool's water-cress (*A. nodifolium*) a drainage ditch (FW4) flows to the west of the site. A large number of large red damselflies (*Pyrrhosoma nymphula*) and variable damselflies (C*oenagrion pulchellum*) were recorded foraging within the site. This site displays similar characteristics to the wetland habitats forming part of the River Barrow cSAC which is separated from this site by the L-4026-1 tertiary road. However due to the discrete size of this site, the degradation of the habitat by illegal dumping activity (recorded during field surveys) and on-going enrichment indicated by the extensive stands of nettles, the ecological value of the site has been reduced.	
6	N25 Ch. 8,550	At the base of the slope a quaking area occurs in wet weather in which watercress (*Rorippa nasturtium-aquaticum*), ivy-leaved crowfoot (*Ranunculus hederaceus*), lesser spearwort (*R.flammula*) and water starwort (*Callitriche cf stagnalis*) grow between tussocks of soft rush (*Juncus effusus*) and some scattered sharp-flowered rush (*J.acutiflorus*). More generally the field is dominated by rushes and wet grass, including creeping bent (*Agrostis stolonifera*), floating sweet grass (*Glyceria fluitans*), rough-stalked meadowgrass (*Poa trivialis*) and Yorkshire fog (*Holcus lanatus*). Lady's smock (*Cardamine pratensis*), bog stitchwort	D

Site No.	Location	Description	Evaluation
		(*Stellaria uliginosa*), creeping buttercup (*Ranunculus repens*) and greater bird's-foot trefoil (*Lotus pedunculatus*) make up the species complement.	
7	Immediately east of N30 Ch. 2,900	The proposed route at this point crosses the western part of a shallow valley which contains a spring (FP2). The western parts of the valley is more mineral than peaty and clumps of bramble (*Rubus fruticosus*) and elder (*Sambucus nigra)* occur with soft rush (*Juncus effusus)* and nettle (*Urtica dioica)* in between. Docks (*Rumex obtusifolius*), (*R.conglomeratus)* are also conspicuous as cattle tend to cross the valley here rather than lower down. There are a few runnels of water in winter with brooklime (*Veronica beccabunga)* and bog stitchwort (*Stellaria uliginosa).* Downstream, and to the east of the proposed alignment the ecological quality of the habitat increases. Water is ponded in stages, so that marsh, wet grassland and willow scrub occur and there are quaking areas rich in organic material. There are extensive areas of yellow flag (*Iris pseudacorus*), sharp-flowered rush (*Juncus acutiflorus*) and soft rush (*J.effusus*) as well as clumps of gorse (*Ulex europaeus*), eared willow (*Salix aurita*) and ash (*Fraxinus excelsior*). Additional marsh plants include: • Lesser spearwort *(Ranunculus flammula)*; • Round-leaved water crowfoot *(R.omiophyllus);* • ivy-leaved water crowfoot *(R.hederaceus);* • floating sweet grass *(Glyceria fluitans);* • small sweet grass *(G.declinata)*;; • marsh bedstraw *(Galium palustre)* ; • creeping forget-me-not *(Myosotis secunda);* • marsh cinquefoil *(Potentilla palustris);* • tormentil *(P.erecta);* • greater birdsfoot trefoil *(Lotus pedunculatus);* and • spotted orchid *(Dactylorhiza fuchsia).* Willow warblers are numerous in the area and there were also wren, blackbird and dunnock seen during the site visit. Long-tailed tit, whitethroat and redpoll are other likely bird species and the site could be important for snipe in winter. This species roosts in such marshes by day and feeds in the surrounding farmland by night	C
8	N30 Ch. 3,350 of the N30 Tie-in	An immature woodland (WS 2) area of deciduous trees is crossed at (N30 Ch. 3350) in which oak (*Q. robur*) is the main species though hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), gorse (*Ulex europaeus*), elder (*Sambucus nigra*) and ash (*F. excelsior*) are regenerating also. Where ground flora occurs it is that of an overgrown field with false oat (*Arrhenatherum elatius*), cocksfoot (*Dactylis glomerata*), marsh thistle (*Cirsium palustre*) etc but it is more common for bramble (*R. fruticosus*) to have	D

Site No.	Location	Description	Evaluatio
		monopolised spaces between and among the planted trees. Adjacent land supports tall beech trees (*F. sylvatica*) together with some Scot's pine (*Pinus sylvestris*).	

10.3.10.6 *Protected & Rare Flora*

No protected flora species were recorded within the study corridor. Irish Whitebeam (*Sorbus hibernica*) occurs in the woodland included within Ecological Site 2 (*see Table 10.3*). Historical records [(1)] of flora species occurring within the route corridor or adjacent to it are listed below:

- meadow barley (*Hordeum secalinum*) has been recorded to the south of the route corridor near Bearstown Bridge and Carrickcloney. Historical records also show that this species was associated with the Pink Point. However flora surveys undertaken at this location did not record this species;
- sharp-leaved fluellen (*Kickxia elatin*) occurs to the south of the route corridor in Dunganstown area; and
- divided sedge (*Carex divisa*) occurs to the south of the route corridor in the Dunganstown area.

10.3.11 *Fauna*

10.3.11.1 *Bats*

Table 10.4 below outlines the bat species recorded in Ireland, their status and the international legal protection afforded to them.

Table 10.4 Bat species in Ireland and their Legal Protection

COMMON NAME	SCIENTIFIC NAME	IRISH RED DATA BOOK STATUS	HABITATS DIRECTIVE	BERN CONVENTION
Daubenton's Bat	*Myotis daubentoni*, Kuhl 1819	*Internationally Important*	Annex IV	Appendix II
Whiskered Bat	*Myotis mystacinus*, Kuhl 1819	*Indeterminate*	Annex IV	Appendix II
Natterer's Bat	*Myotis natterei*, Kuhl 1818	*Indeterminate*	Annex IV	Appendix II
Leisler's Bat	*Nyctalus leisleri*, Kuhl 1818	*Internationally Important*	Annex IV	Appendix II
Common Pipistrelle Bat	*Pipistrellus pipistrellus*, Schreber 1774	*Internationally Important*	Annex IV	Appendix II
Soprano Pipistrelle Bat	*Pipistrellus pygmaeus*, Schreber 1774	*Internationally Important*	Annex IV	Appendix II
Nathusius Pipistrelle Bat	*Pipistrellus nathusii*, Keyserling & Blasius 1839	Not Referenced	Annex IV	Appendix II
Brown Long-Eared Bat	*Plecotus auritus*, Linnaeus 1758	*Internationally Important*	Annex IV	Appendix II
Lesser Horseshoe Bat	*Rhinolophus hipposideros*, Bechstein 1800	*Internationally Important*	Annex II Annex IV	Appendix II

(1) NPWS Protected Species Database

COMMON NAME	SCIENTIFIC NAME	IRISH RED DATA BOOK STATUS	HABITATS DIRECTIVE	BERN CONVENTION
Brandt's Bat	*Myotis brandtii* Eversmann, 1845	Not Referenced	Annex IV	Appendix II

Daubenton's, Leisler's, Common & Soprano Pipistrelles and Brown Long-Eared bats are all distributed widely across the island of Ireland with historical records confirming their presence in the southeast. The Lesser Horseshoe Bat is restricted to the western counties of the Republic, from Cork in the south to Mayo in the north, whilst the Natterer's and Whiskered bats are rare and little is known of their distribution and ecology in Ireland [(1)]. Both Brandt's bat and Nathusius Pipistrelles are considered rare in Ireland, and no historical records exist for their occurrence in the southeast of Ireland. The nearest recorded location for both species is Co. Wicklow [(2)].

During the Phase I Habitat survey a number of potential bat roosting sites were identified. These sites included old buildings and structures, some of which were derelict, barns and bridges (See *Table 10.5* below).

Table 10.5 Description of Structural Roosting Sites

Site No.	Chainage	Description
1	N25 100	Bearstown Bridge, located approximately 300m to the south of N25 Ch. 100 and adjacent to LS-7512 southern tie-in. This bridge is located over the Graiguenakill River. This river is included within the River Barrow cSAC and flows through predominantly semi-natural habitats. Cracks and crevices in the bridge have the potential to support roosting bats while the river has the potential to provide ideal foraging habitat for bat species, particularly Daubenton's bats.
2	N25 650	Farm barns located approximately 100m to the south west of N25 Ch. 650. The site includes three barn structures that provide ideal summer roosting potential for bat species. The barns include wooden support structures that include crevices ideal for supporting bats. The out houses are surrounded by mature trees and established hedgerows providing foraging and commuting routes for bat species.
3	N25 1,300	The quarry face of Pink Point is located at this site, which is also adjacent to the River Barrow. The quarry face contains many crevices that can support roosting bats.

(1) Whilde, A. (1993) Threatened Mammals, Birds, Amphibians and Fish in Ireland. Irish Red Data Book 2: Vertebrates. HMSO, Belfast
(2) Bat Conservation Ireland, website

Site No.	Chainage	Description
4	N25 2,500	Stokestown Castle is located adjacent to N25 Ch. 2,500. This site was identified as a potential roost site and ideal bat habitat. The castle and the associated stable buildings offer ideal roosting conditions for bats with wooden support structures, attic void spaces and crevices recorded throughout the structure. The structures also provide unobstructed access and egress to potential roost sites. The close proximity of the site to the River Barrow and the good connectivity throughout the landscape here increases the value of the habitat for bats.
5	N25 2,800	The Stokestown Estate gate lodge is located immediately to the north of N25 Ch. 2,800. A quarry, surrounded by woodland, is located opposite the gate lodge, across the L-4026-1 tertiary road. Both the gate lodge and the quarry represent good roosting habitat for bats. Potential access to the attic void spaces through the slate roof of the gate lodge was identified.
6	N25 2,800	Stokestown a ruined Victorian Folly is located at this site. It is situated on top of a hill in the middle of a large arable field and is very exposed to adverse weather conditions. No vegetation or linear habitats link the folly to the surrounding countryside. Crevices and cracks were identified throughout the ruined building. The southern wall of the structure has crumbled, further increasing the exposure of the site.
7	N25 3,500	A Victorian farmhouse is located at N25 Ch. 3,500. The main residential house and the farm yard were identified as having a high potential for supporting bats. The buildings are surrounded by pasture and arable fields with well established field hedgerows. The main farmhouse contains a basement area which has the potential to support winter roost sites. Unobstructed access in and out of the out-buildings along with the crevices and other confined spaces were recorded.
8	N25 6,150	This site contains an old farmhouse and a number of out-houses. Both the farmhouse and out-houses were identified as having a high potential for supporting bats. A variety of potential roost sites, including open roof spaces and confined areas under eaves were identified. An area of predominantly coniferous woodland is located to the east of the site, while a linear strip of broadleaved woodland, associated with a minor stream is located immediately to the north of the farmhouse. Established hedgerows and mature treelines surround the farmhouse.
9	N25 8,600	This site consists of a house and bridge with good linkage to the Maudlin River. The riparian vegetation along the river is well established and offers plenty of shelter both to bats and prey species. Loose slates and cracks in the stonework provided access in and out house. The stone-walled bridge contained numerous crevices that have the potential to support bats.
10	N30 1,100	This site was identified as a potential roost site. It consists of a derelict house surrounded by mature ash trees. Open barns surround the main derelict house. The site is located in the midst of arable agricultural landscape. There are hedgerows linking the site to the north, south and west.

No historical records of bats occurring within the route corridor were identified during the desktop review and consultation exercises.

Each of these potential roost sites was surveyed for any evidence of bat presence (see *Table 10.1* for a list of dates on which roost sites were surveyed*)*. The following paragraphs describe the findings of those surveys. The Bat Roost Site No. used in the following paragraphs refers to the Bat Roost Site No. outlined in *Table 10.5* above.

Common pipistrelle (*P. pipisrellus*) and Daubenton's bats (*M. daubentoni*) were recorded foraging along the Graiguenakill River, both upstream and downstream of Bearstown bridge (Bat Roost Site No. 1). However, no evidence was recorded to confirm that the bridge was an active roost site. The riparian habitat both upstream and downstream of the bridge provides ideal foraging habitat for bat species.

Common pipistrelle (*P. pipisrellus*) bats were recorded foraging in close proximity to Bat Roost Site No. 2. A brown long-eared bat was recorded flying inside one of the barns, indicating that this species of bat roosts within the barn.

A high level of Leisler's (*Nyctalus leisleri*) bat activity was detected adjacent to Pink Point, Bat Roost Site No. 3, within the proposed alignment. While no visual record was made at this site due to the bright light obscuring views, the constant sonar recordings suggest that Leisler's bats were foraging on insects above high level lighting over looking the River Barrow. Fainter Leisler's bat sonar signals were also detected above Pink Point, indicating that the bats were foraging in the woodland above the former quarry. No bats were recorded roosting within the face of the former quarry at Pink Point.

Common pipistrelle (*P. pipistrellus*) and brown long-eared (*Plecotus auritus*) bats were recorded at Stokestown Castle, Bat Roost Site No. 4. One brown long-eared bat was recorded flying in sheds attached to the castle, while a number of common pipistrelles were recorded commuting along hedgerows connected to the castle. Both common pipistrelles and brown long-eared bats were recorded foraging along the L-4026-2 tertiary road immediately adjacent to the castle. This tertiary road, which intersects the route alignment to the south of the castle, is bordered by hedgerows of a high ecological value, containing a variety of shrub and tree species and provides ideal foraging conditions for bats. Both species of bats were recorded intersecting the route alignment while foraging along the L-4026-2 tertiary road. A walled garden is located immediately adjacent to the bypass at N25 Ch. 2,250. Bats were also recorded flying east from the L-4026-2 and foraging along the southern wall of the garden. The results of the bat detector surveys confirmed that the castle and associated out-houses supported roosting bats.

An examination of the Stokestown Estate gate lodge, Bat Roost Site No. 5, revealed no evidence of roosting bats. However soprano pipistrelles were recorded foraging along the L-4026-1 tertiary road between the lodge and the disused quarry both during dusk and dawn surveys. The dawn surveys recorded both common and soprano pipistrelle bats at this location immediately prior to sunrise, flying in the direction of the quarry, suggesting that the quarry supports roosting pipistrelles.

A daytime examination of the Stokestown Folly revealed no evidence of use by bats. Similarly, no bat activity was recorded at the folly during dusk bat detector surveys. It is likely that the exposed nature of this site limits its potential to support bat species.

Common pipistrelles and soprano pipistrelles were recorded to the south of N25 Ch. 3,500, Bat Roost Site No. 7. Common pipistrelles were visually identified flying in a large barn shortly after sunset, while faecal droppings were also recorded. Both common and soprano pipistrelles were recorded foraging along the access road to farm buildings adjacent to approximate N25 Ch. 3,600. This access road transects the route alignment.

Common and soprano pipistrelles were recorded within an out-house at Bat Roost Site No. 8, indicating that this out-house supported roosting bats. Both species of bat were also recorded commuting to the south of the farm-yard along hedgerows within the proposed alignment. No bats were recorded entering or exiting the main farm-house. Site management personnel at this location advised field staff that no bats roosted within the main house.

Common pipistrelles were recorded foraging along the Maudlin Stream, Bat Roost Site No. 9 (within the alignment) and adjacent tertiary roads. The derelict house immediately to the west of the proposed alignment at approximate N25 Ch. 8,500 is a confirmed bat roost. Two pipistrelles were visually recorded entering the attic space of the house during a dawn survey. The bats roosting in this building were recorded transecting the proposed alignment at Ballymacar Bridge on their return to the roost.

Brown long-eared bats were recorded emerging from a derelict house at N30 Ch. 1,100, Bat Roost Site No. 10, confirming the roost status of this house. As well as brown long-eared bats, common pipistrelles were recorded foraging within the vicinity of the house shortly after sunset indicating the likelihood of common pipistrelles roosting within the house or associated outbuildings adjacent to the house. Both species were recorded flying eastward from the house towards the proposed alignment. The commuting route of bats roosting at this location may intersect the proposed alignment.

10.3.11.2 Description of Bat Tree Roost Sites

As outlined in *Section 10.3,* trees within the proposed alignment were also assessed for their potential to support roosting bats. The locations of potential and confirmed bat tree roosts are outlined in the Mammal Activity Maps (*Figure 10.2*).

Only one tree was confirmed as a bat tree roost during the baseline field surveys. This mature oak tree occurs within a mature treeline in an area of proposed cutting at approximate N25 Ch. 6,250. One individual common pipistrelle was visually recorded entering the tree during a dawn survey. A number of bats of the same species were also recorded commuting along this treeline.

A list of trees identified as having the potential to support roosting bats is provided in *Table 10.6* below, along with the findings of the surveys at each tree.

Table 10.6 Bat Tree Roosts

Bat Tree Site No.	Location	Description	Roost Potential	Bat Detector Survey Results
1	LS-7513 Realignment	This is an area of woodland that forms part of *Ecological Site 1*. The woodland contains a high number of mature trees that display features such as crevices, cracks, hollows, thick ivy cover and loose bark, associated with bat tree roosts.	Due to the prevalence of features associated with bat tree roosts, the ability of mature trees within this woodland to support summer roosting sites is considered to be high. The additional shelter provided by the woodland and the steeply sloping topography of this site increases the potential for mature trees within the woodland to support winter roosting bats.	While no individual trees were confirmed as supporting roosting bat species, a high degree of bat activity was recorded within and adjacent to the woodland.
2	N25 Ch. 550	Two mature ash trees located along a farm access track. Both trees are covered by ivy. No obvious cracks or crevices were identified but the thick layer of ivy increases the trees' potential to support roosting bats. The trees are located in close proximity to Bat Site No. 2 (see above).	Due to the absence of cracks, crevices and loose bark and the close proximity of Bat Roost Site No. 2 it is considered that the likelihood of these trees to support roosting bats is moderate. The ability of these trees to support roosting bats was considered to be moderate.	No bat activity was recorded at this location.
3	N25 Ch. 1,350	This is an area of woodland that forms part of *Ecological Site 2*. A number of mature trees and older hollowed trees were identified within this woodland. These trees displayed a number of features suitable for supporting roosting bats. The features include thick ivy cover along the trunk and branches, crevices and hollows, cracked limbs and loose bark.	The ability of mature and old hollow trees within this woodland to support roosting bats is considered to be high.	While no individual trees were confirmed as bat roosting trees, a high degree of bat activity was recorded within and adjacent to the woodland. The species recorded foraging in the woodland includes common and Leisler's bats.
4	N25 Ch. 3,100	This is an area of woodland that forms *Ecological Site 3*. the characteristics of this site are similar to that outlined in Site 3 above	As outlined in Site 3 above	While no individual trees were confirmed as bat roosting trees, a high degree of bat activity was recorded within and adjacent to the woodland. The species recorded foraging in the woodland includes common and soprano pipistrelles. This woodland is located in close proximity to the Stokestown Gate Lodge and Quarry, Bat Roost Site No. 5.

Bat Tree Site No.	Location	Description	Roost Potential	Bat Detector Survey Results
5	N25 Ch. 4,500	A mature ash tree in a treelines along the Camlin Stream. While the tree did not display cracks, crevices or loose bark, the thick ivy cover throughout increases the potential of this tree to support roosting bats. Also the presence of the Camlin Stream and an established riparian treeline increases the foraging potential of this area.	The thick ivy cover throughout this tree, coupled with the habitat in which it is located increases the potential for this tree to support roosting bats. It is considered that the roost potential of this tree is high. The potential for this tree to support winter roosting bats is considered to be high, although during times of colder winter episodes, it is likely that bat species would roost in less exposed areas.	A dusk and dawn bat detector survey was undertaken at this location. No bat activity was recorded during the survey.
6	N25 Ch. 5,000	Mature ash, located at the junction of a number of established hedgerows. No cracks, crevices, loose bark or hollows were identified on this tree. However the thick ivy cover throughout the tree increases its potential to support roosting bats.	The thick ivy cover throughout this tree, coupled with it location at the junction of two established hedgerows increases the potential for this tree to support roosting bats. The habitats surrounding this tree are of low ecological value, characterised by intensive agricultural field systems. Due to the above factors, the likelihood for this tree to support summer and winter roosting bats is considered to be low. Also, the exposed aspect of this tree further reduces its potential to support roosting bats during colder winter episodes.	A dusk and dawn bat detector survey was undertaken at this location. No bat activity was recorded during the survey.
7	N25 Ch. 6,000	Mature oak tree located in an established hedgerow, at the edge of the proposed alignment. No cracks, crevices, loose bark or hollows were identified on this tree. A thick ivy cover throughout increases its potential to support roosting bats. Arable fields surround this tree, which is located 200m to the west of Bat Roost Site No. 7.	As Bat Tree Site No. 5 above.	A dusk and dawn bat detector survey was undertaken at this location. No bat activity was recorded during the survey.

Bat Tree Site No.	Location	Description	Roost Potential	Bat Detector Survey Results
8	N25 Ch. 6,200 – 6,500	A high number of mature trees, forming treelines, containing oak and beech are located in this area. Of these, eight beech trees display features such as crevices and hollows, particularly in the root system, that have the potential to support roosting bats. Also, a number of mature oak trees have thick ivy cover, as well as areas of loose bark. These trees are located approximately 100m to the south of Bat Roost Site No. 7. An area of coniferous woodland is located immediately to the east of this site. A watercourse is located approximately 100m to the north of this site.	A number of features that increase the potential of a tree to support roosting bats (i.e. crevices, hollows, thick ivy cover) were identified on trees within this site. This coupled with the close proximity of Bat Roost Site No. 7 and the range of foraging habitats located nearby increases the potential for this site to support roosting bats. The deep crevices associated with the beech trees in this area also indicates the high potential for this site to support winter roosting bats.	A dusk and dawn bat detector survey was undertaken at this location. Common pipistrelle bat activity was recorded during the survey. One individual common pipistrelle was visually recorded entering an oak tree within this treeline. The location of this tree is indicated in the Mammal Activity Map (see *Figure 10.2*).
9	N25 Ch. 7,700	Two trees, one oak and one beech located in a stonewall hedgerow. While both trees do not display cracks, crevices, loose bark or hollows, they are thickly covered in ivy, increasing the potential for the trees to support roosting bats. This site is surrounded by improved agricultural grassland.	As Site 5 above.	A dusk and dawn bat detector survey was undertaken at this location. No bat activity was recorded during the survey.

10.3.11.3 *Other Mammal Survey Findings*

The locations of signs of mammals recorded during the surveys are shown on the Mammal Survey Maps (see *Figure 10.2 a-f in Volume 2*).

Badgers are protected under the Irish Wildlife Acts, 1976 & 2000. The results of the badger surveys are compiled in a confidential report which is only available to Wexford County Council, An Bord Pleanala and the NPWS.

Otters are protected under the Irish Wildlife Acts, 1976 & 2000 and under Annex II & IV of the EU Habitats Directive. No historical records of otters occurring within the study area were identified from the NPWS Biological Records. No otter holts were recorded during the terrestrial mammal survey. An otter print was recorded along the tertiary road LS-7512, to the east of Bearstown Bridge. An otter spraint and further prints were recorded within the proposed alignment, on the intertidal mud-flats along the eastern shore of the River Barrow.

Pine martens are protected under Irish Wildlife Acts, 1976 & 2000 and Annex V of the EU Habitats Directive. Evidence of pine marten activity, which included a spraint and bird feathers (possibly indicating recent foraging) was recorded within a coniferous woodland, approximately 200m to the south of N25 Ch. 7,700.

No field signs of Irish stoat (protected under Irish Wildlife Acts, 1976 & 2000) were recorded within the route corridor. An Irish hare (Irish Wildlife Acts, 1976 & 2000 and Annex V of the EU Habitats Directive) was observed in a field to the south of N25 Ch. 6,300, while a hedgehog (protected under Irish Wildlife Acts, 1976 & 2000) was recorded along a farm access track to the north of N25 Ch. 6,050. Historical records of Irish hares occurring in the townland of Ballykelly were identified from the NPWS Biological Records.

10.3.11.4 *Birds*

All bird species occurring in the wild are protected under the Irish Wildlife Acts 1976 & 2000, with the exception of those listed on Schedule I of the Acts. The woodlands, hedgerows and treelines within the site provide habitat for a range of typical bird species. Bird species observed during the course of the survey include sparrowhawk (*Accipiter nisus),* hooded crow (*Corvus corone*), magpie (*Pica pica*), wood pigeon (*Columba palumbus*), blue tit (*Parus caeruleus*), coal tit (*Parus ater*), robin (*Erithacus rubecula*), blackbird (*Turdus merula*), greenfinch (*Carduelis chloris),* chaffinch (*Fringilla coelebs*), meadow pipit *(Anthus trivialis)*, sedge warbler (*Acrocephalus schoenabaenus*), reed bunting (*Emberiza schoeniculus*)*,* skylarks (*Alauda arvensis*), goldcrest (*Regulus* regulus), chiffchaff (*Phlloscopus collybita*) wren (*Troglodytes troglodytes*), treecreeper (*Certhia familaris)* and mistle thrush *(Turdus viscivorus).* Snipe (*Gallinago gallinago*) was also recorded in the wet grassland and marsh areas during winter months. Little egrets (*Egretta garzetta*) were recorded during the summer of 2006 and 2007 to the south of the Bypass, outside the route corridor. Despite suitable habitat, no kingfishers were recorded during field surveys along the western bank of the River Barrow at Pink Point. Little egrets and kingfishers are listed under Annex I of the EU Birds Directive and are a species of international conservation importance.

10.3.11.5 *Insects*

While no specific surveys were undertaken for invertebrates the following groups of invertebrates were recorded during field surveys: dragonflies, damselflies, butterflies, beetles, molluscs and grasshoppers.

Nelson and Thompson (1) carried out a national distribution survey for dragonfly and damselfly species in 2000. Their survey recorded species in ten kilometre squared sample sites. A number of dragonfly and damselfly species were recorded within the ten kilometre squared sample sites through which the proposed route corridor passes. *Table 10.7* indicates the species recorded, there distribution status and whether they were recorded before or during the 2000 survey.

(1) Nelson, B. & Thompson, R. (2000). The Natural History of Ireland's Dragonflies. Also see http://www.habitas.org.uk/dragonflyireland

Table 10.7 Historical Records of Dragonfly species within or adjacent to the proposed route corridor

Species Name	Distribution Status	Time Recorded
Beautiful demoiselle (*Calopteryx virgo*)	Mainly confined to the south and east of a line from Limerick to Dublin and also Connemara	Pre-2000
Banaded Demoiselle (*Calopteryx splendans*)	Distributed through lowlands in Ireland.	Pre-2000
Large Red Damselfly (*Pyrhosoma nymphula*)	Distributed throughout Ireland	Pre-2000 & 2000
Blue-tailed Damselfly (*Ischnura elegans*)	Distributed throughout Ireland	Pre-2000
Common Blue Damselfly (*Enallagma cyathigerum*)	Distributed throughout Ireland	Pre-2000
Variable Damselfly (*Coenagrion pulchellum*)	Most abundant on mesotrophic pools and small sheltered lakes. Often abundant on cutover raised bogs.	Pre-2000
Common Hawker (*Aeshna juncea*)	Distributed throughout Ireland	Pre-2000
Common Darter (*Sympetrum striolatum*)	Distributed throughout Ireland	Pre-2000 & 2000

The following butterflies have also been recorded by ERM's ecologists during field surveys along the route corridor:

- Large White (*Pieris brassicae*)
- Green-veined White (*Artogeia napi*)
- Orange tip (*Anthocharis cardamines*)
- Small Copper (*Lycaena phlaeas*)
- Painted Lady (*Vanessa cardui*)
- Speckled Wood (*Pararge aegeria*)
- Meadow Brown (*Maniola jurtina*)
- Small Heath (*Coenonympha pamphilus*)
- Peacock (*Inachis io*)
- Red Admiral (*Vanessa atalanta*)

10.3.11.6 Amphibians & Reptiles

Common frogs were recorded to the east of the River Barrow, in the vicinity of drainage ditches.

10.4 DESCRIPTION OF PREDICTED IMPACTS

The potential impacts of the Bypass were examined in the context of the findings of the ecological baseline outlined above. This included an assessment of the potential direct and indirect impacts to the ecological baseline identified along the route corridor.

10.4.1 *Evaluation Criteria*

The potential for ecological and nature conservation impacts has been assessed in line with the NRA's *Criteria for Assessing Impact Significance,* EPA's *Guidelines for Environmental Impact Statements* and the IEEM's *Guidelines for Ecological Impact Assessment.*

As part of the Ecological Impact Assessment (EcIA) the significance of potential ecological impacts has been evaluated taking into account the following factors:

- the magnitude of both positive and negative effects, as determined by intensity, frequency, duration and extent of the impact;
- the vulnerability of the habitat or species to the change caused by the development;
- the ability of the habitat, species or ecosystem to recover, considering both fragility and resilience;
- the viability of component ecological elements and the integrity of ecosystem function, processes and favourable condition;
- value within a defined geographic frame of reference (e.g. national, regional or local);
- the biodiversity value of affected species, populations, communities, habitats and ecosystems, considering aspects such as rarity, habitat diversity and connectivity, species-rich assemblages, and species distribution and extent; and
- designated sites and protected species status.

Significance was determined by the interaction of these criteria with the biodiversity value of ecological receptors within different geographic frames of reference, including national, regional and local zones of influence. The value of the affected feature is used to determine the geographical scale at which the impact is significant. The determination of significance is based on whether the impact will affect the integrity or conservation status of the species, habitat, site or ecosystem within a given geographical frame of reference. Impacts are considered to be either significant or non-significant in their residual effect on each ecological receptor, after taking into account the significance of the impact, zone of influence, mitigation measures and the confidence in predictions associated with the EcIA.

10.4.2 *General Impacts*

General impacts associated with a proposed road development may include the following:

- Permanent or temporary loss of habitat or species due to permanent or temporary land take;
- disturbance to, or displacement/exclusion of a species from foraging habitat due to land take, construction activities, and operating and maintenance activities (eg movement of vehicles and personnel, artificial lighting, dust, spillage of fuels and chemicals, emissions and noise);
- impacts on habitats and species caused by alterations to drainage regimes;
- creation of barriers to the movements of animals, especially mammals, amphibians, invertebrates and plants with limited powers of dispersal, resulting in the potential isolation of populations; and
- fragmentation of habitat or severance of wildlife corridors, particularly hedgerows and treelines, between isolated habitats of ecological importance.
- introduction of alien species; and
- creation of new habitats and introduction of a new species as a result of habitat enhancement proposals and landscaping.

10.4.3 *Designated Conservation Areas*

10.4.3.1 *River Barrow cSAC*

The River Barrow cSAC is the only Natura 2000 site directly intersected by the proposed route alignment. This site is designated a cSAC of European nature conservation importance for the Annex I habitats which occur along and adjacent to the river and the Annex II species which are supported by the river and adjacent habitats. The site is affected by the proposals and an Appropriate Assessment is required. Information is provided in *Annex B* to allow the Competent Authority to undertake this assessment .The impacts to terrestrial habitats associated with the cSAC are outlined in the following *Section.* Information on the aquatic habitats associated with the site is outlined in *Chapter 11.*

The Bypass will bridge old oak woodland, a qualifying habitat of the cSAC, at N25 Ch. 1,350 (see *Figure 10.1*a). The quality of this habitat is higher to the north of the Barrow Crossing, as the woodland thins out at and to the south of the crossing point. Due to the steep terrain in this area, it is anticipated construction will only result in the loss of taller mature trees occurring under the bridge. However, the extent and distribution of this woodland habitat will be retained and hence impacts to the integrity of this qualifying habitat are not predicted. The detailed design will seek to minimise construction activity within this woodland, further reducing direct impacts to the habitat.

The L-4026-1 East Tie-in will be realigned adjacent to the site resulting in a loss of wet grassland habitat amounting to approximately 6,400m^2 (0.64 Ha). However terrestrial species of qualifying interest were not recorded at this section of the cSAC and hence it is predicted that there will be no adverse affect on the qualifying interest of the site. Also the loss of a small strip of habitat at the edge of the cSAC is unlikely to have an adverse effect on the habitats of qualifying interest.

Vehicle exhaust emissions during the operation phase of the bypass have the potential to impact upon cSAC. The key pollutant derived from vehicle emissions which can cause harm to sensitive vegetation are oxides of nitrogen (NO_x). The critical level for NO_x, above which harm is thought to occur, is 30 µg/m^3.

The bridge will be 25m wide and the maximum predicted NOx concentration 10m from the centre carriageway along the bridge is 31.4 µg m^{-3}, which is predicted to occur in 2013. At a distance of 20m the concentration is predicted to be below the threshold level at 26.2 µg m^{-3}. Whilst the level will be around 30 µg m^{-3} in the very immediate vicinity of the bridge, the majority of the habitat will experience levels much lower, below the threshold limit. Therefore it is predicted NOx emissions will not have a significant impact upon this qualifying habitat of the cSAC.

In the absence of mitigation, construction noise from the Bypass has the potential to negatively impact upon otters. As no holts were recorded in the vicinity of the Bypass, otters are only likely to be disturbed during foraging. Impacts to foraging otters may affect the conservation status of this species.

Results of noise assessments in the vicinity of the cSAC (see *Chapter 8*) have indicated the potential for substantial to severe changes in noise levels at particular receptor locations during the operation phase of the Bypass. The fauna likely to be affected by such changes include bats, badgers, and particularly birds [(1)] associated with the old oak woodland, none of which are qualifying species for the cSAC designation. With the exception of otters, the qualifying species associated with the Bypass are restricted to the aquatic environment. Therefore it is not anticipated that noise generated during the operation of the Bypass will significantly affect the site's ability to support

(1) Kaseloo, P.A. (2005) Synthesis of Noise Effects on Wildlife Populations. International Conference on Ecology & Transportation, August 29 - September 2, 2005.

qualifying species. (Impacts to none-qualifying fauna are assessed below *Chapter 10* of the EIS).

The main air quality issue during the construction phase is the deposition of dust. Dust deposition on vegetation can block the stomata of plant leaves which can prevent plant growth. The impact of dust on vegetation is restricted to a 100m area either side of the Bypass during construction. Areas on the proposed site likely to be sources of dust have been identified as follows:

- stockpiles of earth for landscaping and building;
- stripping;
- demolition of any existing structures;
- traffic on haul roads; and
- soiling of main roads.

With the exception of traffic along haul routes, none of the above sources will be located within or adjacent to the cSAC. Also any dust generating activities associated with the construction of the bridge are likely to be of a temporary (shorter than the construction phase) and of a localised nature. Nevertheless, without mitigation measures these impacts have the potential to temporarily impact upon the integrity of the old oak woodland qualifying habitat.

10.4.3.2 River Barrow Estuary pNHA

The eastern half of Ecological Site 3 is located within the River Barrow pNHA. The proposed bridge crossing will span this site and therefore will not have a permanent physical impact upon the site's ecological resource. Construction activity at this site has the potential to degrade the habitats through the operation of plant and machinery. Construction activity will have a short-term major, negative impact upon this site.

The bridge design will be such that the hydrological conditions supporting the wetland floral community associated with this site will be maintained. Therefore no impacts are predicted. While the bridge will alter the light regime at this site, it is considered that this will have an insignificant impact on the flora community present. No negative impacts are predicted for fauna identified at this site.

The terrestrial habitats associated with the pNHA to the east of Ecological Site 3 consist of improved agricultural grassland and arable fields. A further three bridge piers will be installed in this area. Due to the low ecological value of the habitats associated with this area the installation of the bridge piers will not have a significant impact in this area.

The pNHA is located immediately to the north of the L-4026-1 tertiary road and approximately 50m to the north of the main alignment. Improvement works will be carried out to this tertiary road at two locations, adjacent to N25 Ch. 2,900 - 3,300 and adjacent to N25 Ch. 3,600 – 4,000.

The former section of this tertiary road is not directly connected to the southern boundary of the site and the realignment will not result in any direct loss of habitat within the pNHA.

The latter section forms the boundary of the pNHA. The improvement works along this L-4026-1 is divided into three sections, L-4026-1 West Tie-in, Stokestown Port Access Road and the L-4026-1 East Tie-in. A round-about will be installed at the junction of these three roads. The installation of the round-about and the Stokestown Port Access Road realignment will involve a small area of landtake [approximately 3,500m^2 (0.35Ha)] within the pNHA. The habitats lost will consist of an area of improved grassland and woodland dominated by ash and hawthorn tree species. The potential impacts associated with the L-4026-1 East Tie-in realignment is assessed as part of the cSAC (see *Section 10.4.3.1*). The loss of improved grassland habitat will not represent a significant impact to the pNHA, however the loss of a small area of woodland without mitigation will result in a permanent, major negative impact. As the area of woodland is located at the edge of the pNHA there will be no fragmentary or severance impacts associated with the landtake.

Without mitigation measures, general construction activities associated with the road realignments have the potential to have a temporary negative impact upon this site. These impacts include noise disturbance and reduction in air quality resulting from increases in dust during the realignment.

The loss of habitats at this site will also affect fauna species which it supports. There will be a loss of nesting and foraging habitat for a range of common birds. While no bat roosts were recorded within the pNHA the loss of habitat will result in a reduction of foraging habitat. However this is not likely to result in a significant impact as considerable foraging resources for bats will be retained within the pNHA and in the other habitats such as hedgerows and treelines associated with the surrounding area.

10.4.3.3 Oaklands Wood pNHA

As Oaklands Woods pNHA are located over 500m to the north of the proposed scheme (at its nearest point) no significant adverse affects are expected to impact upon this site.

10.4.4 Impacts to Other Ecological Sites

As outlined above a number of the Ecological Sites occurring within the route corridor are located within the cSAC or pNHAs, and impacts to them have been considered as part of the assessment on the cSACs / pNHAs. The impacts to other Ecological Sites, not located within these designated conservation areas are assessed in the following sections.

10.4.4.1 Ecological Site 1 – High Local Importance

The Bypass, the LS-7513 realignment and the installation of a storm control area will result in the permanent loss of approximately 13,000m^2 (1.3 ha) of swamp, scrub and woodland habitats associated within this site. The Bypass will also sever the woodland with the loss of predominantly native tree species, such as oak spp, ash and willow spp. This site contains a range of semi-natural habitats and is considered to be of high ecological value and locally important for nature conservation (see *Table 10.3*). The loss of habitat to landtake and the severance of the woodland habitat will result in a major negative impact on this site.

The loss and severance of habitats at this site will also affect fauna species which it supports. The loss of breeding and foraging habitat for a range of common birds will constitute a minor negative impact.

Leisler's and Common Pipistrelle bats were recorded commuting and foraging within and adjacent to the woodland associated with this site. The reduction and severance of the woodland habitat in this site will result in a loss of foraging area and commuting routes for bats. No bat roosts were recorded in this area and the existing N25 acts as a barrier to this habitat for bats roosting to the west of this road. While a number of roads will be associated with this site once the Bypass is constructed the LS-7513 Tie-in will be a single carriageway tertiary road and is unlikely to represent a barrier to bat movements from the east. Also large areas of the woodland and other surrounding habitats such as hedgerows and treelines will remain in place. Finally due to the low number of bats recorded in this area it is considered that, in the absence of mitigation, the loss of habitats associated with this site will represent a minor negative impact to bats.

The loss of wet grassland and marsh habitat as a result of the installation of the storm control area will, in the absence of mitigation, result in a loss of foraging habitat for a range of common butterfly species.

10.4.4.2 Ecological Site 4 – Moderate Ecological Importance

The Bypass will result in a permanent loss of approximately 6,000m^2 (0.6 Ha) mixed broadleaved coniferous woodland. The tree species lost within this woodland will be predominantly non-native tree species of low conservation value i.e. sitka spruce and sycamore. The Bypass will also sever this woodland.

The loss and severance of woodland habitat at this site will also have an impact upon the fauna species which it supports. The loss of breeding and foraging habitat for a range of common birds will constitute a minor negative impact.

Common pipistrelle bat foraging routes will be severed by the bypass at this location. This species of bat was recorded foraging along the northern and southern boundaries of this woodland. No roosts were recorded in this area and whilst the Bypass will impede the movement of bat species the surrounding area will retain considerable areas of woodland and good networks of hedgerows and other foraging resources. Without mitigation, the loss of woodland habitat at this site will result in minor negative impacts to bats.

10.4.4.3 *Ecological Site 5 – Moderate Ecological Importance*

The installation of a storm control area at this location will result in the loss of a discrete area (approximately 450m^2) of woodland habitat at the western margins of this site. A drainage channel, associated with the storm control area, will be installed within this site creating additional disturbance of the site during construction. Without mitigation the drainage channel will have the potential to alter the current hydrological regime of the site, leading to improved drainage and a reduction in the wet woodland understory associated with this site.

Faunal species associated with this site include a range of common bird species birds and populations of the large red damselflies. The loss of nesting and foraging areas for a range of common birds will represent a minor negative impact at this site. The retention of aquatic habitats in this site will ensure that any impacts to damselflies are minor negative.

10.4.4.4 *Ecological Site 6 – Moderate Ecological Importance*

The Bypass will result in a loss of the majority [approximately 2,500m^2 (0.25Ha.)] of this wet grassland habitat at this site. This site is dominated by rushes and wet grasses such as creeping bent, with a number of other herbaceous species occurring. The loss of this habitat will constitute a moderate negative impact. No specific fauna interest for this site.

10.4.4.5 *Ecological Site 7 – High Ecological Importance*

The proposed alignment intersects the western side of this site, which is dominated by soft rush with abundant clumps of bramble, elder and nettle. The approximate landtake as a result of the Bypass amounts to 3,700m^2 (0.37 Ha) of this Ecological Site. This portion of the site is drier and less species rich than the wetland habitats (i.e. wet grassland, willow scrub, marsh and spring) located to the east of the proposed alignment. The loss of this section of the site will constitute a moderate, permanent negative impact.

The loss of the vegetation associated with this area of the site will not significantly impact upon nesting and foraging habitats for a range of common birds. No other protected fauna were identified at this site.

As the main area of water recharge is located to the north of the spring and the nearest area of cutting for the bypass is located over 250m to the southwest it is anticipate that any impacts to the spring and wetland habitats fed by it in this area will be imperceptible (see *Chapter 12, Section 12.5.5*).

10.4.4.6 *Ecological Site 8 – Moderate Ecological Importance*

The proposed alignment intersects this immature woodland site of moderate ecological importance and will result in the loss of a significant proportion of this site (approximately 5,000m^2 or 0.5 Ha). The vegetation to be lost will consist of an immature oak plantation. Due to the planted and immature nature of the woodland, the loss of habitat will constitute a minor permanent negative impact.

The loss of breeding and foraging habitat for a range of common birds will constitute a minor negative impact.

10.4.5 *Impacts to Terrestrial Fauna*

The impacts to fauna outlined in this Section includes impacts to fauna occurring within the Ecological Sites identified along the route corridor.

10.4.5.1 *Badgers*

Badgers are habitual mammals and occupy the same setts and territories for many generations [(1)]. Badgers follow established pathways throughout their territory and in the absence of mitigation any intersection of these territories and pathways by roads may result in badger fatalities.

Five active, one intermittently active and two inactive badger setts will be directly impacted by the proposed alignment (this information has not been included in the EIS due to confidentially reasons and will be presented to an Bord Pleanala in a separate and confidential report). In the absence of mitigation the active setts consist of two main setts, one annexe sett and two outlier setts. The destruction of any active main or annexe badger setts will constitute a significant impact to the social group of badgers which are reliant on the setts. The destruction of active outlier setts will not constitute a significant impact to the badger population reliant on these setts, as a number of other outlier and annexe setts were recorded in the area.

