



Maynooth Eastern Ring Road

AA Screening Report | May 2019



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Appropriate Assessment Screening Report

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1.0 INTRODUCTION

1.1 Background

Roughan & O'Donovan (ROD) was appointed by Kildare County Council to prepare an Appropriate Assessment (AA) Screening Report in respect of the Maynooth Eastern Ring Road ("the Project"). The AA Screening Report is intended to determine whether or not the Project is likely to have a significant effect on areas designated as being of European Union importance for nature conservation ("Natura 2000 sites"), either individually or in combination with other plans or projects in view of best scientific knowledge and the sites conservation objectives, thereby enabling Kildare County Council ("the Competent Authority") to comply with Article 6(3) of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive). During preparation of the AA Screening Report, the statutory consultee, the National Parks & Wildlife Service (NPWS), provided data on the designations of sites, habitats and species (including birds) of conservation interest.

This document comprises the AA Screening Report in respect of the Project and was prepared by ROD on behalf of Kildare County Council and in accordance with the requirements of the Habitats Directive, the Planning and Development Acts, 2000-2018 ("the P&D Act") and the European Communities (Birds and Natural Habitats) Regulations, 2011-2015 ("the Habitats Regulations"). The aim of this AA Screening Report is to consider and assess the likely significant effects of the construction and operation of the Project and to inform and allow the competent authority to comply with the Habitats Directive. Article 6(3) of the Habitats Directive defines the requirements for assessment of projects and plans for which likely significant effects on Natura 2000 sites may arise.

The provision of a link between the R148 Maynooth to Leixlip Road and the R405 Maynooth to Celbridge Road through the Railpark townland to the east of Maynooth Town has been a roads objective for Maynooth dating back to the Maynooth Town Plan 2002 and is currently an objective of the Maynooth Local Area Plan (LAP) 2013 to 2019 Incorporating Amendment No. 1. The Maynooth Eastern Ring Road is an objective of the Maynooth Local Area Plan as below under 'Roads Infrastructure' contained in Section 7.5.2 of the LAP:

"TRO 2: *"To facilitate the future construction of the following roads and in the interim protect these routes from development:*

(c) Between the Celbridge Road (B) and the Leixlip Road (E)(i) or (E)(ii)."

1.2 Legislative Context

The Habitats Directive and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds ("the Birds Directive") list habitats and species which are, in a European context, important for conservation and in need of protection. This protection is afforded in part through the designation of sites that, in a European context, support significant examples of habitats or populations of species. These sites are generally referred to as "European sites". Specifically, sites designated for wild birds are termed "Special Protection Areas" (SPAs) and sites designated for natural habitat types or other species are

termed “Special Areas of Conservation” (SACs). The complete network of European sites is referred to as “Natura 2000”.

In order to ensure the protection of European sites in the context of land use planning and development, Article 6(3) of the Habitats Directive requires that:

“Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.”

The Court of Justice of the European Union (CJEU) has interpreted this requirement as follows¹:

“Any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects.”

In accordance with the Precautionary Principle, the CJEU interpreted the word “likely” as meaning that as long as it cannot be conclusively demonstrated that a given effect will not occur, that effect is considered “likely” to occur. A likely effect considered to be “significant” only if it interrupts or causes delays in progress towards achieving the Conservation Objectives² of the relevant European site(s).

In its judgment in *People Over Wind*³, the CJEU concluded that the determination of whether or not AA is required in respect of a project must be completed without consideration of “*measures that are intended to avoid or reduce the harmful effects of the envisaged project on the site concerned*”.

In *Kelly vs An Bord Pleanála & anor*⁴, the High Court issued a judgment concluding that “*as a matter of fact and law, that SUDS [Sustainable urban drainage system] are not mitigation measures which a competent authority is precluded from considering at the stage 1 screening stage*”. The judgement further described the SUDS as not a measure that is intended to avoid or reduce the harmful effects of a particular development on a European site and a measure that is not required to be incorporated by reason of the potential effect of a development on a European site, but rather SUDS are required to be incorporated in developments for the reasons set out in the relevant regional drainage policies in light of the objectives of the Water Framework Directive and associated water quality Directives and Regulations.

In Ireland, this requirement for AA is transposed into national law by Part 5 of the Habitats Regulations and Part XAB of the Planning and Development Acts, and the process is termed “Appropriate Assessment” (AA). Where no Environmental Impact Assessment Report is required, only Part XAB applies. Stage 1 of the process, i.e.

¹ Landelijke Vereniging tot Behoud van de Waddenzee, Nederlandse vereniging tot Bescherming van Vogels v. Staatssecretaris van Landbouw, Natuurbeheer en Visserij (Waddenzee) [2004] C-127/02 ECR I-7405.

² Conservation Objectives are referred to, but not defined, in the Habitats Directive. In Ireland, Conservation Objectives are set for Qualifying Interests (the birds, habitats or other species for which a given European site is selected) and represent the overall target that must be met for that Qualifying Interest to reach or maintain favourable conservation condition in that site and contribute to its favourable conservation status nationally.

³ People Over Wind and Peter Sweetman v. Coillte Teoranta (People Over Wind) [2018] C-323/17.

⁴ Kelly -v- An Bord Pleanála & anor [2019] IEHC 84.

determining whether or not a plan or project meets the above criteria for requiring AA, is referred to as “AA Screening”.

Article 6(3) of the Habitats Directive goes on to specify that AA must be carried out by the “competent national authorities”. In Ireland, the “competent authority” is the relevant planning authority for each plan or project, e.g. the local authority or An Bord Pleanála. Consequently, the responsibility for carrying out AA Screening lies solely with the competent authority. In that respect, the AA Screening Report is not in itself an AA Screening, but provides the competent authority with the information it needs in order to carry out its AA Screening.

1.3 Stages of an Article 6 Assessment

The European Commission’s *Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC, 2001) prescribes a staged process, as set out below, the need for each stage being dependent on the outcomes of the preceding stage. The sequence is designed to test the potential effects of plans and projects on European sites:

1. Screening for Appropriate Assessment
2. Appropriate Assessment
3. Assessment of Alternative Solutions
4. Assessment where no alternative solutions exist and adverse impacts remain, i.e. the Imperative Reasons of Overriding Public Interest test, and compensatory measures.

The Habitats Directive prescribes a hierarchy of measures: avoidance, mitigation and compensation in view of best scientific knowledge and the sites conservation objectives. Stage 1 is referred to as “Screening for Appropriate Assessment” and identifies whether a plan or project, either individually or in combination with other plans or projects, would be “*likely to have a significant effect*” upon one or more Natura 2000 sites. In accordance with the Precautionary Principle, a “likely” effect is one that cannot be ruled out on the basis of objective information. The test of significance, then, relates to whether or not a plan or project could undermine the Conservation Objectives (see Section 1.4) of one or more Natura 2000 sites.

