# N4 Collooney to Castlebaldwin

# Oral Hearing

## Compulsory Purchase Order

## and

## Environmental Impact Statement

## Oral Hearing

## Brief of Evidence

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## Brief of Evidence by Dr. William O'Connor

**Table of Contents**

# 1 INTRODUCTION

## 1.1 Name, Qualifications and Experience

My name is William O'Connor and I am the Principal Ecologist with ECOFACT Environmental Consultants Ltd.; a professional practice specialising in ecology and environmental science that I set up in 1999. I hold a Doctorate Degree in Zoology from the National University of Ireland, Galway, and a Masters Degree in Applied Hydrobiology from the University of Wales, Cardiff. I am a Fellow of the Society of Biology, a Chartered Biologist and Chartered Environmentalist. I am also a full member of both the Chartered Institute of Ecology and Environmental Management and the Institute of Fisheries Management.

I have twenty one years professional experience in Ecology; obtained from working as a Senior Biologist with the Fisheries, Conservation and Amenities Section of the Electricity Supply Board (ESB) during the period 1992-1999 and since that time as principal consultant with ECOFACT. Over this period I have operated in a professional consultancy capacity as a senior ecological advisor to a number of national statutory bodies including the National Parks and Wildlife Service (NPWS), Inland Fisheries Ireland (IFI), Waterways Ireland, Northern Ireland Environment Agency, the Office of Public Works, the Environmental Protection Agency, the Northern Ireland Roads Service and the National Roads Authority (NRA). I also regularly work as an ecological consultant for several local authorities. My experience as an aquatic ecologist includes several catchment-wide surveys for protected aquatic species in Irish river systems. I also have extensive experience of terrestrial fauna surveys, including bats, otters, badgers, bird and invertebrates. In relation to bat surveys, I have received formal training from the Bat Conservation Trust and Bat Conservation Ireland and have been surveying bats for over 10 years. Likewise, I have worked on terrestrial mammal surveys throughout the same period. I have held numerous licences for bats, badgers, otters and protected invertebrates issued by both NPWS and NIEA.

I am the Principal Ecologist for the N4 Collooney to Castlebaldwin *Proposed Road Development*, and was the principal author of both the Ecology Chapter of the Environmental Impact Statement (EIS) and the Natura Impact Statement (NIS). I also participated in almost all of the fieldwork undertaken for this project and have been involved in this proposed project since 2005. I was supported in this project by Daireann McDonnell, formerly a Senior Ecologist at ECOFACT, who contributed significantly to the terrestrial

ecology impact assessment. Daireann holds a Masters Degree in Environmental Science from the University of Limerick and a Bachelors Degree in Agriculture and Environmental Science from University College Dublin. He is a member of the Chartered Institute of Ecology and Environmental Management and also a member of the Society of Biology. He has twelve years professional experience as an environmental consultant, working as an Ecologist; with extensive project experience on infrastructure schemes.

A number of additional senior ecologists were involved in the current assessment and also made a significant contribution to same. These included Gerard Hayes BSc, MCIEEM (bats and terrestrial mammals), Dr. Joanne Denyer (wetland habitats) and Dr. Evelyn Moorkens (whorl snails).

### 2.1 The *proposed development*

The *Proposed Road Development* is 14.71km long and will extend from the townlands of Collooney/Toberbride in the north to the townland of Cloghoge Lower at the southern end. It will involve construction of both a new greenfield route and also the retrofitting of a section of the existing N4 south of Collooney which will incorporate online improvement works. My evidence concerns the implications of this *Proposed Road Development* on Flora and Fauna (Ecology).

## 2 METHODOLOGY

The current assessment was prepared following the '*Guidelines for the assessment of ecological impacts of National Realignments – Revision 2*' (NRA, 2009); and took cognisance of additional relevant NRA Guidance. Following a desktop review of available literature and data pertaining to the ecological interests within the study area, a suite of field surveys were initially undertaken during 2005 and 2006, which included a detailed survey of the habitats and flora within the study area, as well as terrestrial mammal surveys, bat surveys, bird surveys and freshwater aquatic ecology studies. These assessments were undertaken over a full year to take account of seasonal variations. The field assessment covered a survey corridor width of 350m on both sides of the proposed route, and was extended to 500m where necessary to include particular ecological features of importance.