One of the inactive setts to be lost is located in an area where a number of other setts were located. Therefore the loss of this sett will not be significant. With regard to the remaining inactive sett, no other setts were located within the area surrounding this sett. Therefore this sett may still be important to the social group and hence its loss will be significant. Similarly the alignment will fragment badger territories, isolating resources and/or annexe setts from main setts. In the absence of mitigation severance and fragmentation of badger territories will have a significant effect on the social groups affected.

10.4.5.2 *Otters*

Little evidence of otter activity (two prints and a spraint in total) was recorded throughout the route corridor and no holts were recorded, ensuring that otter

(1) Hayden & Harrington (2000). Exploring Irish Mammals. Town House.

breeding sites will not be impacted by the proposed scheme. However, otters are very sensitive to disturbances and deterioration of water quality. Howeve, with the implementation of mitigation measures there will not be negative impacts to water quality and fisheries (see *Section 11.4.*). Also to ensure no barriers to otter movements, all watercourse crossings will be constructed to accommodate the moments of otters.

Some disturbance to the movement of otters during the construction period have the potential to occur. Without mitigation, this will constitute a moderate negative impact to otters.

10.4.5.3 Bats

No bats were recorded roosting in structures which will be lost along the proposed road alignment. Only one confirmed bat tree roost was recorded within the alignment. The loss of this tree will result in a significant impacts on bats using this roost site. If appropriate measures are not adopted may result.

Bats will also be directly impacted by the proposed alignment, during construction and operation, due to adverse impacts to bat commuting routes and foraging areas. As outlined above, bats were recorded foraging within, and commuting through, the road alignment at a number of locations (see *Figure 10.2 in Vol. 2*). The Bypass will also result in the loss of foraging habitat for bats and severance to their commuting routes in a number of locations along the route. However other habitats favoured by bats such as woodlands and networks of hedgerows will be retained in the land surrounding the Bypass. Therefore, it is considered that, in the absence of mitigation, the loss of foraging habitats and the severance of commuting routes will represent a moderate negative impact to bats.

Lighting associated with road schemes may alter the foraging resource adjacent to the alignment by attracting prey insect species. This may result in a negative impact for some bat species.

10.4.5.4 Birds

Breeding birds were recorded in a range of habitats occurring within and adjacent to the proposed alignment. Bird species recorded within each ecological site are listed in *Table 10.3* above, while species associated with hedgerows, treelines and grassland habitats are outlined in *Section 10.3.* The majority of the land adjacent to the bypass is improved grassland and arable farmland which does not support a diverse range of bird species. However the loss of habitats associated with each ecological site, along with hedgerows and treelines, will result in a loss of feeding and nesting sites for a range of common birds.

No mute swans or other such species with low take-off trajectories were recorded intersecting the bridge crossing during targeted surveys of this area.

Therefore it is not expected that the cable stays associated with the bridge will have a negative impact to bird species.

Noise disturbance, particularly during the construction period, will have temporary negative impact on birds. Similarly a reduction in bird species and bird numbers has been shown to occur in areas adjacent to roadways [(1)]. Such a reduction will only be experienced adjacent to habitats of ecological value. However, only common species were recorded in these areas (*see Table 10.3*).

No historical records of migrant bird populations occurring within the proposed alignment were identified. Therefore, it is not anticipated that there will be negative impacts to migrant birds during the construction and operation of the proposed development.

10.4.5.5 Invertebrates

The loss of habitats and the creation of artificial surfaces will have a minor, permanent negative impact upon invertebrate populations. The retention of habitats adjacent to the proposed alignment and the creation of artificial wetland habitats using SuDS techniques at storm control areas will ensure that invertebrate populations are sustained.

10.4.5.6 Herpetofauna

Common frogs were recorded in only one location (Ecological Site 3) alone the route corridor. This species is considered to be widespread and common in Ireland [(2)] and no significant impacts are predicted to affect this species.

10.5 *MITIGATION MEASURES*

Outlined below are the recommended mitigation measures, which aim to avoid or reduce the predicted impacts to the flora and fauna associated with the proposed development. General construction and operation mitigation measures associated with a proposed road development include the following:

10.5.1 *General construction mitigation measures*

- Clearance of vegetation such as hedgerows, treelines and woodland will be avoided, where practical, between the 1st March and the 31st August inclusive to avoid impacts to nesting birds;
- Prior to the commencement of construction protected species survey will be undertaken to ensure no changes to those recorded have taken place;
- The working area within, and adjacent to, Ecological Sites, and at the crossing point of hedgerows and treelines, will be fenced and kept to

(1) Reijnen, R., Foppen, R. & Veenbaas, G. (1997) .Disturbance by traffic of breeding birds: evaluation of the effect and considerations in planning and managing road corridors. Biodiversity and Conservation, 6, 567–581.
(2) Whilde, A. 1993. threaten Mammals, Birds, Amphibians and Fish in Ireland. Irish Red Data Book 2: Vertebrates. Belfast

minimum to reduce as much as possible the extent to which these habitats are lost;

- Any hedgerows, treelines and trees within the proposed alignment, that are to be retained, will be fenced off outside the crown spread at the outset of construction activity;
- Where habitats are directly lost as a result of the Bypass construction, new alternative habitats will be created within the lands made available for the Bypass, where feasible. New habitats will resemble, as much as possible, the habitats lost to the Bypass. The preliminary landscape design (*Figure 9.6* in *Vol. 2*) outlines areas where habitats will be recreated within the lands made available for the Bypass;
- Habitats disturbed temporarily during construction activity should be allowed to regenerate naturally, or will be recreated, once construction is complete;
- Keep topsoil and subsoil separate and replace accordingly on restoration and completion of the Bypass;
- All remedial planting associated with the proposed development will be of native seed stock;
- New hedgerows and treelines will be planted along the new road margin such that they will connect to existing linear habitats, where possible, on either side of the Bypass;
- The details of tree planting, species mixes, and habitat creation will be established at the detailed design stage in conjunction with an experienced professional and in consultation with NPWS; and
- Where possible, during the detailed design stage, an experienced professional should input into the design of storm control areas. The installation and design of storm control areas will consider the need to maintain good drainage and natural water flows within the areas in which they are proposed to be installed. The installation of these control areas in, or adjacent, to wetland habitats should be undertaken so that the impact to the existing hydrological regime is minimised as much as possible. Sustainable Drainage solutions (SuDS) should be incorporated into the design of all storm control areas. A SuDs approach would meet good practise and would offer significant habitat recreation and enhancement possibilities.

10.5.2 *General Operation Mitigation Measures*

General operational mitigation measures are described below with respect to:

- Designated Conservation Sites:
- Ecological Sites: and
- habitats and fauna identified along the route alignment.

10.5.3 *Designated Conservation Areas*

10.5.3.1 *River Barrow cSAC*

Where possible, tall trees of the old oak woodland occurring under the bridge will be retained using arboricultural techniques. Where the felling of mature tree species is necessitated compensatory planting will be required. While the Barrow Bridge will prevent the replanting of high-growing oak tree species, shrub and herbaceous species representative of the woodland habitat will be planted so that any vegetation to be removed is replaced. Further mitigation measures outlined to reduce potential impacts to this habitat include:

- Construction activity will be minimised from this woodland, further reducing direct impacts to the woodland;
- Sensitive lighting regime will be used to avoid impacts to fauna species; and
- With the exception of traffic along haul routes, none of the other likely sources of dust will be located within or adjacent to the old oak woodland.

To further avoid the possibility of dust deposition having a localised impact upon vegetation within this habitat, the following mitigation measures should be adopted during construction:

- Management plans are to take into consideration best practice and the NRA *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*;
- The use of wind breaks and barriers is to be assessed;
- Operation and management of a wheel wash and concrete wash out areas;
- Use of a road sweeper(s) to clean the construction site and access roads;
- Trucks hauling spoil or materials are to be covered; and
- Trucks arriving on site to haul material are to be clean, to prevent dirt/ mud (leading to potential sources of dust) being brought into the area – contractual condition with haulage company;
- Speed limits for construction vehicles;
- All plant to be used on site is to be in good working order, will be required to run on low sulphur diesel where possible and is to be of modern design incorporating abatement devices where available. These requirements are to be stipulated in contracts;
- Plant is not to be left running when not in use;
- The lay-down area and contractor's yard(s) are to be sealed as soon as practicable; and
- No on-site burning will be allowed.

The source of dust emissions during construction, as outlined in *Section 10.4.3.1* will be minimised, with the following sources excluded from land within or adjacent to the site:

- stockpiles of earth for landscaping and building;
- stripping;
- demolition of any existing structures; and
- soiling of main roads.

The realignment of the L-4026-1 East Tie-in will involve a small area of fill immediately inside the cSAC boundary. Landscaping of this area with native tree species sourced locally will be undertaken. The appropriate landscaping of this area will ensure that a buffer area is reinstated between this road and the cSAC.

A construction method statement will be developed in consultation with the NPWS prior to the commencement of construction activity within the cSAC.

To avoid any impacts to otters construction activities will avoid, where possible, the main periods of otter foraging activity. Otter passage will be maintained along all watercourses of fisheries value. Passage will be maintained by ensuring that at least one bankside is retained or a mammal underpasses or mammal ledge, where appropriate, is installed at stream and river crossings. Where mammal crossings are installed for otters, mammal-resistant fencing will be placed along both sides of the alignment for a minimum of 50 metres in either direction. Mammal proof fencing should also be installed at both sides of the alignment, adjacent to stretches of the road where a median barrier is to be located.

All measures to mitigate/reduce the impact to badgers outlined in the NRA's *Guidelines for the Treatment of Otters prior to the Construction of a National Road Scheme* will be adopted.

10.5.3.2 River Barrow pNHA

Construction activity will be minimised at this site. Dust mitigation measures outlined in *Section 10.5.3.1* for reducing the impact of dust will also apply to construction activities associated with the pNHA. This will ensure that any potential significant, short-term negative impacts are minimised.

The bridging of Ecological Site 3, associated with this designated site, will ensure that no permanent habitat fragmentation will occur at within the Ecological Site. It is predicted that the change in light regime, due to the overshadowing of the habitat by the new bridge will constitute a permanent minor negative impact.

Areas associated with the realignment of the L-4026-1 West and East Tie-in and the Stokestown Port Road will be landscaped using native species, sourced locally. Where possible, the detailed landscape design for the junction layouts between N25 Ch. 3,550 – 3,850 will incorporate woodland species to recreate habitats lost to the landtake.

10.5.4 Ecological Sites

10.5.4.1 Ecological Site 4

This woodland habitat will be severed by the proposed alignment resulting in permanent, minor, negative impact upon the surrounding ecological resource. Construction activity should be restricted to the minimum area necessary and replacement planting with native woodland species will be undertaken along the embankments in cut between N25 Ch. 2,700 to 3,150 and along the fill embankments between N25 Ch. 3,150 and 3,350. Topsoil removed from the woodland associated with this site should be stored and reused during replacement planting.

10.5.4.2 Ecological Site 5

A SuDS approach will be adopted to the design of the storm control areas associated with this site. The design of the storm control area will be such that it increases the long-term ecological value of the site after construction is completed. The installation of a SuDS drainage system, along with the planting of appropriate wetland tree species such as alder, willow species and ash will recreate and provide an opportunity to enhance the wetland biodiversity of this site, which is currently degraded due to disturbance and nutrient enrichment.

The drainage ditch to be installed in this Ecological Site will be bunded to avoid any alterations to the surrounding wetland habitats. The bunded drainage ditch will also complement the SuDS approach to the storm control area in this site.

10.5.4.3 Ecological Site 6

During the construction phase, activities will be restricted to the minimum area necessary to complete construction. Alternative wetland habitats will be constructed at the storm control area to replace the wet grassland habitat lost at this site.

10.5.4.4 Ecological Site 7

During the construction phase, activities will be restricted to the minimum area necessary to complete construction. The road alignment has been designed so that this area is in fill, thus avoiding potential hydro-geological impacts if the road was at grade or in cut. The run-off from the road at this point will be redirected away from this site so that the surface hydrology of the wetland habitats is not altered by the proposed development. Similarly, the natural drainage of this site will be maintained with the installation of a culvert under the proposed alignment to the west of the wetland habitats. This will ensure that the area of fill does not create a barrier to the dispersion of water from the wetland sites. The installation of a storm control area, following a SuDS approach with appropriate wetland planting, to the south of this site will increase and enhance the wetland habitats in this area.

10.5.4.5 *Ecological Site 8*

The loss of immature woodland at this site constitutes a permanent, minor, negative impact. During the construction phase activities will be restricted to the minimum area necessary to complete construction.

10.5.5 *Terrestrial Fauna*

10.5.5.1 *Badgers*

Badger underpasses will be provided in areas where badger territories will be severed by the new road. The location of badger underpasses are illustrated on the Mammal Activity Maps *Figure 10.2 (Vol. 2).* The selection of underpass locations is determined by the presence of main setts within the alignment; the presence of badger setts, paths or other field signs on both sides of the alignment; and in areas where the badger signs were recorded and the alignment is in cut, the underpasses were moved to the nearest areas where the alignment is in fill.

Where badger underpasses are installed, mammal-resistant fencing will be erected on both sides of the alignment, in accordance with NRA Guidelines. Mammal proof fencing should also be installed at both sides of the alignment, adjacent to stretches of the road where a median barrier is to be located.

Further field surveys will be carried out at the detailed design stage to ensure that no new badger setts are established within or adjacent to the alignment. If new setts or territories are identified during the detailed design stage, new underpasses will be located at appropriate sites.

Active badger setts located within the alignment will be destroyed to facilitate the construction of the new road. Badgers will be excluded from these setts prior to their destruction. The exclusion of badgers will follow the NRA guidelines for the removal of badger setts. Prior to the exclusion of badgers, alternative setts will be identified within the displaced population's territory. If alternative setts are not identified within the badger territory, artificial setts will be created to accommodate displaced badgers.

An experienced professional will supervise the exclusion and destruction of badger setts under licence from the NPWS.

The NRA's *Guidelines for the Treatment of Badgers peior to the Construction of National Road Schemes* should be implemented during the construction phase of the proposed development.

All measures to mitigate/reduce the impact to badgers outlined in the NRA's *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Scheme* will be adopted.

10.5.5.2 Bats

One bat tree roost was recorded within the alignment. The removal of this tree roost should be undertaken in line with the NRA's *Guidelines for the Treatment of Bats during the Construction of National Road Schemes.* Bat boxes will be erected in appropriate locations adjacent to the original tree roost before the felling of the tree. An experienced professional will supervise the demolition of any known roosting sites, under licence from the NPWS. The demolition of roost sites should be carried out in accordance with the conditions of the licence.

Where commuting routes are severed by the alignment, consideration will be given to the installation of planting on either side of the alignment, where feasible, to create a "hop-over" for commuting bats (*Figure 9.6* in *Vol. 2*). This hop-over will consist of gradually increasing vegetation height along the commuting route so that bats fly up and over the new road, avoiding associated traffic.

New lighting associated with the new road should be restricted to major junctions. The lighting at these junctions should be kept to minimum by reducing light spill to areas not targeted by the lights. All lighting should be directed downwards and the height of the light columns should be as low as possible, notwithstanding safety and visibility requirements.

Low pressure sodium lighting should be used, where possible, as these lights have been shown to attract the lowest level of prey insects to lighting. Reducing the amount of prey species attracted to road lighting will in turn reduce the number of bats attracted to the roadside, thus reducing potential fatalities to bat species.

Once established, landscaped areas will provide potential foraging habitat for bats.

All measures to mitigate/reduce the impact to bats outlined in the NRA's *Guidelines for the Treatment of Bats prior to the Construction of a National Road Scheme* will be adopted.

10.5.5.3 Birds

To reduce the impacts to nesting birds, where ever possible, vegetation will not be removed during the nesting season between March and August inclusive.

Prior to the removal of vegetation, a survey for nest sites within the alignment should be undertaken. Where ever possible, unoccupied nests should be removed from the alignment prior to vegetation clearance. The removal and destruction of nest sites should be carried out by an experienced professional qualified ecologist, under licence from the NPWS. Where nests are destroyed artificial bird boxes should be erected in appropriate vegetation adjacent to the original location of the destroyed nest.

10.5.5.4 *Other Fauna*

For other faunal species protected in Ireland i.e. pine martens, Irish hare, no specific mitigation measures are proposed, other than to protect as much semi-natural and natural habitat as possible.

10.6 *RESIDUAL IMPACTS*

The felling of oak trees associated with the old oak woodland will result in a minor negative impact to the cSAC. As the landscaping of the boundary of the cSAC adjacent to the L-4026-1 East-Tie-in will take a number of years to establish, there will be short to medium-term minor negative impacts associated with the loss of habitat at this area of the cSAC. However, once established the landscaping will offset any long-term residual impacts to this part of the cSAC.

The implementation of mitigation measures will avoid any residual impacts to otters.

The implementation of dust mitigation measures will ensure that the impacts to the vegetation associated with the old oak woodland will constitute a temporary, minor negative impact upon the cSAC.

As replacement woodland planting will take a number of years to establish, there will be short to medium-term minor negative impacts associated with the loss of woodland habitat within the pNHA. The establishment of woodland habitats in this area will offset any long-term impacts.

Following the implementation of mitigation measures, only one of the Ecological Sites identified along the alignment will experience major negative impacts as a result of the proposed development. Five of the Sites (Ecological Sites 2,3,4,6 and 8) will undergo minor negative impacts. In the long-term, the implementation of a SuDs approach to the storm water control areas at Ecological Site 5 and 7 will result in neutral/positive impacts.

Residual impacts to Ecological Site 1 will result from a loss of habitat area as a result of the proposed land take and the creation of a barrier to movements for fauna species. The loss of habitat in Ecological Sites 2,3,4,6 and 8 will constitute a short-term minor negative impact. The establishment of alternative habitats within the alignment will replace habitats lost by the proposed development at these sites.

The destruction of main active setts along the alignment will constitute a major negative impact to the local badger populations.

The provision of mammal passages will avoid severance of badger and otter territories along the alignment, while mammal-resistant fencing will reduce the likelihood of otter fatalities on the new road and will guide otters to mammal passes.

The residual impacts to fauna movement will constitute a minor, permanent, negative impact. Once faunal species become habituated to mammal underpasses these residual impacts will be further reduced over time. Similarly, residual impacts arising from disturbance to fauna will also reduce over time, following habitualisation to the new road.

10.7 *ASSESSMENT LIMITATION*

No limitations were encountered during the assessment of the proposed development.

11 *AQUATIC ECOLOGY*

11.1 *INTRODUCTION*

The purpose of this assessment is to identify the likely significant effects on aquatic ecological resources arising from the development of the New Ross Bypass. To assess potential impacts upon the ecological resources, the assessment has focused upon an assessment of the fish populations, invertebrate fauna, water quality, habitat and general overview of ecological status of streams and rivers in the vicinity of the proposed route.

The Southern Regional Fisheries Board (SRFB) was consulted throughout the assessment process and their staff were directly involved in a number of the electro-fishing surveys carried out during the study period.

The alignment crosses the lower River Barrow, as well as other minor rivers and streams that form part of the lower River Barrow catchment area. The River Barrow catchment is defined as hydrometric region 14 and represents the surface catchment drained by the River Barrow upstream of the River Nore confluence and all streams entering tidal water between the Barrow railway bridge at Great Island and Ringwood, Co. Kilkenny. This hydrometric region has a catchment area of 3,068km^2. All watercourses that will be potentially impacted by the proposed development were identified on the 1:50,000 *Discovery Series* Ordnance Survey Map 76. Six watercourses were identified within the study area. The location of each watercourse is outlined in *Figure 12.1 (Volume* 2).

11.2 *METHODOLOGY*

11.2.1 *Overview*

The scope and methodology used for this assessment are based upon the National Roads Authority's *Guidelines for Assessment of Ecological Impacts of National Road Schemes*, with additional guidance taken from the UK Highways Authority's *Design Manual for Roads and Bridges*; the Institute of Ecology and Environmental Management's (IEEM) *Guidelines for Ecological Impact Assessment* and satisfies the requirements of the Environmental Protection Agency's (EPA) *Guidelines on the Information to be Contained in Environmental Impact Statements*.

The assessment comprised a combination of:

- desktop review of existing information on the aquatic ecology of the lower River Barrow and catchment area; and

- field surveys of rivers and streams intersected by the proposed alignment.

11.2.2 *Desktop Review & Consultations*

ERM undertook an extensive desktop review in order to establish an approximate baseline aquatic conditions along the proposed route corridor. The principal sources of information that were referred to included:

- a review of existing published ecological information; it was also possible to consult a number of unpublished data sources as part of this review;
- a review of the National Parks and Wildlife Service (NPWS) database;
- a review of Southern Regional Fisheries Boards and Central Regional Fisheries Boards databases;
- a review of the Environmental Protection Agency's (EPA) database on river water quality;
- identification of any protected species; and
- consultations with appropriate representatives of the SRFB, the EPA and other relevant conservation groups and agencies.

ERM consulted the SRFB on the need to address potential impacts to fisheries. The Fisheries Board advised the study team on drawing up mitigation measures for the construction and operation of the proposed development.

11.2.3 *Field Surveys*

Field surveys were carried out on the 27th and 28th of July, 2005. Dry weather conditions prevailed during the field survey. Conditions were relatively dry in the day before the survey, ensure that all streams displayed lower flow rates indicative of the survey period. All watercourses identified along the route alignment were assessed in terms of:

- stream width and depth;
- substrate type;
- flow;
- dominant riparian vegetation;
- degree of shading;
- general rating of habitat (fisheries perspective);
- fish populations; and
- in-stream faunal assemblages.

Reference to EPA water quality assessment results provided baseline conditions on water quality for each watercourse. A qualitative kick sample was taken at each watercourse in order to provide an overview of the dominant invertebrates present. This also provided an indication of water quality at each site and reinforced water quality information gathered from the EPA river water quality monitoring results.

Fish were captured using the standard Fishery Board electro-fishing equipment and fish captured were held on site in suitable conditions within a bin. Fish were then identified and fork length of salmonids was measured to the nearest millimetre (mm). Trout and salmon age was determined by length frequency distribution. Salmonids were classified according to age as: less than one year old (0+); one year old (1+); two year old (2+); and three year old (3+).

11.2.4 Ecological Evaluation

The evaluation of the aquatic ecological resource was assessed according to the NRA's *Site Evaluation Scheme* outlined in *Chapter 10, Table 10.2*. These criteria evaluate the significance of an aquatic ecological resource within a defined geographical context. The IEEM's *Guidelines for Ecological Impact Assessment*, which also evaluate ecological resources according to a defined geographical context provided guidance for the baseline ecological evaluation.

11.3 EXISTING ENVIRONMENT

11.3.1 Overview

The watercourses crossed by the proposed development all lie within the River Barrow catchment area. The proposed alignment crosses the following watercourses:

- Graiguenakill Stream at N25 Ch 50;
- River Barrow between N25 Ch 1,400 and 1,500;
- Camlin Stream at N25 Ch 4,000 and at the L-4026-1 realignment; and
- Aughnacrew River at N25 Ch 1,150 of the N30 East Tie-in.

Stokestown Stream, while not intersected by the proposed alignment is located within the route corridor, approximately 100m to the south of the proposed alignment and was therefore included in the assessment of the aquatic ecological resources. The River Barrow is the principal watercourse crossed by the Bypass.

11.3.2 Designated Sites

11.3.2.1 River Barrow cSAC

This site qualifies as a cSAC because of its alluvial wet woodlands and petrifying springs, which are priority habitats on Annex I of the EU Habitats Directive. Old oak woodlands, floating river vegetation, estuarine habitats including tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, as well as dry heath and eutrophic tall herbs, all habitats listed on Annex I of the EU Habitats Directive, also occur within the site. The site supports the following species, all listed on Annex II of the Directive:

- Sea lamprey (*Petromyzon marinus*), river lamprey (*Lamptera fluviatilis*) and brook lamprey (*Lamptera planeri*): the River Barrow supports all three species of lamprey. Sea lamprey is widely distributed around the Irish coast. Important populations of river lamprey are associated with the River Barrow. Brook lamprey are the most widespread of the three lamprey species and it is likely that they occur in most catchments throughout Ireland. The principal threat to these species is impediments to upstream migration created by artificial barriers such as weirs, locks and dams (1).

- Atlantic Salmon (*Salmo salar*): Important populations are supported by the River Barrow, and while the Barrow itself is not designated a Salmonid Water, the River Nore, whose confluence with the River Barrow is located upstream of the proposed bypass, is designated a salmonid water. Salmon fry and or parr were also recorded in four of the five watercourses surveyed during the summer of 2005, further indicating the importance of the River Barrow estuary catchment area for supporting populations of Atlantic salmon. Atlantic Salmon (*Salmo salar*): Important populations are supported by the River Barrow, and while the Barrow itself is not designated a Salmonid Water, the River Nore, whose confluence with the River Barrow is located upstream of the proposed bypass, is designated a salmonid water. Salmon fry and or parr were also recorded in four of the five watercourses surveyed during the summer of 2005, further indicating the importance of the River Barrow estuary catchment area for supporting populations of Atlantic salmon.

- Twaite shad (*Alosa fallax lacepede*): The River Barrow is the principle watercourse in Ireland supporting anadromous twaite shad. This species is declining throughout Europe and is also listed as vulnerable in the Irish Red Data Book. The only known spawning population of twaite shad in Ireland occurs in the upper tidal limit of the River Barrow. The spawning ground is located approximately 20km upstream from the proposed bridge crossing near St. Mullins. Mature twaite shad migrate upstream to the spawning site between April and June, with peak spawning activity occurring in late May. The reach of the River Barrow associated with the proposed bypass supports migrating shad. It has been noted that the twaite shad population of the River Barrow are especially threatened by deteriorating water quality and habitat degradation (2).

(1) Igoe, F. et al., (2004). The Sea Lamprey (Petromyzon marinus L.), River Lamprey (Lampetra fluviatilis L.) and Brook Lamprey (Lampetra planeri (Bloch)) in Ireland: General biology, Ecology, Distribution and Status with recommendations for Conservation. Biology and Environment: Proceedings of the Royal Irish Academy, Vol 104B, No. 3, pp. 43 – 56.
(2) Doherty et al., 2004. the Biology, Ecology and Future Conservation of Twaite Shad (*Alosa fallax lace*), Aliis Shad (*Alosa alosa l.*) and Killarney Shad (*Alosa fallax killarnensis tate regan*) in Ireland. Biology and Environment: Proceedings of the royal Irish Academy, Vol 104B, No. 3, pp. 93 – 102.

- Otter (*Lutra lutra*): Otters are known to occupy the main channel of the River Barrow and otter field signs were recorded adjacent to the Graiguenakill River and along the eastern shore of the River Barrow. It is likely that otters are supported by watercourses that support fish species.

- Freshwater pearl mussel (*Margaritifera margaritifera*): This species is found in clean, well-oxygenated rivers which flow over non-calcareous rocks. A river's substrate is of particular importance for freshwater pearl mussels, with clean gravel and sand essential. While this species is generally restricted to soft water, species of *Margaritifera durrovensis* have been recorded from the hard water associated with the River Nore. The distribution of *Margaritifera margaritifera* is widespread, with remnant populations dispersed throughout the country away from the central limestone plain (1). This species is highly endangered. The reasons for the decline of this species are various, with alterations to river beds, increases in turbidity and water pollution providing an example of some of the threats identified. Moorkens (1999) also states that the development of roads close to rivers can result in silt run-off, altering the habitat requirements of this species.

- White-clawed crayfish (*Austropotamobius pallipes*): This species requires relatively hard water with a pH of 7 or above and calcium concentrations of at least 5 mg/l (2). It is widespread in the midlands of Ireland in rivers and lakes underlain by Carboniferous limestone. While this species is associated with the River Barrow cSAC, there are no historical records of this species occurring within or adjacent to the route corridor. Historical records for this species, collected between 1975 and 1985 recorded this species in the Polomounty River. More recent records collected between 1990 and 2003 recorded this species along the River Nore. While this species is associated with the River Barrow, there are no recent records of it occurring within the wider catchment area associated with the Bypass.

- Desmoulin's whorl snail (*Vertigo Moulinsiana*): This species is restricted to old calcareous wetlands. It occurs in Ireland throughout the central limestone region and is associated with the upper reaches of the River Barrow and the River Nore.

- Killarney Fern (*Trichomanes speciosum*): The two-stage life cycle of this fern species requires specific habitat conditions. The sporophyte stage occurs in dripping caves, cliff faces, crevices by waterfalls and cascades, rock crevices in woodlands and very occasionally on the floor of damp woodlands. The gametophyte grows in similar habitats, albeit drier and darker, as it does not appear to require direct contact with water. Stretches of the River Barrow flowing through Co. Carlow support this species. This species is considered to be rare in Ireland and factors causing

(1) Moorkens, E. A. (1999). Conservation Management of the freshwater Pearl Mussel (*Margaritifera margaritifera*). Part 1: Biology of the species and its present situation in Ireland. Irish wildlife Manual No. 8.
(2) Reynolds, J.D., (1998). Conservation Management of the White Clawed Crayfish (Austropotamobius pallipes). Irish Wildlife Manual, No. 1. National Parks and Wildlife Service.

its loss or decline include, inter alia, collection of samples, human disturbance and grazing (1).

The qualifying species associated with area of the cSAC adjacent to the Bypass include lamprey species, twaite shad, Atlantic salmon and otters.

The extent of the cSAC is illustrated on *Figure 10.3* of the EIS, while *Figure 10.1* illustrates the cSAC habitats associated with the Bypass.

The aquatic habitats at the crossing point are characteristic of a tidal river and are dominated by sinuous glide flows. During low tides, intertidal mud flats are exposed, primarily on the eastern bank of the river. These mud flats are representative of the Annex I Habitat *Mudflats and sandflats not covered by sea water at low tide Code 1140 (*see *Photo 11.1* below) and are a qualifying habitat of the cSAC.

The nearest water monitoring station to the proposed river crossing is located approximately 20km upstream at St Mullins. Water quality monitoring at this location have consistently resulted in a Q-value (2) 4 being assigned to the River Barrow, indicating the river is of good water quality.

Photo 11.1 ***Site of proposed River Barrow Crossing point taken from the eastern shore of the river looking west towards Pink Point***

(1) NPWS, (2007). Draft All-Ireland Species Action Plan - Killarney Fern

(2) Q-values refer to the EPA's Biological Water Qualtiy Assessment procedure which assigns water quality ratings to surface watercourses based on the composition of the macroinvertebrate communities inhabiting the river and other relevant factors such as algal growth, turbidity and water depth. Q-values are displayed in a five point biotic index with Q-value 5 representing unpolluted water quality and Q-value 1 representing seriously polluted water quality.

The Bypass will also interact with the Graiguenakill River, which forms part of the cSAC. This river rises to the west of the existing N25 in the townland of Parkstown Lower and flows east to its confluence with the River Barrow to the south of the proposed bypass. The LS-7512 South Tie-in will directly interact with this river. The Graiguenakill Stream (RS-02/RS-04), while not included within the cSAC boundary is a tributary of the Graiguenakill River. The confluence of both these rivers is located to the west of the LS-7513 tertiary road. The Graiguenakill Stream flows in a north-south direction and intersects the proposed bypass immediately to the east of Glenmore Junction.

Due to the interaction of both these rivers with the proposed scheme a 30m section of the river was surveyed at the confluence of the Graiguenakill River and the Graiguenakill Stream. This site was chosen so that a qualitative assessment of the water quality and aquatic habitats of both rivers could be inferred from the results of the field assessment. The stretch of the river surveyed is to the south of the proposed alignment. The river was between 2m to 3m wide and had an approximate 25% riparian cover and 50% instream cover (see *Photo 11.2* below). The riparian vegetation was dominated by willow (*Salix spp.*), ash (*Fraxinus excelsior*) and reed canary grass (*Phalaris arundinacea*). In-stream macro-flora consisted of pondweeds (*Potamageton spp.*) water cress (*Rorippa nasturtium-aquaticum agg.*) and water starwort (*Callitriche stagnalis*)

The river substrate was made up of approximately 30% gravel, 20% fine gravel, 30% silt and sand and 20% mud. Overall the stream could be considered to be of good salmonid nursery habitat. No EPA Q-value rating is available for this river. The qualitative assessment of macro-invertebrates indicated conditions of good water quality with pollution sensitive species represented by the presence of the family *Emphemeridae, Trichoptera* and *Plecoptera.* Furthermore the presence of salmon parr and relatively high numbers of trout fry and parr (see *Histogram 11.1* below) as well as stickleback, eel, flounder and river lamprey (which is listed on Annex II of the Habitats Directive) underlines the local importance of this tributary for the Barrow System.

A further stretch of the Graiguenakill Stream was assessed during the assessment of Ecological Site 1 (see *Table 10.3* and *Figure 10.1*). The stream averaged two metres in width, with narrower sections identified to the north. Natural riparian vegetation, characterised by willow, ash and oak were recorded along the eastern bank of the stream. The western bank of the stream was dominated by aquatic flora such as bulrushes, willowherbs, reed sweet-grass, yellow iris and bindweed. Heavily poached and improved wet grassland along with a linear coniferous plantation is located to the north of the site. Discrete sections of the stream were smothered in aquatic vegetation, suggesting localised enrichment.

The river substrate consisted of approximately 50% gravel, 30% fine gravel and 20% silts and sand. Muddy substrates dominated the stream along the southern boundary of the ecological site. This stretch of the river displays artificial characteristics and it is likely that this stream was realigned in the past. The natural sections of the watercourse display good salmonid nursery habitat conditions with a range of instream habitats, such as riffles, glides and pools identified. Macro-invertebrates associated with this watercourse are outlined in *Table 11.1.*

Table 11.1 Summary of In-Stream Fauna at Graiguenakill River

Order/Family/Species	Presence
Gammarus sp.	Present
Caenidae (Mayfly)	Common
Simulidae (Diptera)	Present
Trichoptera	Common
Plecoptera	Present
Mollusca	Present
Ephemeridae	Present

Histogram 11.1 Salmonids Recorded at Graiguenakill River

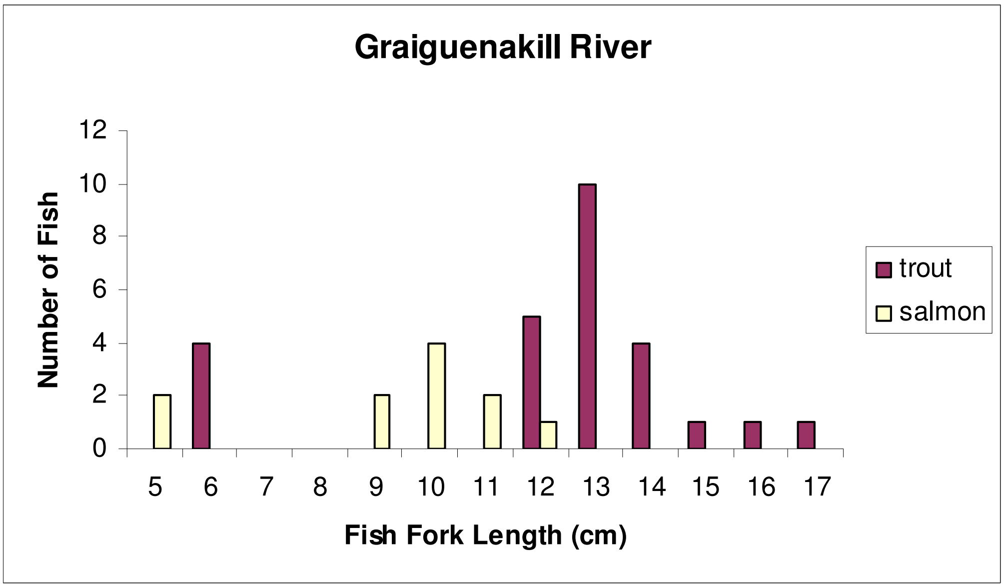


Photo 11.2 Graiguenakill River Site

The Camlin Stream (RS-08) forms the boundary of the cSAC for a short section between the site and L-4026-1. This stream was also surveyed at this boundary. A 30 metre section of the stream was fished downstream from the bridge. The stream was between 1m to 1.5m wide and had an approximate 90 - 100% riparian cover, forming a tunnelled profile along the stream (see *Photo 11.3*). The riparian habitat was characterised by a mature treeline dominated by ash (*F. excelsior*) with alder (*Alnus glutinosa*) and holly (*I. aquifolium*) also occurring. Due to the extremely high levels of shade caused by the tunnelling no instream flora was recorded.

The stream substrate was made up of approximately 50% rocks and cobble with sand and silt making up the remainder. Overall, the stream is considered to be of good salmonid nursery habitat. The qualitative assessment of macro-invertebrates indicated conditions of good water quality with pollution sensitive species represented by the presence of the family *Ecdynuridae* (see *Table 11.2*). The presence of a salmon parr and relatively high numbers of trout fry and parr (see *Histogram 11.2*) underline the habitat quality of this watercourse. Freshwater eel was also recorded at this site. Even though this watercourse forms the boundary of the cSAC it is considered to have high ecological value and is locally important as a feeder stream for the Barrow System.

Table 11.2 Summary of In-Stream Fauna at Camlin Stream - downstream

Order/Family/Species	Presence
Dicranota sp.	Present
Caenidae (Mayfly)	Present
Trichoptera	Present
Ephemeridae	Present
Gammarus sp.	Common
Simulidae	Common
Ancylus sp.	Present

Histogram 11.2 Salmonids Recorded at Camlin Stream – Downstream Site

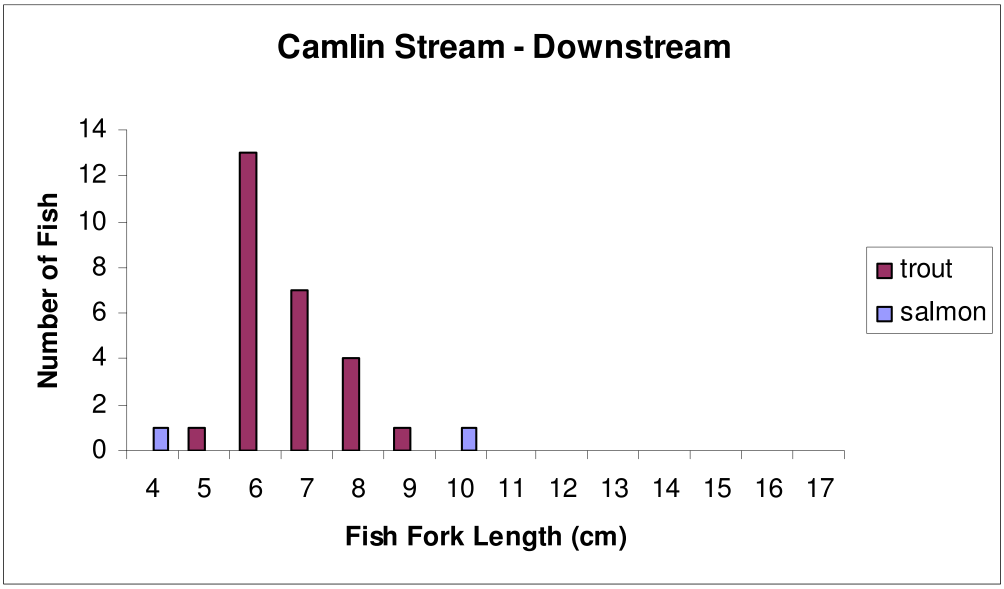


Photo 11.3 Camlin Stream: Downstream Site

11.3.3 Other Watercourses

Results of the baseline analysis for the remaining watercourse assessed in the field are outlined below.

11.3.3.1 Stokestown Stream

This Stream is a direct tributary of the River Barrow entering the main channel opposite the Pink Point. A 30m section of the stream was fished just downstream of Stokestown Bridge. The stream was between 1.5m to 2m wide and had an approximate 50% riparian cover (see *Photo 11.4*). The riparian vegetation was dominated by hawthorn (*Crataegus monogyna*), ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*) and holly (*Ilex aquifolium*). In-stream macro-flora was largely absent with the flora being confined to mosses and algae.

The stream substrate was made up of approximately 50% rocks, cobble and pebbles with gravel, sand and silt making up the remainder. Overall the stream could be considered to be of good salmonid nursery habitat. Macro-invertebrates associated with this stream are outlined in *Table 11.3.* The species identified are indicative of good water quality with pollution sensitive species such as mayfly, caddis fly and stonefly recorded. The presence of a salmon and relatively high numbers of trout fry and parr (see *Histogram 11.3*) are indicative of the presence of good quality habitats in the stream. The stream is therefore considered to be of high ecological value and locally important to the Barrow system.

Table 11.3 Summary of In-Stream Fauna at Stokestown Stream

Order/Family/Species	Presence
Gammarus spp.	Common
Caenidae (Mayfly)	Common
Simulidae (Diptera)	Abundant
Dicranota spp.	Present
Ancylus spp.	Present
Plecoptera	Present
Glossophonia spp.	Present
Ephemeridae	Present

Histogram 11.3 Salmonids Recorded at Stokestown Stream

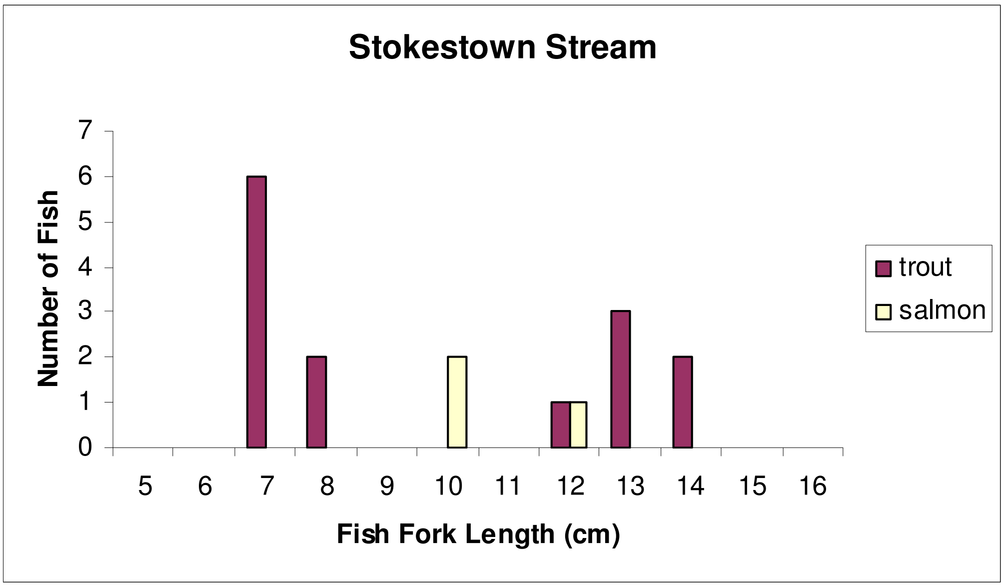


Photo 11.4 Stokestown Stream Site

11.3.3.2 Camlin Stream- Upstream Site

The Camlin Stream (RS-08) is a direct tributary of the River Barrow entering the main channel to the west of Camlin Hill. Only pools were fished at this site, upstream from the R733. The pools are artificially created and provided ideal nursery habitat for salmonid species (see *Photo 11.5* and *Histogram 11.4*). The stream was between 0.5 and 1 metre wide and had a dense riparian cover downstream but was open upstream of the site (see *Photo 11.5*). The riparian vegetation consisted of oak (*Quercus spp.*), Leyland cypress (*Cupresso cyparis Leylandii*), ash (*F. excelsior*) and bramble (*R. fruticosus*). The instream flora was devoid of macrophytes and consisted predominantly of mosses and algae.