If effects are considered likely to be significant, potentially significant or uncertain, or if the Screening process becomes overly complicated, the process must proceed to Stage 2 (AA), with the preparation of a Natura Impact Statement (NIS) to inform the AA that is to be conducted by the competent authority.

If, in spite of the inclusion of the best mitigation measures available, adverse effects on the integrity of one or more Natura 2000 sites still cannot be ruled out, then the process continues to Stage 3 and assesses whether alternative solutions exist. If adverse effects on Natura 2000 sites remain following the consideration of all possible alternatives, then, as established in Article 6(4) of the Habitats Directive, the plan or project may only be implemented where it can be demonstrated that there are imperative reasons of overriding public interest.

1.4 Classification and Conservation Objectives

Special Conservation Interests and Qualifying Interests are the birds, habitats and other species for which Natura 2000 sites are selected. Each Special Conservation Interest or Qualifying Interest in each Natura 2000 site is assigned a Conservation Objective. These are referred to, but not defined, in the Habitats Directive. In Ireland, the Conservation Objective for each Special Conservation Interest or Qualifying Interest in a given Natura 2000 site is the overall target that must be met for it to reach or maintain favourable conservation condition in that site and contribute to its favourable conservation status nationally. Conservation Objectives are set by the NPWS for each Special Conservation Interest or Qualifying Interest of each Natura 2000 site and endorsed by the Government. They form the basis of assessing the potential effects of plans and projects on Natura 2000 sites.

1.5 Assessment Methodology

At this stage of the AA process, the AA Screening Report examines the potential for the Project, either individually or in combination with other plans and projects, to give rise to ecological impacts that would constitute likely significant effects on one or more Natura 2000 sites, in view of best scientific knowledge and on the basis of objective scientific information and the sites' Conservation Objectives. This stage must be completed without the consideration of mitigation that could be considered an add-on measure to avoid or reduce harmful effects on a Natura 2000 site.

Best practice in undertaking AA Screening involves five steps as follows:

1. The first step involves gathering the information and data necessary to carry out a screening assessment. These include, but are not limited to, the details of all phases of the plan or project, environmental data pertaining to the area in which the plan or project is located, e.g. rare or protected habitats and species or invasive species present or likely to be present, and the details of the Natura 2000 sites within the likely zone of impact.
2. The second step involves an examination of the information gathered in the first step and a scientific analysis of the potential impacts of the Project on the receiving environment within the likely zone of impact, focussing on the Natura 2000 sites designated in that zone.
3. The third step evaluates the impacts analysed in the second step against the Conservation Objectives of the relevant Natura 2000 sites, thereby determining whether or not those impacts constitute "likely significant effects", within the meaning of Article 6(3) of the Habitats Directive.
4. The fourth step involves the consideration of the potential for likely significant effects to arise from the combination of the impacts of the plan or project with those of other plans or projects. If it is determined in the third step that Stage 2 (AA) is required, consideration of potential cumulative impacts may be deferred to the NIS that will be prepared at that stage.
5. The last step involves the issuing of a statement of the determination of the AA Screening. Notwithstanding the recommendation made in the AA Screening Report, the responsibility for completing this step lies solely with the competent authority in each case.

The following guidance documents informed the assessment methodology:

- EC (2000) *Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC*. Environment Directorate-General of the European Commission;

- EC (2001) *Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*. Environment Directorate-General of the European Commission;
- DEHLG (2010) *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities*. Department of the Environment, Heritage and Local Government, Dublin; and,
- NPWS (2010a) *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities*. Circular Letter NPWS 1/10 & PSSP 2/10. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

2.0 DESCRIPTION OF THE PROJECT

2.1 Overview

The Project comprises the construction of a 1.55 km length of single carriageway relief road. The route travels between the R405 Celbridge Road and the R148 Leixlip Road. From the R405 at the southern end, the route will travel north along the eastern boundary of the Maynooth Educate Together National School. It will travel north across agricultural grassland, curving east and again west in proximity to Parklands Grove, before bridging the Dublin-Sligo Rail Line and the Royal Canal. The road will then tie into the R148 at the junction with the R157 Dunboyne Road, at the edge of the Carton Estate. The existing ground profile is flat and slightly undulating. Other than the Royal Canal, the only other watercourses are ditches associated with field boundaries. The drawings for the Project including a site location map are provided in Appendix A.

The project is neither connected to, nor necessary for the management of any Natura 2000 Site.

2.2 Need for the Project

Currently there is no suitable road that serves the purpose of providing a ring road to the east of Maynooth which would provide a connection between the R148 Leixlip Road and the R157 Dunboyne Road to the R405 Celbridge Road without travelling through Maynooth town centre. The proposed development will aim to help reduce congestion within Maynooth town centre through the provision of new road infrastructure, including sustainable transport facilities: pedestrian/cyclist facilities and bus stops. The need for the proposed development is supported by existing national/regional and local planning policy.

The need for the proposed development also stems from local needs to improve connectivity and provide improved road infrastructure to local road users.

The proposed road development will achieve the following objectives and this evidences the need for the proposed development:

- Improve connectivity to road users travelling between the M4 Dublin to Sligo Road and the R157 Dunboyne Road to County Meath, removing the need to travel through Maynooth;
- Provide a safer alternative to minor roads within the locality which may currently be used to avoid traffic in Maynooth;
- Contribute to the goals contained in the *Smarter Travel – A Sustainable Transport Future* policy by including new walking and cycling facilities along the length of the proposed development;
- Provide access to the Royal Canal for pedestrians and cyclists, facilitating access for locals to Maynooth and the Maynooth Train Station via the Royal Canal Greenway and to enable walking and cycling loops within the local area as part of the proposed development;
- Provide new road infrastructure to manage the continued development of Maynooth and contribute to alleviate traffic demands through Maynooth town by providing an alternative route to locations such as schools on the R405 Celbridge Road and on the Moyglare Road as well as the National University of Ireland Maynooth (NUIM);

- Provide necessary road infrastructure which will allow for the future development of zoned lands to the east of Maynooth town. The Maynooth Eastern Ring Road has been approved for Local Infrastructure Housing Activation Fund (LIHAF) funding; and
- Provide improved connectivity and access to public transportation along the route as well as an extensive pedestrian and cyclist facilities to enable and promote the use of sustainable travel.

2.3 Location

The Project is located on the eastern side of Maynooth, County Kildare between the Maynooth Educate Together National School on the R405 and the junction of the R157 Dunboyne Road and the R148 Leixlip Road (Figure 2.1).

2.4 General Layout

The road works element of the project will include the following:

- 1.55km of new single carriageway. The footprint of the road will be approximately 30,000m² and 21 m wide in cross section.
- Pedestrian and cyclist facilities will be provided on both sides of the carriageway and access into existing lands will also be provided.
- Construction of one overbridge over the Royal Canal and Dublin-Sligo Railway Line.
- Earthworks, including embankments.
- Construction of road drainage, including treatment systems.
- Landscape planting.
- Diversion of utility services.
- Pavement construction and road markings works.
- Erection of new signage and road lighting.
- All Ancillary works.