Updated field surveys were then carried out during 2009 and 2010, and during the period September to December 2012, to review the original habitat assessments, and also to

establish the status of mammal activity (both bats and terrestrial mammals, including otters) and birds within the study area. Updated botanical field surveys were carried out over the botanical growing seasons of 2012 and 2013 to assess wetland habitats within the study area and to provide informed evaluations of same. Updated bat surveys were carried out during the summer of 2010 and again during the summer of 2013. All buildings within the proposed CPO area were re-checked for the presence/absence of bats during spring 2014. Breeding bird surveys were also updated during 2010 and 2013, and a full 6 month winter bird survey was undertaken during the winter of 2012/2013 to update the previous studies. Updated fisheries and aquatic ecology surveys were also undertaken during 2013, including species specific surveys for white-clawed crayfish, Atlantic salmon, and brook lamprey. A survey for the presence of the Annex II listed Marsh Fritillary butterfly and whorl snails within the study area was also undertaken during 2010, 2012 and 2013.

During 2013 all the desk studies were updated with the most recent data available. In addition to updating surveys, extensive consultation meetings (including onsite meetings) were held with the design team, NPWS, IFI, and the Heritage Officer of Sligo County Council. The concerns of the statutory bodies have been addressed in the scope of research conducted and in the design of mitigation measures, including significant design changes which were informed by the results of the surveys and consultation undertaken.

# 3 RECEIVING ENVIRONMENT

## 3.1 Designated sites

There are no designated nature conservation sites within the footprint of the *Proposed Road Development*. The River Unshin candidate Special Area of Conservation (cSAC) and the Lough Arrow cSAC and Special Protection Area (SPA) complex are identified as being hydrologically connected to the *Proposed Road Development* via surface water hydrology. There are no designated Natural Heritage Areas (NHA) or proposed Natural Heritage Areas (pNHAs) affected by the *Proposed Road Development*, other than those sites that are already identified as being designated within the Natura 2000 network.

The Unshin River cSAC is the closest Natura 2000 site to the *Proposed Road Development.* The landtake line is closest to this designated site in the townland of Knocknagroagh where it is approximately 45m to the north-west. This part of the cSAC contains the Turnalaydan

Stream (Lough Corrran outflow stream). The cSAC occurs circa 450m downstream of the crossing point of the mainline of the proposed road development.

The *Proposed Road Development* is approximately 70m south west of the River Unshin cSAC at Drumfin. This part of the cSAC contains the Drumfin River, a tributary of the Unshin River, and the existing N4 road forms part of the boundary of the cSAC at this location. The existing N4 occurs between the cSAC and the *Proposed Road Development*. The proposed road would cross the Drumfin River approximately 920m upstream of the Unshin River cSAC.

The lower reaches of the Markree Demesne Stream are also located within the Unshin River cSAC. The *Proposed Road Development* runs online at the crossing of the Markree Demesne Stream and crosses this watercourse approximately 630m upstream of the cSAC boundary.

Lough Arrow cSAC is located approximately 700m away from the Proposed Road Development at its closest point. The Drumderry Stream is crossed by the proposed Road Development in this area approximately 2.14km upstream of the Lough Arrow cSAC boundary.

## 3.2 Habitats and Flora

The general landscape of the study area is characterised by low drumlin hills, dominated by agricultural grassland pasture with hedgerows. For most of its length, the proposed route traverses improved and semi-improved agricultural pasture; habitats of low or insignificant ecological value. Wet grassland is also an abundant habitat type in the study area, particularly in inter-drumlin hollows or on poorly-draining slopes. Wet grassland is of local importance (lower value). Other habitats of local ecological value in the study area include treelines and scrub while habitats of low or insignificant ecological value include conifer plantation, artificial surfaces, improved grasslands, drainage ditches, earth banks and stone walls.

Overall, the field study recorded thirty habitats within the study area of the *Proposed Road Development*, classified according to '*A Guide to Habitats in Ireland*' (Fossitt, 2000). During the field survey of the road footprint and wider zone of influence six habitat areas were identified as containing Annex I habitats or a complex of Annex I habitats, evaluated as being of County Importance (or greater). These habitat areas lie outside of any designated

nature conservation sites and were evaluated based on botanical surveys to identify their quality and representativeness, with reference to the '*Interpretation manual of European Union Habitats'* (EC, 2007). The evaluations for these ecological sites were agreed through detailed consultation with the NPWS; taking account of the County Biodiversity Sites listed in the County Sligo Biodiversity Plan and with reference to the NRA guidance '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes, Rev.2*' (NRA, 2009).