The stream substrate was made up of approximately 20% boulders and 80% silt. Overall the stream could be considered to be of good salmonid nursery habitat. The results of the qualitative assessment of macro-invertebrates, outlined in *Table 11.4*, are indicative of moderate to good water quality. The relatively high numbers of trout fry (see *Histogram 11.4*) is indicative of the potential of this stream to support salmonid species. As a result of the data gathered, the river is considered to be of moderate ecological value and locally important to the Barrow system.

Table 11.4 Summary of In-Stream Fauna at Camlin Stream - Upstream site

Order/Family/Species	Presence
Chironomus sp.	Present
Caenidae (Mayfly)	Present
Trichoptera	Present
Ancylus sp.	Present

Histogram 11.4 Salmonids Recorded at Camlin Stream – Upstream Site

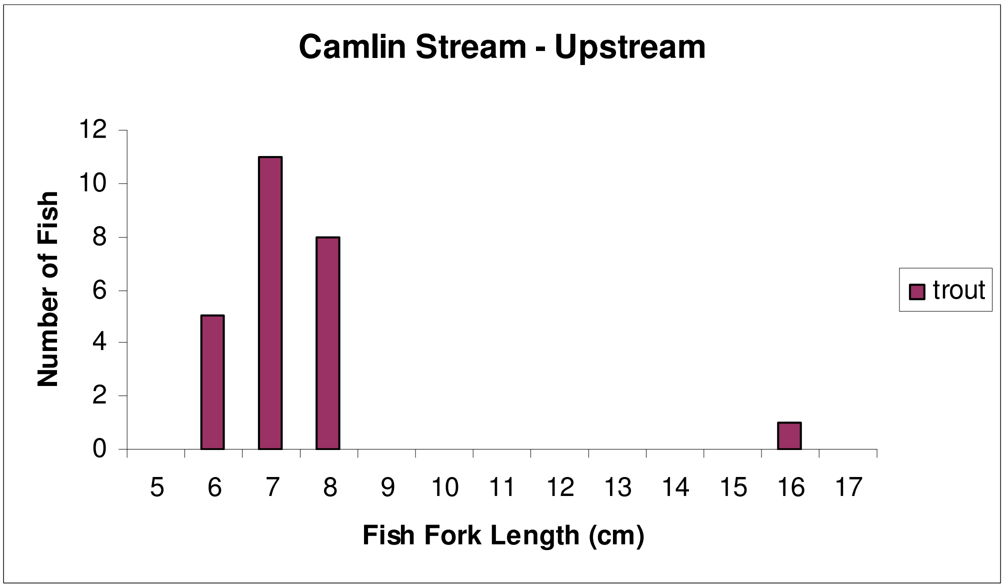


Photo 11.5 Camlin Stream - Upstream Site

11.3.3.3 *Maudlin Stream*

The Maudlin Stream (RS-13/RS-14) is a direct tributary of the River Barrow entering the main channel at Island Bridge. This stream is intersected by the proposed alignment at three locations: N25 Ch. 8,000, N25 Ch. 8,300 and N25 Ch. 8,550 (see *Figures 10.1 and 12.1*). Riparian vegetation is located along the entire length of this river. Linear woodland characterised by mature oak (*Quercus spp.*), beech (*F. sylvatica*) and ash (*F. excelsior*) banks the river at N25 Ch. 8,000, while an area of scrub dominates the northern bank of the stream at N25 Ch. 8,300. A mature treeline dominated by ash (*F. excelsior*) and hawthorn (*C. monogyna*) characterised the riparian vegetation at N25 Ch. 8,550.

A 30 metre section of the stream was electro-fished just upstream of Ballymacar Bridge. The stream was between 1m to 1.5m wide and had an approximate 50% riparian and in-stream cover (see *Photot 11.6*). The riparian vegetation was dominated by oak (*Quercus spp.*), alder (*Alnus glutinosa*), bramble (*Rubus fruticosus*), sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*), hawthorn (*Crataegus monogyna*) and gorse (*Ulex spp.*), while watercress (*Rorippa nasturtium-aquaticum agg.*) and pondweed (*potamogeton spp.*) were prominent in-stream.

The stream substrate was made up of approximately 50% rocks and cobble with sand, gravel and silt making up the remainder. Overall the stream could be considered to be of good salmonid nursery habitat. The qualitative assessment of macro-invertebrates indicated conditions of good water quality with pollution sensitive species represented by the presence of the family *Ecdynuridae*. The presence of a salmon parr and relatively high numbers of trout fry and parr (see *Histogram 11.5*) underlines the potential of this stream to support salmonid populations. Eel were also recorded at this site. As a result of the data gathered and reviewed this watercourse is considered to be of high ecological value and locally important as a feeder stream for the Barrow System.

Table 11.5 Summary of In-Stream Fauna at Maudlin Stream

Order/Family/Species	Presence
Gammarus spp.	Abundant
Caenidae (Mayfly)	Abundant
Simulidae (Diptera)	Common
Dicranota spp.	Present
Ancylus spp.	Present
Ecdynuridae	Present
Ephemeridae	Present

Histogram 11.5 Salmonids Recorded at Maudlin Stream

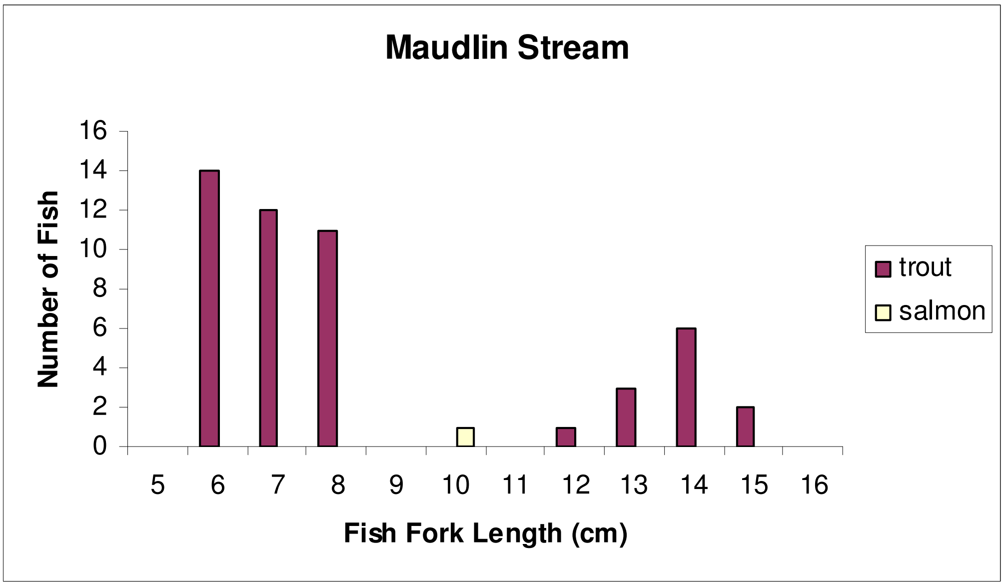


Photo 11.6 Maudlin Stream

11.3.3.4 *Aughnacrew River*

The Aughnacrew River (RS-22) rises adjacent to the proposed Corcoran's Cross Junction and is crossed by the N30 East Tie-in at N30 Ch. 1,150 (see *Figure 12.1*). This river was surveyed immediately upstream of Aughnakean Bridge along the current N30. This river is a tributary of the Pollymounty River, which is itself a tributary of the River Barrow. The Pollymounty River joins the main River Barrow channel to the west of Bigwood, north of New Ross. EPA Q-value records are available for this river from the monitoring station located at Ballinvegga Bridge, approximately 1km to the north of the survey site. Previous water quality analysis from this monitoring station resulted in a Q-value of 3 – 4, indicating slightly polluted water quality. Analysis undertaken in 2003 resulted in a Q-value of 3 indicating a decline in the rivers water quality from slightly polluted to moderately polluted.

Due to dense riparian vegetation impeding the electrofishing survey, only 15 metres of the river were fished. The stream was between 0.5m to 1m wide and had an approximate 90 - 100% riparian cover, forming a tunnelled profile along the stream. The riparian vegetation was dominated by ornamental garden plants and other native species such as hawthorn, willow species and alder (*A.* glutinosa). Due to the extremely high levels of shade, caused by the 'tunnelling' of overhanging vegetation, no instream flora was recorded.

The stream substrate was made up of approximately 50% stones and pebbles with sand and silt making up the remainder. Overall the stream, at this point, is considered to be of moderate salmonid nursery habitat. The results of the qualitative assessment of macro-invertebrates, outlined in *Table 11.6,* are indicative of moderate water quality. Furthermore the relatively low numbers of trout fry (4 in total) underlines the river's deviation from good salmonid nursery conditions. This river is of moderate ecological value and locally important to the Barrow system.

Table 11.6 Summary of In-Stream Fauna at Corcoran's Cross

Order/Family/Species	Presence
Dicranota sp.	Present
Caenidae (Mayfly)	Present
Coleoptera	Present
Simulidae	Common
Trichoptera	Common
Gammarus sp.	Present

11.3.4 *Drainage Ditches*

Drainage ditches (FW4) are a common feature throughout the alignment. They are associated with field boundaries in flat topography and are predominantly seasonal, ranging from dry to wet with stagnant or flowing water. Many drainage ditches are choked with aquatic vegetation such as duckweeds, (*Lemna spp.*), water starwort (*Callitriche*) and pondweeds (*Potamogetum spp.*). Choked drainage ditches, with stagnant water are of low ecological value.

Drainage ditches encountered throughout the route corridor are of low ecological value.

11.3.5 Springs

One spring was identified within the route corridor, to the east of N30 Ch. 2,900 of the N30 tie-in. The species associated with this calcareous spring (FP1) includes brooklime (*Veronica beccabunga*), creeping forget-me-not (*Myosotis secunda*), spotted orchid (*Dactylorhiza fuchsia*) and marsh cinquefoil (*Potentilla palustris*). This spring is associated with a larger wetland habitat, Ecological Site 5 (see *Table 10.3*) and thus constitutes a habitat of high ecological importance.

11.3.6 Fauna

11.3.6.1 Atlantic Salmon

When occurring in freshwater, Atlantic salmon is protected under Annex II of the EU Habitats Directive. Important salmon populations are supported by the River Barrow, and while the Barrow itself is not designated a Salmonid Water; the River Nore, whose confluence with the River Barrow is located upstream of the proposed bypass, is designated a salmonid water. Salmon fry and or parr were also recorded in four of the five watercourses surveyed during the summer of 2005, further indicating the importance of the River Barrow estuary catchment area for supporting populations of Atlantic salmon.

11.3.6.2 Lamprey

The River Barrow supports all three species of lamprey, which are all protected under Annex II of the EU Habitats Directive. River lamprey was also identified during electrofishing surveys of the Graiguenakill River. The first order tributaries of the River Barrow, within or adjacent to the route corridor, are more likely to support sea and river lamprey, while the upper reaches of these first order rivers and second order rivers are more likely to support brook lamprey. The principal threat to these species is impediments to upstream migration created by artificial barriers such as weirs, locks and dams [(1)].

11.3.6.3 Twaite Shad

The River Barrow is the principle watercourse in Ireland supporting anadromous twaite shad (*Alosa fallax Lacepede*). This species is declining throughout Europe and is listed on Annex II and V of the EU Habitats Directive and is also listed as vulnerable in the Irish Red Data Book. The only known spawning population of twaite shad in Ireland occurs in the upper tidal limit of the River Barrow. The spawning ground is located approximately 20km upstream from the proposed bridge crossing near St. Mullins. Mature

(1) Igoe, F. et al., (2004). The Sea Lamprey (Petromyzon marinus L.), River Lamprey (Lampetra fluviatilis L.) and Brook Lamprey (Lampetra planeri (Bloch)) in Ireland: General biology, Ecology, Distribution and Status with recommendations for Conservation. Biology and Environment: Proceedings of the Royal Irish Academy, Vol 104B, No. 3, pp. 43 – 56.

twaite shad migrate upstream to the spawning site between April and June, with peak spawning activity occurring in late May. The reach of the River Barrow associated with the proposed bypass supports migrating shad. It has been noted that the twaite shad population of the River Barrow are especially threatened by deteriorating water quality and habitat degradation (1).

11.3.6.4 *Smelt*

The distribution of smelt (*Osmerus eperlanus L.*) in Ireland is very localised with recent records confirmed in Waterford Estuary and along the River Barrow. This species is listed as vulnerable in the Irish Red Data book. Populations of smelt are generally confined to estuaries and migrate upstream to the lower reaches of large rivers to spawn. Spawning runs upstream take place between January and April, with spawning lasting as long as two weeks. The reach of the River Barrow associated with the proposed bypass supports migrating smelt. Whilst spawning sites are also likely to be associated with the River Barrow none have been recorded to date (2).

11.3.6.5 *Freshwater Pearl Mussel*

Freshwater pearl mussel (*Margaritifera margaritifera*) is listed on Annex II of the EU Habitats Directive. This species is found in clean, well-oxygenated rivers which flow over non-calcareous rocks. A river's substrate is of particular importance for freshwater pearl mussels, areas of clean gravel and sand habitats are essential. While this species is generally restricted to soft water areas, species of *Margaritifera durrovensis* have been recorded from the hard water associated with the River Nore. The distribution of *Margaritifera margaritifera* is widespread, with remnant populations dispersed throughout the country away from the central limestone plain (3).

Both species of freshwater pearl mussel are highly endangered. The reasons for the decline of this species are various, with alterations to river beds, increases in turbidity and water pollution providing an example of some of the threats identified. Moorkens (1999) also states that the development of roads close to rivers can result in silt run-off, altering the habitat requirements of this species.

There are no historical records of this species occurring within the route corridor. The nearest population of *Margaritifera margaritifera* in the River Barrow occurs approximately 20km upstream from the route corridor (4).

(1) Doherty et al., 2004. the Biology, Ecology and Future Conservation of Twaite Shad (*Alosa fallax lace*), Aliis Shad (*Alosa alosa l.*) and Killarney Shad (*Alosa fallax killarnensis tate regan*) in Ireland. Biology and Environment: Proceedings of the royal Irish Academy, Vol 104B, No. 3, pp. 93 – 102.
(2) Quigley et al. (2004). The European Smelt Osmerus eperlanus L. in Ireland: General Biology, Ecology, Distribution and Status with Conservation Recommendations.
(3) Moorkens, E. A. (1999). Conservation Management of the freshwater Pearl Mussel (*Margaritifera margaritifera*). Part 1: Biology of the species and its present situation in Ireland. Irish wildlife Manual No. 8.
(4) Kerney, M. (1999). Atlas of Land and Freshwater Molluscs of Britain and Ireland. Harley Books, England.

11.3.6.6 *White- Clawed Crayfish*

Freshwater crayfish (*Austropotamobius pallipes*) listed on Annex II of the EU Habitats Directive. This species require relatively hard water with a pH of 7 or above and calcium concentrations of at least 5 mg/l [(1)]. It is widespread in the midlands of Ireland in rivers and lakes underlain by Carboniferous limestone. Historical records for this species, collected between 1976 and 1985, contain one recorded this species in the Pollymounty River. More recent records collected between 1990 and 2003 recorded this species along the River Nore. While this species is associated with the River Barrow, there are no recent records of it occurring within the wider catchment area associated with the bypass. It is unlikely to be associated with the tidal stretches of the River Barrow and associated catchment streams occurring within the study corridor. The only stream along the corridor not influenced by tidal water is the Aughnacrew River. There are no records of white-clawed crayfish occurring in this river. No evidence of the presence of this species was recorded during field surveys of this river.

11.3.6.7 *Kingfisher*

The kingfisher is listed on Annex I of the EU Birds Directive. This species is associated with the River Barrow cSAC and historical records have shown that this species occurs within the stretches of River Barrow associated with the proposed scheme [(2)]. Suitable bank side habitat with the potential to support nesting kingfishers was identified along the western bank of the River Barrow at Pink Point. While no kingfishers were identified during field surveys, based on the available historical records and the presence of suitable habitat it is assumed that kingfishers occupy this area.

11.3.6.8 *Little Egret*

The little egret (*Egretta garzetta*) is listed on Annex I of the EU Birds Directive associated with the River Barrow and have been recorded over-wintering in riparian habitats along the River Barrow cSAC. Suitable nesting habitat was identified downstream of the proposed crossing point at Aylwardstown Marsh and Dunganstown. Little egrets were recorded in flight to the south of the proposed crossing point.

11.3.6.9 *Otter*

Otters are known to occupy the main channel of the River Barrow and otter field signs were recorded adjacent to the Graiguenakill River and along the eastern shore of the River Barrow. It is likely that otters are supported by watercourses that support fish species.

(1) Reynolds, J.D., (1998). Conservation Management of the White Clawed Crayfish (Austropotamobius pallipes). Irish Wildlife Manual, No. 1. National Parks and Wildlife Service.
(2) Birdwatch Ireland IWEBS Results, 2004 and NPWS Protected Species Database

11.4 IMPACT ASSESSMENT

11.4.1 *Overview*

The potential impacts of the Bypass were examined in the context of the findings of the ecological baseline outlined above. This included an assessment of the potential direct and indirect impacts to the ecological baseline identified along the route corridor.

11.4.2 *Evaluation Criteria*

The potential for ecological and nature conservation impacts has been assessed following the NRA's *Criteria for Assessing Impact Significance Table 4.2: Aquatic Sites.* This assessment criteria satisfies the assessment requirements outlined in the EPA's *Guidelines for Environmental Impact Statements*.

11.4.3 *General Construction Impacts*

Potential construction impacts to aquatic ecology associated with a road development include:

- runoff from the construction areas, leading to an increase in sedimentation, suspended solids or chemicals within the river;
- dust deposition associated with the on-site demolition works, leading to an increase in suspended solids and sedimentation;
- disturbance of the river bed which would also increase the suspended solids;
- contamination from substances such as fuels, lubricants, cement, concrete, grout, waste water from site toilets and wash facilities;
- disturbance of riparian vegetation leading to a loss of habitat and potential destabilisation of river banks; and
- alterations to river beds during construction activity associated with temporary or permanent watercourse diversions and during the crossing of streams and rivers will have the potential to degrade salmonid nursery habitats.

11.4.4 *General Operation Impacts*

Potential operational impacts to aquatic ecology associated with roads include the following:

- permanent loss of aquatic and/or riparian habitats where the road is constructed over or adjacent to watercourses;

- Obstruction of the upstream movement of aquatic fauna, particularly salmonids and lamprey. The installation of culverts may increase flow velocity, decrease water depths and increase turbulence, resulting in impediments to migrations of anadramous fish species (1);

- Pollution to watercourses from contaminated runoff. The principal components of contaminants from road runoff include:

  - Heavy metals (total and dissolved) and hydrocarbons, including Polycyclic Aromatic Hydrocarbons (PAH), which are both persistent and toxic in the environment;

  - Sodium chloride (from salt de-icing);

  - Accidental spillages involving any polluting material; and

  - Increased sedimentation (derived from soil erosion and aerial deposition).

11.4.5 *General Impacts Associated with Watercourse Crossings*

The crossing of watercourses will involve the removal and severance of riparian vegetation which will result in negative ecological impacts. The magnitude of this impact will depend upon the ecological value of the riparian vegetation.

Culverts, if not appropriately designed, can interfere with the free upstream and downstream movement of fish and macroinvertebrate life. The Fishery Guidelines for Local Authority Works (2) recommends that the culverting of long stretches of watercourses should be avoided. Also the SRFB guidelines (3) on watercourse crossing and the use of bottomless culverts should be adhered

The impacts of a culvert on the movement of fish species relate primarily to the potential changes the culvert will have on the watercourses hydrological conditions. Alterations to the hydrological conditions, preventing fish passage, will result from changes to the watercourse's width, depth, turbulence and water velocity. Culverts with a concrete or uniform flat base can cause a barrier effect to fish as they lack the cryptic natural streambed. The presence of rocks etc in natural riverbeds forms back eddies and areas where the current is reduce. Without the presence of such features fish will be unable to swim against the strongly laminar flow in a culvert.

During the installation of culverts the following potential impacts may arise:

(1) Fitch, G.M., (1996). Avoidance of nonanadromous fish passage impedance caused by highway culverts. Transportation Research Record No. 1559, Environmental, Social, and Economic Effects of Transportation, pp. 34 – 41.
(2)Anon, (1998). Fishery Guidelines ofor Local Authority Works.Dept. Marine, Communications & Natural Resources. Dublin
(3) Southern Regional Fisheries Board (2007). Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works. Ireland.

- disturbance of the river bed which would also increase the suspended solids; and

- contamination from substances used in association with construction activities, such as, fuels, lubricants, cement, concrete and grout.

11.4.6 *General Impacts Associated with Watercourse Diversions*

Watercourse diversions are likely to result in altered hydraulic characteristics and changes in the watercourse profile, particularly changes in width, depth, stream velocity and gradient. Such changes will have a negative impact to fish passage and will result in a decrease in instream aquatic habitats. Diversions will also cause changes in the riparian habitat which will in turn alter the watercourse's foraging resource, light regime and bank stability. Reduced bank stability will lead to an increase in suspended solids, causing a reduction in water quality. Overall, alterations to riparian habitats have the potential to significantly reduce water quality and the functionality of instream habitats to support macroinvertebrate and fish life. Any in-stream construction works associated with diversions are likely to have significant negative impacts.

11.4.7 *Impacts to Designated Sites*

The River Barrow cSAC is the only Natura 2000 site directly intersected by the proposed route alignment. The aquatic habitats included within the pNHA designation are the same as those included in the cSAC. The River Barrow is designated a cSAC of European nature conservation importance for the Annex I habitats which occur along and adjacent to the river and the Annex II species which are supported by the river and adjacent habitats.

The following *Section* considers the features of the cSAC and is based on the information available for the Bypass. Based on this assessment, and the adoption of the mitigation measures outlined, it is concluded that the construction and operation of the Bypass are not anticipated to have a significant impact on the qualifying interest features of the cSAC.

11.4.7.1 *Findings of the Assessment*

A range of potential impacts will affect the integrity of the cSAC. These impacts are listed in *Section 11.4.3* and *11.4.6*. The following assessment is based on the information available during the EIS. The relationship between these impacts and the cSAC are outlined below.

Populations of Annex II listed aquatic species are supported within the site and sensitive flora and fauna are also recorded within, up and downstream of the River Barrow bridge crossing. These protected species are dependent on good water quality and ecological conditions and therefore it is imperative that good water quality is maintained throughout the construction and operation of the River Barrow Bridge crossing. Due to the tidal nature of the River Barrow deleterious impact on water quality have the potential to affect sensitive species and habitats upstream. The generic potential impacts known to be associated with the construction of the bridge piers include:

- Increased levels of suspended solids and turbidity as a result of construction and operation of the bypass and bridge;
- Changes to the hydrology and sediment transport;
- Changes to the surrounding habitat as a result of alterations to erosive/deposition processes surrounding the pier;
- Loss of habitat through direct disturbance; and
- Pollution resulting from construction and operational phases of the Bypass.

However the development of the outline design has taken these factors into account as far as practicable. The bridge design and footprint of the pier effectively minimises potential impacts on the river's natural flow pattern.

Littoral and sublittoral zones and the important faunal communities associated with these habitats may be vulnerable to negative impacts during the construction phase. One bridge pier will be placed within the intertidal mudflats towards the east of the channel. The extent of direct habitat loss associated with the installation of the bridge pier in the intertidal mudflats represents a tiny proportion of the extent of this habitat.

The installation of a temporary impermeable, sealed area or other appropriate technology during the installation of the pier has the potential to alter the riverine processes along the river and create obstacle to fish movements. The development the detailed construction methodology will be taken forward in discussion with the relevant authorities to avoid significant impacts on the features of the cSAC.

Pollutants associated with the road have the potential to negatively impact upon the River Barrow cSAC. These pollutants include:

- heavy metals (total and dissolved), nutrients and hydrocarbons, including Polycyclic Aromatic Hydrocarbons (PAH), which are both persistent and toxic in the environment; and

- accidental spillages involving any polluting material.

Accidental spillage can result in major pollution incidences to watercourses. While trying to predict the occurrence of accidental spillage with any degree of certainty is difficult, an assessment of the following criteria will provide some indication of the pollution risk:

- type of roadway i.e. dual carriageway or motorway;
- length of road;
- traffic volumes; and
- the proportion and type of heavy goods vehicles (HGV's).

The risk assessment of accidental spillage was carried out according to the UK Highway Agency's Design Manual for Roads and Bridges. The assessment found that individual outfalls were found to have a low risk (> 1 in 100year or less than 1%) of serious pollution and the pollution risk for the entire c. 15km of road was found to be 43 years for an average AADT of 15,000 (Design Year). Therefore risk of serious contamination to the River Barrow from accidental spillage is shown to be small based on the DMRB risk assessment method. This risk will be further reduced with the implementation of mitigation measures outlined below.

Potential impacts to the riparian vegetation associated with the cSAC are outlined in *Chapter 10, Section 10.4.3.1.*

The realignment of the LS-7512 South Tie-in will take place immediately adjacent to the Graiguenakill River. Construction activities associated with the realignment of this road will have the potential to negatively impact upon this cSAC river. In order to minimise the potential risk of a significant impact on the features of cSAC there is a commitment to a series of mitigation measures and the adherence to the SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works.*

As the Graiguenakill Stream is directly associated with the Graiguenakill River and therefore directly influences this cSAC River the impacts to this stream are assessed in this *Section.* The Bypass crosses this stream at approximate N25 Ch. 50, while the LS-7513 realignment intersects this stream at a further two locations and has the potential to result in negative construction and operational impacts. In order to minimise the potential of a major impact on this stream there is a commitment to a series of mitigation measures and the adherence to the SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works.*

The riparian habitat associated with Camlin Stream is characterised by a mature treeline, with ash being the dominant species. The intact riparian treeline bordering this stream will be severed at the crossing point at N25 Ch. 4,050. This stream will be diverted to reduce the level of culverting otherwise required for it. As this stream is of high ecological value and the downstream section forms the boundary of the cSAC, any diversions and culverting have the potential to result in a permanent, major negative impact. However, the replacement of existing culverts under the R733 and the L-4026-1 with a new crossing, designed to current standards, has the potential to have a positive impact on this watercourse. With the adoption of the good practise set out in the SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works* significant impact on the designated features of the cSAC can avoided.

11.4.8 Impacts to Watercourses

In general, all the minor watercourses assessed along the route corridor, including those located within the cSAC, are susceptible to low summer base flows (see *Chapter 12*). Low flows during summer periods will limit the capacity of these watercourses to dilute any road discharges and associated pollutants. Without mitigation, pollutants associated with runoff represent a significant local impact to the water quality in the receiving water.

The risk of accidental pollution of watercourses was assessed according methodologies outlined in the UK DMRB (see *Chapter 12*). The risk varies with the length of the road discharging to outfalls and the traffic volume of HGV's on the road. Where the return period of an accidental pollution event is 100years or less (i.e. more than 1%), mitigation measures are deemed to be necessary. All individual outfalls were found to have low risk (> 1 in 100year or less than 1%) of serious pollution and the pollution risk for the entire c. 15km of road was found to be 43 years for an average AADT of 15,000 (Design Year).

11.4.8.1 Stokestown River

As this river is located over 100m to the south of the alignment it is not anticipated that the proposed development will have an impact during the construction or operation phases.

11.4.8.2 Maudlin Stream

The main alignment crosses this stream at three locations, N25 Ch. 8,000, N25 Ch. 8,360 and N25 Ch. 8,580. There will be a loss of riparian habitat at all three locations. Stream diversions will be undertaken along this stream to reduce long lengths of culverting that would otherwise be required. Without mitigation measures the potential impacts associated with the diversion and crossing of this stream are as follows:

- loss of riparian habitat associated with the watercourse. The riparian habitat along this stream consists of mature (linear) beech woodland and scrub habitat. The loss of this habitat will reduce the foraging resource for aquatic fauna and the reduce the shelter provided by the vegetation;

- a reduction in water quality associated with increases in siltation and suspended solids during the realignment of the stream;

- a reduction in water quality resulting from runoff during the construction and operation of the Bypass;

- changes in the hydraulic characteristics and watercourse profile of the stream as a result of the realignment; and

- fording of this stream has the potential to create barriers to fish movement.

Without mitigation, the combined affect of these potential impacts to this watercourse will constitute a permanent, major negative impact.

11.4.8.3 Aughnacrew River

The upper reaches of this stream flow through the proposed location of the Corcoran's Cross Junction. The construction of this junction over this stream will have potential negative impacts including:

- a reduction in water quality resulting from runoff during the construction and operation of the Bypass; and

- fording of this stream has the potential to create barriers to fish movement.

However, due to the moderate ecological value of this stream at this location, it is considered that the potential impacts to this watercourse will constitute a permanent, minor negative impact.

11.4.9 Impacts to Aquatic Fauna

Apart from potential impacts to the fauna associated with the River Barrow, the development will have a negative impact on a number of watercourses crossed by the alignment. These impacts, as described above, have the potential to be both temporary and permanent and include a reduction in water quality; alterations to the hydraulic characteristics of watercourses; a reduction in and severance to riparian habitats; a degradation of instream aquatic habitats; and an overall reduction in aquatic habitat functions. Any of the above impacts will have the potential to have major negative impact upon aquatic fauna.

The installation of water crossings or the diversion of these watercourses have the potential to result in obstructions to the movement of aquatic fauna along these watercourses.

11.5 MITIGATION MEASURES

Measures to avoid or minimise the potential impacts of the proposed development are based upon a number of published guidelines. These include:

- NRA's *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes;*

- Department of the Marine, Communications and Natural Resources' *Fisheries Guidelines for Local Authority Works;*

- SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works;* and

- Northern Regional Fisheries Board (NRFB) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*

Specific mitigation measures for a number of potential impacts that will arise during the construction and operation of the proposed scheme are outlined below.

11.5.1 Mitigating Instream Works

Any instream construction work associated with watercourses should be undertaken outside the fish spawning season, unless expressed permission to the contrary is received by the SRFB. The fish spawning season for the watercourses intersected by the proposed alignment extends from October to June, inclusive. Any further SRFB requirements for extending the designated spawning season for watercourses in the area, or for protecting populations of other protected fauna, such as lamprey, will be adhered to by the contractor. The contractor will develop best practice construction procedures with the SRFB prior to commencing instream construction activities.

Before any construction activities are undertaken adjacent to or within a watercourse, a detailed construction method statement will be developed in consultation with the SRFB by the contractor. The contractor should be familiar with the contents of the CIRIA guidance document Control of water Pollution from Construction Sites – Guidance for Consultants and Contractors [(1)].

All instream works will be undertaken within an impermeable sealed area. The sealed area will facilitate instream works by keeping the work area dry and by reducing the potential for suspended solids to discharge into watercourses. The sealed area should not reduce the watercourse width by an amount that will lead to erosion of banks both upstream and downstream of the site or impede the movement of migrating fish. Only clean, silt free materials shall be used as the fill materials for impermeable sealed area, and all materials must be removed from the watercourse after construction is completed. Dewatering operations will be undertaken within the sealed area and will direct the water to storm control areas to remove sediments. The SRFB shall be consulted on the need to implement a fish salvage programme prior to dewatering.

Monitoring of suspended sediment loadings will be undertaken during instream works.

11.5.2 Mitigating River/Stream Diversions

A method statement for temporary and permanent stream diversions will be developed by the contractor, in consultation with the SRFB. Any temporary or permanent stream diversions to be undertaken will adhere to the SRFB

(1) Masters-Williams et al, 2001. Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. Construction Industry Research and Information Association. United Kingdom.

Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works.

Temporary stream diversions will be required to facilitate the completion of instream works. The diversions should always be excavated in isolation of stream flow, starting from the bottom end of the diversion channel and working upstream to minimize sediment production. Any dewatering flows should be directed to a settling pond to remove sediments. Watercourse diversion should be completed as quickly as possible, preferably within a single day during the low flow period. Upon completion of the instream work, the stream shall be restored to its original configuration and stabilised to prevent bank erosion around the temporary diversion.

During the design of the Bypass, the need for permanent, river diversions have been kept to a minimum by designing the alignment perpendicular to watercourses. However, where the Bypass cannot cross a watercourse perpendicularly, it will be necessary to realign watercourses to reduce the length of the watercourse crossings.

Where a permanent diversion or relocation is absolutely necessary, a compensatory diversion channel shall be designed in detail to the satisfaction of the SRFB. This compensation habitat should ensure that no deterioration of the salmonid, or other protected fish habitat status occurs. The diversion should be bio-engineered to closely replicate the natural flow, substrate and bankside characteristics of the original channel. This will require careful evaluation and cataloguing of the existing features in advance of the relocation design. The construction of the compensation channel shall be carried out in dry conditions without connection to the existing stream or watercourse. The construction of the new channel should be completed well in advance of its use so that native bankside vegetation is established. The bankside should be vegetated with sods removed from the original channel bankside. This will ensure that the seed bank associated with the original bank is preserved, as well as reinforcing the channel's bank, reducing erosion and suspended solids and providing shelter and foraging material for aquatic fauna.

The connection of the new channel to the original watercourse shall be made only during the approved timing windows for instream works. Sufficient notice shall be provided to the SRFB to permit reconnaissance, planning and inspection of the diversion before connection to the watercourse takes place. The contractor will provide the means and expertise to relocate resident fish stocks from the section of the watercourse to be abandoned. The relocation of the resident fish stocks from the original stretch of watercourse (to be abandoned) shall be undertaken without delay and with a minimum of stress to the fish stocks. Re-inspections and evaluations of the success and effectiveness of the diversion shall be made at specified intervals after its placement into service, and any necessary corrections and adjustments will be undertaken by the contractor where such are deemed necessary by the SRFB [1].

11.5.3 *Mitigating the Impacts of Watercourse Crossings*

During the design of the Bypass, bridge crossing have been included wherever possible to reduce the number of culverts. Where the installation of culverts is deemed to be the most feasible option for crossing a watercourse the, proposed culverts will be kept to a minimum length by squaring the proposed alignment with the watercourse. Where it is not possible to square the alignment with the natural watercourse channel, the watercourse will undergo realignment to square the intersection. Such realignments will be kept to a minimum.

Over-sized bottomless box culverts will be used so that the stream or river banksides are retained and the riverbed habitats are not directly impacted by the crossing. The retention of natural banksides will facilitate the movement of mammals. Where natural banksides cannot be retained, mammal passage facilities should be incorporated in the watercourse crossing. The location of mammal pass facilities along watercourses is outlined in *Section 10.5.5.2*.

The design of culverts should include features that allow unobstructed upstream movement of adult fish species. The design criteria for culverts should meet those specified in the SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works* and the NRA's *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*.

11.5.4 *Mitigating Construction Phase Impacts*

Mitigation measures for specific construction phase impacts are outlined below.

11.5.4.1 *Construction Runoff*

The release of contaminating substances and suspended solids to watercourses is recognised as the most likely potential impact to the aquatic ecology throughout the scheme. The release of such substances should be avoided or minimised by reducing site run-off and soil erosion. To achieve this, the following mitigation measures should be undertaken:

- construction vehicles should be restricted to specified construction areas and site clearance areas should be clearly marked, with as much vegetation as possible retained with the construction site boundary;
- where possible, or unless otherwise agreed with the SRFB, construction activity that is to take place close to watercourses should be scheduled for

(1) Chilibeck et al. (1992). Land Development guidelines for the Protection of aquatic Habitats. Department of Fisheries and Oceans, Canada.

drier months i.e. outside the fish spawning season during the summer months;

- site runoff should be diverted away from denuded areas and these areas should be re-vegetated as soon as possible;

- sediment traps, sediment fences and sediment control ponds should be installed to retain sediments on site. The contractor's responsibilities for controlling silt laden water should be specified in the contract documents;

- the following areas should be kept to a minimum size and well away from all watercourses:

  - sand and gravel stockpiles;
  - construction machinery service areas; and
  - concrete mixing areas.

- potential polluting materials such as fuels, oils, grease and hydraulic fluids should be stored in bunded compounds well away from all watercourses. Refuelling of machinery should be carried out in bunded areas;

- pouring of concrete for aprons, sills, and other works should be carried out in dry conditions and allowed cure for 48 hours before re-flooding. Pumped or tremied concrete should be monitored carefully to ensure no accidental discharge into the watercourse. Mixer washings and excess concrete should not be discharged to watercourses. Oil storage tank(s), associated filling areas and distribution pipe work should be situated at least 10m away from watercourses (rivers, lakes, streams, field drains) and 20m from wells or boreholes;

- permanent stream diversion should be completed well in advance of their use. The potential release of suspended solids should be minimised from the new channel before the river is re-routed into it. All temporary stream diversions should be constructed to the criteria laid down for permanent stream diversions; and

- the construction of watercourse crossings and diversions should adhere to the guidance contained within the SRFB *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works.*

11.5.4.1 Mitigating Construction Impacts on Riparian Vegetation

Bankside vegetation should be left intact where possible. A fence should be installed prior to the commencement of site works to ensure that riparian vegetation is retained. The fence should be set back two metres from the bankside or at the edge of a woody canopy (whichever is greater). Where bankside vegetation is to be removed the construction machinery should operate from the bank and remove the vegetation away from the watercourse.

11.5.5 *Operation Mitigation Measures*

Mitigation measures for specific operational phase impacts are outlined below.

11.5.5.1 *Mitigating the Impact of Permanent Aquatic and Riparian Habitat Loss*

As outlined in *Section 11.4*, there will be a permanent loss of habitat at a number of locations along watercourses. The detailed design of the proposed alignment has endeavoured to avoid wherever possible the permanent loss of aquatic and associated habitats. Where habitats could not be avoided the extent of habitat loss will be minimised and new habitats will be created to offset the loss.

Where watercourses are diverted, the new channel section will be planted with sods transplanted from the original channel bankside so that the new bankside resembles the vegetation associated with the original channel.

11.5.5.2 *Mitigating the Impacts of Road Runoff*

Storm run-off from the proposed road to watercourses of fisheries value will be intercepted by drains and directed to storm control areas that will be designed with adequate storage capacity and in a manner to facilitate maintenance and cleaning. Oil interceptors and sediment traps will also be provided. The installation of the drainage system will ensure that the level of particulate matter entering the watercourses will be minimal and as such will have a negligible affect on water quality.

A sustainable drainage scheme (SuDS) approach should be adopted for the design of all storm control areas. The design of these ponds should aim to replicate a natural wetland habitat. Attention will therefore be given at the detailed design stage in relation to size and shape, water depth, supply and quality and general landscaping. The design of storm control areas will be agreed in consultation with the NPWS. Any storm control areas proposed within Ecological Sites (see *Table 10.3*) will conform to the highest level of design specifications to replicate a semi-natural water body. The existing field boundaries in close proximity to the proposed balance ponds will be retained.

11.5.6 *Designated Conservation Areas*

There are a number of mitigation measures which will be implemented during the construction of the Bypass to minimise the risk of the development resulting in a significant impact on the cSAC;

- The area of landtake required for the construction of the pier will be kept to a necessary minimum;

- During construction works which are physically below the MHWS tide, potential increases in siltation and suspended solids will be minimised by the installation of a temporary impermeable, sealed work area; or another appropriate construction technique, which will be developed in consultation with NPWS and SRFB. The installation of the sealed area or alternative construction technique will facilitate the carrying out of construction activity throughout the construction period, while at the same time protecting the aquatic ecology from potential significant adverse impacts. Unless otherwise agreed by the SRFB or the NPWS; these impermeable, sealed work areas or construction technique will be minimised in size (where practicable) and installed in the dry season, outside the fish spawning season.

- A detailed construction method statement for the construction of the River Barrow cSAC Bridge Crossing will be developed in consultation with the NPWS and the SRFB.

All site runoff associated with the construction of the River Barrow bridge crossing will be directed to storm control areas or tanks to prevent direct discharge into the river.

Mitigation measures to minimise impacts to the riparian vegetation are outlined in *Chapter 10, Section 10.5.3.1*.

During the operation phase of the road all surface runoff will be intercepted in a sealed drainage system and directed towards storm control areas. Any drainage outfalls into the cSAC will be such that they do not negatively impact upon the integrity or reduce the water quality of the cSAC.

Mitigation measures to minimise the potential impacts to other watercourses associated with the cSAC and the proposed site (i.e. the Graiguenakill River and Camlin Stream) are outlined in *Table 11.7* below.

11.5.7 *Mitigation Measures for Individual Watercourses*

The measures outlined in *Section 11.5.1 - 11.5.5* above will form the basis of the mitigation measures to ensure that impacts are avoided or minimised at the watercourses identified throughout the alignment.

Table 11.7 below describes the specific mitigation requirements for each minor river, excluding the River Barrow.

11.6 *RESIDUAL IMPACTS*

As part of the construction phase, environmental protection procedures in-line with the mitigation measures outlined above will be implemented prior to the commencement of construction works. Provided good working practices are adopted during the construction of the works, there will be no significant residual impact on water quality of all other watercourses.

Road run-off to streams and rivers (not including the River Barrow) of fisheries value will be fed through pollution control measures that will be designed with adequate storage capacity and in a manner to facilitate maintenance and cleaning. The installation of these measures will mitigate any significantly impacts on water quality.

On the basis of the information currently available and reviewed above, and assuming the proposed mitigation measures are adopted, it is not anticipated that there will be a significant impact on the qualifying interests of the cSAC.

Table 11.7 Watercourse Evaluation, Impacts and Mitigation Measures

Name/Ch.	Overall Evaluation	Length of River Directly Affected	Predicted impacts	Mitigation	Residual Impacts
Graiguenakill River	A	20m	Major Negative	Direct alterations to this river will be avoided. Surface runoff from the LS-7512 South Tie-in will be prevented from directly entering this watercourse.	Not significant
Graiguenakill Stream	C	150m	Major Negative	Stream diversion and the installation of bottomless box culvert, as per the SRFB and NRA Guidelines will ensure that high value aquatic habitats are maintained. Aquatic habitats within the new channel will be representative of the baseline habitats. The diversion of a section of the river will reduce the need for culverting. Wetland riparian vegetation will be installed along the banks of this river.	Minor, negative
Stokestown Stream	C	0m	Neutral	As this watercourse will not be affected by the proposed scheme, no mitigation measures have been proposed.	Neutral
Camlin Stream	C	300m	Major Negative	Stream diversion and the installation of bottomless box culverts, as per the SRFB and NRA Guidelines will ensure that high value aquatic habitats are maintained. Aquatic habitats within the new channel will be representative of the baseline habitats. The diversion of a section of the river will reduce the need for culverting. Wetland riparian vegetation will be installed along the banks of this river.	Minor, Negative.
Maudlin Stream	C	300m	Major Negative	Stream diversion and the installation of bottomless box culvert, as per the SRFB and NRA Guidelines will ensure that high value aquatic habitats are maintained. Aquatic habitats within the new channel will be representative of the baseline habitats. The diversion of a section of the river will reduce the need for culverting. Riparian vegetation will be installed along the banks of this river.	Moderate, negative.
Aughnacrew Stream	D	100m	Minor Negative	Bottomless box culvert will be installed as per the SRFB and NRA Guidelines to ensure that faunal movements are not restricted.	Not significant

12 WATER, SOILS AND GEOLOGY

12.1 INTRODUCTION

This chapter presents an assessment of the potential impact of the proposed Bypass on surface and ground waters, and soils and bedrock geology. This chapter also provides details of the proposed mitigation measures and details the residual impacts remaining following the implementation of these measures.