Surface water Drainage

The proposed road design will include road drainage based on Sustainable Drainage Systems (SuDS) and including attenuation for a 100-year flood event including 10% increase to allow for the effects of climate change. Permanent treatment systems will be provided at each drainage outfall to treat road run-off by removing hydrocarbons and sediment and to limit flows into the surrounding landscape. This will prevent a sudden release of run-off. Surface water run-off from the Project will drain west through Maynooth and into the River Lyreen, a tributary of the Rye Water. The distance that surface water run-off will travel between the Project and the Rye Water Valley/ Carton SAC is c. 2.8km. SuDS would form part of the project and forms part of this project regardless of the existence of any SAC in the vicinity of the Project.

In light of the ruling of the CJEU in Case C323/17 and the judgment in the Irish High Court in Case [2019] IEHC 84, it should be noted that the surface water drainage system is standard practice in line with planning policy and is incorporated on all road projects of this nature. It is not included with the specific aim of avoiding or reducing impacts on any European site.

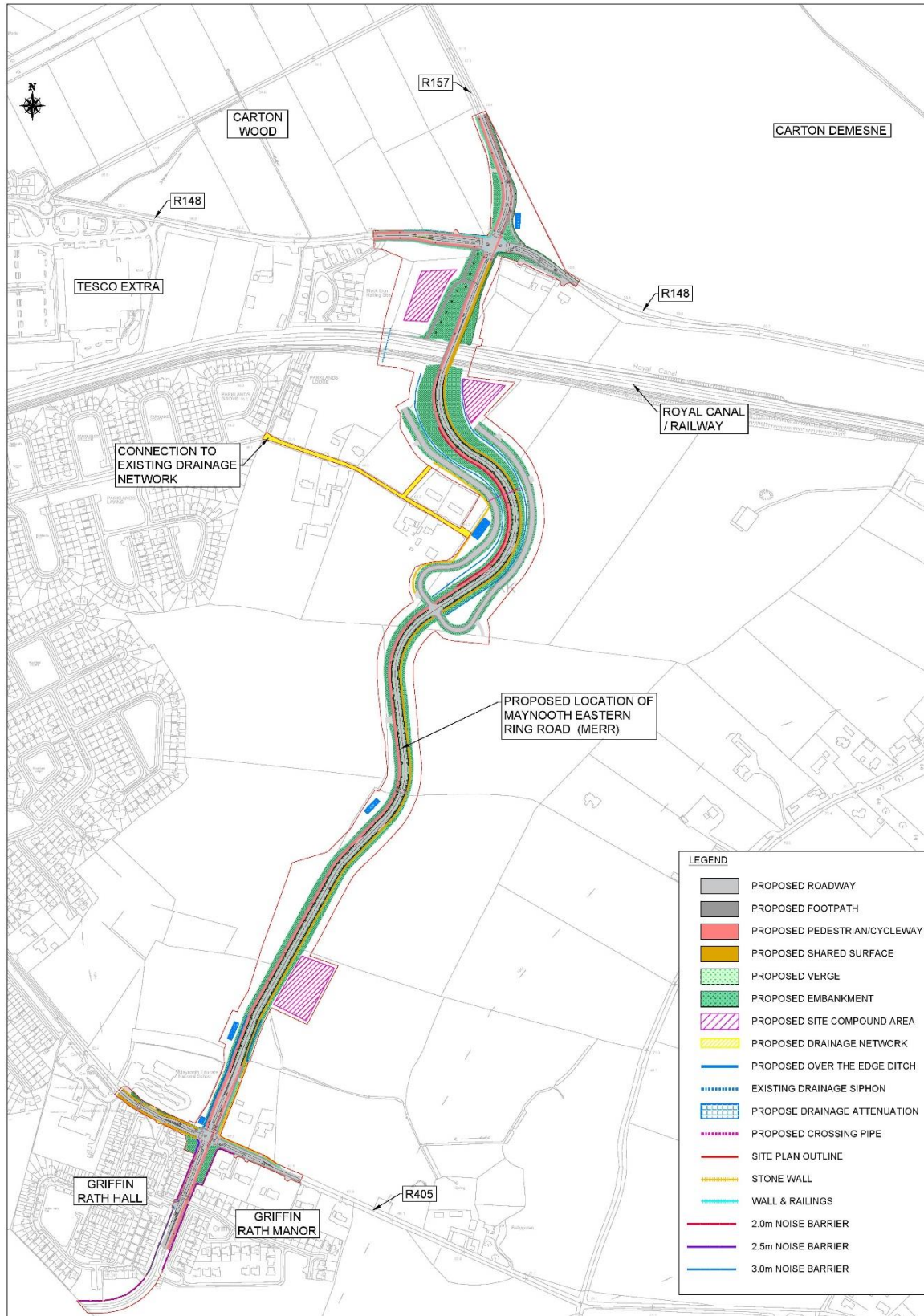


Figure 2.1 Site Location

3.0 NATURA 2000 SITES LIKELY TO BE AFFECTED

3.1 Establishing the Likely Zone of Impact

Section 3.2.3 of the Department of Environment, Heritage and Local Government's *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities* (DEHLG, 2010) outlines the procedure for selecting the Natura 2000 sites to be considered in AA Screening. It states that Natura 2000 sites potentially affected should be identified and listed, bearing in mind the potential for direct, indirect and/or cumulative effects. It also states that the specific approach to Screening in each case is likely to differ depending on the scale and likely effects of the plan or project. However, it advises that the following sites should generally be included:

- *All Natura 2000 sites within or immediately adjacent to the plan or project area;*
- *All Natura 2000 sites within the likely zone of impact of the plan or project; and,*
- *In accordance with the Precautionary Principle, all Natura 2000 sites for which there is doubt as to whether or not they might be significantly affected.*

The “likely zone of impact” of a plan or project is the geographic extent over which significant ecological effects are likely to occur. In the case of plans, this zone should extend to a distance of 15km in all directions from the boundary of the plan area. In the case of projects, however, the guidance recognises that the likely zone of impact must be established on a case-by-case basis, with reference to the following key variables:

- *The nature, size and location of the project;*
- *The sensitivities of the ecological receptors; and,*
- *The potential for cumulative effects.*

For example, in the case of a project that could affect a watercourse, it may be necessary to include the entire upstream and/or downstream catchment in order to capture all Natura 2000 sites with may be affected.