The most common Annex I habitats encountered within the zone of influence of the *Proposed Road Development* were Alkaline fen and Transition mire; these habitats occur commonly within Co. Sligo, outside of any nature designations. These habitat complexes were attributed individual names for the purposes of this project and are described as follows:

- Toberscanavan Lough complex (National Importance) – Mesotrophic lake with priority Annex I Alluvial woodland and Annex I Alkaline fen;
- Lackagh Fen Complex (National Importance) – Annex I Alkaline fen and transition mire habitats, priority Annex I Tufa-forming springs and high diversity marsh habitats also occur;
- Boathole Lough & Lough Corran (County Importance) – Mesotrophic lakes with Annex I Alkaline fen and peatland / transition mire habitat mosaic within cutover raised bog;
- Ardloy & Aghalenane Loughs (National / International Importance) – Mesotrophic lakes with Annex I Alkaline fen and Transition mire habitats and priority Annex I Tufa-forming springs supporting Annex II *Vertigo geyeri*;
- Cuileencroobagh Lough (County Importance) – Annex I transition mire within a complex of cutover raised bog;
- Swallow Holes Complex (National Importance) – Groundwater connected wetlands corresponding to priority Annex I Turlough habitat.

An additional six habitat areas occurring within the zone of influence of the proposed development were identified as being of local importance (higher value) due to the presence of small areas of isolated Annex I habitats or semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness.

No flora protected on Annex I of the EU Habitats Directive or on the Flora Protection Order (1999) were recorded from the zone of influence of the Proposed Road Development; a

particular field survey focus was on those habitat areas evaluated as being of local importance (higher value) or greater. The undulating landscape and calcareous geology occurring in the wider geographical area leads to conditions suitable for the habitats recorded in the footprint of the *Proposed Road Development* to occur commonly elsewhere.

## 3.3 Fauna

With regard to fauna within the zone of influence of the *Proposed Road Development*, a wide range of mammalian fauna were recorded. Badger densities were evaluated as being of local importance (higher value). There are at least nine badger social groups along the route corridor. One active main sett and two active annex/outlier setts lie within the *Proposed Road Development* site. However, the study area presents sub-optimal habitat for badgers, with evidence of a depletion in badger territories and loss of previously recorded dwellings between the period 2005 to 2013. During the surveys evidence of both badger persecution (i.e. shooting) and also a number of road mortalities on the exiting N4 road were recorded.

Other terrestrial mammal species including Otter, Irish hare, Fox, Rabbit and Hedgehog were recorded from the study area. There are no active otter holts within the study area. The only sign of Pine Marten recorded in the study area was a mortality on the existing N4 road. Irish stoat is likely to be present due the abundance of rabbit; its predominant prey.

Overall, seven out of the ten Irish bat species were recorded within the study area during the summer bat surveys. These were Daubenton's bat, Soprano pipistrelle, Common pipistrelle, Leisler's bat, Natterer's bat, Whiskered/Brandt's bats and Brown long-eared bat. Soprano Pipistrelle was by far the most common bat species recorded during the current survey and are recognised as the most common bat species in this area of County Sligo. Most of the *Proposed Road Development* is located in areas currently occupied by agricultural and wet grassland. These areas are of sub-optimal value to the bat populations present, both in terms of habitat and insect prey production. The relatively low bat numbers in the study area is also a reflection of poor roosting opportunities. No significant bat roost will be directly affected by the proposed development; however all buildings and mature trees along the route have the potential to be used occasionally by bats. The most important area for bats in the study area is the Unshin River corridor; it is important to note that the proposed Road Development will be further away from this area than the existing N4.

Over 70 bird species were recorded during the bird surveys. Bird species of ecological importance included a significant number of BOCCI[1] Amber listed species which are associated with the lakes and river corridors in the study area (identified as key ecological receptors). However, much of the study area is sub-optimal for bird species due to the open nature of the countryside and impact of agricultural activities.

The Drumfin River and the Turnalaydan Stream (the Lough Corran outflow) were identified as being key ecosystem receptors; with Annex II listed Atlantic salmon, Brook lamprey, White-clawed crayfish and Otter all supported by these watercourses. Other streams in the study are which contain salmonids are the Markree Demesne Stream and the Drumderry Stream.

Common frog and smooth newts occur throughout the study area, and breed in the wetter areas including Lackagh Fen and Cuileencroobagh Lough.

The Annex II listed Marsh Fritillary butterfly occurs within Alkaline fen and marsh habitat within the study area, associated with its food plant Devil's bit scabious (*Succisa pratensis*). Larval nests of this species were recorded at Lackagh Fen and at the Aghalenane and Ardloy Lough Complex. Whorl snail species were recorded from wetland habitats within the study area occurring at Lackagh Fen and Aghalenane and Ardloy Loughs Complex. These species included *Vertigo geyeri*, an Annex II species, recorded at the Aghalenane and Ardloy Lough Complex. The Annex II listed White-clawed crayfish was recorded in the Drumfin River, Turnalaydan Stream and the Markree Demesne Stream.