12.2 METHODOLOGY

12.2.1 *Literature Review*

A comprehensive desk study was carried out; the information used in the desk study included:

- Geology of South Wexford – A Geological Description of South Wexford and Adjoining Parts of Waterford, Kilkenny and Carlow. Geological Survey of Ireland, 1994;
- 1:100,000 Scale Map Series, Sheet 23, South Wexford. Geological Survey of Ireland, 1994;
- New Ross 2nd River Crossing and Bypass Preliminary Land Based Ground Investigations – Interpretative Report No. KC6049/2. Geotech Specialists Limited, 2007;
- Geological Survey of Ireland Website – Geological Maps and Databases;
- Office of Public Works (OPW) hydrometric Database (*www.opw.ie/hydro/index.asp*);
- Environmental Protection Agency (EPA) dry weather flow and 95 percentiles flow for Gauged Irish catchments (EPA web site); and
- Well data from Wexford County Council.

12.2.2 *Site Investigation*

Ground conditions were investigated between July and October 2006. Intrusive works included the drilling of one hundred and thirty seven boreholes and the excavation of seventy six trial pits. The findings of this investigation have been used to identify the soils and geology underlying the proposed route. This borehole and trial pit information was cross referenced with the data published by the *Geological Survey of Ireland* (GSI).

12.3 *EXISTING ENVIRONMENT*

12.3.1 *Hydrology*

12.3.1.1 *River Barrow*

The 14.8km of proposed bypass is primarily located within the River Barrow catchment system. The exception to this is the 1.4 km of roadway that drains to the Owenduff river system, which drains southwards into Bannow Bay at the village of Wellingtonbridge. The River Barrow at New Ross is tidal and the proposed road crosses its estuarine channel 5.5km south southwest of New Ross (approx 6.4km downstream of the existing N25 New Ross Bridge) at a location called the Pink Point located between Bearstown on the west side and Stokestown on the east side of the River Barrow.

The River Barrow has the second longest mainline river channel in the country and covers an area of approximately 3,070km^2 to its confluence with the River Suir at Cheekpoint, Waterford Harbour and not including the River Nore which joins it north of New Ross. The River Barrow catchment includes parts of counties Laois, Offaly, Kildare, Carlow, Kilkenny, Wexford and Wicklow. The Barrow is joined by the Nore approximately 4 km upstream of New Ross and is tidal for another 13 km upstream to St. Mullin's. The Barrow, in conjunction with stretches of the canal, provides a navigable channel between New Ross and the main Grand Canal system at Athy.

The main tributaries joining the east bank are the Cushina, Figile and Slate which form one tributary at Monasterevin and the Tully, Greese, Lerr, Burren, Mountain and Poulmounty, while on the west bank it is joined by the Owenass, Triogue, Stradbally, Douglas, Fushogue, Gowran, Powerstown and Duiske tributaries.

Most of the main channel of the River Barrow and its main tributaries are part of the Barrow/Nore candidate Special Area of Conservation (cSAC).

The River Barrow catchment is defined as hydrometric region 14 and represents the surface catchment drained by the River Barrow upstream of the River Nore confluence and all streams entering tidal water between the Barrow railway bridge at Great Island and Ringwood, Co. Kilkenny. This hydrometric region has a catchment area of 3,068km^2. The River Nore catchment is referred to as hydrometric region 15 and represents the surface catchment drained by the River Nore upstream of the confluence of the River Nore with the River Barrow. This region has a catchment area of 2,530km^2.

12.3.1.2 *River Barrow Bridge Crossing*

The road scheme will cross River Barrow estuarine floodplain and main channel over a distance of approximately 700m between N25 Ch1,400m and 2,100m. This represents a major river crossing having an upstream contributing catchment area of approximately 5,550km^2.

The nearest hydrometric gauges that provide fluvial flow estimates on the River Barrow are 14018 at Royal Oak (2.415km^2) and 14027 at Graiguenamanagh (2,762 km^2) and 15006 at Brownsbarnon (2,388 km^2) on the River Nore. The nearest OPW tidal gauge on the River Barrow is 14067 located at St. Mullins (17.5km upstream of New Ross) and the New Ross Port Company operate an automatic water level recorder at New Ross Quays (14061).

Table 12.1 Gauged fluvial flow estimates

Ref	Location	River	Catchment Area (km^2)	Median Flow (cumec)	Mean Annual Flood Flow (cumec)	Dry Weather Flow (cumec)	Gauging period
14018	Royal Oak	Barrow	2415	23.8	148.4	3.3	1940 - 2004
14027	Graigue-namanagh	Barrow	2762	29.9	154.9	2.95	1996 - 2004
15006	Brownsbarn	Nore	2388	27.8	299.8	4.70	1954 - 2004

The maximum recorded water level at St. Mullins (produced by a tidal storm surge on the 28th October 2004) was 3.05m O.D. Malin. Therefore the active floodplain area at the crossing site can be defined as the lands located below 3m O.D. Malin.

12.3.1.3 Stream Culvert Crossings

The road alignment crosses several existing streams and land drains. These watercourses will be accommodated within culverts. The streams and contributing drainage catchments are small at the crossing locations (i.e. catchment areas < 10km^2) and consequently do not to present a serious constraint in respect to the sizing of road culverts.

There are twelve streams crossing the Bypass route within culverts. A summary of these stream culvert crossings and contributing drainage areas are presented in *Table 12.2* and shown in *Figure 12.1 in Volume 2*.

Table 12.2 ***Mainline stream culvert crossings and stream diversion lengths and sizes (refer to Figure 12.1 in Volume 2 of the EIS)***

Principal Structure Ref and Approx. Chainage	Principal Stream Ref:	Approx. Length of Crossing	Approx. Catchment Area	Approx Flow m^3/s
N25 Ch 100	RS-04	60m Open Channel + 200m Stream Diversion (01)	$6.73km^2$	5.5
N25 Ch 3,950 N25 Ch 3,950 N25 Ch 3,950	RS-08	165m, 1800mm Ø Pipe Culvert or Box Structure. TBC + 115m Stream Diversion (02/03)	$3.52\ km^2$	3.1
N25 Ch 3,950	RS-09	10m, 1800mm Ø Pipe Culvert or Box Structure. TBC + 22m Stream Diversion (04)	$3.52\ km^2$	3.1
N25 Ch 4,000	RS-10	55m, 1800mm Ø Pipe Culvert or Box Structure. TBC + 100m Stream Diversion (05)	$3.52\ km^2$	3.1
N25 Ch 7,850	RS-12	65m, 1250mm Ø Culvert Pipe. TBC + 18m Stream Diversion (06)	$0.52\ km^2$	0.6
N25 Ch 7,840	RS-13	15m Stream Diversion (07)	$0.52\ km^2$	0.6
N25 Ch 7,850	RS-14	38m 1250mm Ø Pipe Culvert or Box Structure. TBC	$0.36\ km^2$	0.5
N25 Ch 7,990 N25 Ch 8,320 N25 Ch 8,590 N25 Ch 8,650 N25 Ch 8,700	RS-15 RS-17 RS-18	260m, 2100mm or 1800mm Ø Pipe Culvert or Box Structure. TBC + 220m Stream Diversion (08/09/10/11/15)	$3.65/574\ km^2$	3.2/4.8
N25 Ch 8,590	RS-16	70m, 1250mm Ø Pipe Culvert + 13m Stream Diversion (14)	$1.6\ km^2$	2.0
N25 Ch 8,590	RS-20	70m, 1250mm Ø Pipe Culvert	$0.85\ km^2$	0.9
N25 Ch 2,970	RS-21	55m, 1250mm Ø Pipe Culvert + 10m Stream Diversion (12)	$0.50\ km^2$	0.60
N25 Ch 5,000	RS-22	220m Stream Diversion (13)	$0.95\ km^2$	1.0

In addition to these mainline stream culvert crossings, a number of existing streams will be crossed either by the access roads or realignment / upgrade of existing roads (refer to *Table 12.3* and *Figure 12.1 in Volume 2*).

Table 12.3 Offline stream crossings (refer to Figure 12.1 in Volume 2)

Approximate Mainline Chainage (m)	Principle Stream channel reference	Stream	Catchment Area	Tidal
Existing N25 Ch 240 (South of Glenmore Roundabout)	RS-04	Graignuenakill stream	16.60 km^2	Yes (backwatered at highwater spring tide)
Slip road South of Glenmore Roundabout	RS-01, RS-02 & RS-04	Graignuenakill River	16.60 km^2	Yes (within River Barrow Tidal floodplain)
Realignment of existing minor road	RS-08 & RS-09	Camlin Stream	3.52 km^2	No
Existing N25 Ch 1100 Northeast of Corcoran's Roundabout	RS-24	Aughnacrew Stream	2.03 km^2	No

12.3.1.4 *Road Drainage Outfalls*

Table 12.4 presents the storm drainage areas along the proposed road alignment that will be collected in a conventional storm drainage system and discharged to existing natural watercourses via gravity fall. The Bypass drainage system will discharge to 8 different receiving streams.

The storm runoff volume will be 100% from the hard paved area of the road and 70% runoff from grassed embankment and verge areas.

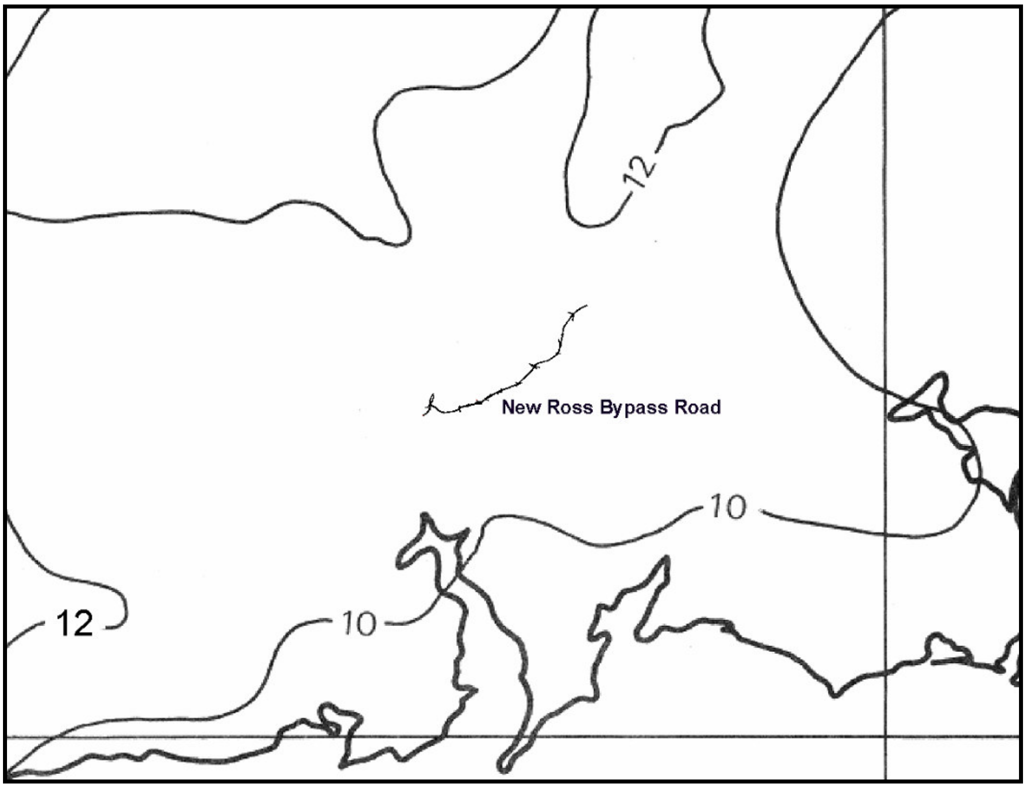
The runoff from each of the above storm drainage catchment areas (refer to *Table 12.4*) will be passed through storm control areas designed to catch the runoff volume and control the peak discharge to the receiving streams so as to limit flooding during periods of high rain intensity. The storm control area usually holds the water for a short period of time and slowly releases it via an outlet flow control valve (i.e. Hydro-break or sluice gate). The maximum permissible discharge to stream and rivers of 3 l/s per ha was assumed.

The natural / green field annual maximum runoff rate per ha is difficult to determine as it will depend on the local characteristics of a given area and consequently will be highly variable. On a catchment scale basis the mean annual maximum runoff rate is approximately 2 to 3 litre per ha. On a smaller scale this annual maximum runoff rate will increase significantly. The Institute of Hydrology 3-parameter catchment characteristic method for small catchments (IH Report 124, 1994) allows Greenfield runoff to be estimated.

$$QBAR = 0.00108(AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$$

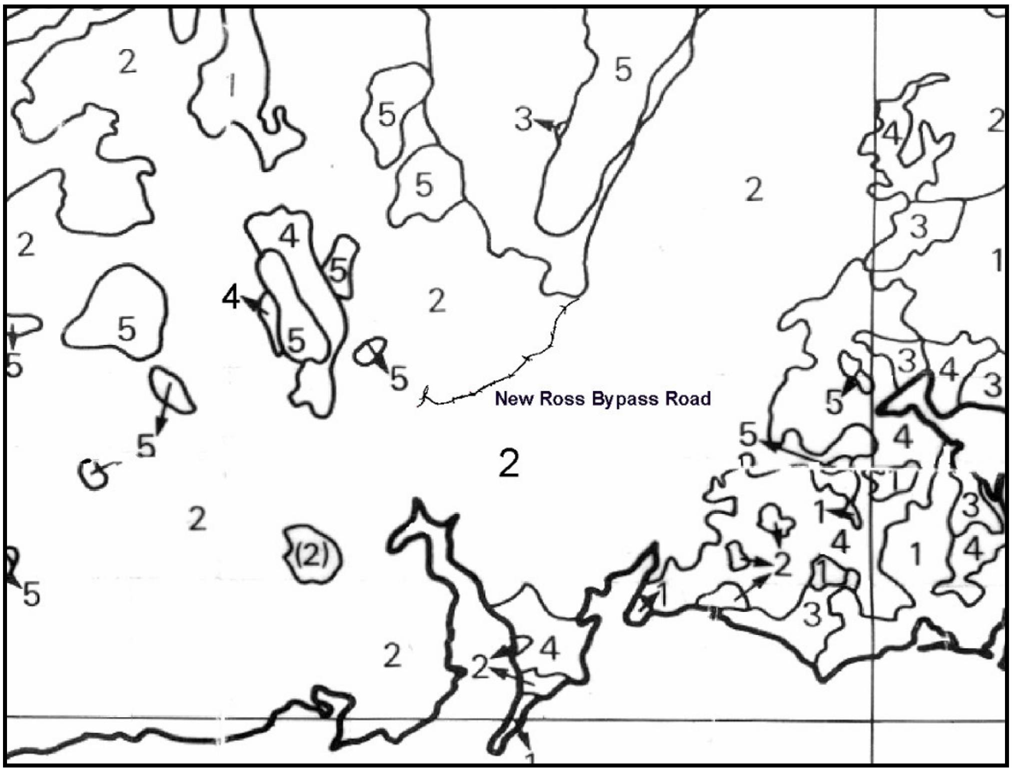
The SOIL factor in the above equation is obtained from the Flood Study (NERC, 1975) Report winter rainfall infiltration potential mapping for Ireland, as shown in *Figure 12.2*.

Figure 12.2 FSR SAAR (mean annual rainfall depth (x 100mm)) Mapping



The Flood Study Report (FSR) mapping shown in *Figure 12.3* for this area gives a Winter Rainfall Acceptance Potential WRAP of Class 2 (*Table 12.5*) for the entire length of roadway.

Figure 12.3 FSR SOIL Index (Winter Rainfall Acceptance Potential) Mapping



The Greenfield runoff rate based on QBAR (mean annual maximum flood rate) is 2.9l/s per ha for SOIL Class 2 based on a minimum AREA = 0.5km^2 and SAAR = 1004mm (*Met Eireann*).

Table 12.4 Proposed road drainage catchment areas and receiving streams

Catchment Reference	Runoff Impervious Area (ha)	Proposed Receiving Watercourse	Outfall Location Approx Chainage
Area A	4.13	RS-02/RS-04	N25 Ch 100
Area B	2.38	RS-06/RS-07	N25 Ch 1,950
Area C	0.45	RS-06/RS-07	N25 Ch 1,950
Area D	2.71	RS-06/RS-07	N25 Ch 1,950
Area E	4.10	RS-08	N25 Ch 3,900
Area F	5.49	RS-08	N25 Ch 3,900
Area G	0.50	RS-11	N25 Ch 5,700
Area H	2.63	RS-11	N25 Ch 5,700
Area J	4.19	RS-13/RS-14	N25 Ch 8,400
Area K	1.55	RS-13/RS-14	N25 Ch 8,400
Area L	4.26	RS-18/ RS-19/ RS-20	N30 Ch 050
Area M	0.2	RS-18/ RS-19/ RS-20	N30 Ch 050
Area N	3.13	RS-21	N30 Ch 2,960
Area P	1.80	RS-21	N30 Ch 2,960
Area Q	2.77	RS-22	N30 Ch 4,950
Area R	1.96	RS-22	N30 East Tie-in Ch 1,100

Table 12.5 Greenfield flood runoff rates for various WRAP soil classes

WRAP Class	SOIL	Annual Maximum Runoff rate
Class 1 Very high winter rainfall acceptance factor	0.15	0.62 l/s per ha
Class 2 high winter rainfall acceptance potential	0.3	2.78 l/s per ha
Class 3 moderate winter rainfall acceptance potential	0.4	5.19 l/s per ha
Class 4 low winter rainfall acceptance potential	0.45	6.70 l/s per ha
Class 5 very low winter rainfall acceptance potential	0.5	8.42 l/s per ha

Based on AREA = 0.5km^2 and SAAR = 1004mm.

The proposed maximum permissible rate was set at 3l/s per ha which generally reflects the estimated Greenfield runoff rate using the IH124 equation and the FSR (1975) rainfall and SOIL mapping (refer to *Figures 12.2* and *12.3*).

The receiving streams warranting attenuation are those watercourses that have local channel restrictions and undersized culverts. The receiving stream channels located within the River Barrow Floodplain area are unlikely to benefit from or require attenuation mitigation measures as such locations will be flooded in any case by the River Barrow either at times of high spring tide, tidal storm surge events or fluvial flood events. At such locations the storm discharges will occur well in advance of the River Barrow flood and thus will avail of the ample spare capacity in the Barrow system prior to the flood.

12.3.1.5 *Low Flow Estimation*

The dry weather flow (98-percentile fluvial flow) in the River Barrow based on extrapolation of measured dry weather flows from the gauging stations presented in *Table 12.1* gives a flow of 8.65cumecs representing a low flow rate of 1.56 l/s per km^2 of catchment area. The 95 percentile low–flow rate is 11.74 cumecs or 2.11 l/s per km^2 of catchment area.

In smaller, ungauged catchments a 95-percentile rate of 1.0 l/s per km^2 is generally adopted. However very small catchments and particularly upland catchments can completely run dry in extended drought periods and a lower rate of 0.5 l/s per km^2 should be considered.

12.3.2 *Soils & Geology*

The regional topography is a gentle undulating glacial landscape. In the south west the route crosses the River Barrow, the western bank rising steeply and the eastern bank forming the river floodplain. The route continues towards the northeast rising and falling over and around a series of small hills. The land is drained by a few minor streams flowing northwest away from the route towards the River Barrow, and to the south west. The majority of the land traversed by the route is farmland.

During the Quaternary period in the New Ross area, glacial sediments, generally till, deposited by ice from the midlands are expected to be much thinner than those in the eastern area deposited by ice from the Irish Sea Basin. The tills may include limestone debris from the midlands and also sandstones, shales and granites from the north western part of the area.

Ground investigation works show the main strata encountered comprising an incomplete cover of Glacial Deposits, predominantly cohesive including granular material of unpredictable extent and materials that were borderline cohesive / granular in nature. Alluvium, comprising clay and peat was encountered in the River Barrow floodplain as well as in the area. In localised areas deposits of weathered bedrock mixed with Glacial Deposits were present overlying the bedrock. Made Ground was also encountered locally and topsoil was also present throughout.

Table 12.6 Overburden Descriptions

Ground Type	Description
Made Ground	Encountered in one location associated with material placed at the edge of an existing road embankment and comprising mainly clayey sandy gravel with cobbles including mudstone and tarmac. Possibly in another location comprising topsoil underlain by cobbles with gravel of granite.
Alluvium	The deposits in the River Barrow floodplain are consolidated comprising a firm to stiff dessicated clay layer to some 0.7 to 1.0m depth underlain by very soft to soft plastic amorphous peat or clay, generally with a high silt content. A basal sand layer was encountered locally. The clay generally included small pockets of fibrous peat. Other areas of thin Alluvium deposits were encountered locally close to streams, comprising silty very sandy gravel.
Glacial Deposits (Cohesive)	The deposits in the River Barrow floodplain generally comprise firm becoming stiff to very stiff with depth, slightly sandy, slightly gravelly clay with occasional cobbles. Elsewhere they were generally firm, stiff or very stiff, locally soft and generally comprised slightly sandy, slightly gravelly clay, locally silt, and with occasional to some cobbles and occasional boulders. The gravel content was generally sub-angular to sub-rounded of mudstone, siltstone and occasional quartz and granite.
Glacial Deposits (Granular)	The deposits in the River Barrow floodplain comprise sand and gravel mixtures with variable fines and cobble content and locally boulders. Elsewhere the deposits had a wide range of particle size grading comprising sand and gravel mixes with variable fines and cobble content. Gravel content was most dominant, including angular to sub-rounded mudstone, siltstone, sandstone and occasional quartz, tending to be more angular and tabular close to rockhead.
Weathered Bedrock	Minor deposits were encountered at shallow depth on the edge of the River Barrow floodplain, comprising clay, sand and gravel mixtures including soft and firm clays and gravels. Elsewhere the deposits were of limited extent and comprised clays and gravels which could be easily excavated, with the exception of occasional cobbles and boulders. Clays were soft to stiff, broadly similar to the Cohesive Glacial Deposits and the gravels broadly similar to the more angular Granular Glacial Deposits.

The depths of the various quaternary deposits vary across the area. In the River Barrow floodplain the following depths are representative of those that were encountered during the ground investigation works:

- *Topsoil* - Generally 0.2 to 0.5m.

- *Alluvium* - 0.0 to 8.0m – thicker towards the river.
- *Glacial Deposits (Cohesive)* - 0.0 to 4.5m – thicker towards the river.
- *Glacial Deposits (Granular)*- 0.0 to 5.0m – thicker towards the river, absent in east.
- *Weathered Bedrock* - 0.0 to 2.2m - present only in localised zones.
- *Bedrock* - Proven by 10.0 to 15.0m approx - rockhead at 0.8m to 16.5mbgl, deeper closer to river.

In the rest of the area northeast from the River Barrow crossing the following strata depths were encountered along the proposed route:

- *Made Ground* - < 1.4m – encountered locally.
- *Topsoil* - Generally 0.2 to 0.5m.
- *Alluvium* - < 2.0m – encountered only locally.
- *Glacial Deposits* - (Cohesive & Granular) Generally < 4.0m. Absent or very thin in some areas. Thicker deposits < 10.0m in some areas. Glacial Deposits are variable, predominantly cohesive with some granular zones. Granular deposits are most notable within the thicker deposits.
- *Weathered Bedrock* - Generally thin < 2.0m. Encountered locally underlying Glacial Deposits and locally below Topsoil where Glacial Deposits absent.
- *Bedrock* - Proven < 10.0m.

The GSI identifies the bedrock geology of the New Ross area as comprising Lower Ordovician metasediments (*Figure 12.4*). A more detailed geological map showing individual units and features within the Ordovician rock, identified as forming the Ribband Group in this area has also previously been published by the GSI (GSI, 1994). The proposed road development is underlain by two formations within this Ribband Group as shown in *Figure 12.5 (Volume 2)*. Generally the western section of the route up to approximate chainage 5800 is underlain by the Oaklands Formation (OA) and to the east of this by the Ballylane Formation (BY).

The Ribband Group is characterised by a thick succession of variously coloured slaty mudstones, the colour variations reflecting changes in which deposition took place. Frequently the mudstones are thinly laminated with pale grey siltstones only a millimetre or two thick, giving them a pin-striped or "ribband" appearance (GSI, 1994).

- *Ballylane Formation* - Characterised by thinly laminated green, green-grey and grey slaty mudstones and green or pale grey siltstones, with occasional greywacke sandstones and andesitic volcanics. The strata is generally described as moderately strong or strong, locally very strong, and slightly or moderately weathered. Weak to moderately weak, highly weathered zones were encountered locally at rockhead and also locally at depth with the less weathered strata, at locations corresponding to probable fault zones.

- *Oaklands Formation* - Characterised by green, red or purple buff and occasional grey slates, laminated with siltstones; with rare tuffs. Site investigation data described the formation as moderately weak to moderately strong and moderately weathered generally to depths approximately 2.0 to 6.0m below rockhead underlain by moderately strong or strong and slightly weathered strata. Weak to moderately weak, highly weathered zones were encountered locally in two locations to depths approximately 6.0 and 11.0m below rockhead as well as being associated with probable fault zones. Bedding fractures are generally steeply dipping, 60 to 90 degrees.

As part of the ground investigation, a seismic refraction survey was carried out in five areas to determine depth to rockhead. Intrusive works comprising boreholes and trial pits along the proposed route encountered bedrock at varying depths generally less than 10m with deeper occurrences in the River Barrow floodplain area averaging around 15m below ground level.

The proposed road development crosses five fault lines along the main route from west to east at approximate chainages N25 Ch 1,500, N25 Ch 3,600, N25 Ch 4,200, N25 Ch 5,800, and N30 Ch 100 (Ballymacar to Corcoran's Cross Junction). From site investigation data, the Oaklands and Ballylane Formations and the mudstones and siltstones units exhibited similar geotechnical properties.

There are a number of major Caledonian fold axes with associated steeply dipping bedding running approximately east north east to west south west across the area.

The Geological Survey of Ireland's karst database indicates that there are no identified karst features located within the area.

There are various mineral workings within the area as shown on *Figure 12.6 (Volume 2)*, including quartz and iron at the Ballymacar Junction.

Numerous cuts below the existing ground level will be made along the length of the development. There will be 13 main cut sections of between 3.0 and 14.0m (approx.), as well as other areas of excavation in shallow cut and close to grade. *Table 12.7* summarises the main areas of cut along the Bypass. Levels are taken relative to the centre line of the alignment.

Table 12.7 Sections of cut along the alignment

Road section	Chainage (m)	Approx length of cut section (m)	Approx. max. cut depth (m)	Approx depth to rockhead (m)
N25 Approx total cut length of 3350m	100 - 600	500	8	1.0 - 3.0, locally <4.0
	850 - 1050	200	3	0.5 - 1.0
	2600 - 3100	500	14.0	0.5 - 2.0, locally <6.0
	4400 - 5300	950	14	1.0 - 5.0, locally <8.0
	5900 - 6400	500	5	0.5 - 1.5
	6800 - 7100	300	3.0	0.5 - 4.0
	8000 - 8250	250	8.0	1.0 - 1.5
	8400 - 8550	150	3.5	1.5 - 3.0
N30 Approx total cut length of 1100m	400 - 700	300	3.5	1.5 - 3.5
	1100 - 1600	500	2.0	1.0 - 3.0
	2200 - 2800	600	8.5	1.0 - 3.0, locally 5.0
	3700 - 3900	200	4.5	0.5 - 3.0
	4400 - 4700	300	2	0.5 - 3.0
N30 East tie-in Approx total cut length of 0m	-	-	-	-

The majority of these cut sections will be into cohesive glacial deposits and bedrock, with small quantities into weathered bedrock and granular glacial deposits.

The main areas of fill are listed in *Table 12.8*. Levels are taken relative to the centre line of the alignment.

Table 12.8 Sections of fill along the alignment

	Chainage (m)	Length of fill section (m)	Approx. max. fill depth (m)
N25	0 - 100	100	9.5
	600 - 850	200	3.0
Approx total fill length of 3300m	1050 - 1200	150	7.5
	2100 - 2250	150	11.5
	2250 - 2600	350	4.0
	3100 - 3450	350	8.0
	3700 - 4400	700	9.5
	5300 - 5900	600	8.0
	6400 - 6800	400	5.0
	7200 - 8000	800	4
	8250 - 8400	150	4.5
	8550 - 8700	150	10.0
N30	0 - 200	200	10.0
Approx total fill length of 1600m	1600 - 2200	600	7.5
	2800 - 3600	800	9.5
	4000 - 4400	300	4
	4700 - 5000	300	4
N30 East Tie-in			
Approx total fill length of 1000m	0 - 1000	1000	6.0

12.3.3 Hydrogeology

12.3.3.1 Regional Hydrogeology

The proposed route is underlain by two aquifer types (*Figure 12.7: Volume 2*). The Oaklands Formation in the western section is classified as a locally important aquifer that is moderately productive in local zones. Locally important aquifers (Ll) are generally capable of 'good' well yields, 100 to 400 m^3/d (1000 to 4000 gph). The Ballylane Formation underlying the eastern section is classified as a poor aquifer that is generally unproductive except for local zones. Poor aquifers (Pl) have 'moderate' or 'low' well yields, less than 100 m^3/d (1000 gph).

The GSI has produced a groundwater protection scheme for the area, identifying one nearby scheme located two kilometres westward and up-gradient of the proposed western end of the route. This is called the Glenmore Scheme as shown in *Figure 12.8 (Volume 2: Drawings).*

Groundwater vulnerability mapping has also been produced by the GSI and presented on their website (*Figure 12.9: Volume 2*). The aquifer to the west up to the Ballymacar Junction is classified as having an extreme vulnerability, with bedrock near to surface in numerous locations. Further northwards the majority is classified as having a high to low rating, with some locations of extreme vulnerability.

In September 2006, groundwater levels in the River Barrow floodplain area within the subsoil strata were monitored with levels varying between 0.5 and 1.2m below ground level. A month later after a period of rainfall, the levels rose to ground level with some artesian conditions recorded up to 0.6m above ground level. Bedrock groundwater levels in the area may be tidally influenced with levels in two boreholes having a 0.3 to 0.4m difference between high and low tides, however as there was sustained rainfall between consecutive day measurements and there were no differences in other boreholes it is unsure is there is an influence without further data.

Throughout the rest of the area to the west, groundwater monitoring piezometers were installed in areas of proposed cut and at proposed structure sites within bedrock or at rockhead. Groundwater ingress observed during the site investigation works was noted in granular deposits and from more sandy zones within the cohesive deposits at depths ranging from approximately 1.5 to 8.0m below ground level. The granular deposits may contain some areas of perched water. In bedrock, levels were observed at rockhead or close to it. Water strikes shallower than 3.0m were generally associated with nearby streams and the plateau area towards the north of the route.

12.3.3.2 Domestic Well Data

The presence of domestic wells in the vicinity of the alignment has been based on information supplied by the Local Authority and the EIS Agricultural Consultant. It includes:

- Details on well locations and owners names collated during the agricultural consultant's survey;
- Wexford County Council hydrochemical laboratory results for water samples taken from private well supplies when the owners applied for domestic well grants;
- Site investigation data including locations of groundwater monitoring piezometers and water levels;
- Locations of wells owned by Owner PWSS#2 (*Figure 12.10*); and
- Review of the Geological Survey of Ireland (GSI) website relating to groundwater vulnerability mapping.

The well supply locations have been assessed as to whether they are likely to be located up-gradient or down-gradient of the proposed alignment and whether they are adjacent to either cut or fill road sections. The general GSI aquifer vulnerability rating has also been considered. *Figures 12.10* and *12.11* show the well locations that have been identified by the Agricultural Consultant (blue and labelled PWSS1[1], PWSS2 etc.) and Wexford County Council (green and with a reference number). It is possible that those that are marked close together may be the same supply well (i.e. the same well may have been separately referenced by Wexford C.C. and the Agricultural consultant). *Tables 12.9* and *12.10* present the data provided by the agricultural survey (*Table 12.9*) and Wexford County Council (*Table 12.10*), with additional information interpreted from available mapping.

Water quality data in *Table 12.10* was available for review from Wexford County Council for private water supplies located within 500m of the proposed road alignment. These sampling locations represent private owners that have applied for individual well grants from the local authority from 1997 to the present. The laboratory data is included in this assessment for guidance only as is it unknown when the samples were taken and the data may be up to 10 years old. Some of the samples had micro bacteriological contamination which would be expected for an agricultural area.

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(1) PWSS1: Private Well Source Supply #1 etc Please refer to Figure 12.10.

Table 12.9 Private water supply sources located close to the proposed alignment (locations obtained from Agricultural Consultant)

Owner no. (*Fig 12.10*)	Easting	Northing	Direction from main road section		Projected location on road section				GSI groundwater vulnerability rating
			m	elevation	Chainage	Cut / Fill	Final level (m)	Nearby groundwater levels (mbgl)	
PWSS 1	267609	123464	70	downgradient	N25-470	cut	-6.5	3.90 to 6.33	E
	267657	123473	34	downgradient	N25-480	cut	-6.0	3.90 to 6.33	E
	267737	123404	48	downgradient	N25-590	cut	-1.0	3.90 to 6.33	E
PWSS 2	269783	123704	28	downgradient	N25-2780	cut	-12.6	3.02 to 5.63	E
	269780	124185	508	downgradient	N25-2780	cut	-12.6	3.02 to 5.63	E
PWSS 3	270212	123519	181	upgradient	N25-3200	fill	6.9	2.00 to 3.21	E
PWSS 4	270509	123493	263	upgradient	N25-3530	fill	0.3	3.60	E
	270542	123503	257	upgradient	N25-3550	fill	0.3	3.60	E
PWSS 5	271418	123910	242	upgradient	N25-4350	fill	1.1	9.08	E
PWSS 6	271391	124001	165	downgradient	N25-4380	cut	-0.7	9.08	E
PWSS 7	271730	124737	257	upgradient	N25-4990	cut	-10.3		E
PWSS 8	271731	124776	293	upgradient	N25-5000	cut	-7.3		E
PWSS 9	272238	124845	136	upgradient	N25-5550	fill	3.0	0.39 to 5.15	E
PWSS 10	273220	125139	50	downgradient	N25-6560	fill	4.7	3.35	E
	273246	125113	16	downgradient	N25-6580	fill	4.2	3.35	E
PWSS 11	273882	125126	260	upgradient	N25-7100	fill	0.2	3.73	E
PWSS 12	274169	126696	635	upgradient	N25-8500	cut	-2.0		E
PWSS 13	274722	126451	20	downgradient	N25-8640	fill	10.0		E
PWSS 14	274868	126296	118	upgradient	N25-8550	fill	0.6		E
PWSS 15	275220	126544	188	upgradient	N30-360	fill	0.3	2.85 to 4.05	E
PWSS 16	275502	126704	102	upgradient	N30-740	cut	-0.7	2.85 to 4.05	E
PWSS 17	276002	126661	328	upgradient	N30-1000	fill	0.0		H-L
PWSS 18	275884	127157	142	downgradient	N30-1300	cut	-1.5		H-L
PWSS 19	276370	127499	111	upgradient	N30-1930	fill	6.4	1.17 to 5.45	H-L
PWSS 20	276716	127743	91	downgradient	N30-2300	cut	-5.8	2.36 to 7.60	H-L
PWSS 21	276594	128108	58	upgradient	N30-2630	cut	-8.5	3.00 to 7.56	E
PWSS 22	276789	128148	71	downgradient	N30-2700	cut	-6.3	2.13 to 6.20	E
	276947	128171	226	downgradient	N30-2750	cut	-3.5	2.13 to 6.20	H-L
PWSS 23	276632	128351	136	upgradient	N30-2880	fill	5.6		E

Owner no. (*Fig 12.10*)	Easting	Northing	Direction from main road section		Projected location on road section				GSI groundwater vulnerability rating
			m	elevation	Chainage	Cut / Fill	Final level (m)	Nearby groundwater levels (mbgl)	
PWSS 24	276884	128853	20	downgradient	N30-3420	fill	5.9	2.65 to 4.18	E
	277405	129294	396	upgradient	N30-4120	cut	-0.2		H-L
PWSS 25	276826	129832	368	downgradient	N30-4230	fill	1.8		H-L
PWSS 26	277322	130272	231	downgradient	N30-4900	fill	1.4	3.85 to 5.18	H-L
PWSS 27	277774	130588	140	downgradient	N30 East Tie-in -350	fill	6.2		H-L

Mbgl: metres below ground level

E : extreme groundwater vulnerability rating; H-L: High to low vulnerability rating

Table 12.10 Water quality data from private supplies sampled from 1997 to present (from Wexford County Council)

Well ID (*Fig 12.10*)	Easting	Northing	Direction from main road section: m	Direction from main road section: elevation	Projected location on road section: Chainage	Projected location on road section: Cut / Fill	Projected location on road section: Final level (m)	GSI groundwater vulnerability rating	Bacteria	E. Coli.	Colour	Turbidity	Taste	Odour	pH	Conductivity	Ammonium	Nitrite	Total Chlorine	Free Chlorine	Aluminium	Iron	Manganese	Nitrates
2371	271236	123507	468	upgradient	N25-4050	fill	9.5	E	9	0	2	0	0	0	6.18	268	0	0	0	0	0.000	17	0.00	25.10
1586	271395	124009	163	downgradient	N25-4390	cut	-0.7	E	0	0	0	0	0	0	5.90	239	0	0	0	0	0.000	0	0.00	36.10
1962	271428	124052	121	downgradient	N25-4440	cut	-2.5	E	0	0	0	0	0	0	0.00	0	0	0	0	0	0.000	0	0.00	
2635	271804	124748	226	upgradient	N25-5140	cut	-7.7	E	130	1	20	0	0	0	5.87	0	0	0	0	0	0.000	35	0.00	42.70
1180	273341	125545	385	upgradient	N25-6900	cut	-3.3	E	0	0	0	0	0	0	6.00	319	0	0	0	0	0.000	15	0.00	37.40
4067	273836	125212	148	upgradient	N25-7110	fill	0.2	E	0	0	0	0	0	0	0.00	0	0	0	0	0	0.000	0		
3192	275437	125997	800	upgradient	N30-80	fill	7.6	E	118	1	0	0	0	0	6.23	417	0	0	0	0	0.000	31	0.00	38.70
2711	275314	126417	327	upgradient	N30-480	cut	-0.8	E	0	0	5	0	0	0	6.06	347	0	0	0	0	0.000	35	0.00	62.90
3075	275534	126745	76	downgradient	N30-760	cut	-0.5	E	0	0	0	0	0	0	5.65	224	0	0	0	0	0.000	17	0.00	51.90
1140	275801	127454	445	upgradient	N30-1400	cut	-1.5	H-L	0	0	3	0	0	0	6.29	340	0	0	0	0	0.033	0	0.016	6.65
1485	276153	127424	250	upgradient	N30-1650	fill	0.8	H-L	108	0	0	0	0	0	6.19	321	0	0	0	0	0.000	18	0.00	64.20
1486	276159	127427	248	upgradient	N30-1660	fill	1.6	H-L	0	0	0	0	0	0	0.00	0	0	0	0	0	0.000	0	0	0.40
1322	276286	127409	126	upgradient	N30-1740	fill	4.7	H-L	0	0	0	0	0	0	5.73	364	0	0	0	0	0.000	12	0.00	48.80
713	276250	127377	124	upgradient	N30-1780	fill	6.1	H-L	0	0	0	0	0	0	5.70	212	0	0	0	0	0.000	0	0.00	42.20
934	276709	127417	176	downgradient	N30-2030	fill	3.8	H-L	0	0	1	0	0	0	6.79	335	0	0	0	0	1.000	30	2	14.5
1014	277339	128924	463	upgradient	N30-3540	fill	2.1	H-L	0	0	7	0	0	0	6.79	337	0	0	0	0	2.000	30	10	16.5
1540	277274	130301	286	upgradient	N30-4900	fill	1.4	H-L	0	0	4	0	0	0	6.19	360	0	0	0	0	0.000	21	0.00	26.40
4170	277402	130569	367	upgradient	N30 East-100	fill	2.4	H-L	0	0	0	0	0	0	5.82	286	0	0	0	0	0.000	0	0.093	0
3925	277399	130587	383	upgradient	N30 East-110	fill	2.4	H-L	5	0	0	0	0	0	5.65	248	0	0	0	0	0.000	32	0.00	22.90
1294	277355	130653	464	upgradient	N30 East-120	fill	2.4	H-L	0	0	0	0	0	0	6.30	350	0	0	0	0	0.000	15	0.00	34.30
4305	277629	130555	443	upgradient	N30 East-220	fill	3.8	H-L	0	0	0	0	0	0	0.00	0	0	0	0	0	0.000	0		
3231	277458	130729	200	upgradient	N30 East-230	fill	3.8	H-L	0	0	6	0	0	0	5.93	256	0	0	0	0	0.000	109	0.00	43.60
2075	277708	130535	137	upgradient	N30 East-280	fill	4.5	H-L	4	0	140	0	0	0	5.91	372	0	0	0	0	0.000	3204	100	27.30
411	277717	130529	126	upgradient	N30 East-290	fill	4.9	H-L	0	0	20	0	0	0	6.38	261	0	0	0	0	0.000	857	2100	3.40
935	278554	130459	850	upgradient	N30 East-355	fill	2.2	H-L	0	0	1	0	0	0	6.89	389	0	0	0	0	0.300	40	5	14.5

12.4 *CONSTRUCTION IMPACTS AND MITIGATION*

12.4.1 *Impacts to Hydrology, Soils and Hydrogeology*

Large construction sites, if not properly managed and operated, can lead to significant impact on surface quality. The main source of contamination is suspended sediment in runoff waters from the work site and accidental spillage of liquid cement, fuel oils and lubricants from construction. The following identifies the main potential issues that have been considered in the assessment which can arise in the absence of appropriate mitigation:

- Silty/soiled water can arise from excavations, exposed ground, stockpiles of soil and excess material, plant and wheel washings, site roads and disturbance of drains and streambeds (i.e. in-stream construction of culverts and channel diversions/improvement works), topsoil placing and landscaping of road embankments and washing of finished road surfaces to remove accumulated soil. During construction phases, exposed soil is often dampened to avoid generation of dust. The dampening waters will impact on nearby watercourses if allowed to migrate.

- Physical interference of streams at crossing points through the installation of temporary culverts and roadways can have significant hydrological consequences on watercourses and fisheries if not appropriately designed.

- Liquid cement due to its high alkalinity and corrosive nature is highly polluting and can give rise to major fish kills. The accidental spillage of oils and hydraulic fluids can have significant water quality consequences on watercourses and fisheries.

- Other sources of contamination during the constructional phase are from the use of bitumen compounds in the wearing course of the road and silanes for waterproofing of concrete surfaces.

- There is the possibility of contamination of the aquifer in the event of accidental spillage during construction particularly in shallow overburden areas.

- The bedrock aquifers may be impacted by various activities involving site clearance / earthworks, and spillages / leakages from construction plant and at refuelling and storage depots located on site.

- In sections cut into the bedrock or shallow overburden, any fissure permeability if present in the underlying bedrock is at risk of blockage by infiltrating sediment/fines generated during earthworks / Soil stripping activities. This may be most notable in the weathered bedrock of the locally important Oaklands Formation aquifer in the west.