Owing to the location of the Project, i.e. Maynooth, cumulative effects were considered to be likely at the outset of the screening process. Therefore, taking into account the key variables outlined above, the likely zone of impact for the Project was defined as the area within:

- *The entire land and surface water area within 10km of the Project boundary*

ArcView software was used in conjunction with publicly available Ordnance Survey Ireland (OSi) maps and shapefiles provided by the NPWS to identify the boundaries of Natura 2000 sites in relation to the likely zone of impact (Table 3.1; Figure 3.1). It was determined that one Natura 2000 site, namely the Rye Water Valley/ Carton SAC, occurs within the likely zone of impact of the Project. No other Natura 2000 sites occurs within the likely zone of impact and therefore the Rye Water/ Carton SAC is the only site which is potentially impacted, and, therefore it is the only site considered in this report.

Table 3.1 Natura 2000 sites within the likely zone of impact of the Project

Natura 2000 Site	Site Summary	Closest Proximity
<p>Rye Water Valley/ Carton SAC [001398]</p> <p>Site area: 72.29ha</p>	<p>Rye Water Valley/Carton SAC is located between Leixlip and Maynooth, in Counties Meath and Kildare, and extends along the Rye Water, a tributary of the River Liffey. The Rye Water in Carton Estate is dammed at intervals, creating a series of lakes. The conservation importance of the site lies in the presence of several rare and threatened plant and animal species, and the presence of petrifying springs, a priority Annex I habitat. The woods found on Carton Estate and their birdlife are of additional interest and contain a variety of rare and protected species.</p>	<p>The Project is 0.75km from the SAC and is connected hydrologically through 2.8km of surface water drains, ditches and the River Lyreen.</p>

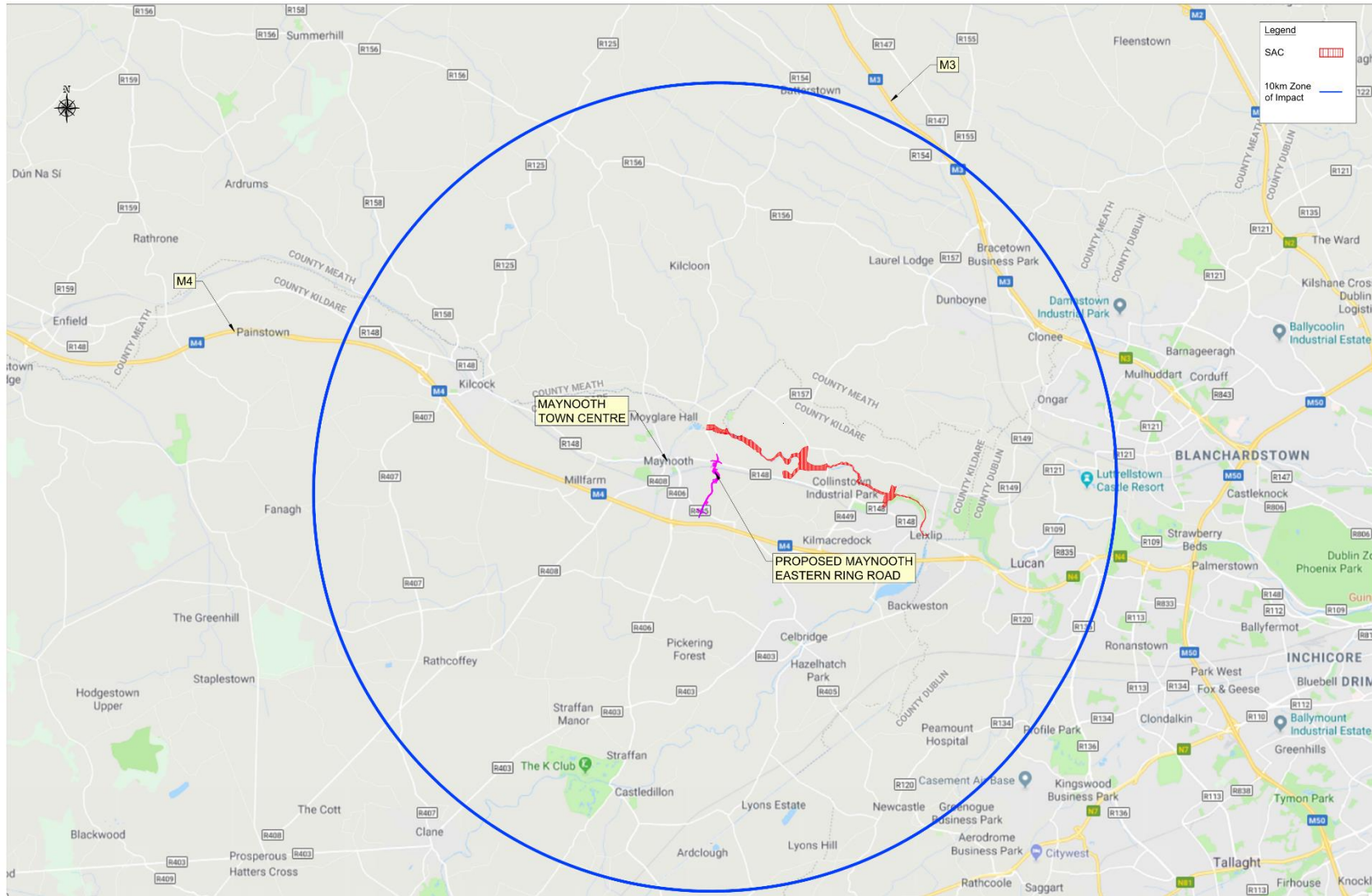


Figure 3.1 Location of Natura 2000 sites in relation to the likely zone of impact of the Project

3.2 Ecological Assessment

In order to examine baseline ecological conditions and determine the presence and proximity of any Qualifying Interests of the Rye Water Valley/ Carton SAC in relation to the Project, data relating to the ecology of the Project area and protected sites potentially affected by the Project were obtained from statutory and non-statutory consultees, through a comprehensive desk study and an ecological survey.

A desk study was undertaken in March 2018 to gather the information and data necessary to carry out the screening assessment. The NPWS map viewer was used to identify Natura 2000 sites within the Likely Zone of Impact. A review of the Site Synopsis (NPWS, 2011) and Natura 2000 Standard Data Forms (NPWS, 2011) of the Rye Water Valley/ Carton SAC was undertaken. As no Conservation Objectives have been developed for the Site, Conservation Objectives from Natura 2000 Sites with the same Qualifying Interests in similar conditions have been used, as recommended by the NPWS, namely the River Barrow and River Nore SAC and the Slieve Tooley / Tormore Island / Loughros Beg Bay SAC (NPWS, 2011; NPWS, 2015). The Conservation Objectives for these sites are presented in Appendix B to this report.