# 4 POTENTIAL IMPACTS

There are no direct impacts arising from the *Proposed Road Development* affecting designated conservation sites; taking account of distance between the development and these sites and in the absence of any direct ecological pathways for impacts potentially affecting cSAC, SPA and NHA (including pNHA) sites. However, all the watercourses in the study area drain into water-dependant Natura 2000 sites; namely the Unshin River cSAC and the Lough Arrow cSAC and SPA complex. This gives rise to the potential for indirect effects on these designated areas, though potential water quality impacts and spread of non-native invasive species. However, these potential impacts can be mitigated and it is not

[1] Birds of Conservation Concern in Ireland

predicted that any significant impacts on the Natura 2000 network would occur as a result of the construction and operation of the proposed development.

Direct loss of habitats within the footprint of the road were identified, with further impacts arising from site clearance and potential water quality impacts affecting aquatic habitats. The scale of impacts affecting habitat complexes identified as key ecological receptors is assessed as being potentially significant in the local context; evaluated as certain for the limited areas of direct land take which were not excluded at design stage. The significance of direct land take has been minimised by design stage avoidance of sensitive and high quality Annex I habitats within these complexes. The significance of impacts affecting Annex I habitats within and adjacent to sensitive ecological receptors was evaluated in consultation with regional staff and central scientific staff of the NPWS. Direct habitat loss within these key ecological receptors include a strip of alder / ash woodland at the eastern margin of the Toberscanavan Loughs Complex, which does not correspond to Annex I habitat; a small area of wet grassland/marsh habitat within the southern portion of the Lackagh Fen Complex which does not correspond to Annex I habitat; and a small area of cutover bog and transition mire, at the south-eastern corner of Boathole Lough and Lough Corran which does correspond, in part, to an intimate mosaic of Annex I habitats regenerating on cutover bog. Direct land take within habitats identified as being of local importance (higher value) are also identified and evaluated, including a small area of wet woodland, with affinity to priority annex I alluvial woodland, at the Drumfin River crossing.

The proposed road development was identified as having the potential for indirect impacts on sensitive ecological receptors, particularly groundwater and surface water dependant habitats and species. The potential for significant impacts potentially affecting Annex I and priority Annex I habitats including Alkaline fen, Transition mire and Tufa forming springs within the Lackagh Fen Complex and the Aghalenane and Ardloy Loughs Complex have been effectively avoided by sensitive design.

Impacts affecting the main watercourses crossed by the *Proposed Road Development* were also evaluated as being potentially significant in the absence of mitigation. Any civil engineering works taking place in the immediate vicinity of any watercourse have the potential to generate and release suspended solids and other pollutants. However with the mitigation measures proposed significant impacts on water quality and aquatic species and habitats would be avoided during the construction phase. With the provision of modern water quality treatment and attenuation ponds there would be a positive benefit in terms of water quality and aquatic ecology during the operational phase.

New road realignments have the potential to have a wide range of impacts on mammals. Construction results in habitat loss due to land take and once built, roads can act as physical barriers to wildlife migrations, thereby reducing dispersal and colonisation movements. Unmitigated impacts affecting fauna identified as key ecological receptors were not considered to be significant for the majority of mammalian species, with the exception of badger communities in the local context; where breeding setts, foraging ground and commuting routes will be lost through the construction of the proposed road.

The road will result in the disruption of up to nine badger social groups along the route corridor and will result in the direct loss of one active main sett and two active annex/outlier setts. Other setts may also be lost due to disturbance impacts, as a result of their proximity to the *Proposed Road Development*. It is considered that the additional three inactive annexe/outlier setts within the *Proposed Road Development* may become active prior to construction. In addition to impacts on setts, the road will result in disturbance to foraging areas, habitat fragmentation and restriction of access to water in some cases. Mitigation measures have been provided to reduce the potential impacts and these will allow badgers to continue to use the local area following the completion of the *Proposed Road Development*. Badger communities were assessed as being affected in the short-term in the local context, but not at a significant level, with the implementation of mitigation. Badgers will benefit from the provision of mammal proof fencing along the route, and will use the new habitats created through the implementation of the landscaping plan. No long-term impacts affecting the conservation status of this species in the local context (i.e. significant impacts) are identified. Pine marten populations associated with affected woodland habitats may potentially be impacted; however, residual impacts are evaluated as being below significant levels for both species, limited to the local context. All terrestrial mammals will benefit significantly from the provision of mammal proof fencing.

The *Proposed Road Development*, in the main, does not significantly impact on commuting, foraging or roosting sites for bats. No known significant bat roosts are affected, although minor tree roosts and building roosts will be affected. Most of the *Proposed Road Development* is located in areas of low value to the bat populations present, both in terms of roosting, foraging habitat and insect prey production. Moreover, the proposed road generally runs parallel to the existing N4, with the northern and southern section of the proposed road online with the existing road therefore reducing the scale of impacts on established foraging and commuting routes. The landscaping measures proposed will have positive benefits for bats. Overall, the construction and operation of the *Proposed Road Development* is not

evaluated as having the potential for significant effects on local bat populations in the short or long term.