- Local reduction of water levels in the cuttings, potentially cut off or reduce groundwater flow paths with possible downstream impacts on groundwater supply and on sensitive groundwater ecosystems.

- Exposed soil that is "dampened" to reduce dust emissions may produce surface runoff that may impact exposed fissured bedrock.

- The usage of lime (as an additive to re-used soils) can result in problem for water quality if allowed to enter the hydrological system.

- The production of fines, which may migrate into the groundwater, from crushed bredrock.

12.4.2 *Constructional Mitigation - Hydrology, Soils and Hydrogeology*

12.4.2.1 *Overview*

The construction mitigation measures listed in *Chapter 10: Terrestrial Ecology* and *Chapter 11: Aquatic Ecology* are also applicable to this section. The contractors will take into account good site works practice in accordance to the NRA guidelines, the Department of the Marine, Communication and Natural Resources, CIRIA and EPA guidelines should reduce such environmental impacts:

- National Roads Authority – Design Manuals for Roads and Bridges;
- CIRIA Report 142: Control of Pollution from Highway Discharges; and
- CIRIA Report C648: Control of water pollution from linear construction projects.

12.4.2.2 *Control Against Flooding*

In particular temporary stream/river crossings will either have sufficient culvert open area to cater for flood flows or will have a low level deck and easily overtopped during flood events.

12.4.2.3 *Protection of Surface Waters*

Instream works will be minimised, where practicable, so as to protect and maintain the natural stream conditions. However, construction of the Barrow Crossing will require such works. Work near rivers and other waterbodies will be carried out during drier months, where possible, so as to minimise the potential runoff volume from the works area.

A buffer area of existing vegetation will be retained alongside watercourses where possible and the use of silt fence may be an option to protect streams and rivers.

There will be no direct surface discharges from the works site to the nearby streams. Runoff will be diverted away from excavated areas; and sediment-laden wash down from aggregate heaps and dust control should be directed to and contained within a settlement area before being discharged to nearby watercourses.

Refuelling and storage of plant and potentially harmful substances will take place well away from any surface water courses. It is essential to ensure the use of cement and wet concrete in or close to any watercourse is carefully controlled.

12.4.2.4 Protection of Groundwater

Site clearance works and excavation of road profile during construction will reduce the protective soil cover, increasing the vulnerability of the underlying aquifers to pollution. As a reduction mitigation measure guidelines associated with the operation of constructional sites, designed to minimise adverse water quality and fisheries impacts (CIRIA 2001 and Dept of the Marine and Natural Resources, 1998), will be implemented. Measures comprise:

- Provision for the protection of soil surfaces from rainfall erosion.
- Stockpiles and spoil located well away from exposed bedrock areas and supply sources (springs and wells).
- Careful control of the use of cement and wet concrete in or close to any exposed areas.
- Storage of fuels, oils and chemicals, if necessary on site, on an impervious base protected by a bund. Refuelling of plant to be undertaken well away from exposed bedrock areas, and any spillages immediately contained on site and the contaminated soil removed from the site for suitable treatment and disposal.
- Foul drainage from site offices and temporary lavatories to be either directly connected into the nearby public foul sewer or removed to a suitable treatment facility.
- Pumping of excavation works to avoid groundwater seepage at excavation faces.

12.5 OPERATION PHASE

12.5.1 Potential Impacts - Hydrology and Water Quality

12.5.1.1 Hydrology

The scale and nature of the proposed scheme has significant potential to impact on the hydrology of the area it traverses both during construction and operation phases. Potential impacts include changes in existing hydrology which may increase potential for flooding in the area, the reduction of infiltration rate of rainfall to groundwater due to the impermeable nature of the road surface and the impact on surface water and groundwater quality due to pollution potential of road drainage. The potential impacts on surface hydrology are listed below.

Structures such as bridges and culverts can obstruct and cause interference with river, streams and floodplains at road crossing points. They can also result in the removal of flood storage as a result of the road footprint or the deposition of material at certain sites.

Hydraulic structures such as bridges, culverts and diversion channels may impede flow during times of flood thus causing water levels upstream of structures to be raised above what would occur in the absence of the structure.

Culvert structures and stream diversions can potentially obstruct / present a barrier to fish passage.

The proposed road horizontal alignment and associated sliproads, roundabouts etc. will result in the diversion/realignment of a number of streams and local drainage channels (refer to *Tables 12.2 and 12.3*). The primary streams affected are RS-04, RS-08, RS-10, RS-15 and RS-22. To ensure appropriate design and mitigate any potential impact on flooding both locally, upstream and downstream detailed flood risk assessment will be carried out as part of the detailed design and Section 50 and 47 Applications for OPW approval under the 1945 Arterial drainage act for culverts and diversions respectively.

There is only one significant river bridge crossing proposed. The proposed scheme crosses the River Barrow 5.5km south-southwest of New Ross at The Pink Point. Preliminary flood assessment of the river reach indicates that under 100 year design flood conditions the flood level at the road crossing will be less than 4m O.D. Malin. Under such conditions a large proportion of flood flow will be conveyed on its overbanks. The impact of the proposed N25 Bridge Structure on upstream flood levels in the River Barrow could represent a moderate to significant impact if adequate provision for overbank flow through the road embankment is not made. Mitigation measures are set out in *Section 12.5.2*.

The volume of flood storage lost to the road embankment on the Barrow floodplain is not significant in respect to the large size of the floodplain, contributing catchment and the damped nature of the Barrow flood peak at the road crossing point (gradual rise and fall of the hydrograph over a number of days). The flood storage loss impact resulting from the road embankment is classified as minor and therefore does not require mitigation.

Increase in runoff characteristics due to impervious road pavement and increased transmission time and point loading will result in a possible increase in the overall flood peak magnitude and flooding frequency in the smaller receiving streams. Diversion of water between local drainage catchments due to the location and drainage runs of road storm system and outfalls will result. Such diversions are considered minor and do not require mitigation.

The combined impervious pavement area of the bypass road scheme is c. 56 ha. A paved area has a more rapid response to rainfall than a greenfield area (i.e. it will drain more quickly). The volume of runoff is also greater due to the impervious nature of the pavement, which does not allow infiltration. The storm/drainage water from the scheme will be collected in pipes, open channels or grass swales and will be discharged to receiving water courses at 8 proposed outfall locations (*Table 12.4*). Such road drainage storm outfalls could potentially have a moderate to significant local impact on flooding in the receiving stream, depending on the stream's channel capacity and the capacity of existing downstream culverts. This represents a moderate to significant local impact and will require mitigation. Mitigation measures are set out in *Section 12.5.2*.

The presence of the proposed road and drainage scheme is likely to result in some alterations of local runoff flow and direction in the immediate environs of the road. It also has the possibility of conveying storm water more rapidly to surface water bodies thus increasing the peak runoff rate and runoff volume. This increase in peak flow may cause flooding where there is either a lack of channel capacity or a restrictive structure downstream of the outfall. This represents a moderate to significant local impact and will require mitigation. Options to mitigate this impact include attenuating the discharge from the road and / or by providing increased channel capacity if appropriate. Mitigation measures are discussed further in *Section 12.5.2*.

Outfall discharging to watercourses within the River Barrow floodplain reach will only produce slight increases in stream flow as the storm volume is small compared to the river and tide flood volume and the timing of the peaks would rarely coincide. In this case the potential impact is classified as a slight negative local impact and does not require mitigation.

12.5.1.2 Water Quality

Road runoff can detrimentally affect the water quality of receiving surface watercourses and groundwaters. Roads are designed to drain freely thereby preventing a build-up of standing water on the carriageways. Contaminants deposited on the road are quickly washed from the road surface off during rainfall and in considerably higher concentrations during the first flush runoff.

Road runoff contamination may be generated from a variety of sources including construction, traffic, accidental spillages and atmospheric deposition. Critically first flush runoff events and immediate runoff of rainfall after a dry period have a tendency to occur in the summer period when the stream flow and available dilution is low. This can lead to significant local impact on the water quality, fisheries and the benthos of the receiving stream. The most likely impact of untreated road runoff is the increased total and suspended solids loading and associated trace amounts of heavy metals and hydrocarbons.

The major contaminants associated with roads are suspended solids, hydrocarbons including Polycyclic Aromatic Hydrocarbons (PAHs), which are relatively persistent and toxic in the environment, metals (copper, zinc and formerly lead), pesticides and herbicides, de-icing agents, nutrients, and those arising from accidental spillages (chemicals, biological and bacteriological). Road runoff contamination may be generated from a variety of sources: traffic, maintenance, accidental spillages and atmospheric deposition.

Table 12.11 below presents extracted from the UK Design Manual for Roads and Bridges Volume 11 annex III presents typical Pollutant Build-up rates per annum (kg/ha/a). The highlighted column represents the expected data for the New Ross Bypass. It should be noted that the category which the proposed Bypass is placed (15,000 - 30,000) represent the upper-end of the likely future flows along the Bypass (*Table 5.2*).

Table 12.11 Typical Pollutant Build-up Rates (kg/ha/a)

Traffic Flow Two Way AADT	Total Solids (Kg)	COD (Kg O2)	NH4 – N (Kg N)	Total Copper (Kg)	Soluble Copper (Kg)	Total Zinc (Kg)	Soluble Zinc (Kg)
< 5000	2500	250	4.0	0.4	0.2	0.4	0.2
5000 - 15000	5000	400	4.0	0.7	0.3	1.0	0.5
15000 - 30000	7000	550	4.0	1.0	0.4	2.0	1.0
> 30000	10000	700	4.0	3.0	1.2	5.0	2.5

The UK DMRB recommends that a 5-day build-up of contaminants on the road surface discharging to the 95 percentile low flow is used to assess the impact on receiving streams from road drainage discharges. The first flush rainfall event is usually taken as 10 to 15 mm/day.

The impact to groundwater and standing waters is estimated on the basis of an annual loading rate, the mean annual rainfall and an appropriate recharge coefficient to the aquifer system (depends on the road drainage collection system – filter (French) drains, swales, closed pipes, etc.).

The likely impact of untreated road runoff from the proposed New Ross Bypass is the increased total and suspended solids loading to receiving waters and associated trace amounts of heavy metals (Cu, Zn and Lb) and hydrocarbons. In respect to the fishery sensitive receiving streams, this potential impact represents a significant local negative impact and will require mitigation. Mitigation measures are set out in *Section 12.5.2*.

The Bypass will discharge to the following streams presented in *Table 12.12.* All receiving streams are of limited catchment area and thus result in low summer base flows resulting in poor available dilution during the critical low flow periods.

Table 12.12 Low Flow Dilutions within Receiving Streams 10mm

Stream reference	Stream catchment area	Estimated 95-percentile low flow	Road paved area	Available Dilution
RS-04	6.7 km^2	3.5 l/s	4.13 ha	Moderate to low
RS/06/rs-07	0.5 km^2	< 0.5 l/s	5.54 ha	Very low
RS-08	3.5 km^2	< 2 l/s	9.59 ha	Very low
RS-11	1.3 km^2	< 1 l/s	3.13 ha	Very low
RS-13/RS-14	0.52 km^2	< 0.5 l/s	5.74ha	Very low
RS-18/19/20	6.6 km^2	3.3 l/s	4.46 ha	Moderate to low
RS-21	0.5 km^2	< 0.5 l/s	4.93 ha	Very low
RS-22	0.95 km^2	< 0.5 l/s	4.73 ha	Very low

Table 12.13 Storm Control Area Storage Requirements

Road Drainage Areas	Area (Hectare)	Max. allowable discharge (l/s)	Approx. Retention (m^3)
Area A	4.13	8.25	2000
Area B	2.38	6.75	1600
Area C	0.45	1.50	400
Area D	2.71	5.25	1250
Area E	4.10	10.5	2500
Area F	5.49	8.25	2000
Area G	0.50	1.50	400
Area H	2.63	5.25	1250
Area J	4.19	9.0	400
Area K	1.55	4.50	1100
Area L	4.26	9.75	2200
Area M	0.2	1.50	400
Area N	3.13	4.50	1100
Area P	1.80	4.50	1100
Area Q	2.77	6.75	1600
Area R	1.96	4.50	1100

The proposed road discharges and associated pollutant loadings represent a moderate to significant local impact on the water quality in the receiving streams and will require mitigation. Mitigation measures are set out in *Section 12.5.2*.

12.5.1.1 Accidental Spillages

The risk of serious pollution to receiving watercourses resulting from accidental spillage is a major issue with road infrastructure projects. The risk of accidental spillage has been calculated for each of the proposed receiving streams using the methodology in the UK DMRB and predicted traffic flows for the Design Year (*Table 5.2*).

The risk is influenced by the type of roadway (dual carriageway or motorway), length of road, the traffic volume, and proportion and type of heavy goods vehicles (HGV's). The UK Highway Agency (HA) provide a simple formula for assessing the likelihood of an accident involving a heavy goods vehicle carrying hazardous liquids (mainly oil and petrol tankers) with the assumption that this will give some indication of the pollution risk.

$$P_{acc} = RL * SS *(AADT * 365.25 * 10^{-6})*(\%HGV / 100)$$

Where:

P_{acc} = probability of serious accidental spillage in one year over a given road length

RL = road length in kilometres

SS = serious accidental spillage rate per million HGV km/year

= 0.0024 urban motorway

= 0.0019 rural motorway

= 0.0075 all purpose Urban Road

= 0.0025 all purpose Rural Road (recommended factor for New Ross Bypass)

AADT = annual average daily traffic

%HGV = percentage of Heavy Goods Vehicle

The probability that a spillage will cause a pollution incident is calculated thus:

$P_{pol/year} = P_{acc} * P_{pol}$

Where:

P_{pol} = the risk reduction factor, dependent upon emergency services response times, which determines whether a serious spillage will cause a serious pollution incident.

P_{pol} = 0.75 for emergency response time to site > 20minutes and discharging to a sensitive river classification (assumed applicable to New Ross).

P_{pol} = 0.3 for emergency response time to site > 20minutes and discharging to an aquifer.

The risk varies with length of road discharging to outfall and the traffic volume of HGV's on the road. Where the return period of an accidental pollution event is 100years or less (i.e. more than 1%), mitigation measures are deemed to be necessary. All individual outfalls were found to have low risk (> 1 in 100year or less than 1%) of serious pollution and the pollution risk for the entire c. 15km of road was found to be 43 years for an average (over the three Bypass links for which data was provided) AADT of 15,000 (Design Year).

12.5.2 *Mitigation Measures - Hydrology and water quality*

The Contractor will seek and receive OPW consent for all proposed watercourse crossings (i.e. The Barrow Bridge Structure and stream culvert crossings, new and upgraded) in order to satisfy the requirements of Section 50 of the Arterial Drainage Act 1945 and the necessary hydraulic assessment reports of the individual crossings furnished to the OPW as part of the Section 50 application. The design flow for all culvert and bridge crossings is the 1 in 100 year flood event increased by 20% to allow for climate change.

Culvert and water crossings design guidelines from the Southern Regional Fisheries Board and the NRA's *Guidelines for the Crossing of Watercourses during the construction of National Road Schemes* (March 2005) should be taken into consideration when designing culverts. Consultation with the Southern Regional Fisheries Board will be undertaken by the contractor during the detailed design stage. The minimum culvert size to be used in existing watercourses will be a 900mm diameter, or greater if required for ecological purposes.

Road drainage has been designed to accommodate the existing natural hydrology in the vicinity of the Bypass. This will include for the interception of overland, interflow and groundwater flow by the road footprint and its safe disposal to nearby existing streams/drains.

Runoff from the road will be attenuated to a discharge rate appropriate to the characteristics of the receiving watercourse so as to prevent flooding of land.

Runoff from the road will be subject to treatment to ensure that it does not significantly reduce the water quality in the receiving environment. All storm water will be passed through oil/petrol interceptors and storm control areas for attenuation and settlement prior to outfalling to the receiving watercourses. The storm control areas along the Bypass will act as additional protection against serious pollution incident allowing major spills to be isolated within the control area for removal/treatment.

Current best practice in the design and implementation of Sustainable Urban Drainage systems (SUDs) will be utilised and the Contractor will have regard to the following documents when designing the road drainage system. CIRA (2001) Sustainable Urban Drainage Systems – best practice manual for England, Scotland, Wales and Northern Ireland and CIRIA (2000) Sustainable Urban Drainage Systems – design manual for Scotland and Northern Ireland.

At the River Barrow Bridge crossing the soffit height of the structure will be designed to provide adequate clearance (minimum 1m freeboard above the 100 year design flood level) to allow flood debris to pass underneath unhindered. There is a navigation requirement that considerably exceeds the flood/hydraulic freeboard requirement. (i.e. 36m above mean spring high water level).

The integrity of the flood plain in terms of overbank conveyance at the crossing of the Barrow Estuary will be maintained by the provision of a sympathetic bridge structure allowing overbank flood conveyance to take place on both banks, thus reducing the contraction impact of the road crossing on the River Barrow floodplain which must evacuate combined fluvial and upstream tidal waters.

First flush volumes of a minimum of 15 mm rainfall intensity will be accommodated in storm control areas prior to outfalling to sensitive receiving watercourses. Such facilities can also be used to contain if necessary accidental spillages.

A maintenance program in respect to the regular inspection and maintenance of road outfalls, petrol interceptors, filter drains, open drains, water quality improvement/ wetland systems and road culverts should be prepared and implemented throughout the operational phase of the scheme.

12.5.3 Potential Impacts - Soil & Geology

The proposed development will increase the potential for soil erosion during flooding events. This may result from the increased runoff from the carriageway during intense rainfall, or where the surface water / groundwater drainage channels have been affected. Surface water bodies will potentially have a higher degree of channel bank erosion, this in turn leading to the loss of ecological habitat. Erosion will also increase sediment loading which will potentially damage aquatic life.

Removal of overburden subsoil material at cut areas will result in an increase in vulnerability of the underlying aquifer to pollution. Most of the route particularly southwest of the Ballymacar Junction is classified as having an extreme vulnerability with the initial 5800m of the route overlying a locally important aquifer.

It is expected that at each of the eleven main cut sections the road vertical alignment will be cut into bedrock, however from site investigation data it is expected that the levels will be below the groundwater table. There are two potential areas that may be impacted where drainage from nearby hillsides is likely to result in the groundwater table being above the cut level, between chainage N25 Ch 6800 to 7100 and N30 Ch 2100 to 2800. In all areas cut into bedrock there will be a potential impact to the quality of the groundwater from contaminated water runoff.

Materials generated in the road cutting section can be utilised in the fill section of the proposed road. If the volume of fill exceeds that of cut and consequently additional material is required, this can be sourced locally. Site investigation data indicates that the majority of cohesive and granular glacial deposits and weathered bedrock clays may be reused, apart from some soft material close to surface. Also the majority of bedrock material once crushed will be free-draining and suitable for reuse.

There will be no impact of the road development on contaminated land as the route is rural and landuse is predominantly agricultural and there are no landfills or other contaminated land areas affected.

The proposed road will have a potential impact on cavity development and collapse within the bedrock. It is possible that surface run-off from the carriageway, may flow preferentially into the bedrock and lead to cavity development. Possible impact will be greatest at the cut sections where the level is cut into bedrock or stops close to it.

In areas of embankment fill, there will be a potential impact on settlement in the underlying strata. With an embankment height of 5.0m the long term settlement depth in a soft to firm clay up to 5.0m deep is expected to be 70mm, in firm clay of 50mm and in a stiff-clay of 30mm. For an embankment fill height of 10m these figures would be 140mm, 90mm and 60mm respectively.

12.5.4 *Mitigation Measures – Soils and geology*

The vertical alignment has been designed as far as possible to balance the amount of cut generated and fill material required, which will reduce the need to dispose of surplus material off site. As noted in *Chapter 3*, it is anticipated that there will be a surplus of approximately 135,000m^3 of acceptable fill material and 58,000m^3 of topsoil. The topsoil surplus may be used for landscaping purposes. Regarding the need to import material off-site, local sources should be used as afar as possible. Existing quarrying locations recorded on the GSI website are shown on *Figure 12.6*.

Where soft ground is encountered, this will need to be removed, and fill material imported. Consideration will be given to the type and source of this material, and ground treating methods or piling to bedrock may be required, particularly in the low lying River Barrow floodplain.

Where the route is cut directly into bedrock or underlain by a thin subsoil cover, then the road design should be such that any subterranean drainage paths encountered are not affected in terms of flow conveyance and water quality.

Changes in the chemical composition of soils, caused by flow of carriageway runoff should be prevented. This may result from the flooding of unsaturated soils, or rise in groundwater levels above 'normal', thus allowing the water to react with the chemical constituents in the soil. At sites of particular sensitivity clay bunds may be required and sections of closed drain should be considered where domestic well supplies are located nearby. The addition of lime to soils prior to reuse needs to be carefully undertaken, if deemed necessary. The Contractor will apply best practice to take into account the vulnerability of the underlying aquifer.

12.5.5 *Potential Impacts - Hydrogeology*

There may be a reduction in the quality of groundwater locally as a result of contaminated road runoff infiltration via proposed filter drains. During intense rainfall events, runoff from the road pavement is likely to contain some degree of silt/dust and pollutants from atmospheric deposition, vehicle emission, litter and general road maintenance, as well as from possible accidental road spillage incidents.

It is not anticipated that the proposed route will affect the baseflow of the region's main watercourse, the River Barrow. Smaller spring fed streams may be affected at deep cutting sites which intercept the groundwater table similar to the impact on local domestic borehole and spring water supplies. These impacts are localised and rated moderate in severity.

The only groundwater Source Protection Area, the Glenmore Scheme is located approximately 2km to the west of the proposed route. It is also considerably up-gradient of the development and is therefore not likely to be impacted.

During the operational phase of the development, the proposed development may lead to the alteration of natural groundwater flow patterns. Deep road cuttings below the permanent water table have a potential to affect local well yields and spring recharge particularly if these are shallow, located down gradient and within 250m of the cutting. Outside of this the impact is generally slight to imperceptible.

There may be a reduction in the quality of groundwater locally as a result of contaminated road runoff infiltration via proposed filter drains. During intense rainfall events, runoff from the road pavement is likely to contain some degree of silt / dust and pollutants from atmospheric deposition, vehicle emission, litter and general road maintenance, as well as from possible accidental road spillage incidents.

The most vulnerable wells will be those located close to the cut sections especially where the bedrock is exposed. The locations that are immediately up-gradient of these sections will be at risk of dewatering as the groundwater table is lowered through seepage through the cut rock faces, and those down-gradient will be at risk from the migration of contaminants from the road surface into the water supply.

Fill sections may also have an impact, in particular from contamination issues. Any surface water runoff has the potential to infiltrate the subsoil and migrate into the groundwater. Where wells are located downgradient, short distances from the proposed alignment and where the subsoil thickness is shallow corresponding to an 'extreme' vulnerability rating they will be considered at risk. To a lesser degree areas of fill may reduce the 'natural' surface runoff and drainage from the land upgradient of the supply wells. This may lead to flooding conditions close to the development, which could act as a pathway for contaminants to enter the well supplies.

Moving west to east the following private wells have been identified as being potentially at risk.

N25

N25 Ch 470 – 590	Three wells owned by Owner PWSS#1 (*Figure 12.10*; hereafter wells referred to in this text as Owner#, Owner#3 etc.) west of the River Barrow that are considered to be at risk from the development. These vary from approximately 30 to 70 metres downgradient of the proposed alignment which will be cut to depths from 1.0 to 6.5m below ground level north of the wells. Nearby site investigation boreholes indicated the depth to water table of between 3.90m and 6.33m. The area has also been mapped by the GSI as having an extreme groundwater vulnerability.
N25 Ch 2300 to 3300	East of the River Barrow around Stokestown Castle, Owner #2 has two wells identified as being downgradient of the development. Another information source has identified four wells on the property each appearing to be to the north and downgradient of the alignment. It is likely that two of these are those listed during the Agricultural Consultant's survey. The road alignment will be cut up to a depth of 12.6m below ground level in this area and the wells are therefore at considerable risk. Nearby water levels in exploration boreholes indicated levels from 3.02 to 5.63m below ground level. The vulnerability is given an extreme rating as very shallow soil coving in the area, and the cut section will most likely be into the underlying bedrock aquifer.
N25 Ch 4380 to 4440	Three wells located in Camlin, one identified as belonging to Owner #6 and likely to also be 1586, and 1962 are located approximately 121 to 165m downgradient of the main road development, and are closer to a minor access road. The main road section immediately upgradient will be cut from 0.7 to 2.5m and it is possible that the water table in these wells could be affected. As there will be some development works of an access road just upgradient, even though it will comprise fill material, as it is so close there may be a slight risk from surface runoff migrating into the supplies depending on their actual elevations.
N25 Ch 4990 to 5140	Three wells located close together in Camlin, identified as Owner #7, Owner #8 and 2635 are located approximately between 226 and 293m upgradient of the development that will have cut sections from 7.3 to 10.3m. With such a deep cut, these wells may be affected through dewatering.

N25 Ch 6560 to 6580	Two wells belonging to Owner #10 in Creakan Upper are located approximately 16 and 50m upgradient of the development. The water table in these is unlikely to be affected, however as they are relatively close there may be a slight risk from surface runoff migrating into the supplies depending on their actual elevations. With an associated fill level of 4.2 to 4.7m above ground level the development may act as a barrier to surface water runoff and result in localised flooding which could impact the water quality.
N25 Ch 6560 to 6580	Owner #13's well in Ballymacar is located only 20m downgradient of a 10m fill section. As the well is so close to the proposed development it is likely to be at risk during the development works, especially from the migration of pollutants.

N30

N30 Ch 740 to 760	Owner #16's well in Ballymacar is located 102m from a section that will be cut to 0.7m. The location is likely to be the same as that identified as 3075. It is unclear whether this well is either upgradient or downgradient of the development. There may be a slight risk of dewatering at this location if it is upgradient, and possible contaminant issues if downgradient.
N30 Ch 1300	The well belonging to Owner #18 in Ryleen may be potentially at risk. It is located approximately 142m downgradient of a 1.5m cut section. The GSI give the area as having a high to low vulnerability rating, however as the well is located on a commercial property the actual usage may be high and the zone of influence during pumping may extent to the road development. The well would therefore be at risk from contaminants migrating into the supply.
N30 Ch 2300	Owner #20's well in Ryleen, approximately 91m downgradient of a 5.8m cut section is potentially at risk. The groundwater vulnerability rating for the area is high to low as not enough information was available at the time of mapping by the GSI. Nearby water table levels of 2.36 to 7.6m below ground level have been observed in monitoring piezometers, and the water table is therefore likely to be intercepted, increasing the potential for contaminants to migrate into the system.

N30 Ch 2630 In Lackan, Owner #21's well is located approximately 58m upgradient of the alignment. The area is given an 'extreme' vulnerability rating based on shallow subsoils. With a cut section of 8.5m most likely into bedrock the well is at risk from dewatering.

N30 Ch 2700 Also in Lackan, Owner #22's is 71m downgradient of the alignment and will be at risk from contaminant sources. The cut section will be 6.3m below ground level, that will intercept the water table, reported to vary from 2.13 to 7.56 m deep in nearby monitoring piezometers.

N30 Ch 3420 Owner #24's well in Lackan is only 20m downgradient of the development that will be adjacent to a fill section of 5.9m. This well will be at risk of contamination during the development works and throughout the operational phase.

N30 East Tie-in

N30 East Tie-in Ch 140 There is a slight risk of contamination during both the development and operational phases to Owner #27's well that is located 140m downgradient of the alignment. The adjacent section will be filled to 6.2m. As the surrounding ground has been mapped by the GSI as having a 'high to low' vulnerability the potential impact may not be too high.

It is considered that the remaining wells that have been identified along the length of the development will not be impacted by the proposed development. These have been assessed to be either too far away from the actual alignment or where they are adjacent to fill sections that will have less potential impact to those along cut sections. The majority of the 'non-impacted' wells are also located within areas with deeper soil cover overlying the aquifer, and have thus been assigned 'high to low' vulnerability ratings rather than 'extreme'.

12.5.6 Mitigation – Hydrogeology

Where sensitive sites or water supply wells are located close to the Bypass, mitigation measures to reduce dewatering through cut sections will be employed. One such option is the use of impermeable clay bunds at the cut interface to avoid drawdown in the cutaway. This bunding should be extended in depth to an impervious stratum.

Where there are high infiltration rates and shallow free draining overlying soils, the drainage system will require the use of filter drains or swales to reduce the impact to the underlying aquifers.

Subterranean drainage intercepted in the bedrock cuttings during the construction phase will need to be continued through the use of either a piped solution or a sufficiently permeable granular bed beneath the roadway so as to mitigate possible long-term changes in the drainage.

The potential for cavity development as a result of localised discharges to groundwater swill be reduced, as appropriate, by discharging any generated drainage to designed outfalls to surface watercourses.

Road drainage will be enclosed (closed-pipe system) along the vulnerable road cut sections to prevent uncontrolled infiltration to the aquifer, as appropriate. In addition, monitoring of water levels in well / spring supplies within 250m of the road cuttings should be undertaken during the construction phase and if shown to be adversely impacted by the time of the operational phase, then either an alternate source should be provided or the well should be deepened to allow deeper abstraction from the bedrock aquifer.

12.6 *RESIDUAL IMPACTS*

12.6.1 *Hydrology*

The following are the residual impacts of the Bypass on the drainage and hydrology of the receiving environment.

The proposed road drainage will be collected and discharged to watercourses at 8 proposed outfall sites resulting in potential localised water quality impact at these outfall sites. This impact will be minimised through the use of filter drains, swales or water quality improvement control areas (constructed wetlands) or similar devices designed to provide extended retention for particulate settlement and filtration. The residual impact will be minor negative local impact to receiving water quality.

The proposed flood control measures incorporated in the proposed road drainage system will minimise increases in peak runoff to the receiving stream. Increases in flows are unavoidable in the smaller streams, as the proposed road will divert some runoff from adjacent stream drainage areas. Local channel improvement works, where identified as necessary, will minimise this impact. A residual impact of the road drainage will be the overall locally increased flow volume to the receiving streams, the significance of this on flow velocities and flood levels can be minimised by the proposed flood control measures and/or local channel improvement works. The residual impact will be a minor to moderate local negative impact.

Risk of serious contamination to surface watercourses from accidental spillage is shown to be small based on the DMRB risk assessment method and this is reduced even further by the use of filter drains and water quality improvement control areas/wetland systems and petrol interceptors upstream of the outfall.

The presence of culverts and other structures spanning watercourses slightly increases the risk of flooding due to debris blockage potential and due to potential uncertainty in estimating the design flow. This can be minimised by increasing the capacity of the culvert and providing a regular programme of inspection and maintenance.

12.6.2 *Soils, Geology & Hydrogeology*

Road construction may interfere with fissure / preferential subterranean flow pathways preventing natural groundwater drainage. Silt and sediment escapement may block or reduce fissure permeability affecting local drainage and groundwater flow. Proper site management and, where domestic well supplies are close to the road scheme, the use of piped/porous media drains, particularly in the areas of exposed bedrock where sediments are free to enter the fissures, is expected to reduce the impact. The residual impact will be of minor negative local impact to receiving groundwater quality and quantity.

The use of filter drains in cuttings and shallow fill sections (<1m fill depth) and swales in the deeper fill sections will allow road drainage to infiltrate and potentially contaminate the soil and groundwater. This impact is considered slight given the filtering effect provided by Filter (French) drains and swales.

Risk of serious contamination of the soil and groundwater from accidental spillage is shown to be relatively small based on the DMRB risk assessment calculations. A large proportion of this theoretical accidental spillage would come from hydrocarbon compounds which are less dense than water and are highly immobile in soils, which reduces the risk of impact. The inclusion of oil / petrol interceptors at outfall locations will also reduce the impact, which would then be considered slight.

13 AGRICULTURAL PROPERTIES

13.1 INTRODUCTION

This section discusses the impact on agricultural properties of the road scheme. The following issues have been addressed:

- overview of agricultural characteristics of the area;
- total land take of the scheme;
- areas of soil types and land quality affected;
- details of enterprise types on farms;
- number of farms affected by the route;
- impact from land take;
- impact from severance;
- impact on access to land parcels;
- impact on farm structures (building/ yards) etc; and
- mitigation measures to reduce impacts, where appropriate.

13.2 METHODOLOGY

The assessment has been based on aerial survey information, on site survey and meetings and discussions with landowners. Most of these meetings took place in September 2005 and were undertaken as part of the preparation of this section to assess impacts on individual agricultural landholdings. All farms directly impacted (e.g. access, land take, severance, loss of farm buildings) by the construction and operation of the road scheme have been identified and assessed. The assessment has considered the affected area, which refers to the combined land area of all the individual farms which are directly impacted. It should be noted that farmers affected may also have other land outside the affected area, which has not been included in this study. The land take required for the construction and operation of the scheme has also been considered.

In assessing impacts the significance criteria outlined in *Table 13.1* have been developed.

Table 13.1 Significance criteria for agricultural properties

Impact	Significance Criteria
Severe	The farm enterprise cannot be continued as a result of the scheme or there is a dramatic change required in the future management of the farm. This would occur where land take was of such a scale that the remaining land would not form a viable unit or where severance was of such a nature to make the holding unworkable or where important farm buildings and facilities were removed and could not be replaced. Impact of this degree would be most likely to occur on a dairy or stud farm.
Major	The farm enterprise cannot be continued without considerable management or operational changes. This would typically occur where the farm was split in two due to severance but where access between the severed portions and the farm buildings could still be achieved effectively. Typically where the impact is major an enterprise change would be necessitated e.g. from dairy to beef.
Moderate	The farm enterprise can be continued as before but with increased management or operational difficulties. While portions of the land would be severed the enterprise mix would be such that the farming system could continue perhaps with additional labour contractor charges or other changes.
Minor	The farm enterprise experiences inconvenience as a result of the scheme. Severance would not occur and the farm buildings and facilities would be left in place. Typically only a small portion of land would be removed at the boundary of the farm.
Not Significant	An impact is not significant where the farm enterprise suffers a slight inconvenience.

These criteria assess the medium to long term impacts in terms of how the farm will operate and what degree of change will be caused by the proposed road.

13.3 DESCRIPTION OF EXISTING AGRICULTURAL PROPERTIES AND PRACTICES

13.3.1 *Overview*

This section compares agricultural activity at a national and county level with that of the area affected by the road scheme.

13.3.2 *Review of National Statistics*

This assessment refers to the most recent National Census of Agriculture Statistics, derived from the June 2000 Census of Agriculture (in particular Tables 1, 4, 41 and 42) – the 2000 Census is the latest complete Census of Agriculture. Reference is also made to the Fact Sheet on Irish Agriculture; December 2006 and Compendium of Agricultural Statistics 2006 on the official Department of Agriculture website.

In 2005, nationally there were approximately 4.35 million hectares of land used for agriculture (the total national area is 6.9 million ha) and this represented approximately 9% of Ireland's Gross Value Added at factor cost. Between 1991 and 2000 there had been a drop of 17.5% in the total number of people working on farms in Ireland. In 2005, approximately 5.7% of the Irish work force worked on farms and approximately half of these workers had off-farm employment. There is a national historic trend of decreasing number of farms and an increasing average size. For example, in 1991 the average farm size was 26 hectares - in 2000 the average size was 31.4 hectares and in 2003 the average size was 32.3 hectares. Also, in this period there had been a decline in the proportion of dairy farmers and an increase in the proportion of beef farmers.

13.3.3 Agriculture in the Study Area

As over 93% of the farming enterprises being impacted by the Bypass are in County Wexford, existing agricultural data has been used from this county for comparison purposes. In County Wexford, there is a total agricultural area of approximately 184,981 hectares. The average size of farms in County Wexford is 40.1 hectares which is somewhat larger than the national average of 31.4 hectares in 2000 (*Table 13.2* below). In County Wexford there was an average of 3.1 parcels of land per farm (the same as the national average). There were a high percentage of farms in the size categories 30 – 50 hectares (25.5%) and 50 – 100 hectares (22.5%) within the County in 2000 whereas nationally, in the same size categories, there were only 21% and 14% respectively. When compared to the national statistics there are more tillage and mixed crops and livestock farmers in County Wexford.

Table 13.2 Farms classified by size nationally and in County Wexford (Census of Agriculture 2000)

	Farm Size Categories (ha)							**Totals**	**Average Farm Size (ha)**
	0 - <10	10 - <20	20 - <30	30 - <50	50 - <100	100 - <200	>200		
Actual Numbers of Farms									
National	28,419	34,290	25,045	29,627	19,535	3,940	671	14,1527	31.4
Wexford	761	679	710	1177	1040	214	32	4,613	40.2
Percentage of Farms									
National	20.1	24.2	17.7	20.9	13.8	2.8%	0.5	100.0%	-
Wexford	16.5	14.7	15.4	25.5	22.5	4.6	0.7	100.0%	-

13.3.4 Farm Size and Agricultural Land Use Along The Proposed Route

13.3.4.1 Overview

The construction and operation of the preliminary design would affect 44 farms. Details of these farms in terms of the land use and size of affected area are presented in *Annex C* and shown on *Figures 13.1* in *EIS Volume 2 (Drawings)*.

13.3.4.2 *Farm Size*

The average farm size of the farms along the route based on information gathered in the farmer interviews is approximately 48 hectares (see *Table 13.3*). This is larger than that shown for County Wexford i.e. 40.1 hectares (*Table 13.2*).

13.3.4.3 *Land Use*

The National Census of Agricultural Statistics categorise land use into seven agricultural groups: specialist beef, specialist dairy, mixed grazing livestock, specialist tillage, mixed crops and livestock, specialist sheep and other. For this assessment, the following similar categories have been used:

- mainly dairy (majority dairy livestock);
- drystock beef & sheep (remaining livestock enterprises – includes specialist sheep, specialist beef cattle and mixed farms with cattle sheep and horses);
- mainly tillage (specialist tillage);
- mixed crops and livestock (various crops and livestock);
- other (e.g. forestry, horse rearing and dog rearing as main enterprise).

Table 13.3 below shows the land use statistics for the farms affected by the scheme based on the above categories compared to national statistics. Land use for farms affected by the scheme is shown in *Figures 13.1 a-b* in *EIS Volume 2 (Drawings)*.

Table 13.3 Land use statistics

Farm/ Enterprise Category	Total Nos. of affected farms within each category	% of farms within each category			Total area of affected land within each category (ha)	% area of land within each category (1)		Average size of farm within each category (ha)	
		Farms along roue	Farms in Co Wexford (2000)	Farms nationally		Land along route	Land nationally	Farms along route	Farms nationally
Mainly Dairy	10	22.7	19.3	18.6	738.7	35	25.34	74	42.8
Drystock Beef & sheep	13	29.5	46.7	74.3	423	20	63.78	33	26.9
Mainly Tillage	3	7	16.3	2.6	173.3	8	4.14	58	50.5
Mixed Crops & Livestock	17	38.5	15.4	3.3	769	36	5.75	45	53.9
Other	1	2.3	2.3	1.2	10	1	0.99	10	25.1
Total	**44**	**100%**	**100%**	**100%**	**2114 ha**	**100%**	**100%**	**48(2)**	**31.4**

Table 13.3 above shows that the percentages of farms and land within each category. There are more dairy and mixed crops and livestock category farms and less drystock beef and sheep and tillage category farms along the route than in Co Wexford. Thirty eight per cent of affected farms along the route are mixed cropping and livestock (approximately 33% of the affected land). While only 22.7% of farms are dairy farms these farms are larger and occupy 35% of the affected area.

13.3.5 *Soils along the Scheme*

Soil types influence the nature and intensity of farming that can be carried out. In this section reference is made to the Soils' Associations of Ireland and their Land Use Potential (1980) and the General Soil Map of Ireland 1980. Using the soil classifications referred to in this map the predominant soil encountered along the proposed route can be described as soil association 14.

(1) The statistics from the June 2000 Census do not include a county-by-county analysis of the percentage of total land within each category or the average size of farms within each category.
(2) The average farm size (48 ha) is larger than the June 2000 Census figure for the average size of farms in Co. Wexford (40 ha).

13.3.5.1 *Acid Brown Earth (Soil Associations 14)*

This soil is associated with gently rolling topography with uniform slopes. It is a well drained soil of loam to clay loam texture. It is generally friable and has good moisture holding capacity. The soil is suitable for a wide range of uses and the cropping in the affected area consists of grassland, cereals, beet, potatoes and vegetables (in that order).

There are small areas of gley type soils where drainage is impeded but this is unusual. Along the eastern shore of the River Barrow there are 50 – 60 hectares of reclaimed marshes. These form areas of low lying fertile grassland and are generally not suitable for tillage because of the soft nature of these soils. The soil type of each farm is described in *Annex C*.

13.4 CONSTRUCTION IMPACTS AND MITIGATION MEASURES

13.4.1 Overview

The main impacts to agricultural enterprises, which determine the future viability of each farm, will occur during the construction phase due to the land take requirements, resulting in the loss of agricultural land, severance, reduced access, etc. Any interaction between the proposed road and existing land drainage has been accommodated for in the design of the scheme. Whilst there will be disturbance on farms affected by the scheme during the construction phase, this disturbance will be temporary. This section considers the impacts for the construction of the scheme, in terms of the loss of agricultural land and the effects on individual farms.

13.4.2 Loss of Agricultural Land – National and Regional Impact

The agricultural land take required for the construction and operation of the scheme is approximately 117 hectares. This permanent land take represents 0.0026% of the total national agricultural area (4,443,948 hectares) and 0.06% of the area within County Wexford – 184,981 hectares. The loss will not be significant at a national or county level.

The agricultural area affected, which includes farms where there will be changes to access, land take, severance or loss of farm buildings etc. is approximately 2,114 hectares (44 individual farms). The land take required (117 hectares) is approximately 5.5% of the affected area. Approximately 286 hectares of land will be severed in the affected area (13.5%). These impacts represent a significant adverse impact on the affected area.

13.4.3 Individual Farm Impacts

The approximate land take required of 117 hectares will affect 44 farms. Details of the farms affected in terms of the type of enterprise, size of the affected area, soil association and land quality are presented in *Annex C*. For each of the 44 farms, the predicted impacts are also presented in *Annex C*.

13.4.3.1 *Land take*

A reduction in land area will reduce the viability of a farm. Land take is addressed in the significance criteria by using the percentage of the land taken out of the total land area of the farm and by considering the quality of the land taken. The land take required may also result in the loss of farm yards, buildings and access roads. The impact is increased if farm structures will be affected however along the proposed road scheme no farm buildings are taken. The level to which land take affects the viability of an individual farm is not solely dependent on the amount of land removed, but is also dependent on factors such as quality of the land taken, total area of holding, type of enterprise, severance, access etc. Therefore, the assessment examines the overall level of impact considering all factors and any mitigation currently identified. The results of this assessment are presented in *Annex C*.

13.4.3.2 *Severance*

Twenty four farms are affected by severance (52% of all farms along the Bypass and 74% of the affected area). Farms can be severed in two or more sections by the proposed scheme. The more segments created as a result of the scheme, the more severe the effects. Increasing the segmentation of a farm increases the long term fixed and variable costs and reduces the viability. The effects may be more severe depending on the enterprise on the farm. For example, the effect will be more severe if the scheme severs a milking parlour from an area where dairy cows graze than the effect resulting from the scheme severing an area used for dry stock or crops where the livestock do not have to be walked to the farm yard daily.