A geotechnical investigation was carried out by Priority Geotechnical Ltd. (Appendix C) using seismic refraction and electrical resistivity to model the profile of the site. A desk study, which included a review of the geotechnical report, was carried out to facilitate Stage 1 Appropriate Assessment Screening of the likely significant effects of proposed construction activities on Annex I habitats, Article 12 (including Annex I), Annex II (and IV) species and supporting wetland habitats via groundwater pathways. The desk study was undertaken by ROD hydrogeologist Dr. Patrick Morrissey who has 10 year's post-graduate experience in academic research and consultancy and is highly experienced in carrying out design and assessment in a karst groundwater setting. He has carried out numerous karst tracer studies and groundwater analysis including numerical modelling. Patrick also has experience in modelling groundwater flow with contaminant transport and has also spent time working with unsaturated water and contaminant flow models.

The desk study was used to determine whether the proposed construction works have the potential to impact on Groundwater Dependant Qualifying Interests for the Rye Water Valley/Carton SAC [001398]. The potential for impacts relate to changes in the local groundwater flow regime affecting the petrifying springs and tufa formations which are a qualifying interest of site. The proposed road construction is either at-grade or in embankment and no cuttings into bedrock will take place. A small number of abutments for the proposed bridge over the canal will require excavation or piling to the bedrock potentially encountering groundwater. Given the limited scale and extent of such works any associated impacts will be localised and of a temporary nature. It is therefore concluded that there is no potential for significant effects on the local groundwater flow regime and subsequently on any associated qualifying interest of the Rye Water Valley/Carton SAC [001398].

An ecological walkover survey was conducted on the 14th March 2018 by Patrick O'Shea. Patrick is an Ecologist with over six years experience in ecological survey and assessment. The walkover survey was designed to examine baseline conditions and determine the presence and proximity of any Qualifying Interests of the Rye Water Valley/ Carton SAC, or, any features or habitats which could be important for the Qualifying Interests, in relation to the Project.

The information gathered during the desk study and field survey was used to inform the screening process, in particular, in the identification of pathways of risk between

the Project and the Qualifying Interests of the Rye Water Valley/ Carton SAC and the assessment of the likely significant effects of the Project in view of the Conservation Objectives for the site. Pathways of risk are considered to be watercourses linking the Project to the Rye Water Valley/ Carton SAC.

3.3 Site Description

Rye Water Valley/ Carton SAC

Rye Water Valley/Carton SAC is located between Leixlip and Maynooth, in Counties Meath and Kildare, and extends along the Rye Water, a tributary of the River Liffey. The Rye Water in Carton Estate is dammed at intervals, creating a series of lakes. Reed Sweet-grass (*Glyceria maxima*) is frequent around the lakes, along with Yellow Iris (*Iris pseudacorus*), Reed Canary-grass (*Phalaris arundinacea*), Bulrush (*Typha latifolia*), Water Forget-me-not (*Myosotis scorpioides*), Marsh-marigold (*Caltha palustris*) and starworts (*Callitriche spp.*). Along the remainder of the site the river has been dredged and much of the reed fringe removed. To the north-west of Carton Bridge a small clump of willows (*Salix spp.*), with dogwood (*Cornus sp.*), Alder (*Alnus glutinosa*), Ash (*Fraxinus excelsior*) and Elder (*Sambucus nigra*) occurs. The ground flora found here includes Golden Saxifrage (*Chrysosplenium oppositifolium*), Meadowsweet (*Filipendula ulmaria*), Common Valerian (*Valeriana officinalis*), Wavy Bitter-cress (*Cardamine flexuosa*) and Bittersweet (*Solanum dulcamara*).

The woods on Carton Estate are mostly old demesne woods with both deciduous and coniferous species. Conifers, including some Yew (*Taxus baccata*) – a native species, are dominant, with Beech (*Fagus sylvatica*), oak (*Quercus sp.*), Sycamore (*Acer pseudoplatanus*), Ash and Hazel (*Corylus avellana*) also occurring. The ground flora is dominated by Ivy (*Hedera helix*), with such species as Hedge Woundwort (*Stachys sylvatica*), Wood Speedwell (*Veronica montana*), Woodruff (*Galium odoratum*), Wood Avens (*Geum urbanum*), Common Dog-violet (*Viola riviniana*), Wild Angelica (*Angelica sylvestris*), Ramsons (*Allium ursinum*), Ground-ivy (*Glechoma hederacea*) and Ivy Broomrape (*Orobanche hederaceae*) also found.

Hairy St. John's-wort (*Hypericum hirsutum*), a species legally protected under the Flora (Protection) Order, 2015, occurs in Carton Estate and there is an old record from the estate for the similarly protected Hairy Violet (*Viola hirta*). However, this latter species has not been recorded from the site in recent years. Another species listed in the Red Data Book, Green Figwort (*Scrophularia umbrosa*), occurs on the site in several locations by the Rye Water. The woods at Carton Demesne are the site of a rare Myxomycete fungus, *Diderma deplanatum*.

The marsh, mineral spring and seepage area found at Louisa Bridge supports a good diversity of plant species, including stoneworts, Marsh Arrowgrass (*Triglochin palustris*), Purple Moor-grass (*Molinea caerulea*), sedges (*Carex spp.*), Common Butterwort (*Pinguicula vulgaris*), Marsh Lousewort (*Pedicularis palustris*), Grass of parnassus (*Parnassia palustris*) and Cuckooflower (*Cardamine pratensis*). The mineral spring found at the site is of a type considered to be rare in Europe and is a habitat listed on Annex I of the E.U. Habitats Directive. The Red Data Book species Blue Fleabane (*Erigeron acer*) is found growing on a wall at Louisa Bridge. Within the woods, Blackcap, Woodcock and Long-eared Owl have been recorded. Little Grebe, Coot, Moorhen, Tufted Duck, Teal and Kingfisher, the latter a species listed on Annex I of the E.U. Birds Directive, occur on and about the lake. The Rye Water is also a spawning ground for Trout and Salmon, and the rare, Whiteclawed Crayfish (*Austropotamobius pallipes*) has been recorded at Leixlip. The latter two species are listed on Annex II of the E.U. Habitats Directive.

The rare Narrow-mouthed Whorl Snail and Desmoulin's Whorl Snail occur in marsh vegetation near Louisa Bridge. Both are rare in Ireland and in Europe and are listed on Annex II of the E.U. Habitats Directive. The scarce dragonfly, *Orthetrum coerulescens*, has also been recorded at Louisa Bridge. The conservation importance of the site lies in the presence of several rare and threatened plant and animal species, and the presence of petrifying springs, a habitat type listed on Annex I of the E.U. Habitats Directive. The woods found on Carton Estate and their birdlife are of additional interest.

The site is designated as an SAC under the Habitats Directive. The following habitats and species are listed as the Qualifying Interests of the site:

[7220] Petrifying Springs

[1014] Narrow-mouthed Whorl Snail (*Vertigo angustior*)

[1016] Desmoulin's Whorl Snail (*Vertigo moulinsiana*)

An assessment of the population of Desmoulin's Whorl Snail and Narrow-mouthed Whorl Snail in the Rye Water Valley/ Carton SAC (Moorkens & Killeen, 2011) classified the population as 'Favourable' and 'Unfavourable' respectively.