The proposed road realignment gives rise to a slight reduction in habitat for terrestrial macroinvertebrates. The most ecologically significant habitats affected with regard to terrestrial macroinvertebrates are fen/peatlands, wet grassland and woodland; however, the loss of these habitats would be proportionally small considering the availability of these habitats in the vicinity of the *Proposed Road Development* and the wider study area. Two Annex II listed terrestrial invertebrates were recorded within the study area; the Marsh fritillary butterfly and the whorl snail *Vertigo geyeri*. As a result of sensitive design, including drainage design, there will be no land take or direct impacts potentially affecting the habitats supporting the whorl snail *Vertigo geyeri*. Indirect effects with regard to hydrogeological impacts were also accounted for at design stage. The key areas for Marsh Fritillary in the study area have also been avoided by sensitive design, and as with other winged invertebrates the implementation of the landscaping plan will benefit this and other butterfly species in terms of habitat connectivity.

Loss of amphibian habitat will not be significant and the main wetlands which are used by amphibians for breeding have been avoided. The loss of habitat used by amphibians under the *Proposed Road Development* will not be significant with reference to the prevalence of drains and wet grassland in the general area.

# 5 MITIGATION MEASURES

A Schedule of Environmental Commitments is provided in Chapter 16 of the Environmental Impact Statement which highlights the individual mitigation measures necessary for implementation during the construction and operational phase of the *Proposed Road Development* to protect sensitive ecological receptors.

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

In line with environmental legislation and environmental awareness, an ecological evaluation with regard to ecological constraints was undertaken with reference to the National Road Authority's '*Guidelines for Assessment of Ecological Impacts of National Road Schemes. Rev 2*' (NRA, 2009). Consideration of European Sites was taken into account during Route Corridor Selection. Construction of the chosen route avoids any direct impacts on the Natura 2000 network.

The geometry of the alignment at Doorly, Lackagh and Knocknagroagh was modified to facilitate the moving of the road footprint to the west of the centreline of the Preferred Route; thereby significantly avoiding direct impacts on the undesignated ecological site described as Lackagh Fen. In the townlands of Drumfin and Cloonlurg the alignment geometry was modified to facilitate the moving of the road footprint to the west of the Preferred Route, thereby reducing volumes of peat generated by the *Proposed Road Development*; further measures were introduced to the drainage design to avoid hydrological impacts to the peatland habitats within the Boathole and Lough Corran Complex. At Kingsbrook and Aghalenane, the alignment was modified to facilitate the moving of the road footprint to the west of the centreline of the Preferred Route, thereby avoiding direct impacts on Ardloy and Aghalenane Loughs. The chosen route option avoids the Loughymeenaghan wetland site, which is evaluated as being of international importance in the County Sligo Wetland Survey Report. In fact, the *Proposed Road Development* will be at a greater distance from this site than the existing N4 road corridor. Overall, the amended preferred route is considered to have the least impact on ecology with regard to direct and significant impacts on habitat features identified as sensitive ecological receptors.

Specific mitigation measures have also been identified to reduce, ameliorate or negate potential impacts affecting key ecological receptors. Compensatory measures including reinstatement and enhancement measures will be provided where works affecting woodland, wetland and aquatic habitats (including their dependant faunal communities) will be affected in the long term. The proposed landscaping mitigation measures include for the replanting of riparian wet woodland at the Drumfin River corridor within the CPO, which will provide a substantial net gain of wet woodland at this location. Similarly, the acrotelm and surface sods taken from the cutover bog and transition mire habitats at the south eastern corner of the Lough Corran complex will be used for the reinstatement of the peat repository site within the CPO directly adjacent to this peatland complex. Following the implementation of the proposed mitigation measures residual impacts for habitats identified as being key ecological receptors within the zone of influence are evaluated as being reduced to not significant.

Ecologically sensitive habitats have been avoided to the greatest extent possible; this has included adjusting and re-routing the proposed corridor to avoid Annex I habitats at Aghalenane and Ardloy Loughs complex and also at Lackagh Fen. Specific design-stage mitigations have been developed to include drainage layers and perforated drainage pipes below the road embankment, in addition to hydraulic barriers to prevent hydrological or hydrogeological change to these sensitive wetland habitats. Mitigation for the avoidance of impacts to the hydrological and hydrogeological regime at these sensitive sites is of particular importance for the protection of groundwater-dependant priority Annex I Tufa spring habitats which occur within the zone of influence of the Proposed Road Development at these wetland sites.