The location of the severance impact is also important. If the impact occurs close to the milking parlour the impact would be higher than if the impact occurred at a part of the farm away from the milking cow grazing area.
In cases where there are shared access tracks and tunnels because of severance there may be an increased risk from the spread of diseases such as Tuberculosis and Brucellosis. This risk is acceptable and is balanced by the benefit which the access provides to severed farms.

Extra labour may be required to manage livestock. It may be necessary to use the public road to gain access to grazing paddocks and there are safety issues associated with these situations. Long term labour, farm transport and fuel costs will rise. Severance will result in a continuous increase in fixed costs, particularly labour and machinery. Machinery operates most efficiently in large regularly shaped fields. Severance tends to lead to an increase in "angulation" of fields thus rendering them less efficient for machinery to operate in. Water and electricity supplies (for electric fencing) may also be severed.

Where the proposed road severs existing land drainage systems and natural surface run off there is a potential for a negative impact on land quality. Any field drainage systems affected will be reinstated as part of the CPO process.

In certain cases access to the farm yard may be severed. Milk lorries require access on a daily or every 2nd or 3rd day to collect milk. Feed, fertiliser, other goods' deliveries and collection of crops and livestock may also be disrupted. Farmers may have to erect additional testing and handling facilities on severed parcels of land to herd their animals for disease testing if access is not possible.

As for land take, the level to which severance affects the viability of an individual farm is not solely dependent on the division of land. A total of 12 farms are within the Major and Severe Impact categories (27.3% of the total number of farms). The results of the assessment which examines all inter-related factors are presented in *Annex C*.

13.4.3.3 Construction Disruption

Other temporary impacts will occur during the construction phase. The activity of earth moving machinery, transport lorries and other ancillary vehicles will generate noise and dust during construction. While farm animals may be sensitive to sudden unexpected noises they generally have a high tolerance to noise emissions from construction machinery. Sudden noise sources; for example rock blasting; may cause farm animals to take flight and possibly harm themselves or other farm animals.

There could be occasional difficulties with access to severed land parcels due to the passage of machinery and equipment along the construction corridor. This will affect farmers who need to move livestock from one part of the farm to another. However, alterations to access arrangements during the works will be discussed with the landowner in advance. In the affected area there are public roads used on a daily basis to walk milking cows from the milking parlour to other parts of the farm. The disruption caused to this activity should be minimised by good planning and timing of construction operations.

Construction works may temporarily affect surface water sources used for agricultural purposes. Mitigation measures for surface water sources are described in *Chapter 12* (Water, Soils and geology) and *Chapters 10 & 11* (Terrestrial ecology and Aquatic ecology).

13.4.4 Proposed Mitigation Measures for the Construction Phase

Boundary fencing will be erected to delineate the site boundary and prevent disturbance to adjacent land. Issues expected to result from disruption during the works will be addressed during consultations on accommodation works. Liaison between the contractor and farmers during the works will also minimise difficulties caused by the restriction of access to severed land parcels.

Good communication with farmers will facilitate the organisation of farm enterprises, so that vulnerable livestock are kept as far away as possible from the construction work during critical times. The contractor will be informed of the location of particularly sensitive areas, such as farms with horses. Precautions will be taken by the contractor to control noise and vibration as discussed in *Chapter 8* (Noise and Vibration). The contractor will notify in advance all land owners likely to be affected by any explosions. It may be necessary to house animals in this situation or move to a suitably quiet, well fenced part of the farm. The contractor will also employ measures to prevent the spread of dust and mud onto adjoining lands (*Chapter 7*, Air Quality & Climatic Factors). In new road construction projects the impact of dust is generally not significant on grazing livestock and if an exceptional impact was being experienced livestock would have to be moved from the affected area which would be localised. A project liaison officer will be appointed during the construction phase to facilitate communications between affected landowners and the contractor.

If a water supply is affected during construction, an alternative water supply will be provided. General mitigation measures which will be implemented during the construction phase are detailed in *Chapters 6, 8, 9, 10, 11 and 12.* Such mitigation should be planned before construction commences.

13.5 OPERATIONAL IMPACTS AND MITIGATION MEASURES

13.5.1 *Operational impacts*

The impacts from the land take and severance are permanent and will affect farms after the construction phase.

Land take impacts during the operational phase are described in *Section 13.4.2*. Forty four farms will be directly affected by the operation of the scheme. Based on the preliminary design, approximately 117 hectares of agricultural land will be required for the operation of the scheme. The land take will be approximately 5.5% of the total affected area. There will be no direct impact on farm yards.

Severance impacts during the construction phase are described in *Section 13.4.2.* While severance will affect 52% of the farms (74% of the affected area) the impact on a county or regional level is not significant. Severance will create 30 new land segments which is approximately 0.002 % of the total segments in County Wexford and an increase of approximately 25% in the total segments in the affected area. Approximately 13.5 % of the affected area will be severed by the proposed road.

The impact from the traffic noise and traffic lights will be similar in effect to that experienced along many of our busy national routes. Farm animals adapt to this type of noise without negative impact.

Dust and air emissions from the proposed road during the operation phase are projected to be within acceptable parameters for protection of vegetation and farm animal health (see *Chapter 7*).

The drainage design of the proposed scheme will protect the water quality for farm animals as specified in *Chapter 12* (Water, Soils and Geology). The affected area is subject to large storm water run off events (similar to flash flooding) from surrounding hills in a few areas. The water tends to run off diffusely across the land as there are no open field side land drains in these areas. Camlin & Creaken Upper and Ryleen & Lacken are areas which are periodically subject to this type of run off. The preliminary drainage assessment takes into account the quantity of run off from the carriage of the proposed road scheme and the capacity of outfalls to take surrounding land run off.

Each farm has been assessed to determine the impacts during the construction and operation of the proposed scheme. The results of the assessment are presented in detail in *Annex C*. The majority of farms are in the not significant - moderate impact categories.

13.5.2 Proposed Mitigation Measures for the Operational Phase

Consultations with landowners have been taken into consideration in the preliminary design of accommodation roads. The impact on agricultural traffic will depend on the source of this traffic. On affected farms, the day to day movement of tractors may be adversely impacted. However agricultural traffic sources from farms not directly affected by the scheme should not experience a negative impact. The suggestions received from landowners have been evaluated and where possible incorporated. Accommodation roads will provide landowners with access onto the local road network and access between multiple land parcels severed by the scheme and avoid the requirement for direct access onto the scheme. Access roads will be provided where necessary to link current or future access points with the local road network or as a means of crossing the mainline. Permanent access arrangements to some severed parcels of land have been addressed as part of the preliminary design. Other small parcels of severed, landlocked land will be acquired through the CPO process. The scheme crosses watercourses and field drainage systems. The drainage design for the scheme has taken into consideration suggestions for agricultural land drainage.

Annex C sets out the impacts and proposed mitigation for each farm affected by the Bypass.

13.6 RESIDUAL IMPACTS

The new road will be a permanent feature in the affected area. The majority of farming along the proposed route is intensive and the majority of farmers work full–time on their farms. A direct impact on 1% and the loss of 0.06% of the agricultural land in County Wexford is not significant and must be balanced against the benefits derived from upgrading the infrastructure.

Farmers as members of the local community will benefit from the relative improvement in the traffic situation.

The impacts from land loss and severance are permanent residual impacts and financial compensation will be necessary and this has been undertaken as part of the CPO process. There may be a gradual increase in the net worth of farmers affected by the new route due to proximity of the new route to other parts of their farm. Maintenance of roadside surface water drains is necessary to prevent flooding of farmland adjoining the new route.

There are 44 farms affected by the Bypass and of these, 10 are dairy farmers, 13 are beef farmers, 3 mainly tillage, 17 are mixed crops and livestock farmers, 1 is categorised as other (horse rearing & dog rearing enterprise). The land quality along the scheme is generally very good.

Approximately 117 hectares of agricultural land will be required for the Bypass. Overall, there will be a significant impact on farms affected, however the impact of the scheme will not be significant at a county or national level. The permanent land take will be approximately 5.5% of the total affected area and severance will affect 52% of the farms (74% of the affected area). The majority (73%) of farms are in the not significant - moderate impact categories.

Tables 13.4 and *13.5* present the overall effects of the Bypass on affected farms based on the impacts and mitigation measures in *Annex C*. This considers the individual effects arising from land take and severance in relation to the farm enterprise type, farm size, land quality and soil association. Other aspects such as drainage, watercourses, access points, farm buildings or yards affected have also been considered. The level of impact assumes that mitigating measures already incorporated into the preliminary design will be provided. The assessment also assumes that accommodation works for fences, electricity supplies, water sources and drainage systems will be provided. Holding pens and gates may also be required in severed parcels of land and it is assumed that these will be provided if necessary. A project liaison officer will be appointed during the construction phase to facilitate communications between affected landowners and the contractor.

Table 13.4 presents the overall impacts in terms of farm numbers within enterprise categories, whilst *Table 13.5* presents the overall impacts in terms of land area within enterprise categories.

Table13.4 Summary of overall impacts - number of farms within Enterprise Categories

	Nos. of Farms within Enterprise Categories					
Level of Impact	**Mainly Dairy**	**Drystock beef & sheep**	**Mainly Tillage**	**Mixed Crops and Livestock**	**Other (horse & dog rearing)**	**Totals**
Non-significant	1	5	0	3	0	9
Minor	2	4	1	5	0	12
Moderate	4	2	1	5	0	11
Major	2	0	0	4	0	6
Severe	1	2	1	1	1	6
Total number of farms						44

Enterprises with Major and Severe Impacts	Number of Farms in the Major and Severe Impact categories	Percentage of each enterprise with Major and Severe Impacts (%)
Mainly Dairy	3	30
Drystock Beef & sheep	2	15
Tillage	1	33
Mixed Crops and Livestock	5	29
Other	1	100%
Total	**12**	

A total of 12 farms are within the Major and Severe Impact categories (27.3% of the total number of farms)

Table 13.5 Summary of overall impact - land area within Enterprise Categories (ha)

	Land Area within Enterprise Categories (ha)					
Level of Impact	**Mainly Dairy**	**Drystock beef & sheep**	**Mainly Tillage**	**Mixed Crops and Livestock**	**Other (horse & dog rearing)**	**Total ha**
Non-significant	5.55	164	0	123	0	292.4
Minor	356	173	12.2	190.7	0	732.2
Moderate	186	63.5	160	262.3	0	672
Major	95.6	0	0	115	0	210.5
Severe	95.5	22.4	1	78	10	207
Total area						2114 ha

Enterprises with Major and Severe Impacts	Area of Farms in the Major and Severe Impact categories (ha)	Percentage of each enterprise with Major and Severe Impacts (%)
Mainly Dairy	191	26
Drystock Beef & sheep	22.4	5.3
Tillage	1	0.6
Mixed Crops and Livestock	194	25
Other	10	100%
Total	**418**	

A total of 418 hectares are within the Major and Severe Impact categories (20% of the total area of affected farms)

From *Tables 13.4* and *13.5*, it can be seen that 12 farms (27% of the total farm numbers) will be in the major and severe impact categories. These farms comprise of approximately 418 hectares or 20% of the affected land studied.

14 ARCHAEOLOGICAL HERITAGE

14.1 INTRODUCTION

An assessment has been carried out of the archaeological and cultural heritage effects and impacts associated with the proposed Bypass. The assessment follows on from work undertaken for the route selection process, and comprised an intensive desk-based study of the route, in accordance with the methodology defined by NRA. The aim of this study was to identify all known archaeological and cultural heritage constraints within c. 50m of the road, as well as to assess the likelihood of significant archaeological features being uncovered. This chapter presents the findings of the assessment. Consultation with the NRA was undertaken during the course of the preparation of this chapter.

In total the Bypass traverses 17 townlands (Cappagh, Jamestown, Graiguenakill, Forestalstown, Ballyverneen, Stokestown, Landscape, Camlin, Creakan Lower, Creakan Upper, Arnestown, Ballymacar, Ryleen, Lacken, Berkeley, Rathgaroge and Knockroe). The development also crosses the River Barrow at a point known as the 'Pink Point'. All the townlands are located in Co. Wexford with the exception of Cappagh, Jamestown, Graiguenakill, Forestalstown and Ballyverneen, which are in Co. Kilkenny. In general the alignment runs across a gently undulating landscape of valleys and hills with good visual aspects in most cases.

The assessment found that there are 17 Archaeological and Cultural Heritage Constraints (AHC) within the study area. In total twelve will be directly impacted upon, four will be indirectly impacted upon and one will not be impacted upon.

14.2 METHODOLOGY

14.2.1 *Overview*

The assessment of archaeological and cultural heritage was based on a desk study that utilised a number of sources including:

- the Record of Monuments and Places,
- the Shipwreck Archive,
- the National Museum of Ireland Topographical Files,
- the Wexford and Kilkenny County Development Plans, and
- documentary, cartographic and aerial photographic sources supplemented by a field inspection of the alignment.

14.2.2 *Archaeological Heritage*

Irish National Monuments legislation does not differentiate between archaeological sites on the basis of relative importance. All recorded archaeological monuments are therefore considered to be very important. The National Monuments Section, Department of Environment, Heritage & Local Government has defined a 'constraint ring' around each recorded monument and this area is also considered to be very important.

In the context of this study, designated areas such as Conservation Areas and Architectural Conservation Areas are also considered to be very important. This is because of the designation that they carry and the protection that this designation affords.

14.2.3 *Assessment Criteria*

Impacts were categorised and assessed as either:

- direct impact; or
- indirect impact; or
- no predicted impact.

A *direct impact* is where an archaeological (or cultural heritage) feature or site is physically located within the footprint of the alignment and entails the removal of part, or all of the monument or feature.

An *indirect impact* is where a feature or site of archaeological heritage merit or its setting is located in close proximity to the footprint of a potential route alignment. These impacts may be reduced or eliminated at the detailed design stage and through the implementation of mitigation strategies.

No predicted impact occurs where the potential route does not adversely or positively affect an archaeological heritage site.

The assessment of the terrain and the examination of the type, density and distribution of archaeological sites within the landscape gives rise to the identification of areas and sites of archaeological potential. These areas may be included given their:

- close proximity to recorded archaeological monuments;
- association with either topographic features or wetland terrain;
- place name evidence; and
- find spots of stray finds.

Avoidance is the preferred mitigation measure. However, given the extensive footprint and geographical extent of linear road development it is inevitable that some impacts will occur. Early recognition of the type and level of impact make it possible to minimise and reduce the loss of archaeological and architectural heritage features and provide suitable mitigation measures.

A rating of the significance of each impact is given; i.e. profound, significant, moderate, slight or imperceptible. These terms are described as follows:

- **Profound** - Applies where mitigation would be unlikely to prevent or remove adverse effects. This category applies to adverse, negative effects only. These effects arise where an archaeological site is completely and irreversibly destroyed by a proposed development.

- **Significant** - An impact which, by its magnitude, duration or intensity, alters an important aspect of the archaeological environment. An impact like this would be where part of a site would be permanently impacted upon, leading to a loss of character, integrity and data about the archaeological feature/site.

- **Moderate** - A moderate direct impact arises where a change to the site is proposed which though noticeable, is such that the archaeological integrity of the site is not comprised and the effect is reversible. This arises where an archaeological feature can be incorporated into a modern day development without damage and that all procedure used to facilitate this are reversible.

- **Slight** - An impact which causes changes in the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument.

- **Imperceptible** - An impact capable of measurement without noticeable consequences.

14.2.4 Desk Study

14.2.4.1 Recorded Archaeological Sites and Monuments

The Record of Monuments and Places was consulted for the relevant parts of Co. Wexford (Ordnance Survey 6" Sheets no. 29, 30, 34 and 35) and Co. Kilkenny (Ordnance Survey 6" Sheets no. 37 and 41). The Records of Monuments and Places (RMP) is a list of archaeological sites known to the National Monuments Service. The relevant files for these sites contain details of documentary sources and aerial photographs, early maps, OS memoirs, OPW Archaeological Survey notes and other relevant publications. It builds upon information contained in the non-statutory Sites and Monuments Record. In total 7 RMP sites were located within the study area and are listed in *Table 14.1*.

14.2.4.2 Recorded Archaeological Finds

The topographical files in the National Museum of Ireland were consulted to determine if any archaeological artefacts had been recorded from the area. This is the national archive of all known finds recorded by the National Museum. It relates primarily to artefacts but also includes references to monuments and has a unique archive of records of previous excavations. Other published catalogues of prehistoric material were also studied: Raftery (1983 - Iron Age antiquities), Eogan (1965; 1993; 1994 - bronze swords, Bronze Age hoards and goldwork), Harbison (1968; 1969a; 1969b - bronze axes, halberds and daggers) and the Irish Stone Axe Project Database (School of Archaeology, U.C.D.). The following townlands were assessed; Ballymacar, Berkeley, Camlin, Creakan lower, Creakan upper, Lacken, Landscape, Rathgaroge, Ryleen, Stokestown and Knockroe in Co. Wexford and Ballyverneen and Cappagh, Jamestown, Graiguenakill and Forestalstown in Co. Kilkenny. There were no archaeological finds recovered from the townlands assessed.

14.2.4.3 Cartographic Sources

Detailed analysis of the 1st edition Ordnance Survey (OS) maps for the whole route was undertaken (OS 6" sheets WX029, 030 & 034). These maps were compiled in 1840 and give a good indication of the settlement distributions and field layouts prior to the onset of intensive agriculture. The maps were compared to both the 3rd edition OS (1922) and aerial photographs (ERM:AP), in order to appraise the 19th century appearance of the alignment.

14.2.4.4 Previous Excavations and Assessments

The Excavations Bulletin website (*www.excavations.ie*) was consulted to identify previous excavations that may have been carried out within the study area. This database contains summary accounts of excavations carried out in Ireland from 1970 to 2002. The available Excavations publications were also consulted (Bennett 2006). The following townlands were assessed: Cappagh, Jamestown, Graiguenakill, Forestalstown, Ballyverneen, Stokestown, Landscape, Camlin, Creakan Lower, Creakan Upper, Arnestown, Ballymacar, Ryleen, Lacken, Berkeley, Rathgaroge and Knockroe.

Management For Archaeology Underwater Ltd was contracted by RPS Environmental Sciences to conduct an archaeological assessment of two proposed bridge crossing points spanning the River Barrow at New Ross. The objective of the underwater archaeological survey was to identify whether underwater archaeological remains were present in the vicinity of either crossing point, with a view to using such information in the route selection process. The assessment was carried out under licence numbers 01D009 and 01R017 by Mr. Donal Boland on behalf of Management for Archaeology Underwater Ltd in March 2001.

14.2.4.5 Aerial Photography

Aerial photographs were examined to establish if any previously unrecorded potential archaeological sites occurred along the routes. Aerial photographs are often a rich source for identifying subsurface archaeological features. Slight differences in ground moisture can lead to changes in growth and as a result these changes can be detected from above. Two potential sites were identified through aerial photography and are listed in *Table 14.1*. In addition to this aerial photographs were used to analyse landscape flux and change in comparison to cartographic sources.

14.2.4.6 Historical Research

Historical research began with an assessment of bibliographic sources including the British and Irish Archaeological Bibliography (www.biab.ac.uk) and Hayes Indices of manuscripts and periodicals (Hayes 1965; 1970). It continued with a review of published books and periodicals on the area including Lewis Topographical Dictionary (1837) and the archives of the Wexford County Library.

14.2.4.7 Shipwreck Archive

A record of shipwrecks (Shipwreck Archive) for Irish coastal and inland waters is kept by the Underwater Unit of the National Monuments Section, Department of Environment, Heritage and Local Government in Dublin. This record contains any information relating to wrecks as well as grid references and any survey notes. Only one wreck was listed as coming from the River Barrow, south of New Ross. Details of this site are listed in *Annex D*3 A further two wrecks were identified by side-scan sonar (Boland 2001).

14.2.5 Non Invasive Archaeological Investigations - Field Assessment

Following the desk based study outlined above, the alignment was walked in full, and all sites identified during the desk study within 100m of the alignment were visited. These potential archaeological sites were assessed and observations made. The majority of the land in the study area was under agricultural use at the time of field walking. The area as a whole has also undergone intensive arable agriculture over a long time period. Where intensive ploughing has taken place, subsurface remain are often difficult to identify by visual survey. Results of the field walking are listed in *Annex D1*. In total four new potential sites were identified and allocated AHC numbers (see *Table 14.1*).

14.3 LEGISLATION, STANDARDS AND GUIDELINES

The following legislation, standards and guidelines were taken into account during the assessment:

14.3.1 Legislation

- National Monuments Act, 1930, amended 1954, 1987 and 2004.
- Heritage Act, 1995.
- National Cultural Institutions Act, 1997.

- The Architectural Heritage (National Inventory) and Historic Properties (Miscellaneous Provisions) Act, 1999.

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

- European Convention Concerning the Protection of the Archaeological Heritage (the 'Valetta Convention') ratified by the Republic of Ireland in 1997.

- Council of Europe Convention on the Protection of the Architectural Heritage of Europe, (the 'Granada Convention') ratified by Ireland in 1997.

14.3.2 Standards / Guidelines

- Code of Practice between the National Roads Authority and the Minister for Arts, Heritage Gaeltacht and the Islands, 2000.

- Advice notes on Current Practice (in the preparation of Environmental Impact Statements), 2003, Environmental Protection Agency.

- Guidelines on the information to be contained in Environmental Impact Statements, 2002, Environmental Protection Agency.

- National Roads Authority Guidelines for the Assessment of Archaeological/ Heritage Impacts of National Roads Schemes, 2005.

14.4 DESCRIPTION OF THE EXISTING ENVIRONMENT

14.4.1 Archaeological and Historical Background

Following the desk based survey of the alignment and a study of the archives of Wexford County Library a historical and archaeological background was prepared for the study area, focusing on the alignment itself. The development of the area is based on its connection to the Barrow River and the evolution of the town of New Ross, which is located outside the study area. The archaeological and historical background has been divided in constituent time periods: the Prehistoric period, Early Medieval period and the Late and Post Medieval period.

14.4.2 Prehistoric Period (7000 BC - AD 400)

The Mesolithic period dates from 7,000 – 4,000 BC in Ireland. The recorded evidence for this early prehistoric period in Co. Wexford is sparse. Early diagnostic flint finds were recovered in the townland of Camlin just south of Gorey and between Kilmichael and Carnsore in 1982 in the north of the county (Stout 1987 and Culleton 1984). These were identified as later

Mesolithic blades similar to material recovered on the beaches of Larne in Co. Antrim, (Stout 1987, 3). It is thought this activity would have been centred along coastal and riverine locations exploiting the natural resources and access routes these locations provided. The flint scatters on the glacial beaches of Poulshone, Blackwater and Rosslare may have been particularly attractive. O'Donovan (1940s, unpublished) argues that it is likely that the Barrow around New Ross was used in a similar fashion. The River Barrow reaches a confluence with the River Nore 3.2 kilometers north of New Ross town. This area is marked by large areas of marsh and rich fish stocks which O'Donovan believes would have been exploited by Mesolithic peoples some time between 5,500 and 4,000 BC. Later Mesolithic activity is known north of the River Barrow, represented by a series of flint scatters centred on natural fording points (currently the subject of a doctoral thesis by Thomas Kador, School of Archaeology, UCD - he believes this indicates the Barrow was used as a communication link through the Mesolithic with a series of suitable fording locations located along the Barrow). The narrowing of the river in the vicinity of New Ross and the series of natural rock outcrops in this area make it a suitable Mesolithic fording point, although no flint scatters or settlement have been recovered as yet.

The earliest archaeological monuments in the area date to the Neolithic period, 4,000-2,400 BC. In Wexford, upstanding Neolithic monuments tend to be centred along the east coast, along the Slaney valley and towards the centre of the county. The deposition of axe heads is also centred on coastal or riverine locations such as Newbay, Enniscorthy, Carrigmanion, Glasscarrig and Great Saltee Island (Culleton 1984, Corcoran 1966, Stout 1987). Pollen cores extracted northeast of New Ross on Forth Mountain by Mary Scribbins in the 1970s indicate forest clearance was undertaken in the Neolithic from around 4000 BC. A stone axe was recovered from Mylerspark townland close to New Ross in 1928 (NMI 1928:763) while possible Neolithic activity was encountered in excavations at McMurrough's Island townland in 1985. This produced a polished stone axe and a number of raw and diagnostic flints, with a hearth and pit which may date to the Neolithic period.

Similar to the Mesolithic period, Neolithic activity in the broader Wexford area is sparse. Two portal tombs have been positively identified with five other possible Megalithic sites (Moore 1996, 1-2), while only seventeen stone axe heads and four adze heads are known from the county for this period. Although the evidence for activity is rare, Neolithic sites have been identified and it is likely they may have also been centred on riverine and coastal locations such as the River Barrow.

The Bronze Age period in Ireland dates from 2,500-500 BC. Upstanding Bronze Age monuments within the county show four major distributions relating to the northeast of the county, the east and southeast coastline, the Slaney valley and the Barrow Valley. This is not surprising as the densest distributions of Bronze Age monuments are centred on the best drained and most easily cultivated lands (Gardiner and Ryan 1964).

A marked concentration of standing stones along the Slaney Valley such as at Cotts and Enniscorthy (MacAlister 1921, 77) and along the Barrow Valley is evident. These may have served as navigational or territorial markers along the riverine routes with a third marked concentration at Carnsore point supporting this view (Stout, 1987 32). Riverine valleys would have provided natural routes of communication as well as acting as obvious territory marker locations. As such the concentration of markers along the Barrow and Slaney valleys indicates a wider social landscape centred along the Barrow River throughout the Bronze Age.

The most common monument type of the Bronze Age is burnt mounds, traditionally interpreted as cooking places (Waddell, 1998, 174). Thirty-six of these monuments are known in Wexford centred on three locations (Gorey, Hollyfort and New Ross). The New Ross examples as a whole are kidney shaped measuring c. 8m across and are situated mainly south of the town, taking advantage of the water sources of the Barrow and associated tributaries, (Stout, 1987, 36). A burnt mound site is located in close proximity to the road take to the northeast of New Ross town in the townland of Rathgaroge (NGR 27715, 13038). The concentration of sites in this area, and observations made during field walking, indicate there is a high likelihood of further monuments being uncovered in this area.

Finds for the period include a Bronze Age sword recovered from the vicinity of New Ross (Eogan, 1965, 613) as well as a 'hoard of bracelets' and a probable gold fibulae recovered from the River Barrow in 1895 (Fraser and Johnson, 1895, 386 and Harbison, P. 1965, 18). A flat bronze axe from the townland of Rosbercon, close to the Barrow, was also recovered in the mid 20th century (NMI 1959: 689). Deposition of Bronze Age artefacts in or beside riverine and coastline locations is a repeated pattern in Wexford and the country as a whole and is seen elsewhere in the county at locations such as at Cahore and Carickshedoge (Bremner, 1926, 89).

Known Iron Age evidence within Co. Wexford as a whole is extremely rare (600BC-400AD). A ring barrow at Hook Head and a hill top enclosure at Ballyleigh may date to this period. The only sites thought to be definitively Iron Age are the promontory forts at Pollshone, Nook, Baginbun and Templetown with a fifth possible example at Saltee Island Great. Westropp explored two of these in 1906 and 1918 but did not confirm an Iron Age date, (Westropp, T.J., 1906, 239-258, and Westropp, T.J., 1918, 1-18). Interestingly three of the four promontory forts are positioned on the approach, or entrance to the Barrow Estuary, and ultimately the site of New Ross. Ptolemy's map dating to the 2nd century AD lists this area as 'Menapia', occupied by the Brigantes Tribe (Culleton, 1999). The Brigantes were a well known sea-faring people known in coastal Britain in the Humber and Firth regions and even as far abroad as the Netherlands. This evidence emphasises the importance of boat travel during this prehistoric period.

14.4.3 *Early Medieval Period (c. AD 400 - 1170)*

The Early Medieval period in Ireland is defined by the beginning of historical documentation which was brought in with the formal introduction of Christianity into the country (400AD-1170AD). This sees the start of an archaeological and historical record for settlement specifically around the site of the modern town of New Ross. St. Abban is accredited with the foundation of a monastery in the late 6th or early 7th century (Butler, T., 1976, 79). Abban was a nephew of St. Ibar and trained at his famous school on Beg Eire Island in the harbour of Wexford (Rowe and Wilson 1996). It is thought the students of Beg Eire may be responsible for numerous foundations in the county including Ardcolm, Ardcavan and St. Vogues as well as New Ross (O'Donovan 1933). This may explain the townland names of Begeire (Lloyd) and Begeire (Loftus) to the east of New Ross Town.

This foundation of the early ecclesiastical centre may have brought with it the establishment or improvement of a road network. O'Lochlainn discusses the network of roads already established upon the Norman arrival in the high medieval period (1940, 465). Specifically there were five roads centred around the Royal site of Tara, one of which ran in a southerly direction along the following route: Tara, Dublin, Tallaght, Saggart, Rathcoole, Kilteel, Ballymore Eustace, Dunlavin, Baltinglass, Rathvilly, Tullow, Leighlinbridge, Goresbridge, Ullard, Graig, St. Mullins, Ross, Rosbercon and Waterford. A second minor road is thought to have joined with this road at Ross running from Wexford to Clonmines.

It is also thought there may have been Danish activity in the area surrounding New Ross in this period. Typically a Viking presence is associated with Waterford and Wexford from the late 9th or early 10th century with the establishment of the two Viking towns (Culleton, 1999). Placename evidence, stray finds and annalistic accounts of Viking raids, however, imply their activity was much more extensive throughout the county. The first Viking raid in the Co. of Wexford was recorded in 819 AD on Beg Eire Island in Wexford Harbour (Jenkins, J. 2001). From here Viking raiders easily accessed inland settlements, mainly on navigable rivers such as the Slaney and the Barrow. The plundering of Taghmon's Augustinian Friary in 917, however, indicated the Vikings were also active outside the confines of the rivers (Browne 1993, 6-7).

It is thought that the baronies of Forth and Bargy to the southeast of Wexford were partially settled with a Viking presence to be used as a rural hinterland to support the town of Wexford. It is also possible that silver mining was undertaken in Barrystown and Mablehaven within the county. A hoard of silver ingots recovered from modern Clonmines has been identified as possible being mined from one of these sources (Furlong 1968, 35-42). Inquisitions into lands of the Marshalls and De Valences in 1282, 1307 and 1384 describe the labour of the Ostmen employed in the barony of Forth and it is thought that an established Viking presence was in this area, pre-dating the arrival of the Normans (Swan 1972, 80-87).

Placename evidence indicates the southern townland on the River Barrow 'Arklow' derives from Norse origin. Thirteen names within the county carry a prefix or suffix that is Norse origin, for example the suffix ore from Carnsore and Greenore implies a sandy point. New Ross specifically is thought to derive from 'Ross Mac Truim' or the wood of the son of Truim. Truim is thought to be a Gaelic version of Crume, a King of Denmark in the 9th century (Hore, Vol 1, 1900). Viking presence on the Barrow is pointed to by O'Donovan (O'Donovan, 1940's unpublished). The Barrow River was known to be exploited in this period for its salmon fisheries and with rich fish stocks 3.2 kilometers north of New Ross at the junction of the Barrow and the Nore, it seems probable a small Viking settlement, as advocated by Hore, may have developed around the site of the modern town (Hore, Vol 1, 1900).

The references to a road network and Early Medieval sites indicate a sizeable ecclesiastical centre was developing around the site of the modern town of New Ross, presumably based on the advantageous location adjacent to the River Barrow. This may have been supplemented with a Danish presence at this time. Outside of this settlement the vast majority of settlements were ringforts, a rural fortified farmstead typical of the period. In all, c. 150 ringforts survive in Co. Wexford, although if crop marks and unidentified earthworks are included the number rises to c. 600. Bennett noted there were no particular geographical densities of the monuments although she did note they were densest within the brown soil group of western Wexford within altitudes of 30-120m. She concluded the ring forts showed a distinct awareness to altitude, soil quality and drainage (Bennett, 1989, 42). In general the proposed development falls within the preferred altitude and soil groups. Six earthworks, 'earthwork sites', enclosures and ringforts have been identified within c. 50m of the route including two in the townland of Lacken (WX030:030 and WX030:031).

14.4.4 *Late Medieval and Post Medieval period (c. AD 1170 - 1900)*

The history of the area in the Post Medieval period is dominated by the establishment and growth of the seigniorial manor of Ross and more specifically New Ross town to the north of the study area. In terms of upstanding monuments and documented accounts it is also the period with the greatest number of sites and historical texts.

A series of additional monuments from this period are evident within the wider area. There are castle sites in the townlands of Lacken, Berkeley and Arnestown (Wexford) and Forestalstown (Kilkenny) as well as a tower house in the townland of Stokestown. In addition there are two moated sites in the townlands of Ballymacar and Slaght and a chapel site in Rathgaroge.

The castle site in close proximity to the route is that in Lacken (WX030:029). The site is known locally as 'Castle Field' and recorded as 'site of Castle' on the first edition of the OS. The probable manor of Lacken is recorded in records dating to 1372, 1606, 1617 and 1637 although no specific mention is made of the Castle. The site is significant, however, as it lies in close proximity to two ringforts within the same townland (WX030:020 and WX030:030). The site is also directly beside a possible Medieval road and a farmstead marked on the 1st edition of the OS. This indicates continuous settlement may have been undertaken in Lacken from the Early Medieval period. Arnestown also lies in relatively close proximity to the site but survives only as a possible castle site, mentioned in the Civil Survey (Simington 1953, 205).

The tower house site of Stokestown (WX034:015) is located in relatively close proximity to the route. Stokestown Castle is listed under the protected structures in the Wexford Development plan in 2001 as are the associated features of Stokestown Lodge and Stokestown Folly (AHC 6). The castle is described by Mark Bence Jones (1988, 265) as a three-storey, five-bay mid 18th century gable house. The tower house was incorporated into a 19th century stable yard and castle acting as the centre of a sizeable demesne (see below).

14.4.5 *Inventory of Archaeological Sites and Sites of Archaeological Potential*

The archaeological sites and sites of archaeological potential identified during the assessment are listed below. Their locations are marked on the accompanying *Figure 14.1 (Volume 2)*. These were identified from a number of sources including the Record of Monuments and Places, the relevant County Development Plan, documentary and cartographic sources, aerial photographs and field survey. The tables list these sites with reference to the:

- type of site;
- its legal status (whether or not the site is included in the record of monuments and places or the record of protected structures);
- the type and level of impact the proposed road will have on the site; and
- the level of mitigation required for the site.

The full inventory of Archaeological Heritage Sites is laid out in *Annex D4*.

14.5 *IMPACTS ON THE ENVIRONMENT*

14.5.1 *Overview*

Table 14.1 summarises the impact of the alignment on Recorded Archaeological Monuments and Places and on Sites of Archaeological Potential.

Table 14.1 Effects on identified archaeological receptors

AHC ID	*Legal Status and Ref.*	*Townland*	*NGR*	*Description*	*Proximity to road (m) **	*Type and Significance of Impact*	*Mitigation Measures Proposed*
1	x	Ballyverneen	268267, 123187	Curving field boundary	7	Direct, potentially significant impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
2	x	Ballyverneen	268482, 123203	River crossing	16	Direct, potentially significant impact.	A survey of the rock face to identify possible features mentioned in MAU report 2001
3	x	Ballyverneen	268813, 123248	River crossing	12	Direct, potentially significant impact.	Underwater archaeological assessment has been undertaken, no further mitigation required
5	x	Stokestown	269772, 123724	Enclosure, possible	90	Indirect, moderate impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
13	x	Arnestown	274219, 125791	Mounds, possible	1	Direct, potentially significant impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
17	x	Ryleen	275094, 126729	Settlement location (1st edition)	3	Direct, moderate impact.	Geophysical investigation of feature will be undertaken prior to construction.
20	x	Ryleen	275438, 126908	Enclosure, possible	101	No predicted Impact	No further mitigation measures will be required.
22	RMP WX030:029	Lacken	27661, 12828	Castle Site	0	Direct, profound impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.

23	RMP WX030:030	Lacken	276740, 128390	Earthwork, site	0	Direct, profound impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
24	x	Lacken	276794, 128771	Settlement location (1st edition)	31	Direct, moderate impact.	Geophysical investigation of feature will be undertaken prior to construction.
25	x	Lacken	276783, 128873	Settlement location (1st edition)	64	Indirect, moderate impact.	Geophysical investigation of feature will be undertaken prior to construction
27	RMP WX034:015, RPS WCC0719	Stokestown	269400, 123690	Tower house	10	Direct, significant impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
59	RMP WX029:020	Lacken	276470, 126410	Enclosure	33	Direct, significant impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
61	RMP WX030:031	Lacken	276969, 126840	Enclosure	53	Indirect, moderate impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
68	RMP WX030:014	Rathgaroge	277240, 130390	Enclosure, site	0	Direct, profound impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.

69	RMP WX030:077	Rathgaroge	277150, 130380	Fulachta Fiadh	30	Direct, significant impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.
72	x	Arnestown	274344, 125998	Mounds, possible	61	Indirect, moderate impact.	Geophysics and site specific test excavation will be undertaken prior to development to determine if archaeological features survive within the road take.

**For sites included in the Record of Monuments and Places, the distance recorded is from the edge of the constraint area to the centreline of the alignment. For all other archaeological and cultural heritage constraints the distance recorded is from the centre of the constraint to the centreline of the alignment.*

14.5.2 Impacts on Recorded Archaeological Monuments and Places and Sites of Archaeological Potential

The proposed scheme will have a direct impact on six recorded archaeological monuments and places. The sites are as follows:

- a castle site in the townland of Lacken (WX030:029);
- the site of an earthwork in the townland of Lacken (WX030:030);
- a tower house in the townland of Stokestown (RMP034:015/ RPS WCC0719);
- an enclosure in the townland of Lacken (WX029:020);
- the site of an enclosure in the townland of Rathgaroge (WX030:014); and
- a Fulacht Fiadh in the townland of Rathgaroge (WX030:077).

The proposed scheme will have an indirect impact on one recorded archaeological monument and place. The site is as follows; an enclosure in the townland of Lacken (WX030:031).

The proposed scheme will have a direct impact on six sites of archaeological potential. The sites are as follows:

- a curving field boundary in the townland of Ballyverneen (AHC 1);
- two river crossing points in the townland of Ballyverneen and Stokestown (AHC 2 and AHC 3);

- a group of possible mounds in the townland of Arnestown (AHC 13); and

- two settlement locations at Ryleen and Lacken (AHC 17 and AHC 24).

The proposed scheme will have an indirect impact on three sites of archaeological potential:

- an enclosure in the townland of Stokestown (AHC 5);

- a settlement site at Lacken (AHC 25), and

- possible mounds in the townland of Arnestown (AHC 72).

The proposed scheme will have no predicted impact on a possible enclosure in the townland of Ryleen (AHC 20).

Watercourses are considered to be of high archaeological potential, containing features such as Fulachta Fiadh or burnt mounds, fords, ancient bridging sites, mills, and longphorts and producing archaeological artefacts such as log boats, organic material and votive offerings of axeheads and metalwork. The alignment crosses Bearstown Stream (N25 Ch 100, N25 Ch 200 and N25 Ch 225), a local tributary (that flows from Slaght to the Barrow passing near Landscape crossing at N25 Ch 3,800 - 4,100 and N25 Ch 4,350), and the Ballymacar Stream (N25 Ch 8,300 - 8,400, N25 Ch 8,580 - 8,700, N25 Ch 800-8,050 & N30 Ch 100).

Riverbank sites have been favoured for human occupation since prehistoric times for their proximity to rich food sources and fresh water and have additionally served as routeways, boundaries, defences and as a focus for ritual. The Bypass crosses the Barrow River between N25 Ch 1,350 - 1,500.

14.6 *MITIGATION MEASURES*

14.6.1 *Overview*

In accordance with the Code of Practice agreed between the National Roads Authority and the then Minister for Arts, Heritage, Gaeltacht and the Islands in June 2000 every effort has been made to avoid direct impacts on archaeological monuments and places. As a result, the proposed scheme is directly impacting on the zones of archaeological potential of eight recorded archaeological monuments and places.

All necessary licences, procedures, consents and directions as specified by the National Monuments Acts 1930-2004 will be complied with. All archaeological finds and features revealed will be recorded appropriately prior to construction of the proposed scheme in agreement with the Project

Archaeologist and the National Monuments section of the Department of the Environment, Heritage and Local Government and under the direction of the Minister.

Mitigation measures will involve either preservation by record or preservation in-situ. All mitigation measures will be carried out in accordance with current best practice.

14.6.2 *Archaeo-geophysical Survey*

Geophysical investigation embraces non-invasive methods of investigating the sub-surface for monumental and artefactual remains. The use of archaeo-geophysical prospection can be effective at detecting a wide variety of archaeological features, thereby affording the opportunity to adapt plans at a pre-construction phase. It is normally used to identify areas of archaeological potential which can then be target tested. It is proposed to carry out geophysical investigations of the following sites – AHC no. 1, 5, 13, 17, 22, 23, 24, 25, 27, 59, 61, 68, 69 and 72.

14.6.3 *Aerial Survey*

A low-level aerial survey will be undertaken for specific sites along the alignment to:

- identify and determine the extent of previously known and unknown archaeological features; and
- examine areas of known archaeological potential.

14.6.4 *Site Specific Test Excavations*

Targeted test excavation will take place where there is an indication that archaeological remains are likely to occur. Evidence from cartographic, historical or photographic sources may point to areas of archaeological significance. Targeted testing then allows an assessment to be made on the extent of any surviving archaeology before any further mitigation is decided upon. Should any archaeological material be uncovered, excavation would then be required. The following features that will be impacted have been identified as requiring site specific test excavation – AHC no. 1, 5, 13, 22, 23, 27, 59, 61, 68, 69 and 72.

14.6.5 *Centreline Test Excavation*

General archaeological investigations on the remainder of the alignment will take the form of test trenches excavated by machine under archaeological supervision. The trenches will be at least 2m in width and, in general will follow a standard array, consisting of one continuous centre line trench with offsets at set intervals, to the limit of the road take. The overall aim will be to perform an adequate amount of archaeological testing in all areas subject to the satisfaction of the Project Archaeologist.

Centreline test excavation should take into account areas of wetland including areas identified in the townlands of Arnestown, Rathgaroge and Stokestown (marked Ruanflugh on the 1st edition Ordnance Survey map). An appropriate methodology for these areas will be agreed with the Project Archaeologist.

14.6.6 *Survey*

It is recommended that a survey of all townland boundaries that will be impacted by the proposed development takes place prior to works. This survey should include a photographic survey and drawn sections of the following townland boundaries:

- Janestown/Forestalstown N25 Ch. 000-100;
- Stokestown/Landscape N25 Ch. 3100-3400;
- Landscape/Camlin N25 Ch. 3900-4100;
- Camlin/Creakan Lower N25 Ch. 4900-5100;
- Camlin/Creakan Upper N25 Ch. 5600-5800;
- Creakan Upper/Arnestown N25 Ch. 6800-6900;
- Arnestown/Ballymacar N25 Ch. 7900-8500;
- Ballymacar/Ryleen N25 Ch. 8600- N30Ch. 100;
- Ryleen/Lacken N30 Ch. 1500-1600;
- Lacken/Berkeley N30 Ch. 3900-4100;
- Berkeley/Knockroe N30 Ch. 4900-100;
- Berkeley/Rathgaroge N30 Ch. 4900-5000; and
- Rathgaroge/Knockroe N30 Ch. 1000-1200.