3.4 Conservation Objectives

Article 6(3) of the Habitats Directive specifies that AA Screening be undertaken in view of the Conservation Objectives of the relevant Natura 2000 site(s), which are in turn defined by their detailed Attributes and their corresponding Targets. Therefore, the evaluation of the potential impacts as either constituting likely significant effects or not may be limited to an assessment of these impacts against the specific Targets for each Conservation Objective of the site.

Article 1(e) of the Habitats Directive defines the conservation status of a natural habitat as the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as "favourable" when all of the following criteria are met:

- Its natural range and areas it covers within that range are stable or increasing;
- The specific structure and functions that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and,
- The conservation status of its typical species is favourable.

Article 1(i) defines the conservation status of a species as the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations. It will be taken as "favourable" when all of the following criteria are met:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and,
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Conservation Objectives specify targets in respect of the ecological structure and functions of a given Natura 2000 site that are necessary for the restoration and maintenance of the favourable conservation status of a Special Conservation Interest or Qualifying Interest (EC, 2012).

Site-specific Conservation Objectives for the Rye Water Valley/ Carton SAC have not to date been developed. However, generic Conservation Objectives apply. For the purposes of the screening, Conservation Objectives for the Qualifying Interests present in the Rye Water Valley/ Carton SAC have been applied from respective Qualifying Interests (in similar conditions) in other SACs, (as recommended by the NPWS).

Comparison Site Conservation Objectives

The Conservation Objectives for the River Barrow and River Nore SAC were chosen for Petrifying Springs and Desmoulin's Whorl Snail because it is geographically close and represents a slow flowing freshwater river system. Conservation Objectives for Narrow-mouthed Whorl Snail in similar conditions were difficult to find.

The Conservation Objectives for Narrow-mouthed Whorl Snail are, where available, similar across all of the SACs for which this species is a Qualifying Interest and cover distribution, habitat extent, habitat suitability and presence of both juveniles and adults. Taking this into account, the Conservation Objectives for the Slieve Tooley/Tormore Island/Loughros Beg Bay SAC were used.

Each Qualifying Interest is assigned a Conservation Objective of either restoration or maintenance of its favourable conservation condition within the SAC. These Conservation Objectives are further defined by Attributes, which describe the environmental parameters and ecological characteristics intrinsic to the conservation condition of the Qualifying Interests, with corresponding Targets that must be met if the conservation condition is to be judged as favourable.

4.0 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

4.1 Sources and Types of Likely Significant Effects

The potential for the Project to have likely significant effects on the Qualifying Interests of the Rye Water Valley/ Carton SAC is analysed and evaluated in this section.

Having regard to the results of the desk study that was carried out to inform this AA Screening Report, it is considered that the individual elements of the Project with the potential to give rise to negative impacts on the Qualifying Interests of the sites are:

- General construction activities leading to accidental discharge of pollutants into watercourses.
- General construction activities leading to the disruption of groundwater flows.
- Run-off during operation leading to the discharge of pollutants into watercourses.

4.2 Potential Likely Significant Effects on Qualifying Interests

In Ecological and Environmental Impact Assessment, for an impact to occur there must be a risk enabled by having a “source”, e.g. construction works at a proposed development site, a “receptor”, e.g. an SAC or other ecologically sensitive feature, and a pathway between the source and the receptor, e.g. a watercourse connecting the proposed development to the SAC. The risk of the impact does not automatically mean that it will occur or that it will be significant. However, identification of the risk does mean that there is a possibility of ecological or environmental damage, with the level and significance of the impact depending upon the nature and exposure to the risk and the characteristics of the receptor.

Pathways for impacts are considered to be through surface water run-off and through changes to ground water flows. Surface water run-off will be controlled through best practice procedures during construction and through appropriate design during operation.

Table 4.1 below states the potential for likely significant effects on the Qualifying Interests and their individual Attributes and Targets.

Table 4.1 Identification of likely significant effects on the Rye Water Valley/ Carton SAC. * = a “priority habitat” in danger of disappearing from the EU. Numbers in square brackets are Natura 2000 codes.

Qualifying Interest	Closest Proximity	Conservation Objective	Attribute	Target	Likely Significant Effect
Petrifying Springs* [7720]	At least 700m directly and 2.8km hydrologically	To maintain the favourable conservation condition of Petrifying springs with tufa formation (<i>Cratoneurion</i>) in the Rye Water Valley/ Carton SAC, as per the River Barrow and River Nore SAC [002162] (NPWS, 2011).	Habitat area	Area stable or increasing, subject to natural processes.	No Likely Significant Effect - No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Petrifying Springs. There will be no disruption to the supply of groundwater to the SAC (See Section 3.2). The topography is slightly undulating and flat and there are no watercourses linking the Project to the Rye Water/ Carton SAC, therefore there is no risk of sedimentation or pollutant run-off during construction. Given the nature of the works and the distance between the Project and Petrifying Springs, there are no potential pathways for impacts from the Project that could lead to likely significant effects on the habitat area of Petrifying Springs in the Rye Water Valley/ Carton SAC.
			Habitat distribution	No decline, subject to natural processes.	No Likely Significant Effect - No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Petrifying Springs. There will be no disruption to the supply of groundwater to the SAC (See Section 3.2). The topography is slightly undulating and flat and there are no watercourses linking the Project to the Rye Water/ Carton SAC, therefore there is no risk of sedimentation or pollutant run-off during construction. Given the nature of the works and the distance between the Project and Petrifying Springs, there are no potential pathways from the Project that could lead to likely significant effects on the Habitat distribution of Petrifying Springs in the Rye Water Valley/ Carton SAC.
			Hydrological regime: height of water table; water flow	Maintain appropriate hydrological regimes	No Likely Significant Effect - No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Petrifying Springs. There will be no disruption to the supply of groundwater to the SAC (See Section 3.2). The Project will be constructed entirely at grade or on embankment, therefore there is no risk of alterations in the water table height or water flow. Given the nature of the works and the distance between the Project and Petrifying Springs, there are no potential pathways from the Project that could lead to likely significant effects on the Hydrological regime in the Rye Water Valley/ Carton SAC.
			Water quality	Maintain oligotrophic and calcareous conditions	No Likely Significant Effect - No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Petrifying Springs. There will be no disruption to the supply of groundwater to the SAC (See Section 3.2). Given the scale and nature of the works and the distance between the Project and Petrifying Springs, there are no potential pathways for impacts on water quality, specifically relating to nutrient availability and pH. levels, from the Project that could lead to likely significant effects on Petrifying Springs in the Rye Water Valley/ Carton SAC.