The creation of new wetland habitats as part of the proposed drainage design, incorporating constructed wetlands would be considered appropriate to mitigate for the removal of marsh and wet grassland habitat within the study area. Appropriate measures, following the NRA (2010) '*Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads*'will be taken to ensure that machinery does not facilitate the establishment and spread of non native species into the *Proposed Road Development* area.

Mitigation measures to protect water quality are set out in the Hydrological and Hydrogeological Assessment and also in the Erosion and Sediment Control Plan. Drainage design measures will include surface water treatment and constructed wetland attenuation systems. These will provide protection for the surface water features within the study area and would lead to improvements in water quality with respect to the unregulated run-off currently derived from the existing road. The drainage design for the *Proposed Road Development* includes for surface water treatment and attenuation systems which will adequately protect the watercourses within the study area during the operational phase of the *Proposed Road Development*. This would lead to improvements in water quality and subsequently fisheries value resulting in positive effects, with reference to the existing N4 road corridor.

In terms of protecting fish populations and aquatic ecology the mitigation measures have been designed to follow the *'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes'* by (NRA 2008) and the manual *'Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement Works*' by Kilfeather (2007). All instream works will undertaken outside the salmonid and brook lamprey spawning seasons. The window for instream works is therefore July to

September inclusive within these watercourses. Fish and crayfish translocation will be undertaken as necessary in diverted river stretches, and all riparian and aquatic habitats will be reinstated to the satisfaction of Inland Fisheries Ireland. Clear span bridges will be provided at the Drumfin River and the Turnalaydan Stream crossings. Culverts at all other watercourse crossings, that support fish, will be oversized and laid below the riverbed grade level by approximately 500mm. This includes the crossings on the Markree Demesne Stream, the Springfield Stream, the Lissycoyne Stream, the Drumderry Stream and the Drumderry tributary due south of Castlebaldwin. Fisheries enhancement measures including the provision of instream habitat features are proposed for the re-profiled section of channel at the Turnalaydan Stream crossing. These features include the installation of rock armouring along the river bank, random boulder features within the wetted width and the creation of a meandering channel.

A range of mitigation measures will be provided for badgers, including a pre-construction survey, badger evacuation measures, protection of setts, provision of underpasses, badger resistant fencing, supervised sett destruction and creation of artificial setts, following the NRA (2006) '*Guidelines for the treatment of badgers prior to the construction of National Road Schemes*'. All the mitigation measures set out in the manual *'Guidelines for the Treatment of Otters during the Construction of National Road Schemes'* (NRA, 2008) will be adhered to. These measures will include a pre-construction survey for otters. In order to minimise disturbance to this species no work will be undertaken at night in the vicinity of watercourses. The provision of badger / mammal fencing will serve to reduce the potential for otter entering the road corridor. All culverts/bridges greater than 1m in internal diameter will be made passable by otters (and badgers) by providing a ledge or a separate 600mm diameter mammal underpass.

The mitigation measures designed for bats closely follow the NRA (2005a) '*Guidelines for the Treatment of Bats during the Construction of National Road Schemes'* and also the Irish Wildlife Manual No. 25, published by the NPWS '*Bat Mitigation Guidelines for Ireland'* (Kelleher and Marnell, 2006). The key measures which will be provided are; pre-construction surveys, provision of alternative roosts, provision of underpasses, careful timing of the works, restriction on lighting, checking of mature trees prior to felling by an ecologist, checking of buildings/ structures prior to demolition by an ecologist, and habitat creation and provision of vegetation corridors along the alignment.

Areas to be removed or directly impacted will be examined by a suitably qualified ecologist for the presence of Marsh Fritillary butterfly larvae prior to the commencement of works and

a translocation programme will be undertaken should Marsh Fritillary be recorded. The construction works adjacent to the sensitive wetland habitats identified within the Proposed Road Development will require adequate fencing to avoid trampling and further impacts outside of the required land take. Monitoring for the presence of Marsh Fritillary and control of the contractor's works on site within these sites will be managed by an appointed site ecologist in direct consultation with the NPWS.

Measures for the protection of the hydrological and hydrogeological regime at Aghalenane and Ardloy Loughs have been included in the design for the Proposed Road Development. These requirements are specified to avoid impacts affecting the calcareous spring habitats at this location which support Vertigo geyeri. The protection of these spring habitats, as detailed in the Hydrological and Hydrogeological assessment, Chapter 14, will effectively protect the population of this protected species with regard to the Proposed Road Development.

Areas that have been identified as of importance for breeding birds are limited to the wetland habitats, including reed beds, within the wider study area. No habitats of significant importance for breeding birds will be affected by the Proposed Road Development. No removal of semi-natural habitat, (hedgerows and scrub) will be removed during the breeding season to prevent unnecessary impacts on nesting birds.