14.6.7 *Archaeological Excavation*

Archaeological excavation involves the preservation by record of archaeological remains. It would normally be undertaken following the discovery of archaeological material that cannot be preserved by being left in-situ in the ground. A time period will be factored in to facilitate these excavations being completed well ahead of the construction phase of the project.

14.6.8 *Archaeological Monitoring*

The term 'archaeological monitoring' refers to the monitoring of construction of ground works, by a suitably qualified and experienced archaeologist(s), so as to identify finds, features or deposits of archaeological potential that may exist. Archaeological monitoring of construction works will take place where approved by the appointed Project Archaeologist, in consultation with the Department of the Environment, Heritage and Local Government.

14.6.9 *Project Archaeologists and the Code of Practice*

The Code of Practice was agreed between the National Roads Authority and the Minister for Arts, Heritage, Gaeltacht and the Islands (NRA and DAHGI 2000) to provide a structured and strategic framework for the management of all archaeological aspects of road planning and construction.

Project Archaeologists have been appointed to ensure the proper management of the archaeological work and that mitigation strategies are in keeping with best practice and policies determined by the Minister for the Environment, Heritage and Local Government.

14.7 *RESIDUAL IMPACTS*

It is not anticipated that any residual impacts will remain when the archaeological mitigation measures are put in place.

15 ARCHITECTURAL HERITAGE

15.1 INTRODUCTION

This chapter presents the findings of an assessment of the architectural heritage effects and impacts associated with the proposed New Ross Bypass. The assessment comprised a desk-based study in accordance with the requirements of the NRA. The aim of this study was to identify all known architectural heritage constraints within c. 50m of the alignment of the Bypass. Consultation with the NRA was undertaken during the course of the preparation of this chapter.

The results show that there are 15 Architectural Heritage Constraints (AHC) within the study area. In total eight will be directly impacted upon, five will be indirectly impacted upon and two will not be impacted upon.

15.2 METHODOLOGY

15.2.1 Overview

The assessment of architectural heritage was based on a desk study utilising a number of sources including the Irish Architectural Archive, Record of Monuments and Places, the Wexford and Kilkenny County Development Plans, documentary, cartographic and aerial photographic sources supplemented by a field inspection of the alignment.

15.2.2 Architectural Heritage

Under the Architectural Heritage (National Inventory) and Historic Properties (Miscellaneous Provisions) Act, 1999, legislation does not differentiate between protected structures on the basis of relative importance. A structure is either a protected structure or it is not. Each local authority compiles and maintains a record of protected structures, contained within the relevant development plan. All protected structures are therefore considered to be very important.

Architectural Heritage in Ireland has also been assessed by the National Inventory of Architectural Heritage (NIAH) on a county by county basis. Wexford has been completed. Local Authorities are obligated to consider all buildings assessed by the NIAH for inclusion into the Record of Protected Structures.

15.2.3 Assessment Criteria

Impacts may be categorised as either:

- direct impacts, or

- indirect impacts, or
- no predicted impacts.

A *direct impact* is where a feature of site of architectural heritage merit is physically located in whole or in part within the footprint of a potential route alignment. In this case the main form of mitigation would be realignment and avoidance, where feasible, and having regard to the significance of the feature or site concerned.

An *indirect impacts* is where a feature or site of architectural heritage merit or its setting is located in close proximity to the footprint of an alignment. In this case mitigation could ameliorate and reduce potential negative impacts.

No predicted impact is where the alignment does not adversely or positively affect an architectural heritage site.

The level of impact has been defined in accordance with the criteria provided in the published Environmental Protection Agency Guidelines (Environmental Protection Agency, 2003), i.e. profound, significant, moderate, slight or imperceptible. These terms are described as follows:

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

- **Significant** – 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 impact upon leading to a loss of character and integrity in the architectural structure or feature. Appropriate mitigation is likely to reduce the impact.

- **Moderate** – An impact that results in a change to the architectural heritage which, although noticeable, is not such that alters the integrity of the heritage. The change is likely to be consistent with existing and emerging trends. Impacts are probably reversible and may be of relatively short duration. Appropriate mitigation will reduce the impact.

- **Slight** – An impact that causes some minor change in the character or 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.

- **Imperceptible** – An impact on architectural heritage of local importance that is capable of measurement but without noticeable consequences.

15.2.4 Desk Study

15.2.4.1 Irish Architectural Archive

The Irish Architectural Archive on Merrion Square, Dublin 2, was established in 1976 to collect and preserve records of Irish architectural heritage, and since then it has established itself as the principle source of records and information concerning architecture and architects in Ireland during all periods. The Archive's reference collection, photographic collection and Press Cuttings collection were assessed for information relevant to structures in the study area.

15.2.4.2 Historical Research

Historical research began with an assessment of bibliographic sources including the British and Irish Archaeological Bibliography (www.biab.ac.uk) and Hayes Indices of manuscripts and periodicals (Hayes 1965; 1970). It continued with a review of published books and periodicals on the area including Lewis Topographical Dictionary (1837) and the archives of the Wexford County Library.

15.2.4.3 County Development Plans

The Wexford County Development Plan 2001 and the Draft Wexford County Development Plan 2007-2013 and the Kilkenny County Development Plan 2002 were also consulted. The development plans include Record of Protected Structures which list every structure which is of special architectural, archaeological, artistic, cultural, scientific, social or technical interest within the counties (Structures included in Record of Protected Structures are listed in *Annex D4*).

15.2.4.4 Cartographic Sources

Detailed analysis of the 1st edition Ordnance Survey maps for the whole route was undertaken (Wexford OS 6" sheets 029, 030 & 034). These maps were compiled in 1840 and give a good indication of the settlement distributions and field layouts prior to the onset of intensive agriculture.

15.2.4.5 Aerial Photography

Aerial photographs were examined to establish if any features of architectural heritage interest were visible along the alignment (ERM:AP).

15.2.4.6 National Inventory of Architectural Heritage

A comprehensive assessment of the architectural heritage of Co. Wexford has yet to be undertaken by the National Inventory of Architectural Heritage. The National Inventory of Architectural Heritage Survey of Historic Gardens and Designed Landscapes were assessed and include a number of the designed landscapes within the study area.

15.2.4.7 *Field Assessment*

Following the desk based study outlined above, the alignment was walked in full and all sites identified within 50m of the centreline were visited. These potential sites were assessed and observations made. The majority of the land in the study area was under crop or tillage at the time of field walking. The area as a whole has also undergone intensive arable agriculture over a long time period. Sites identified during field walking are listed in *Annex D1*.

15.2.5 Legislation, Standards and Guidelines

The following legislation, standards and guidelines were taken into account during the assessment:

15.2.5.1 *Legislation*

- National Monuments Act, 1930, amended 1954, 1987 and 2004.
- Heritage Act, 1995.
- The Architectural Heritage (National Inventory) and Historic Properties (Miscellaneous Provisions) Act, 1999.
- Local Government (Planning and Development) Act, 2000.
- Council of Europe Convention on the Protection of the Architectural Heritage of Europe, (the 'Granada Convention 1984') ratified by Ireland in 1997.
- European Council Directive on Environmental Impact Assessment (85/337/EEC), 1985 and Amending Directive (97/11/EC), 1997.
- Charter for the Conservation and Restoration of Monuments and Sites (Venice 1964).
- Convention for the Protection of World Cultural and National Heritage.

15.2.5.2 *Standards / Guidelines*

- Code of Practice between the National Roads Authority and the Minister for Arts, Heritage Gaeltacht and the Islands, 2000.
- Advice notes on Current Practice (in the preparation of Environmental Impact Statements), 2003, Environmental Protection Agency.
- Guidelines on the information to be contained in Environmental Impact Statements, 2002, Environmental Protection Agency.

- Architectural Heritage Protection Guidelines for Planning Authorities, Department of the Environment, Heritage and Local Government, 2004.

- Guidelines for the assessment of Architectural Heritage Impacts of National Roads Schemes, 2005, National Roads Authority.

- Guidelines on the information to be contained in Environmental Impact Statements, 2002, Environmental Protection Agency.

- Action of Architecture 2002-2005, Government Policy on Architecture.

15.3 DESCRIPTION OF THE EXISTING ENVIRONMENT

15.3.1 Architectural Heritage Background

Following the desk based survey of the alignment and a study of the archives of Wexford County Library a historical and archaeological background was prepared for the study area, focusing on the alignment itself.

One of the most significant features in the architectural heritage of the study area is the level of continuity and survival of early settlement patterns. The cores of estates in this part of Co. Wexford often possess ancient roots with 18th and 19th century houses built alongside the remains of tower houses and other medieval features. There is evidence for some level of continuity of settlement from the early medieval period in the townland of Lacken where a group of ringforts, a medieval castle site and 19th century farmhouse and farm are located in close proximity. At Rathgargoge a chapel site, Whitemoore House and a small settlement around Corcoran's Crossroads are located in close proximity. Continuity is also evident in features such as the field and estate boundaries around Arnestown, Landscape and Stokestown.

The system of estate landholding imposed on the countryside was linked to the construction of classical houses with demesne landscapes and associated large farms more commonly associated with England and continental Europe. Arnestown may originate well before 1653 when Simington (1953, 205) records a castle site there:

> *'…leadth the river of Barrow aforesaid northward to ye Pill called Clossoran a quarter of a mile distant a stream in a valley eastward to a place called Glanigloghscoltihie, where onto Leith eastward the castle of Arnestowne.'*

Although details of Arnestown lands are not entered in the Civil Survey, Griffith's Valuation published in 1853 does list the lands of Arnestowne. This records the townland as having an extent of c. 614 acres most of which is held in rent to a Sir Thomas N. Redington who was presumably the proprietor of Arnestown Estate and house at this time. The house and a number of features associated with the estate, including garden and boundary elements, are still visible on the aerial photographs (OS 6" 1840, ERM:AP).

Stokestown Castle is recorded in Simington as a 'faire castle' held by Nicholas Dormer an Irish papist (1953, 203). The number of acres is estimated at 500 broken down as '5 meadow, 15 moore, 10 wood, 100 arable and 370 pasture'. The land was held at a value in this period at £50. The estate is also recorded in the introduction to 'Whitchurch' parish in the words:

'The said parish (Whitechurch)…begin at a Pill called the Pill of Stokestowne which floweth out of vemaine of the River of Barrow a quarter mile south of ye Castle of Strokestowne, from which Pill leadth ye meare against a stream eastward to a foard which lieth from ye Castle of Ould Court a quarter if a Mile eastward A mile distant from thence by a ditch which meareth betwixt ye lands of Ouldcourt and Stockestowne aforesaid, Northward to a Pill called ye Pill of Camlin'.

Griffith's Valuations (1853) list the lands of Stokestown at c. 604 acres. Almost all of this was held in lease by Sarah Deane from George Drake who was probably the head of the estate at this time. Sarah Deane in turn sub-let this land to a variety of tenants as allotments of house, offices and lands. The built heritage of Stokestown estate in this period still survives notably as a castle, lodge house and folly tower all of which are protected under the Wexford County Development Plan as well as portions of a probable walled garden. Similarly to Arnestown the estate bounds as outlined in the 1st edition OS (1840) are still discernible in the present field boundaries.

Directly east of Stokestown is the townland of Landscape, which is effectively occupied by the estate of the same name shown on the 1st edition OS (1840). Some on the plantation and garden features and the estate house still survive while its outline is preserved in the contemporary field system. The estate is not included in the Civil Survey but is listed in the Griffith Valuation as c. 160 acres all of which is held in lease to George Drake (similarly to Stokestown) with the exemption of four acres for an endowed school house. In the mid 19th century George Drake was a powerful land owner in this area holding in excess of 700 acres.

15.3.2 Inventory of Architectural Heritage Sites

The architectural heritage sites identified during the assessment are listed below. Their locations are marked on the accompanying Figure (see *Figure 15.1* in *Volume 2*). These were identified from a number of sources including the Record of Monuments and Places, the relevant County Development Plan, documentary and cartographic sources, aerial photographs and field survey. The tables list these sites with reference to the:

- Type of site,
- Its legal status (whether or not the site is included in the Record of Protected Structures and Record of Monuments and Places),
- The type and level of impact the alignment will have on the site
- The level of mitigation required for the site.

The full inventory of Architectural Heritage Sites is laid out in *Annex D.*

15.4 CONSTRUCTION AND OPERATION EFFECTS

15.4.1 Overview

Table 15.1 summarise the impact of the proposed route on the Architectural Heritage sites and features.

Table 15.1 Impact on architectural heritage sites

AHC ID	Legal Status and Ref.	Townland	NGR	Description	Proximity to road (m) *	Type and Significance of Impact	Mitigation Measures Proposed
4	x	Stokestown	269340, 123541	Estate garden feature	60	Indirect, moderate impact.	Geophysical investigation and architectural recording of feature will be undertaken prior to construction.
6	RPS WCC0718	Stokestown	269823, 123592	Folly	53	Indirect, significant impact.	Retention of structure in situ.
8	x	Creakan Upper	272579, 124873	Stone structure	66	Indirect, moderate impact.	Architectural recording of feature will be undertaken prior to construction.
11	x	Arnestown	273685, 125228	Estate garden feature	6	Direct, moderate impact.	Geophysical investigation of feature will be undertaken prior to construction.
12	x	Arnestown	272685, 125228	Settlement (1st edition)	86	Indirect, moderate impact.	Architectural recording of feature will be undertaken prior to construction.
14	x	Ballymacar	274733, 126484	Bridge	12	Direct, significant impact.	Architectural recording of feature will be undertaken

							prior to construction.
15	x	Ballymacar	274850, 126536	Settlement and structure (1st edition)	9	Direct, moderate impact.	Architectural recording of feature will be undertaken prior to construction.
16	x	Ryleen	275043, 126530	Settlement (1st edition)	100	No predicted impact	No further mitigation measures will be required.
18	x	Ryleen	275094, 126729	Settlement (1st edition)	42	Direct, moderate impact.	Architectural recording of feature will be undertaken prior to construction.
19	x	Ryleen	275479, 126700	Settlement (1st edition)	102	No predicted impact	No further mitigation measures will be required.
26	x	Rathgaroge	277248, 130303	Crossroads (1st edition)	30	Direct, moderate impact.	Architectural recording of features will be undertaken prior to construction.
29	x	Stokestown	269400, 123690	Estate	0	Direct, significant impact.	Geophysical investigation of feature will be undertaken prior to construction.
31	x	Landscape	270628, 123593	Estate	0	Direct, significant impact.	Geophysical investigation of feature will be undertaken prior to construction.
42	x	Arnestown	273898, 124651	Estate (1st edition)	0	Direct, significant impact.	Geophysical investigation of feature will be undertaken prior to construction.

58	x	Lacken	276618, 128378	Settlement (1st edition)	53	Indirect, moderate impact.	Architectural recording of feature will be undertaken prior to construction.

15.4.2 *Impacts on Recorded Archaeological Monuments and Places and Sites of Archaeological Potential*

The Bypass will have a direct impact on eight architectural heritage features, will have an indirect impact on five architectural heritage features and will have no predicted impact on two architectural heritage features.

15.5 MITIGATION MEASURES

15.5.1 *Overview*

Mitigation will be carried out in accordance with current best practice and will involve either preservation in-situ or preservation by record using the following measures:

15.5.2 *Archaeo-geophysical Survey*

Geophysical investigation embraces non-invasive methods of investigating the sub-surface for monumental and artefactual remains. The use of archaeo-geophysical prospection can be effective at detecting a wide variety of archaeological features, thereby affording the opportunity to adapt plans at a pre-construction phase. It is normally used to identify areas of archaeological potential which can then be target tested. It is proposed to carry out geophysical investigations along the full alignment where approved by the appointed Project Archaeologist. Geophysical investigation of the following sites will also be undertaken – AHC no. 4, 11, 29, 31 and 42.

15.5.3 *Architectural Recording*

Architectural recording involves the production of a written account generally supplemented by measured drawing and a photographic survey. The written account should include a description of the exterior and interior along with an historical account of the structure and an appraisal of its cultural significance. The photographic survey will record the exterior, interior and setting and may include additional photographs of significant architectural features. Depending on the significance of the building in question the measured survey may range from basic sketch plans to fully dimensioned floor plan, sections, elevations and large scale drawings of significant architectural features. The following features will be architecturally recorded - AHC no. 4, 8, 12, 14, 15, 18, 26 and 58.

15.6 *RESIDUAL IMPACTS*

No residual impacts will remain when the appropriate mitigation measures are put in place.

16 MATERIAL ASSETS

16.1 INTRODUCTION

This chapter presents the predicted impacts on material assets due to the proposed Bypass. Regarding this EIS, and this chapter in particular, material assets refers to potential impacts on private properties and utility infrastructure. Other relevant material assets include agricultural holdings, which are examined in *Chapter 13: Agricultural Properties*.

16.2 METHODOLOGY

Impacts on private property were based on information provided by MMP, who determined the number of private properties that will be acquired to accommodate the Bypass.

Information on the presence and location of utilities was provided by MMP.

16.3 CONSTRUCTION IMPACTS AND MITIGATION

16.3.1 Property Acquisition

Four properties will be acquired to accommodate the Bypass. These are shown in *Figure 9.5* in Volume 2 and are summarised in *Table 16.1*.

Table 16.1 Properties to be acquired

Reference (Fig 9.5)	CPO ID	Approx chainage
128	207	N25 3,800
74	230	N25 7,250
64	236	N25 8,700
63	235	N25 8,700

Measures to compensate parties affected by land acquisition, drainage works, reinstatement of boundaries and loss of facilities are part of the compensation arrangements that have been made under the compulsory purchase system.

16.3.2 Utilities

The conflicts with existing utilities are summarised in *Table 16.2*.

Table 16.2 ***Utility conflicts with the proposed Bypass***

Utility	No. of conflicts
10 kV overhead powerline (ESB)	28
38 kV overhead powerline (ESB)	1
220 kV overhead powerline (ESB)	1
Overhead Eircom lines	24
Underground Eircom cables	6

Consultation with Wexford County Council and Kilkenny County Council identified that no known water services are located along the proposed route or within the surrounding area.

The 10kV and 38 kV lines will be either diverted underground via ducting or carried over the Bypass. The 220kV line will require a major alteration.

NTL/Chorus has been contacted to confirm if any of their services are present in the area. At present no known services are conflicting with the proposed route.

BT Ireland (Formally Esat) has been contacted to confirm if any of their services are present in the area. BT Ireland confirmed that no known services are conflicting with the proposed route.

The Eircom services will be either carried under or over the Bypass at the conflicts points.

All proposed diversion works will be agreed in advance with the appropriate utility provider. The implementation of the Utility Diversion Strategy (to be developed by the contractor), will ensure that no significant impacts on utilities will occur during construction.

16.4 OPERATION IMPACTS AND MITIGATION

No significant impacts on material assets will occur during the construction and operation of the Bypass.

16.5 RESIDUAL IMPACTS

Compensation will be provided through the CPO in the terms of the material assets affected. Nonetheless, it is recognised that the acquisition of property, particularly residential property, will cause disruption to those directly affected.

17 INTERRELATIONSHIPS& INTERACTIONS OF PREDICTED IMPACTS

17.1 INTRODUCTION

The purpose of this section is to determine the inter-relationships between the various affected environmental topics. This includes cumulative impacts (impacts which accumulate over space or time to generate a larger overall impact), cross-media impacts and other impact interactions.

The EC Guidelines state why this is an important process:

"An impact which directly affects one environmental medium may also have an indirect impact on other media (sometimes referred to as cross media impacts). This indirect effect can sometimes be more significant than the direct effect"

For example, in some cases, changes in noise or vibration levels may have a profound effect on nesting birds and badgers. Whilst the additional noise may not constitute a significant increase when using simple assessment methods, the indirect impacts on the ecology may be profound.

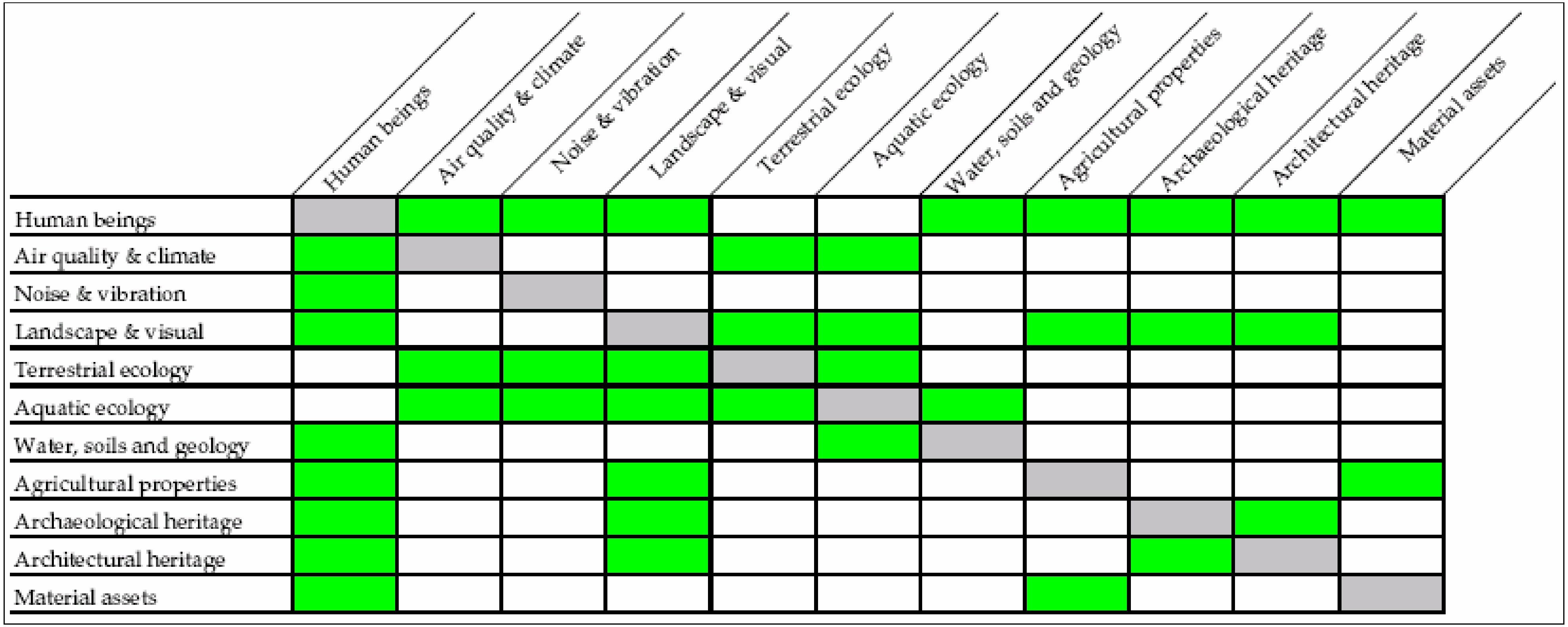
Visual intrusion may also have an indirect impact on the amenity value of sites of historical interest. Again, in the absence of the analysis of indirect impacts, visual intrusion may not be considered as significant. However, the indirect impacts may be considered as being substantial." (E.C. 1999, p8)

17.2 METHODOLOGY

Impact interactions and interrelationships have been considered throughout the EIA process and in the preparation of the individual impact chapters (*Chapters 6 - 16*) so that it may take into account the 'broader picture' of how the proposed development may affect the various environmental media.

A summary matrix was developed to identify interactive impacts of certain environmental topics to inform and guide the assessment work. The matrix is presented as *Figure 17.1*.

Figure 17.1 Impacts interaction and interrelationship matrix



The key impact interactions are described in *Table 17.1*.

Table 17.1 Key impact interactions and interrelationships

Interaction	Description
Human beings and Noise & vibration	Noise and vibration impacts during construction and operation of the Bypass will impact on receptors (primarily the occupiers of residential houses) along the alignment. However, the corresponding reduction in traffic will result in an improved noise environment for the population of New Ross town.
Human beings and Air quality & climate	Air quality impacts during construction (dust) and operation (traffic emissions) of the Bypass will impact on receptors (primarily the occupiers of residential houses) along the alignment. The reduction in traffic-related emissions will improve the air quality of New Ross.
Landscape Resources and Terrestrial & Aquatic ecology	A preliminary landscape design has been developed to address predicted negative landscape and visual impacts as a result of the Bypass. Such landscaping has been developed and designed with a view to improving the ecological aspects of the Bypass (e.g. use of native planting, providing ecological linkages across the locality, providing new habitats etc.).
Terrestrial ecology and Aquatic ecology	Both of these aspects of the wider ecological environment are strongly linked. The terrestrial environment will drain into the network of streams, lakes and rivers while the aquatic environment supports the majority of flora.
Archaeological heritage & Architectural heritage and Human beings	The link between these three environmental topics is based around the historical, academic and cultural value attached to archaeological and architectural heritage resources. There are also strong interrelationships between archaeological and architectural heritage resources.
Water, soils & geology and Aquatic ecology	There are direct and physical links between the overall water environment and its components (hydrogeology, hydrology and geology) and the aquatic environment. Any impact on the water environment is almost certain to impact on the aquatic environment.

The consideration of impact interactions and potential cumulative impacts has been addressed during the preparation of the EIA and in each of the individual impact chapters. Examples include:

- *Chapter 7* (Air quality and climatic factors) addressed potential air quality impacts on potential human receptors and on ecological receptors (River Barrow cSAC);
- *Chapter 12* (Water, soils and geology) and *Chapter 11* (Aquatic ecology) both consider the various water quality impacts arising from the Bypass;
- *Chapter 9* (Landscape Resources) and *Chapter 10* (Terrestrial ecology) both have assisted the development of the preliminary landscape design, which has been designed to address the predicted negative landscape and visual impacts from the Bypass whilst maximising the

ecological benefits of any landscaping through the use of native planting; ecologically beneficial species which will enhance the local and regional biodiversity; and

- *Chapters 10* (Terrestrial ecology) and *11* (Aquatic ecology) have both considered the respective implications of the others ecological impacts and mitigation, as well as the cumulative impacts on all ecological resources. *Chapter 11* also presents an assessment of the integrity of the River Barrow cSAC.

17.3 CUMULATIVE IMPACTS

There is the potential for cumulative impacts to arise during the construction and operation of the Bypass. However, given the rural location of the Bypass, cumulative impacts arising with another major construction project are unlikely.

Any expansion and growth of New Ross may potentially result in additional traffic flows. Furthermore, long-term changes to commuting patterns to the larger towns in the region (which may arise as a result of the reduced journey times) may also increase flows on the Bypass.

18 *SUMMARY OF MITIGATION MEASURES*

18.1 *INTRODUCTION*

This chapter presents a summary of the recommended mitigation measures from each of the individual environmental topic chapters. This summary is provided for easy of reference with regards to the mitigation measures. However, the reader is directed to the relevant chapter to gain an understanding of the context within which the various measures are recommended.

18.2 *HUMAN BEINGS*

Mitigation measures regarding construction will comprise implementation of good practice construction management and control. These measures are covered in *Sections 7.4.2* (Air Quality and Climatic Factors), *8.4.1* (Noise and Vibration) and *9.5* (Landscape Resources).

The Contractor will be required to develop and implement an Environmental Operating Plan (EOP) with the local authority and the NRA in advance of any construction works. The contractor will have regards to the Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan (In Prep., National Roads Authority, 2007).

Any temporary road closures will be notified in advance. Diversion and alternative routes will be agreed with the local authority in advance. Adequate road and directional signage, informing all road users of the diversion and alternative routing, will be put in place in advance of the temporary road closure. Appropriate reductions in speed limits, if applicable, will apply to all temporary diversions and alternative routes.

To address potential short-term and long-term socio-economic impacts when the Bypass opens, signage will be put in place in accordance with the NRA Policy on the Provision of Tourist & Leisure Signage on National Roads to notify all road users of the facilities available in New Ross. Specific signage will be put in place which encourages cyclists and pedestrians to use the old national primary route, rather than the Bypass route.

Mitigation has also been considered in the form of replacement structures (B01 - B11) to facilitate access along the local roads. Such structures will maintain the original access route following the opening of the Bypass.

18.3 *AIR QUALITY AND CLIMATIC FACTORS*

Management of the construction activities can effectively reduce the potential for dust to arise and cause a nuisance at nearby receptors. By identifying any on-site practices and activities that might be especially liable to generate dust (e.g. excavation, stockpiles), control measures can be put in place and therefore reduce potential impacts to a minimum. The main mitigation measure for both dust and non-dust emissions will be through the implementation of appropriate management programmes and the Contractor's Environmental Operating Plan.

The effectiveness of the mitigation measures can be assessed through continual monitoring of emissions during the construction phase. An environmental management programme should be required as part of the contracting process and as a minimum should include dust deposition monitoring in areas close to where construction activities are being carried out. Management plans are to take into consideration best practice and the NRA *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*.

18.4 NOISE AND VIBRATION

Best practical means will be used to minimise construction noise by adopting the recommendations set out in BS 5228. In particular, the following noise control (mitigation) measures will be implemented:

- Proper use of plant with respect to minimising noise emissions and regular maintenance will be required. All vehicles and mechanical plant will be fitted with effective exhaust silencers and will be maintained in good efficient order;

- The use of inherently quiet plant where appropriate - all major compressors and generators will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;

- Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum;

- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance, and if necessary, acoustic enclosures will be provided; and

- The construction contractors will be obliged to adhere to the relevant codes of practice for construction working and the guidance given therein to minimise noise emissions from the site.

All contractors will be required to comply with S.I. No 632 of 2001 European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001, amended by S.I. No 241 of 2006. Where feasible, earth works or noise barriers will be installed at an early stage to help mitigate the impact of construction noise.

The Contractor will be required to assess the impact of their construction activities against the criteria set down in the NRA guidelines.

Noise mitigation will be required at location 118 (N25 Ch. 3,600 - 3,700; please refer to *Figure 9.5* in *Volume 2* for the location of location 118) to ensure that the design of the road will meet the goals set within the NRA guidance document. This barrier should be approx 3m in height and approximately 140m in length.

18.5 LANDSCAPE RESOURCES

Measures to mitigate landscape and visual impacts during construction will include, as appropriate:

- design and construction process to be conducted to minimise land take;
- design and construction process to be conducted to minimise tree removal or encroachment on valued habitats and landscape resources;
- protection of valued habitats and wooded areas by means of the introduction of temporary protective fencing during the construction stage;
- control of after dark construction lighting in the interest of visual amenity;
- maintenance of tidy and contained site compounds;
- use of irrigation system to control the evacuation of dust from the construction site;
- the storage of topsoil in heaps of a height not exceeding 2m in the interest of visual amenity and indeed to protect soil structure;
- the spreading of topsoil, reseeding and replanting as soon as possible after sections of the work are complete; and
- protection of newly restored areas during early establishment stage whilst other construction activities are taking place.

The implementation of landscape design, including land forming and planting will have, as a principal objective, the mitigation of landscape and visual impacts and this is illustrated in *Figure 9.6a-h* and *j-m* (*Vol. 2*) Preliminary

Landscape Design. The scheme has been developed, taking into account the following broad design objectives:

- ecologically sensitive integration of the road into the receiving environment. The proposed landscape treatments will complement the surrounding ecological network and will counter the potential barrier and fragmentation effect of the proposed bypass as well as compensate for the loss of habitat;

- consideration of the landscape character and context of the road in the preparation of the landscape design which will also consider the road user. The scheme will aim to retain and reinforce regional identity;

- use of landscape treatments that require minimal long term maintenance;

- a range of different habitats will be created to enhance local biodiversity including grasslands, scrub, woodland planting and hedgerows;

- a soil management plan will be prepared to address procedures to take place during site clearance and for the construction phase. Particular mitigation measures addressed in the soil management plan will cover the following:

    - Topsoil to be stripped will be stored near the location from which it was taken and stockpiles will not exceed 2m in height in order to preserve soil structure.

    - Replacement topsoil will be placed in the area from which it was originally taken.

    - In the event that proposed earthworks embankments or cuttings are required to be reinforced, thereby prohibiting the planting of tree or shrub plant material, these areas, being deemed unsuitable for planting will be located, where possible, in parts of the scheme for which minimal visual impact will arise.

- species chosen will seek to enhance local biodiversity through providing food for birds and animals, increased species diversity etc. Berried and other fruiting species as well as evergreens will be included in the design;

- use of native species throughout the scheme is encouraged. The guide to landscape treatments for national road schemes in Ireland stipulates the following in regard to the use of native species 'The plant species mixes reflect native plant communities adjacent to or in the vicinity of the road scheme. Therefore only planting stock that complies with the sourcing conditions of the Native Woodland Scheme should be considered for landscape treatments on national road schemes. In such cases, deliveries must be accompanied by an approved Provenance Declaration Form/Suppliers Document incorporating the appropriate Certificate of Provenance number.' Use of non native species may be acceptable in particular locations where non native planting species are present and are a part of local landscape character; and

- a landscape and habitat maintenance plan will be required from the contractor to address the establishment maintenance period (usually 3 years post planting) and long term maintenance.

Mitigation measures have also been proposed to address general elements of the Bypass:

- the engineering design sought to route the road around significant prominent hills such as Camlin Hill, Lacken Hill and other ridgelines located in the townlands of Ballymacar and Creakan thereby reducing the potential visibility of the proposals;

- earthwork slopes will be designed where space allows to mimic naturalistic profiles, and to match in with the existing landform;

- new signs will be positioned wherever safety allows to avoid new significant visual intrusion to nearby properties and to avoid the loss of established vegetation;

- fencing or other built elements, for example boundary walls or structures for noise attenuation will be of a colour to blend in with the surrounding landscape. In regard to noise attenuation, the use of earthworks bunds or mounds as noise screens is preferable to the use of fences or similar built structures. Post and rail style of fencing is predicted to be most suited to the receiving landscape; and

- existing redundant roadside clutter such as signs which are no longer needed and broken fences will be removed, thus improving the visual environment.

The various specific landscape and visual mitigation measures are summarised in *Tables 9.6* and *9.7* and illustrated in *Figure 9.6a-h* and *j-m* (*Vol. 2*).

18.6 TERRESTRIAL ECOLOGY

General construction mitigation measures are recommended as follows:

- Clearance of vegetation such as hedgerows, treelines and woodland will be avoided, where possible, between the 1st March and the 31st August inclusive, to avoid impacts to nesting birds;

- Prior to the commencement of construction protected species survey will be undertaken to ensure no changes to those recorded have taken place;

- The working area within; and adjacent to, Ecological Sites 1 to 8, and at the crossing point of hedgerows and treelines; will be fenced and kept to minimum to reduce as much as possible the extent to which these habitats are lost;

- Any hedgerows, treelines and trees within the proposed alignment, that are to be retained, will be fenced off outside the crown spread at the outset of construction activity;

- Where habitats are directly lost as a result of the Bypass construction, new alternative habitats will be created within the lands made available for the Bypass, where feasible. New habitats will resemble, as much as possible, the habitats lost to the Bypass. The preliminary landscape design (*Figure 9.6* in *Vol. 2*) outlines areas where habitats will be recreated within the lands made available for the Bypass;

- Habitats disturbed temporarily during construction activity should be allowed to regenerate naturally, or will be recreated, once construction is complete;

- Keep topsoil and subsoil separate and replace accordingly on restoration and completion of the Bypass;

- All remedial planting associated with the proposed development will be of native seed stock;

- New hedgerows and treelines will be planted along the new road margin such that they will connect to existing linear habitats, where possible, on either side of the Bypass;

- The details of tree planting, species mixes, and habitat creation will be established at the detailed design stage in conjunction with an experienced professional and in consultation with NPWS; and

- Where possible, during the detailed design stage, an experienced professional should input into the design of storm control areas. The installation and design of storm control areas will consider the need to maintain good drainage and natural water flows within the areas in which they are proposed to be installed. The installation of these control areas in, or adjacent, to wetland habitats should be undertaken so that the impact to the existing hydrological regime is minimised as much as possible. Sustainable Drainage solutions (SuDS) should be incorporated into the design of all storm control areas. A SuDs approach would meet good practise and would offer significant habitat recreation and enhancement possibilities.

Regarding the River Barrow cSAC, the following mitigation measures are recommended:

- Where possible, tall trees of the old oak woodland occurring under the bridge will be retained using arboricultural techniques. Where the felling of mature tree species is necessitated compensatory planting will be required. While the Barrow Bridge will prevent the replanting of high-growing oak tree species, shrub and herbaceous species representative of the woodland habitat will be planted so that any vegetation to be removed is replaced. Further mitigation measures outlined to reduce potential impacts to this habitat include:

    - Construction activity will be minimised from this woodland, further reducing direct impacts to the woodland;
    - Sensitive lighting regime will be used to avoid impacts to fauna species; and
    - With the exception of traffic along haul routes, none of the other likely sources of dust will be located within or adjacent to the old oak woodland.

- To further avoid the possibility of dust deposition having a localised impact upon vegetation within this habitat, the following mitigation measures should be adopted during construction:

    - Management plans are to take into consideration best practice and the NRA *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*;
    - The use of wind breaks and barriers is to be assessed;
    - Operation and management of a wheel wash and concrete wash out areas;
    - Use of a road sweeper(s) to clean the construction site and access roads;
    - Trucks hauling spoil or materials are to be covered; and
    - Trucks arriving on site to haul material are to be clean, to prevent dirt/ mud (leading to potential sources of dust) being brought into the area – contractual condition with haulage company;
    - Speed limits for construction vehicles;
    - All plant to be used on site is to be in good working order, will be required to run on low sulphur diesel where possible and is to be of modern design incorporating abatement devices where available. These requirements are to be stipulated in contracts;
    - Plant is not to be left running when not in use;

  - The lay-down area and contractor's yard(s) are to be sealed as soon as practicable; and
  - No on-site burning will be allowed.

- The source of dust emissions during construction, as outlined in *Section 10.4.3.1* will be minimised, with the following sources excluded from land within or adjacent to the site:

  - stockpiles of earth for landscaping and building;
  - stripping;
  - demolition of any existing structures; and
  - soiling of main roads.

- The realignment of the L-4026-1 East Tie-in will involve a small area of fill immediately inside the cSAC boundary. Landscaping of this area with native tree species sourced locally will be undertaken. The appropriate landscaping of this area will ensure that a buffer area is reinstated between this road and the cSAC.

- A construction method statement will be developed in consultation with the NPWS prior to the commencement of construction activity within the cSAC.

- To avoid any impacts to otters construction activities will avoid, where possible, the main periods of otter foraging activity. Otter passage will be maintained along all watercourses of fisheries value. Passage will be maintained by ensuring that at least one bankside is retained or a mammal underpasses or mammal ledge, where appropriate, is installed at stream and river crossings. Where mammal crossings are installed for otters, mammal-resistant fencing will be placed along both sides of the alignment for a minimum of 50 metres in either direction. Mammal proof fencing should also be installed at both sides of the alignment, adjacent to stretches of the road where a median barrier is to be located.

- All measures to mitigate/reduce the impact to badgers outlined in the NRA's *Guidelines for the Treatment of Otters prior to the Construction of a National Road Scheme* will be adopted.

Regarding the River Barrow pNHA, the following additional mitigation measures are proposed:

- Construction activity will be minimised at this site. Dust mitigation measures outlined in *Section 10.5.3.1* for reducing the impact of dust will also apply to construction activities associated with the pNHA. This will ensure that any potential significant, short-term negative impacts are minimised.

- The bridging of Ecological Site 3, associated with this designated site, will ensure that no permanent habitat fragmentation will occur at within the Ecological Site. It is predicted that the change in light regime, due to the overshadowing of the habitat by the new bridge will constitute a permanent minor negative impact.

- Areas associated with the realignment of the L-4026-1 West and East Tie-in and the Stokestown Port Road will be landscaped using native species, sourced locally. Where possible, the detailed landscape design for the junction layouts between N25 Ch. 3,550 – 3,850 will incorporate woodland species to recreate habitats lost to the landtake.

Specific mitigation measures for the remaining Ecological Sites are provided below:

- *Ecological Site 4*: This woodland habitat will be severed by the proposed alignment resulting in permanent, minor, negative impact upon the surrounding ecological resource. Construction activity should be restricted to the minimum area necessary and replacement planting with native woodland species will be undertaken along the embankments in cut between N25 Ch. 2,700 to 3,150 and along the fill embankments between N25 Ch. 3,150 and 3,350. Topsoil removed from the woodland associated with this site should be stored and reused during replacement planting.

- *Ecological Site 5*: A SuDS approach will be adopted to the design of the storm control areas associated with this site. The design of the storm control area will be such that it increases the long-term ecological value of the site after construction is completed. The installation of a SuDS drainage system, along with the planting of appropriate wetland tree species such as alder, willow species and ash will recreate and provide an opportunity to enhance the wetland biodiversity of this site, which is currently degraded due to disturbance and nutrient enrichment.

- The drainage ditch to be installed in this Ecological Site will be bunded to avoid any alterations to the surrounding wetland habitats. The bunded drainage ditch will also complement the SuDS approach to the storm control area in this site.

- *Ecological Site 6*: During the construction phase, activities will be restricted to the minimum area necessary to complete construction. Alternative wetland habitats will be constructed at the storm control area to replace the wet grassland habitat lost at this site.

- *Ecological Site 7*: During the construction phase, activities will be restricted to the minimum area necessary to complete construction. The road alignment has been designed so that this area is in fill, thus avoiding potential hydro-geological impacts if the road was at grade or in cut. The run-off from the road at this point will be redirected away from this site so that the surface hydrology of the wetland habitats is not altered by the proposed development. Similarly, the natural drainage of this site will be maintained with the installation of a culvert under the proposed alignment to the west of the wetland habitats. This will ensure that the area of fill does not create a barrier to the dispersion of water from the wetland sites. The installation of a storm control area, following a SuDS approach with appropriate wetland planting, to the south of this site will increase and enhance the wetland habitats in this area.

- *Ecological Site 8*: The loss of immature woodland at this site constitutes a permanent, minor, negative impact. During the construction phase activities will be restricted to the minimum area necessary to complete construction.

Regarding badgers, the following mitigation measures are recommended:

- Badger underpasses will be provided in areas where badger territories will be severed by the new road. The location of badger underpasses are illustrated on the Mammal Activity Maps *Figure 10.2 (Vol. 2).* The selection of underpass locations is determined by the presence of main setts within the alignment; the presence of badger setts, paths or other field signs on both sides of the alignment; and in areas where the badger signs were recorded and the alignment is in cut, the underpasses were moved to the nearest areas where the alignment is in fill.

- Where badger underpasses are installed, mammal-resistant fencing will be erected on both sides of the alignment, in accordance with NRA Guidelines. Mammal proof fencing should also be installed at both sides of the alignment, adjacent to stretches of the road where a median barrier is to be located.

- Further field surveys will be carried out at the detailed design stage to ensure that no new badger setts are established within or adjacent to the alignment. If new setts or territories are identified during the detailed design stage, new underpasses will be located at appropriate sites.

- Active badger setts located within the alignment will be destroyed to facilitate the construction of the new road. Badgers will be excluded from these setts prior to their destruction. The exclusion of badgers will follow the NRA guidelines for the removal of badger setts. Prior to the exclusion of badgers, alternative setts will be identified within the displaced population's territory. If alternative setts are not identified within the badger territory, artificial setts will be created to accommodate displaced badgers.

- An experienced professional will supervise the exclusion and destruction of badger setts under licence from the NPWS.

- The NRA's *Guidelines for Site Works in the Vicinity of Badger Setts* should be implemented during the construction phase of the proposed development.

- All measures to mitigate/reduce the impact to badgers outlined in the NRA's *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Scheme* will be adopted.