Qualifying Interest	Closest Proximity	Conservation Objective	Attribute	Target	Likely Significant Effect
			Vegetation composition: typical species	Maintain typical species	No Likely Significant Effect - No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Petrifying Springs. There will be no disruption to the supply of groundwater to the SAC (See Section 3.2). The topography is slightly undulating and flat and there are no watercourses linking the Project to the Rye Water/ Carton SAC, therefore there is no risk of sedimentation or pollutant run-off during construction. Given the nature of the works and the distance between the Project and Petrifying Springs, there are no potential pathways for impacts on vegetation composition from the Project that could lead to likely significant effects on Petrifying Springs in the Rye Water Valley/ Carton SAC.
Desmoulin's Whorl Snail (<i>Vertigo moulinsiana</i>) [1016]	At least 700m directly and 2.8km hydrologically	To maintain the favourable conservation condition of Desmoulin's Whorl Snail in the Rye Water Valley/ Carton SAC, as per the River Barrow and River Nore SAC [002162] (NPWS, 2011).	Distribution: occupied sites	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Desmoulin's Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on the distribution of occupied sites. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on Desmoulin's Whorl Snail.
			Population size: adults	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Desmoulin's Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on the population size. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the population size of Desmoulin's Whorl Snail.
			Population density	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Desmoulin's Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on the population density. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the population density of Desmoulin's Whorl Snail.

Qualifying Interest	Closest Proximity	Conservation Objective	Attribute	Target	Likely Significant Effect
			Area of occupancy	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Desmoulin's Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on the area of occupancy. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the area if occupancy of Desmoulin's Whorl Snail.
			Habitat quality: vegetation	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Desmoulin's Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on habitat quality. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the habitat quality of Desmoulin's Whorl Snail.
			Habitat quality: soil moisture levels	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Desmoulin's Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on habitat quality. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the habitat quality of Desmoulin's Whorl Snail.
Narrow-mouthed Whorl Snail (<i>Vertigo angustior</i>) [1014]	At least 700m directly and 2.8km hydrologically	To maintain the favourable conservation condition of Narrow-mouthed Whorl Snail in the Rye Water Valley/ Carton SAC, as per the Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190] (NPWS, 2015)	Distribution: Occupied sites	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Narrow-mouthed Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on the distribution of occupied sites. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the distribution of Narrow-mouthed Whorl Snail.
			Occurrence in suitable habitat	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Narrow-mouthed Whorl Snail and there will be no disruption to the supply of groundwater to the SAC (See Section 3.2), therefore there are no pathways for impacts on the occurrence of suitable habitat. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the distribution of Narrow-mouthed Whorl Snail.

Qualifying Interest	Closest Proximity	Conservation Objective	Attribute	Target	Likely Significant Effect
			Habitat quality	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Narrow-mouthed Whorl Snail, which inhabit wetland habitats, therefore there are no pathways for impacts on habitat quality. Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the habitat quality of Narrow-mouthed Whorl Snail.
			Optimal soil wetness	No decline, subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Narrow-mouthed Whorl Snail, which inhabit wetland habitats. There will be no disruption to the supply of groundwater to the SAC (See Section 3.2). Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the optimal soil wetness for Narrow-mouthed Whorl Snail.
			Habitat extent	Area of suitable habitat stable or increasing subject to natural processes.	No Likely Significant Effect – No works will take place within the Rye Water Valley/ Carton SAC. There is no direct hydrological connectivity between the Project and Narrow-mouthed Whorl Snail, which inhabit wetland habitats. There will be no disruption to the supply of groundwater to the SAC (See Section 3.2). Given the distance from the Project and the nature of the works, and the fact that SUDS will be used to attenuate and treat run-off during operation, the Project will not lead to likely significant effects on the habitat extent for Narrow-mouthed Whorl Snail.

5.0 POTENTIAL IN-COMBINATION EFFECTS

5.1 Legislative Context

A key requirement of the Habitats Directive is to determine whether the Project is likely to have a significant effect when considered in combination with other plans and projects. As the underlying intention of the in-combination provision is to take account of cumulative effects, and as these effects often only occur over time, plans or projects that are completed, approved but uncompleted, or proposed (but not yet approved) should be considered in this context (EC, 2002). A cumulative impact arises from incremental changes caused by other past, present or reasonably foreseeable future action (plans and or projects) together with the Project.

The main driver for considering and assessing plans and or projects in combination with the Project is to ensure that cumulative impacts are captured. For example, the effects of a plan on water quality may be insignificant when considered alone, but when combined with the effects of increased pollution from other plans or projects, may lead to likely significant effects. To that end, the “in-combination test” is about addressing cumulative impacts.

The potential cumulative impacts on the Rye Water Valley/ Carton SAC from the Project in combination with other plans and projects are considered and assessed in this section.

In the case of the Maynooth Eastern Ring Road, the Project provides for potential negative impacts on species and habitats listed as Qualifying Interests of the Rye Water Valley/ Carton SAC. Therefore, an assessment of the potential cumulative impacts of the Project with other plans or projects in the likely zone of impact must be undertaken.

Cumulative impacts were assessed by looking at all previous developments, current developments in planning and proposed future developments within 15 km of the proposed site location from 2008 to 2018.

Beyond 5 years into the future, there is too much uncertainty associated with development proposals and, therefore, this AA Screening Report can only be based on data that is readily available.

This assessment has considered cumulative impacts that are:

- (a) Likely;
- (b) Significant; and,
- (c) Relating to a future event, reasonably foreseeable.

The cumulative assessment evaluates the additional change resulting from the proposed development in relation to the theoretical baseline scenario. None of the developments identified during the cumulative assessment were determined to result in likely significant effects. Table 5.1 below details the assessment of potential cumulative impacts between the MERR and individual plans and projects that was undertaken.

Table 5.1 Assessment of the potential of likely significant effects in combination with other plans and projects.

Description	Potential for likely significant effects
<p>Details: 181 houses, crèche and associated infrastructure. Planning Reference: 16/1153, 18/761 and 18/762. Status: Permission granted Distance from the Maynooth Eastern Ring Road: 100m</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Measures are in place to protect the environment during construction and operation. The foul waste water will be connected to the public sewerage system and SUDs will be used to treat and limit the flow of surface water run-off. Therefore, there are no pathways for interactions between these projects and any Natura 2000 site.</p>
<p>Details: 200 housing units, crèche and associated infrastructure. Planning Reference: 16/282. Status: Permission granted Distance from the Maynooth Eastern Ring Road: c.3km</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Surface water run-off rates will be maintained at green-field rates during the operation of the proposed development. Wastewater from the proposed development will tie into the Lower Liffey Valley Regional Sewerage Scheme. Therefore, there are no pathways for interactions between these projects and any Natura 2000 site.</p>
<p>Details: 151 residential dwellings and two story creche. Planning Reference: 09/8 and 14/519. Status: Permission granted Distance from the Maynooth Eastern Ring Road: Immediately adjacent.</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Measures are in place to protect the environment during construction and operation. The foul waste water will be connected to the public sewerage system. Therefore, there are no pathways for interactions between these projects and any Natura 2000 site.</p>
<p>Details: 141 residential dwellings and two story creche. Planning Reference: 09/246, 14/1002, 16/937. Status: Permission granted Distance from the Maynooth Eastern Ring Road: 500m</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Measures are in place to protect the environment during construction and operation. The foul waste water will be connected to the public sewerage system. Therefore, there are no pathways for interactions between these projects and any Natura 2000 site.</p>