Standing water and drainage channels that could potentially be used by amphibians for spawning, between the months of February to June, will require an inspection by an ecologist to ensure that no spawn or tadpoles are present. A derogation license from the NPWS will be required if frogs are to be interfered with and frogs will be relocated to a suitable habitat in the locality.

The mitigation measures identified in this assessment will be implemented and adhered to. Construction phase monitoring by a suitably qualified ecologist with knowledge of terrestrial habitats and fauna, as well as protected aquatic conservation interests is required whom will be appointed by the Environmental Manager as is required during the construction phase, as per the NRA Environmental Operating Plan Guidance (2006).

# 6 RESIDUAL IMPACTS

The *Proposed Road Development* is not located in any site designated for nature conservation at either a national (i.e. NHA) or international (i.e. SAC, SPA) level. There will therefore be no direct impact on any designated conservation site. A separate Natura Impact Statement (NIS) has been prepared to inform the Appropriate Assessment for the *Proposed Road Development*. The NIS report concluded that the *Proposed Road Development* will not, beyond reasonable scientific doubt, have adverse effects, whether directly, indirectly or cumulatively, on the integrity of any Natura 2000 site.

There will also be no significant short-term or long-term indirect impacts on any site designated for nature conservation as a result of the construction and operation of the *Proposed Road Development*. A range of mitigation measures at design, construction and operational phases have been included in the proposal to ensure that significant water quality impacts are avoided, principally the Erosion and Sediment Control Plan. With the implementation of these measures water quality impacts would be limited to the immediate vicinity of the *Proposed Road Development* only and would be moderate and short-term only. With the provision of the proposed modern and appropriate water quality protection measures within the road drainage design, long term impacts would be moderate positive in relation to the aquatic environment.

The *Proposed Road Development* will not result in any significant short-term or long-term impacts affecting habitats evaluated as being of county to national and international importance i.e. key ecological receptors. Potential significant impacts affecting ecologically sensitive sites which occur within wetland complexes at Toberscanavan Lough, Lackagh Fen, Boathole Lough and Lough Corran and Aghalenane and Ardloy Loughs have been effectively avoided through sensitive design. Design phase mitigations are in place to minimise and avoid hydrological and hydrogeological impacts affecting the groundwater regime at these sites. These habitats areas are not located within, nor are they scheduled for designation as conservation sites. The undulating landscape and calcareous geology leads to ideal conditions for these habitats within the wider study area of the *Proposed Road Development*. It is noted that both fen and transition mire Annex I habitats occur commonly within Co. Sligo outside of any nature designations. With the implementation of mitigation measures prescribed, there are no significant residual impacts identified with regard to Annex I habitats arising from the *Proposed Road Development*.

The removal of habitats of local ecological value such as wet grassland, treelines and scrub is also identified, with effects limited to the local context and not evaluated as significant,

taking account of mitigation measures to reinstate scrub and woodland habitat as part of the landscape plan. Removal of habitats of low or insignificant ecological value such as conifer plantation, artificial surfaces, improved grasslands, drainage ditches, earth banks and stone walls will not be significant in the local context. Temporary and localised effects are envisaged during the construction of the proposed road at proposed watercourse crossings. These will include increased suspended solids and habitat disturbance at each crossing point of the road. However, with the implementation of the Erosion and Sediment Control Plan, provided for effective mitigation, these impacts are deemed to be temporary at most with a full recovery of the aquatic ecology expected in the local context; therefore these impacts will not be significant.

The predicted impact of the *Proposed Road Development* on badgers is limited to the local context with implications for individual communities. Impacts will arise during both the short-term construction and long-term operational phase of the *Proposed Road Development*. The badger populations within the study area are evaluated as being of local importance (higher value). In the context of ongoing trends and taking account of the mobility of badger communities within the study area and the mitigation measures provided, the predicted impacts are evaluated as not being significant in the context of the overall project, i.e. within the local scale. Impacts affecting a single entrance active sett is evaluated as significant in the local context, but with mitigation will be reduced to not significant, i.e. the integrity of this badger community (its conservation status) will not be affected. There are no active otter dwellings affected by the *Proposed Road Development* and otters will continue to use the river corridors in the study area during both the construction and operational phases. With the provision of suitably designed structures and mammal proof fencing, the impacts on terrestrial mammals in the local area can be reduced to below significant levels. Indeed, all the terrestrial mammal species are expected to use and benefit from the mammal underpasses, mammal-friendly culverts and road/river underpasses that will be provided. Likewise all terrestrial mammal species will benefit from the implementation of the landscaping plan.