Regarding bats, the following mitigation measures are recommended:

- One bat tree roost was recorded within the alignment. The removal of this tree roost should be undertaken in line with the NRA's *Guidelines for the Treatment of Bats during the Construction of National Road Schemes.* Bat boxes will be erected in appropriate locations adjacent to the original tree roost before the felling of the tree. An experienced professional will supervise the demolition of any known roosting sites, under licence from the NPWS. The demolition of roost sites should be carried out in accordance with the conditions of the licence.

- Where commuting routes are severed by the alignment, consideration will be given to the installation of planting on either side of the alignment, where feasible, to create a "hop-over" for commuting bats (*Figure 9.6* in *Vol. 2*). This hop-over will consist of gradually increasing vegetation height along the commuting route so that bats fly up and over the new road, avoiding associated traffic.

- New lighting associated with the new road should be restricted to major junctions. The lighting at these junctions should be kept to minimum by reducing light spill to areas not targeted by the lights. All lighting should be directed downwards and the height of the light columns should be as low as possible, notwithstanding safety and visibility requirements.

- Low pressure sodium lighting should be used, where possible, as these lights have been shown to attract the lowest level of prey insects to lighting. Reducing the amount of prey species attracted to road lighting will in turn reduce the number of bats attracted to the roadside, thus reducing potential fatalities to bat species.

- Once established, landscaped areas will provide potential foraging habitat for bats.

- All measures to mitigate/reduce the impact to bats outlined in the NRA's *Guidelines for the Treatment of Bats prior to the Construction of a National Road Scheme* will be adopted.

Regarding birds, the following mitigation measures are proposed:

- To reduce the impacts to nesting birds, where ever possible, vegetation will not be removed during the nesting season between March and August inclusive.

- Prior to the removal of vegetation, a survey for nest sites within the alignment should be undertaken. Where ever possible, unoccupied nests should be removed from the alignment prior to vegetation clearance. The removal and destruction of nest sites should be carried out by an experienced professional qualified ecologist, under licence from the NPWS. Where nests are destroyed artificial bird boxes should be erected in appropriate vegetation adjacent to the original location of the destroyed nest.

18.7 AQUATIC ECOLOGY

The following mitigation measures to address construction impacts are recommended:

- construction vehicles should be restricted to specified construction areas and site clearance areas should be clearly marked, with as much vegetation as possible retained with the construction site boundary;

- where possible, or unless otherwise agreed with the SRFB, construction activity that is to take place close to watercourses should be scheduled for drier months i.e. outside the fish spawning season during the summer months;

- site runoff should be diverted away from denuded areas and these areas should be re-vegetated as soon as possible;

- sediment traps, sediment fences and sediment control ponds should be installed to retain sediments on site. The contractor's responsibilities for controlling silt laden water should be specified in the contract documents;

- the following areas should be kept to a minimum size and well away from all watercourses:

    - sand and gravel stockpiles;
    - construction machinery service areas; and
    - concrete mixing areas.

- potential polluting materials such as fuels, oils, grease and hydraulic fluids should be stored in bunded compounds well away from all watercourses. Refuelling of machinery should be carried out in bunded areas;

- pouring of concrete for aprons, sills, and other works should be carried out in dry conditions and allowed cure for 48 hours before re-flooding. Pumped or tremied concrete should be monitored carefully to ensure no accidental discharge into the watercourse. Mixer washings and excess concrete should not be discharged to watercourses. Oil storage tank(s), associated filling areas and distribution pipe work should be situated at least 10m away from watercourses (rivers, lakes, streams, field drains) and 20m from wells or boreholes;

- permanent stream diversion should be completed well in advance of their use. The potential release of suspended solids should be minimised from the new channel before the river is re-routed into it. All temporary stream diversions should be constructed to the criteria laid down for permanent stream diversions; and

- the construction of watercourse crossings and diversions should adhere to the guidance contained within the SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works*.

- Bankside vegetation should be left intact where possible. A fence should be installed prior to the commencement of site works to ensure that riparian vegetation is retained. The fence should be set back two metres from the bankside or at the edge of a woody canopy (whichever is greater). Where bankside vegetation is to be removed the construction machinery should operate from the bank and remove the vegetation away from the watercourse.

Measures to avoid or minimise the potential impacts of the proposed development are based upon a number of published guidelines. These include:

- NRA's *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*;

- Department of the Marine, Communications and Natural Resources' *Fisheries Guidelines for Local Authority Works*;

- SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works*; and

- Northern Regional Fisheries Board (NRFB) *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites*.

There are a number of mitigation measures which will be implemented during the construction of the Bypass to minimise the risk of the development resulting in a significant impact on the River Barrow cSAC:

- The area of landtake required for the construction of the pier will be kept to a necessary minimum;

- During construction works which are physically below the MHWS tide, potential increases in siltation and suspended solids will be minimised by the installation of a temporary impermeable, sealed work area; or another appropriate construction technique, which will be developed in consultation with NPWS and SRFB. The installation of the sealed area or alternative construction technique will facilitate the carrying out of construction activity throughout the construction period, while at the same time protecting the aquatic ecology from potential significant adverse impacts. Unless otherwise agreed by the SRFB or the NPWS; these impermeable, sealed work areas or construction technique will be minimised in size (where practicable) and installed in the dry season, outside the fish spawning season.

- A detailed construction method statement for the construction of the River Barrow cSAC Bridge Crossing will be developed in consultation with the NPWS and the SRFB.

Regarding instream works, the following mitigation measures are recommended:

- Any instream construction work associated with watercourses should be undertaken outside the fish spawning season, unless express permission to the contrary is received by the SRFB. The fish spawning season for the watercourses intersected by the proposed alignment extends from October to June, inclusive. Any further SRFB requirements for extending the designated spawning season for watercourses in the area, or for protecting populations of other protected fauna, such as lamprey, will be adhered to by the contractor. The contractor will develop best practice construction procedures with the SRFB prior to commencing instream construction activities.

- Before any construction activities are undertaken adjacent to or within a watercourse, a detailed construction method statement will be developed in consultation with the SRFB by the contractor. The contractor should be familiar with the contents of the CIRIA guidance document *Control of water Pollution from Construction Sites – Guidance for Consultants and Contractors*.

- All instream works will be undertaken within an impermeable sealed area. The sealed area will facilitate instream works by keeping the work area dry and by reducing the potential for suspended solids to discharge into watercourses. The sealed area should not reduce the watercourse width by an amount that will lead to erosion of banks both upstream and downstream of the site or impede the movement of migrating fish. Only clean, silt free materials shall be used as the fill materials for impermeable sealed area, and all materials must be removed from the watercourse after construction is completed. Dewatering operations will be undertaken within the sealed area and will direct the water to storm control areas to remove sediments. The SRFB shall be consulted on the need to implement a fish salvage programme prior to dewatering.

- Monitoring of suspended sediment loadings will be undertaken during instream works.

The following mitigation measures are recommended in relation to any proposed stream diversions and/or have been considered during the design of the Bypass:

- A method statement for temporary and permanent stream diversions will be developed by the contractor, in consultation with the SRFB. Any temporary or permanent stream diversions to be undertaken will adhere to the SRFB document *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works*.

- Temporary stream diversions will be required to facilitate the completion of instream works. The diversions should always be excavated in isolation of stream flow, starting from the bottom end of the diversion channel and working upstream to minimize sediment production. Any dewatering flows should be directed to a settling pond to remove sediments. Watercourse diversion should be completed as quickly as possible, preferably within a single day during the low flow period. Upon completion of the instream work, the stream shall be restored to its original configuration and stabilised to prevent bank erosion around the temporary diversion.

- During the design of the Bypass, the need for permanent, river diversions have been kept to a minimum by designing the alignment perpendicular to watercourses. However, where the Bypass cannot cross a watercourse perpendicularly, it will be necessary to realign watercourses to reduce the length of the watercourse crossings.

- Where a permanent diversion or relocation is absolutely necessary, a compensatory diversion channel shall be designed in detail to the satisfaction of the SRFB. This compensation habitat should ensure that no deterioration of the salmonid, or other protected fish habitat status occurs. The diversion should be bio-engineered to closely replicate the natural flow, substrate and bankside characteristics of the original channel. This will require careful evaluation and cataloguing of the existing features in advance of the relocation design. The construction of the compensation channel shall be carried out in dry conditions without connection to the existing stream or watercourse. The construction of the new channel should be completed well in advance of its use so that native bankside vegetation is established. The bankside should be vegetated with sods removed from the original channel bankside. This will ensure that the seed bank associated with the original bank is preserved, as well as reinforcing the channel's bank, reducing erosion and suspended solids and providing shelter and foraging material for aquatic fauna.

- The connection of the new channel to the original watercourse shall be made only during the approved timing windows for instream works. Sufficient notice shall be provided to the SRFB to permit reconnaissance, planning and inspection of the diversion before connection to the watercourse takes place. The contractor will provide the means and expertise to relocate resident fish stocks from the section of the watercourse to be abandoned. The relocation of the resident fish stocks from the original stretch of watercourse (to be abandoned) shall be undertaken without delay and with a minimum of stress to the fish stocks. Re-inspections and evaluations of the success and effectiveness of the diversion shall be made at specified intervals after its placement into service, and any necessary corrections and adjustments will be undertaken by the contractor where such are deemed necessary by the SRFB.

The following mitigation measures are recommended in relation to any proposed watercourse crossings and/or have been considered during the design of the Bypass:

- During the design of the Bypass, bridge crossing have been included wherever possible to reduce the number of culverts. Where the installation of culverts is deemed to be the most feasible option for crossing a watercourse the, proposed culverts will be kept to a minimum length by squaring the proposed alignment with the watercourse. Where it is not possible to square the alignment with the natural watercourse channel, the watercourse will undergo realignment to square the intersection. Such realignments will be kept to a minimum.

- Over-sized bottomless box culverts will be used so that the stream or river banksides are retained and the riverbed habitats are not directly impacted by the crossing. The retention of natural banksides will facilitate the movement of mammals. Where natural banksides cannot be retained, mammal passage facilities should be incorporated in the watercourse crossing. The location of mammal pass facilities along watercourses is outlined in *Section 10.5.5.2*.

- The design of culverts should include features that allow unobstructed upstream movement of adult fish species. The design criteria for culverts should meet those specified in the SRFB's *Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works* and the NRA's *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*.

The following mitigation measures are proposed for specific watercourses to be impacted by the Bypass:

- *Graiguenakill River*: Direct alterations to this river will be avoided. Surface runoff from the LS-7512 South Tie-in will be prevented from directly entering this watercourse.

- *Graiguenakill Stream*: Stream diversion and the installation of bottomless box culvert, as per the SRFB and NRA Guidelines will ensure that high value aquatic habitats are maintained. Aquatic habitats within the new channel will be representative of the baseline habitats. The diversion of a section of the river will reduce the need for culverting. Wetland riparian vegetation will be installed along the banks of this river.

- *Camlin Stream:* Stream diversion and the installation of bottomless box culverts, as per the SRFB and NRA Guidelines will ensure that high value aquatic habitats are maintained. Aquatic habitats within the new channel will be representative of the baseline habitats. The diversion of a section of the river will reduce the need for culverting. Wetland riparian vegetation will be installed along the banks of this river.

- *Maudlin Stream:* Stream diversion and the installation of bottomless box culvert, as per the SRFB and NRA Guidelines will ensure that high value aquatic habitats are maintained. Aquatic habitats within the new channel will be representative of the baseline habitats. The diversion of a section of the river will reduce the need for culverting. Riparian vegetation will be installed along the banks of this river.

- *Aughnacrew Stream*: Bottomless box culvert will be installed as per the SRFB and NRA Guidelines to ensure that faunal movements are not restricted.

The following mitigations measures are proposed to address runoff from the Bypass:

- Storm run-off from the proposed road to watercourses of fisheries value will be intercepted by drains and directed to storm control areas that will be designed with adequate storage capacity and in a manner to facilitate maintenance and cleaning. Oil interceptors and sediment traps will also be provided. The installation of the drainage system will ensure that the level of particulate matter entering the watercourses will be minimal and as such will have a negligible affect on water quality.

- A sustainable drainage scheme (SuDS) approach should be adopted for the design of all storm control areas. The design of these ponds should aim to replicate a natural wetland habitat. Attention will therefore be given at the detailed design stage in relation to size and shape, water depth, supply and quality and general landscaping. The design of storm control areas will be agreed in consultation with the NPWS. Any storm control areas proposed within Ecological Sites (see *Table 10.3*) will conform to the highest level of design specifications to replicate a semi-natural water body. The existing field boundaries in close proximity to the proposed balance ponds will be retained.

- All site runoff associated with the construction of the River Barrow bridge crossing will be directed to storm control areas or tanks to prevent direct discharge into the river. During the operation phase of the road all surface runoff will be intercepted in a sealed drainage system and directed towards storm control areas. Any drainage outfalls into the cSAC will be such that they do not negatively impact upon the integrity or reduce the water quality of the cSAC.

18.8 WATER, SOILS AND GEOLOGY

- The contractor will take into account good site works practice in accordance to the NRA guidelines, the Department of the Marine, Communication and Natural Resources, CIRIA and EPA guidelines should reduce such environmental impacts:

    - National Roads Authority – Design Manuals for Roads and Bridges;
    - CIRIA Report 142: Control of Pollution from Highway Discharges; and
    - CIRIA Report C648: Control of water pollution from linear construction projects.

- Instream works will be minimised, where practicable, so as to protect and maintain the natural stream conditions. However, construction of the Barrow Crossing will require such works. Work near rivers and other waterbodies will be carried out during drier months, where possible, so as to minimise the potential runoff volume from the works area.

- A buffer area of existing vegetation will be retained alongside watercourses where possible and the use of silt fence may be an option to protect streams and rivers.

- There will be no direct surface discharges from the works site to the nearby streams. Runoff will be diverted away from excavated areas; and sediment-laden wash down from aggregate heaps and dust control should be directed to and contained within a settlement area before being discharged to nearby watercourses.

- Refuelling and storage of plant and potentially harmful substances will take place well away from any surface water courses. It is essential to ensure the use of cement and wet concrete in or close to any watercourse is carefully controlled.

- Site clearance works and excavation of road profile during construction will reduce the protective soil cover, increasing the vulnerability of the underlying aquifers to pollution. As a reduction mitigation measure guidelines associated with the operation of constructional sites, designed to minimise adverse water quality and fisheries impacts (CIRIA 2001 and Dept of the Marine and Natural Resources, 1998), will be implemented. Measures comprise:

    - Provision for the protection of soil surfaces from rainfall erosion.

    - Stockpiles and spoil located well away from exposed bedrock areas and supply sources (springs and wells).

    - Careful control of the use of cement and wet concrete in or close to any exposed areas.

    - Storage of fuels, oils and chemicals, if necessary on site, on an impervious base protected by a bund. Refuelling of plant to be undertaken well away from exposed bedrock areas, and any spillages immediately contained on site and the contaminated soil removed from the site for suitable treatment and disposal.

    - Foul drainage from site offices and temporary lavatories to be either directly connected into the nearby public foul sewer or removed to a suitable treatment facility.

    - Pumping of excavation works to avoid groundwater seepage at excavation faces.

The following operational mitigation measures are proposed:

- The contractor will seek and receive OPW consent for all proposed watercourse crossings (i.e. The Barrow Bridge Structure and stream culvert crossings, new and upgraded) in order to satisfy the requirements of Section 50 of the Arterial Drainage Act 1945 and the necessary hydraulic assessment reports of the individual crossings furnished to the OPW as part of the Section 50 application. The design flow for all culvert and bridge crossings is the 1 in 100 year flood event increased by 20% to allow for climate change.

- Culvert and water crossings design guidelines from the Southern Regional Fisheries Board and the NRA's *Guidelines for the Crossing of Watercourses during the construction of National Road Schemes* should be taken into consideration when designing culverts. Consultation with the Southern Regional Fisheries Board will be undertaken by the contractor during the detailed design stage. The minimum culvert size to be used in existing watercourses will be a 900mm diameter, or greater if required for ecological purposes.

- Road drainage has been designed to accommodate the existing natural hydrology in the vicinity of the Bypass. This will include for the interception of overland, interflow and groundwater flow by the road footprint and its safe disposal to nearby existing streams/drains.

- Runoff from the road will be attenuated to a discharge rate appropriate to the characteristics of the receiving watercourse so as to prevent flooding of land.

- Runoff from the road will be subject to treatment to ensure that it does not significantly reduce the water quality in the receiving environment. All storm water will be passed through oil/petrol interceptors and storm control areas for attenuation and settlement prior to outfalling to the receiving watercourses. The storm control areas along the Bypass will act as additional protection against serious pollution incident allowing major spills to be isolated within the control area for removal/treatment.

- Current best practice in the design and implementation of Sustainable Urban Drainage systems (SUDs) will be utilised and the contractor will have regard to the following documents when designing the road drainage system. CIRA (2001) *Sustainable Urban Drainage Systems – best practice manual for England, Scotland, Wales and Northern Ireland* and CIRIA (2000) Sustainable Urban Drainage Systems – *Design Manual for Scotland and Northern Ireland*.

- At the River Barrow Bridge crossing the soffit height of the structure will be designed to provide adequate clearance (minimum 1m freeboard above the 100 year design flood level) to allow flood debris to pass underneath unhindered. There is a navigation requirement that considerably exceeds the flood/hydraulic freeboard requirement. (i.e. 36m above mean spring high water level).

- The integrity of the flood plain in terms of overbank conveyance at the crossing of the Barrow Estuary will be maintained by the provision of a sympathetic bridge structure allowing overbank flood conveyance to take place on both banks, thus reducing the contraction impact of the road crossing on the River Barrow floodplain which must evacuate combined fluvial and upstream tidal waters.

- First flush volumes of a minimum of 15 mm rainfall intensity will be accommodated in storm control areas prior to outfalling to sensitive receiving watercourses. Such facilities can also be used to contain if necessary accidental spillages.

- A maintenance program in respect to the regular inspection and maintenance of road outfalls, petrol interceptors, filter drains, open drains, water quality improvement/ wetland systems and road culverts should be prepared and implemented throughout the operational phase of the scheme.

- The vertical alignment has been designed as far as possible to balance the amount of cut generated and fill material required, which will reduce the need to dispose of surplus material off site. It is anticipated that there will be a surplus of approximately 135,000m^3 of acceptable fill material and 58,000m^3 of topsoil. The topsoil surplus may be used for landscaping purposes. Regarding the need to import material off-site, local sources should be used as afar as possible.

- Where soft ground is encountered, this will need to be removed, and fill material imported. Consideration will be given to the type and source of this material, and ground treating methods or piling to bedrock may be required, particularly in the low lying River Barrow floodplain.

- Where the route is cut directly into bedrock or underlain by a thin subsoil cover, then the road design should be such that any subterranean drainage paths encountered are not affected in terms of flow conveyance and water quality.

- Changes in the chemical composition of soils, caused by flow of carriageway runoff should be prevented. This may result from the flooding of unsaturated soils, or rise in groundwater levels above 'normal', thus allowing the water to react with the chemical constituents in the soil. At sites of particular sensitivity clay bunds may be required and sections of closed drain should be considered where domestic well supplies are located nearby. The addition of lime to soils prior to reuse needs to be carefully undertaken, if deemed necessary. The contractor will apply best practice to take into account the vulnerability of the underlying aquifer.

- Where sensitive sites or water supply wells (*Section 12.5.5*) are located close to the Bypass, mitigation measures to reduce dewatering through cut sections will be employed. One such option is the use of impermeable clay bunds at the cut interface to avoid drawdown in the cutaway. This bunding should be extended in depth to an impervious stratum.

- Where there are high infiltration rates and shallow free draining overlying soils, the drainage system will require the use of filter drains or swales to reduce the impact to the underlying aquifers.

- Subterranean drainage intercepted in the bedrock cuttings during the construction phase will need to be continued through the use of either a piped solution or a sufficiently permeable granular bed beneath the roadway so as to mitigate possible long-term changes in the drainage.

- The potential for cavity development as a result of localised discharges to groundwater swill be reduced, as appropriate, by discharging any generated drainage to designed outfalls to surface watercourses.

- Road drainage will be enclosed (closed-pipe system) along the vulnerable road cut sections to prevent uncontrolled infiltration to the aquifer, as appropriate. In addition, monitoring of water levels in well / spring supplies within 250m of the road cuttings should be undertaken during the construction phase and if shown to be adversely impacted by the time of the operational phase, then either an alternate source should be provided or the well should be deepened to allow deeper abstraction from the bedrock aquifer.

18.9 AGRICULTURAL PROPERTIES

The following mitigation measures are recommended during the construction of the Bypass:

- Boundary fencing will be erected to delineate the site boundary and prevent disturbance to adjacent land. Issues expected to result from disruption during the works will be addressed during consultations on accommodation works. Liaison between the contractor and farmers during the works will also minimise difficulties caused by the restriction of access to severed land parcels.

- Good communication with farmers will facilitate the organisation of farm enterprises, so that vulnerable livestock are kept as far away as possible from the construction work during critical times. The contractor will be informed of the location of particularly sensitive areas, such as farms with horses. The contractor will notify in advance all land owners likely to be affected by any explosions. It may be necessary to house animals in this situation or move to a suitably quiet, well fenced part of the farm. The contractor will also employ measures to prevent the spread of dust and mud onto adjoining lands. In new road construction projects the impact of dust is generally not significant on grazing livestock and if an exceptional impact was being experienced livestock would have to be moved from the affected area which would be localised.

- A project liaison officer will be appointed during the construction phase to facilitate communications between affected landowners and the contractor.

- If a water supply is affected during construction, an alternative water supply will be provided.

- Accommodation roads will provide landowners with access onto the local road network and access between multiple land parcels severed by the scheme and avoid the requirement for direct access onto the scheme. Access roads will be provided where necessary to link current or future access points with the local road network or as a means of crossing the mainline.

- Permanent access arrangements to some severed parcels of land have been addressed as part of the preliminary design. Other small parcels of severed, landlocked land will be acquired through the CPO process. The drainage design for the scheme has taken into consideration suggestions for agricultural land drainage.

18.10 ARCHAEOLOGICAL HERITAGE

In accordance with the Code of Practice agreed between the National Roads Authority and the then Minister for Arts, Heritage, Gaeltacht and the Islands in June 2000 every effort has been made to avoid direct impacts on archaeological monuments and places. As a result, the proposed scheme is directly impacting on the zones of archaeological potential of eight recorded archaeological monuments and places. The following mitigation measures are proposed to address these impacts:

- All necessary licences, procedures, consents and directions as specified by the National Monuments Acts 1930-2004 will be complied with. All archaeological finds and features revealed will be recorded appropriately prior to construction of the proposed scheme in agreement with the Project Archaeologist and the National Monuments section of the Department of the Environment, Heritage and Local Government and under the direction of the Minister.

- Mitigation measures will involve either preservation by record or preservation in-situ. All mitigation measures will be carried out in accordance with current best practice.

    - *Archaeo-geophysical Survey:* Geophysical investigation embraces non-invasive methods of investigating the sub-surface for monumental and artefactual remains. The use of archaeo-geophysical prospection can be effective at detecting a wide variety of archaeological features, thereby affording the opportunity to adapt plans at a pre-construction phase. It is normally used to identify areas of archaeological potential which can then be target tested. It is proposed to carry out geophysical investigations of the following sites – AHC no. 1, 5, 13, 17, 22, 23, 24, 25, 27, 59, 61, 68, 69 and 72.

- *Aerial Survey*: A low-level aerial survey will be undertaken for specific sites along the alignment to identify and determine the extent of previously known and unknown archaeological features and examine areas of known archaeological potential.

- *Site Specific Test Excavations*: Targeted test excavation will take place where there is an indication that archaeological remains are likely to occur. Evidence from cartographic, historical or photographic sources may point to areas of archaeological significance. Targeted testing then allows an assessment to be made on the extent of any surviving archaeology before any further mitigation is decided upon. Should any archaeological material be uncovered, excavation would then be required. The following features that will be impacted have been identified as requiring site specific test excavation – AHC no. 1, 5, 13, 22, 23, 27, 59, 61, 68, 69 and 72.

- *Centreline Test Excavation*: General archaeological investigations on the remainder of the alignment will take the form of test trenches excavated by machine under archaeological supervision. The trenches will be at least 2m in width and, in general will follow a standard array, consisting of one continuous centre line trench with offsets at set intervals, to the limit of the road take. The overall aim will be to perform an adequate amount of archaeological testing in all areas subject to the satisfaction of the Project Archaeologist.

- Centreline test excavation should take into account areas of wetland including areas identified in the townlands of Arnestown, Rathgaroge and Stokestown (marked Ruanflugh on the 1st edition Ordnance Survey map). An appropriate methodology for these areas will be agreed with the Project Archaeologist.

- *Survey*: It is recommended that a survey of all townland boundaries that will be impacted by the proposed development takes place prior to works. This survey should include a photographic survey and drawn sections of the following townland boundaries:

    - Janestown/Forestalstown N25 Ch. 000-100;
    - Stokestown/Landscape N25 Ch. 3100-3400;
    - Landscape/Camlin N25 Ch. 3900-4100;
    - Camlin/Creakan Lower N25 Ch. 4900-5100;
    - Camlin/Creakan Upper N25 Ch. 5600-5800;
    - Creakan Upper/Arnestown N25 Ch. 6800-6900;

- Arnestown/Ballymacar N25 Ch. 7900-8500;
- Ballymacar/Ryleen N25 Ch. 8600- N30Ch. 100;
- Ryleen/Lacken N30 Ch. 1500-1600;
- Lacken/Berkeley N30 Ch. 3900-4100;
- Berkeley/Knockroe N30 Ch. 4900-100;
- Berkeley/Rathgaroge N30 Ch. 4900-5000; and
- Rathgaroge/Knockroe N30 Ch. 1000-1200.

- *Archaeological Excavation*: Archaeological excavation involves the preservation by record of archaeological remains. It would normally be undertaken following the discovery of archaeological material that cannot be preserved by being left in-situ in the ground. A time period will be factored in to facilitate these excavations being completed well ahead of the construction phase of the project.

- *Archaeological Monitoring*: The term 'archaeological monitoring' refers to the monitoring of construction of ground works, by a suitably qualified and experienced archaeologist(s), so as to identify finds, features or deposits of archaeological potential that may exist. Archaeological monitoring of construction works will take place where approved by the appointed Project Archaeologist, in consultation with the Department of the Environment, Heritage and Local Government.

- *Project Archaeologists and the Code of Practice*: The Code of Practice was agreed between the National Roads Authority and the Minister for Arts, Heritage, Gaeltacht and the Islands (NRA and DAHGI 2000) to provide a structured and strategic framework for the management of all archaeological aspects of road planning and construction. Project Archaeologists have been appointed to ensure the proper management of the archaeological work and that mitigation strategies are in keeping with best practice and policies determined by the Minister for the Environment, Heritage and Local Government.

18.11 ARCHITECTURAL HERITAGE

Mitigation will be carried out in accordance with current best practice and will involve either preservation in-situ or preservation by record using the following measures:

- *Archaeo-geophysical Survey*: Geophysical investigation embraces non-invasive methods of investigating the sub-surface for monumental and artefactual remains. The use of archaeo-geophysical prospection can be effective at detecting a wide variety of archaeological features, thereby affording the opportunity to adapt plans at a pre-construction phase. It is normally used to identify areas of archaeological potential which can then be target tested. It is proposed to carry out geophysical investigations along the full alignment where approved by the appointed Project Archaeologist. Geophysical investigation of the following sites will also be undertaken – AHC no. 4, 11, 29, 31 and 42.

- *Architectural Recording*: Architectural recording involves the production of a written account generally supplemented by measured drawing and a photographic survey. The written account should include a description of the exterior and interior along with an historical account of the structure and an appraisal of its cultural significance. The photographic survey will record the exterior, interior and setting and may include additional photographs of significant architectural features. Depending on the significance of the building in question the measured survey may range from basic sketch plans to fully dimensioned floor plan, sections, elevations and large scale drawings of significant architectural features. The following features will be architecturally recorded - AHC no. 4, 8, 12, 14, 15, 18, 26 and 58.

18.12 MATERIAL ASSETS

Measures to compensate parties affected by land acquisition, drainage works, reinstatement of boundaries and loss of facilities are part of the compensation arrangements that have been made under the compulsory purchase system.

The implementation of the Utility Diversion Strategy, will ensure that no significant impacts on utilities will occur during construction.

Consultation with Wexford County Council and Kilkenny County Council identified that no known water services are located along the proposed route or within the surrounding area.

The 10kV and 38 kV ESB lines will be either diverted underground via ducting or carried over the Bypass. The 220kV line will require a major alteration.

NTL/Chorus has been contacted to confirm if any of their services are present in the area. At present no known services are conflicting with the proposed route.

BT Ireland (Formally Esat) has been contacted to confirm if any of their services are present in the area. At present no known services are conflicting with the proposed route.

The Eircom services will be either carried under or over the Bypass at the conflicts points.

All proposed diversion works will be agreed in advance with the appropriate utility provider.

19 SUMMARY OF RESIDUAL IMPACTS

19.1 INTRODUCTION

This chapter presents a summary of the residual impacts from each of the individual environmental topic chapters. This summary is provided for easy of reference with regards to the residual impacts. However, the reader is directed to the relevant chapter to gain an understanding of the context within which the residual impacts are presented.

19.2 HUMAN BEINGS

The residual impact of construction is a negative impact of moderate significance due to disruption and nuisance resulting from the construction of the scheme. While the various mitigation measures and the development of an Environmental Operating Plan will reduce the significance of these impacts to slight, they will still remain for the duration of the construction phase, which will be approximately 36 months.

For the duration of construction, the local economy will receive a positive impact of slight significance due to local spending by construction workers and indirect/spin-off, positive, economic impacts as a result of the construction of the scheme.

A Cost Benefit analysis has indicated a positive cost benefit ratio for the Bypass, with savings to both travel time and fuel consumption. The scheme costs were Discounted to 2002 with a Discount Rate of 4.0% and have an Evaluation Period of 30 years with the First Scheme Year (Opening Year) being 2013.

The opening of the Bypass will result in positive impacts of moderate significance for New Ross due to traffic flow reductions of approximately 54% for the Opening year and positive impacts of moderate to major significance (approximately 54%) by the Design year. The reduction in traffic flows will result in reduced severance, visual impacts, noise and traffic emissions.

The opening of the scheme is likely to result in short-term negative impacts of slight significance regarding the economy of New Ross and the surrounding areas. However, in the medium to longer-term, positive economic benefits are likely to arise through reduced congestion, improved quality of life and townscape, and reduced journey times (specifically for those travelling to the town).

The provision of the Bypass will not result in any significant negative impacts for the majority of the various road users along the existing roads which will interact with the Bypass alignment. While these road users will be impacted during temporary road closures, once the scheme is completed the replacement structures (*Table 6.8*) will ensure that there is no significant impact for the majority of roads.

However, for some road users, negative impacts will arise, essentially due to increased journey times and longer distances. Minor negative impacts arise for pedestrians and cyclists at the key junctions along the alignment (Glenmore, R733, Ballymacar Bridge and Corcoran's Cross), and also at the local road LS-7501 (will be realigned to connect to the Glenmore junction).

The realignment of L 8048-1 will result in moderate negative impacts for vehicles and cyclists and major negative impacts for pedestrians. The reason for these impacts is that the extinguishment and realignment of the L 8048-1 will increase journey times and distances for all road users.

The extinguishment and realignment of the L-4003-3 will result in moderate negative impacts for pedestrians and minor negative impacts for other road users. L-4026-1 West-tie in and Stokestown Port local road proposals will result in minor negative for pedestrians and cyclists.

19.3 AIR QUALITY AND CLIMATIC FACTORS

With the implementation of the mitigation measures outlined in *Section 7.4.2* (and in *Section 18.3* above), it is anticipated that the impact during this phase of the project can be reduced to moderate and short-term.

There will be no significant impacts from construction traffic.

There will be a positive impact to air quality along the existing road network in the town of New Ross as a result of the Bypass. One road where PM_{10} concentrations are predicted to exceed the air quality limit value in the baseline situation is brought within the limit values as a direct result of the new road.

There will be a small increase in pollutant concentrations adjacent to the proposed route. However, no air quality limit values are predicted to be exceeded.

There will be no exceedance of the air quality limit value for NO_x for the protection of vegetation and sensitive habitat at the cSAC and NHA.

There will be a reduction in greenhouse gas emissions from the traffic network in the area as a result of the introduction of this scheme.

19.4 NOISE AND VIBRATION

Noise and vibration impacts from the construction phase can be effectively mitigated through good management practices. Based on a worst-case assessment noise impacts from the construction phase will be significant but short-term at approximately 70 properties. The overall project is scheduled to take approximately 36 months to construct, and impacts are likely over a small period of this time. As highlighted in *Section 8.4.1* there are a number of locations within 100m of the alignment that may experience more prolonged impacts. Through monitoring and management of the construction phase these can be minimised. At two locations it has been identified that the Criteria may be exceeded by 8 dB which would be a significant impact but is likely to be short term.

No significant residual vibration impacts from the construction phase are likely.

Location 118 that has been identified in *Table 8.6* as requiring noise mitigation. The model showed that, the impacts arising from the road can be mitigated to ensure that the noise levels experienced at all the noise sensitive receptors meets the design criteria outlined in the NRA guidance documents. This noise barrier will reduce the un-mitigated noise level to 56dB, over 13dB over the baseline noise level. This is a residual impact of severe significance.

Table 8.10 indicates the change in noise levels along the alignment at the other locations that were modelled. Although all these locations meet or are below the design criteria for national roads, the change in noise levels remains significant and the impact of this magnitude is considered to be 'substantial to severe' and 'permanent'. It should be stated that the impact is greater in this area due to the fact that, as outlined in the baseline above, noise levels along the alignment are particularly low due to the rural setting. Thus, significant residual operational noise impacts are thus predicted at all receptors listed in the lower 3 rows of *Table 8.10* (locations 1 west, 1 east, 19, 23, 71, 74, 94, 110, 118, 127, 147, 151, 200).

A reduction in traffic flows on the existing road network will result in a reduction of noise levels within New Ross of approximately 3 to 4 dB(A). This would be a moderate and permanent positive impact for all the houses facing the roads where traffic flow will be reduced due to the Bypass.

19.5 LANDSCAPE RESOURCES

Permanent and direct impacts upon the landscape will result from the Bypass, in particular the proposed structures, earthworks, mainline alignment and side roads. Impacts include the loss of vegetation and localised changes to topography arising from earthworks cuttings and embankments.

Indirect impacts on landscape character will apply in terms of the effect of the proposals on the setting of a given landscape character area as perceived by the viewer. In this regard four local landscape character areas were identified and the significance of the indirect impact was assessed as follows.

- New Ross Urban Centre – Not Significant.
- River Barrow and Floodplain – Substantial Impact.
- Flat to undulating farmland to the north east of new Ross – Moderate to Substantial Impact.
- Farmed Hills South of New Ross - Substantial Impact.

With regard to visual impacts, a total of 205 viewpoint locations were assessed. The visual impact significance is predicted to be greater during the construction and pre establishment phases of the scheme. In the pre establishment phase, construction works will be completed and planting will have just been implemented and will be in a very immature stage of growth. The planting will not therefore be adequately developed for the purpose of providing visual filtering of the road proposals. The significance of the impact is estimated to be substantial at 42 viewpoint locations. Visual impacts of a moderate to substantial significance are predicted to arise at 12 viewpoint locations. Visual impacts of a moderate significance are predicted to arise at 24 viewpoint locations. Visual impacts of a moderate to slight significance are predicted to arise at 14 viewpoint locations. Visual impacts of a slight significance are predicted to arise at 25 viewpoint locations. Visual impacts in the range of slight to not significant are predicted to arise at 88 viewpoint locations.

The post establishment phase of the project is defined as 15 years post implementation of the landscape design scheme and assumes that planting and seeding has established and developed appropriately. The significance of the visual impact of the proposals is expected to be less that that assessed at the pre establishment phase for the majority of the viewpoint locations assessed. In this regard, the significance of the impact is estimated to be moderate to substantial at 23 viewpoint locations. Visual impacts of a moderate significance are predicted to arise at 27 viewpoint locations. Visual impacts of a moderate to slight significance are predicted to arise at 1 viewpoint location. Visual impacts of a slight significance are predicted to arise at 39 viewpoint locations. Visual impacts in the range of slight to not significant are predicted to arise at 115 viewpoint locations.

19.6 TERRESTRIAL ECOLOGY

The felling of oak trees associated with the old oak woodland will result in a minor negative impact to the cSAC. As the landscaping of the boundary of the cSAC adjacent to the L-4026-1 East-Tie-in will take a number of years to establish, there will be short to medium-term minor negative impacts associated with the loss of habitat at this area of the cSAC. However, once established the landscaping will offset any long-term residual impacts to this part of the cSAC.

The implementation of mitigation measures (*Section 18.6*) will avoid any residual impacts to otters.

The implementation of dust mitigation measures will ensure that the impacts to the vegetation associated with the old oak woodland will constitute a temporary, minor negative impact upon the cSAC.

As replacement woodland planting will take a number of years to establish; there will be short to medium-term minor negative impacts associated with the loss of woodland habitat within the River Barrow pNHA. The establishment of woodland habitats in this area will offset any long-term impacts.

Following the implementation of mitigation measures, only one of the Ecological Sites identified along the alignment will experience major negative impacts as a result of the proposed development. Five of the Sites (Ecological Sites 2,3,4,6 and 8) will undergo minor negative impacts. In the long-term, the implementation of a SuDs approach to the storm water control areas at Ecological Site 5 and 7 will result in neutral/positive impacts.

Residual impacts to Ecological Site 1 will result from a loss of habitat area as a result of the proposed land take and the creation of a barrier to movements for fauna species. The loss of habitat in Ecological Sites 2, 3, 4, 6 and 8 will constitute a short-term minor negative impact. The establishment of alternative habitats within the alignment will replace habitats lost by the proposed development at these sites.

The destruction of main active setts along the alignment will constitute a major negative impact to the local badger populations.

The provision of mammal passages will avoid severance of badger and otter territories along the alignment, while mammal-resistant fencing will reduce the likelihood of otter fatalities on the new road and will guide otters to mammal passes.

The residual impacts to fauna movement will constitute a minor, permanent, negative impact. Once faunal species become habituated to mammal underpasses these residual impacts will be further reduced over time. Similarly, residual impacts arising from disturbance to fauna will also reduce over time, following habitualisation to the new road.

19.7 AQUATIC ECOLOGY

As part of the construction phase, environmental protection procedures in-line with the mitigation measures outlined above will be implemented prior to the commencement of construction works. Provided good working practices are adopted during the construction of the works, there will be no significant residual impact on water quality of all other watercourses.

Road run-off to streams and rivers (not including the River Barrow) of fisheries value will be fed through pollution control measures that will be designed with adequate storage capacity and in a manner to facilitate maintenance and cleaning. The installation of these measures will mitigate any significantly impacts on water quality.

On the basis of the information currently available and reviewed above, and assuming the proposed mitigation measures are adopted, it is not anticipated that there will be a significant impact on the qualifying interests of the cSAC.

19.8 WATER, SOILS AND GEOLOGY

The proposed road drainage will be collected and discharged to watercourses at 8 proposed outfall sites resulting in potential localised water quality impact at these outfall sites. This impact will be minimised through the use of filter drains, swales or water quality improvement control areas (constructed wetlands) or similar devices designed to provide extended retention for particulate settlement and filtration. The residual impact will be minor negative local impact to receiving water quality.

The proposed flood control measures incorporated in the proposed road drainage system will minimise increases in peak runoff to the receiving stream. Increases in flows are unavoidable in the smaller streams, as the proposed road will divert some runoff from adjacent stream drainage areas. Local channel improvement works, where identified as necessary, will minimise this impact. A residual impact of the road drainage will be the overall locally increased flow volume to the receiving streams, the significance of this on flow velocities and flood levels can be minimised by the proposed flood control measures and/or local channel improvement works. The residual impact will be a minor to moderate local negative impact.

Risk of serious contamination to surface watercourses from accidental spillage is shown to be small based on the DMRB risk assessment method and this is reduced even further by the use of filter drains and water quality improvement control areas/wetland systems and petrol interceptors upstream of the outfall.

The presence of culverts and other structures spanning watercourses slightly increases the risk of flooding due to debris blockage potential and due to potential uncertainty in estimating the design flow. This can be minimised by increasing the capacity of the culvert and providing a regular programme of inspection and maintenance.

Road construction may interfere with fissure/preferential subterranean flow pathways preventing natural groundwater drainage. Silt and sediment escapement may block or reduce fissure permeability affecting local drainage and groundwater flow. Proper site management and, where domestic well supplies are close to the road scheme, the use of piped/porous media drains, particularly in the areas of exposed bedrock where sediments are free to enter the fissures, is expected to reduce the impact. The residual impact will be of minor negative local impact to receiving groundwater quality and quantity.

The use of filter drains in cuttings and shallow fill sections (<1m fill depth) and swales in the deeper fill sections will allow road drainage to infiltrate and potentially contaminate the soil and groundwater. This impact is considered slight given the filtering effect provided by Filter (French) drains and swales.

Risk of serious contamination of the soil and groundwater from accidental spillage is shown to be relatively small based on the DMRB risk assessment calculations. A large proportion of this theoretical accidental spillage would come from hydrocarbon compounds which are less dense than water and are highly immobile in soils, which reduces the risk of impact. The inclusion of oil/petrol interceptors at outfall locations will also reduce the impact, which would then be considered slight.

19.9 AGRICULTURAL PROPERTIES

The Bypass will be a permanent feature in the affected area. The majority of farming along the proposed route is intensive and the majority of farmers work full–time on their farms. A direct impact on 1% and the loss of 0.06% of the agricultural land in County Wexford is not significant and must be balanced against the benefits derived from upgrading the infrastructure. Farmers as members of the local community will benefit from the relative improvement in the traffic situation.

The impacts from land loss and severance are permanent residual impacts and financial compensation will be necessary and this has been undertaken as part of the CPO process. There may be a gradual increase in the net worth of farmers affected by the new route due to proximity of the new route to other parts of their farm. Maintenance of roadside surface water drains is necessary to prevent flooding of farmland adjoining the new route.

There are 44 farms affected by the Bypass and of these, 10 are dairy farmers, 13 are beef farmers, 3 mainly tillage, 17 are mixed crops and livestock farmers, 1 is categorised as other (horse rearing & dog rearing enterprise). The land quality along the scheme is generally very good.

Approximately 117 hectares of agricultural land will be required for the Bypass. Overall, there will be a significant impact on farms affected, however the impact of the scheme will not be significant at a county or national level. The permanent land take will be approximately 5.5% of the total affected area and severance will affect 52% of the farms (74% of the affected area). The majority (73%) of farms are in the not significant - moderate impact categories.

19.10 *ARCHAEOLOGICAL HERITAGE*

It is not anticipated that any residual impacts will remain when the archaeological mitigation measures (*Section 18.10*) are put in place.

19.11 *ARCHITECTURAL HERITAGE*

No residual impacts will remain when the appropriate mitigation measures are put in place.

19.12 *MATERIAL ASSETS*

Compensation will be provided through the CPO in the terms of the material assets affected. Nonetheless, it is recognised that the acquisition of property, particularly residential property, will cause disruption to those directly affected.

The implementation of the Utility Diversion Strategy (to be developed by the contractor), will ensure that no significant residual impacts on utilities will occur during construction.

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