With the mitigation measures proposed, disruption to minor bat roosts and some established bat commuting routes along the corridor of the proposed road will be reduced to below significant levels. The scale of the predicted impacts will be within a local context only and will not be significant. Bats again will benefit from the landscaping measures proposed, and will be able to pass under the proposed bridges on the main watercourses.

Interference with nesting birds would not take place with the mitigation measures proposed. No significant populations of protected species were recorded within the survey area.

Although, potential nesting habitat would be lost (scrub, treelines, hedgerows and woodland), these are common throughout the study area. Therefore, predicted impacts on birds would be below significant levels, in the local context.

With the mitigation measures proposed, predicted impacts during construction affecting watercourses and aquatic ecological interests will not be significant. The provisions for water quality protection set out in the Erosion and Sediment Control Plan will effectively reduce the potential for negative effects on fish species within the zone of influence to below significant levels. The drainage design for the *Proposed Road Development* includes for surface water treatment and attenuation systems which will adequately protect the watercourses within the study area during the operational phase of the *Proposed Road Development*. This would lead to improvements in water quality and subsequently fisheries value resulting in positive effects, with reference to the existing N4 road corridor.

The mitigation measures proposed for fish during the construction phase will ensure that impacts on aquatic macroinvertebrates would not be significant. Drainage design measures will include surface water treatment and constructed wetland attenuation systems. These will provide protection for the surface water features within the study area and would lead to improvements in water quality with respect to the unregulated run-off currently derived from the existing road. This is considered to be of benefit to aquatic macroinvertebrates and predicted impacts would be positive in the long term.

There would also be a slight reduction in habitat for amphibians and amphibian populations would be disturbed during the construction phase. However amphibian populations would not be expected to be significantly affected and will benefit from the landscaping and drainage plan.

With the proposed road, there would be a slight reduction in habitat for terrestrial macroinvertebrates. The most ecologically significant habitats affected with regard to terrestrial macroinvertebrates are fen/peatlands, wet grassland and woodland; however, the loss of these habitats has been avoided to the greater extent at design stage and would be proportionally small considering the availability of these habitats in the vicinity of the *Proposed Road Development* and the wider study area. Many terrestrial macroinvertebrate species will benefit from the implementation of the landscaping plan as this will improve habitat connectivity across the study area. The predicted impact on terrestrial macroinvertebrates will not be significant in the local context, with the implementation of the mitigation measures proposed. Two Annex II listed terrestrial invertebrates were recorded

within the study area; the Marsh fritillary butterfly and the whorl snail *Vertigo geyeri*. The dispersed nature of the Marsh fritillary population within the study area, in addition to the limited footprint of the *Proposed Road Development* affecting habitats supporting this species and mitigation measures proposed results in the evaluation that residual impacts affecting this species arising from the *Proposed Road Development* will not be significant in the local context.

Predicted impacts with regard to *Vertigo geyeri* take account of the design stage avoidance of direct impacts on Vertigo habitat; in addition to the proposed drainage design and the impact evaluation set out in the groundwater and surface water mitigations. With the implementation of these measures for the avoidance of indirect groundwater impacts affecting *Vertigo geyeri* habitat, there will not be any significant impacts affecting this species in the local context. It is proposed that the Aghalenane / Ardloy complex will be managed into the future by the NPWS with the potential for positive impacts on this species.

# 7 RESPONSES TO SUBMISSIONS

There are no responses to submissions necessary in relation to Ecology.

# 8 SUMMARY AND CONCLUSIONS

During the EIA process there has been extensive consultation with the various appropriate statutory bodies including National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland. The concerns of the statutory bodies have been addressed in the scope of research conducted and in the design of mitigation measures which meet the requirements imposed by the relevant National and European legislation.

The EIS and NIS outline the extensive measures devised to avoid or mitigate against negative impacts from this *Proposed Road Development* on designated sites, flora, and fauna. These measures will ensure that the ecological features described will not suffer any significant impacts or deterioration in their ecological status as a result of the construction and operation of the N4 Collooney to Castlebaldwin *Proposed Road Development*.

# 9 GUIDANCE FOLLOWED

Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008)

Environmental Impact Assessment of National Road Schemes – A practical guide (NRA Re. 1 2008)

Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (NRA 2006b)

Guidelines for the Treatment of Badgers Prior to the Construction of a National Road Schemes (NRA 2006)

Guidelines for the Treatment of Bats during the Construction of National Road Schemes (NRA 2005b)

Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA 2008)

Guidelines for the Treatment of Otters during the Construction of National Road Schemes (NRA, 2008)

*Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads*' NRA (2010) '

Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment (IEEM 2006);

Kilfeather, P. (2007) Maintenance and Protection of the Inland Fisheries Resource during Road Construction and Improvement works. Requirements of the Sothern Regional Fisheries Board.

Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.