Description	Potential for likely significant effects
<p>Details: Additional classrooms, astro-turf playing pitch, boundary fence and floodlights. Planning Reference: 08/1946, 11/9. Status: Permission granted Distance from the Maynooth Eastern Ring Road: 150m</p>	<p>No likely significant effect – This development subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Measures are in place to protect the environment during construction and operation. The foul waste water will be connected to the public sewerage system. Owing to the nature and scale of this development and its distance from the Natura 2000 sites, there are no pathways for interactions between these projects and any Natura 2000 site.</p>
<p>Details: Two story 16 classroom primary school. Planning Reference: 17/383. Status: Permission granted Distance from the Maynooth Eastern Ring Road: Immediately adjacent.</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Measures are in place to protect the environment during construction and operation. The foul waste water will be connected to the public sewerage system. Therefore, there are no pathways for interactions between these projects and any Natura 2000 site.</p>
<p>Details: Royal Canal Greenway. Planning Reference: n/a Status: Permission granted Distance from the Maynooth Eastern Ring Road: Within site</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Owing to scale of the development, there is no potential for cumulative impacts with the Maynooth Eastern Ring Road.</p>
<p>Details: 1.7km link road Planning Reference: P8/16003 Status: Under judicial review Distance from the Maynooth Eastern Ring Road: 750m</p>	<p>This project is now under judicial review, so may not progress. The application lodged in 2016 included an AA Screening within concluded that there would be no impacts on any Natura 2000 site. Owing to the fact that run-off from the MERR will be attenuated and treated before discharged, there are no pathways for interactions between these projects and any Natura 2000 site.</p>
<p>Details: 450 housing units, crèche and associated infrastructure. Planning Reference: Status: 16/1345 Status: Permission granted Distance from the Maynooth Eastern Ring Road: c.7km near Kilcock</p>	<p>No likely significant effect – This development was subject to AA Screening and EIS which concluded that that there would be no Likely Significant Effects in the Rye Water Valley/ Carton SAC because of the lack of surface water pathways between the project and the Rye Water Valley/ Carton SAC. This project is 7km from the Rye Water Valley/ Carton and there is no hydrological connectivity between the project and the Rye Water, therefore there are no pathways for interaction between the MERR and this project.</p>

Description	Potential for likely significant effects
<p>Details: 64 dwelling units and associated infrastructure. Planning Reference: 15/463 Status: Permission granted Distance from the Maynooth Eastern Ring Road: c.7km near Kilcock</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. This project is 7km from the Rye Water Valley/ Carton and there is no hydrological connectivity between the project and the Rye Water, therefore there are no pathways for interaction between the MERR and this project.</p>
<p>Details: 8 semi-detached houses Planning Reference: 16/251 Status: Permission granted Distance from the Maynooth Eastern Ring Road: c. 3.3km</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Owing to scale of the development, there is no potential for cumulative impacts with the Maynooth Eastern Ring Road.</p>
<p>Details: 7 housing units and associated infrastructure. Planning Reference: 13/1010 Status: Permission granted Distance from the Maynooth Eastern Ring Road: c. 3.3km</p>	<p>No likely significant effect – This development was subject to Appropriate Assessment Screening by the competent authority which concluded that there would be no impacts on any Natura 2000 Site. Owing to scale of the development, there is no potential for cumulative impacts with the Maynooth Eastern Ring Road.</p>
<p>Details: South-Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study; Draft Flood Risk Management Plans. Planning Reference: N/A Status: N/A Distance from the Maynooth Eastern Ring Road: Within project area</p>	<p>No likely significant effect – These are high-level flood risk assessments. Any works arising out of the recommendations will be subject to AA including an in-combination assessment.</p>
<p>Detail: Maynooth Town Local Area Plan 2013-2019 Planning Reference: N/A Status: N/A Distance from the Maynooth Eastern Ring Road: Within project area</p>	<p>No likely significant effect – This is a high-level plan which was subject to its own AA. The plan includes objectives to protect the integrity of the Natura 2000 Network. Any projects arising from the plan will be subject to AA and an in-combination assessment.</p>
<p>Detail: Kildare County Development Plan 2017-2023 Planning Reference: N/A Status: N/A Distance from the Maynooth Eastern Ring Road: Within project area</p>	<p>No likely significant effect – This is a high-level plan which was subject to its own AA. The plan includes objectives to protect the integrity of the Natura 2000 Network. Any projects arising from the plan will be subject to AA and an in combination assessment.</p>

Description	Potential for likely significant effects
<p>Detail: Intel Ireland FAB 24C conversion. Alterations to existing Intel Factory. Planning Reference: N/A Status: Built Distance from the Maynooth Eastern Ring Road: c. 3km</p>	<p>No likely significant effect – This project was subject to an NIS which included mitigation measures to avoid adverse effects on the SAC. Following a review of the NIS and the mitigation measures being implemented, it can be concluded that there will be no interactions between these projects that could lead to likely significant effects. This conclusion has been reached based hydrological connectivity of the MERR and the Rye Water and the mitigation in place at the intel site which prevents impacts on water quality in general and the QIs of the SAC.</p>

5.2 Considering of the potential for likely significant effects in combination with multiple plans and projects

Table 5.1 above illustrates the types of development being undertaken around Maynooth. These developments will facilitate the expansion of Maynooth and improve access within and around the town. When considering the potential for likely significant effects arising from the MERR in-combination with other plans and projects, the interaction between all of the plans and projects must be considered as well as interactions between the MERR and each plan or project individually.

In the case of the MERR and the plans and projects analysed in Table 5.1, the potential impacts relate to water quality and ground water supply to the Rye Water Valley/ Carton SAC during construction and operation. The developments considered in Table 5.1 have been subject to their own AA and have measures incorporated for the reasons set out in the relevant regional drainage policies in light of the objectives of the Water Framework Directive and associated water quality Directives and Regulations.

As described in Section 3.2 of this report, the MERR will have no impact on ground water flow and supply, therefore there is no potential for impacts whatsoever on the Qualifying Interests that are dependent on ground water flows, either alone or in-combination with other plans and projects.

5.3 Conclusion of In-combination Assessment

As long as the Project is carried out according to environmental and construction best practice guidelines, the Project will not result in Likely Significant Effects on the Rye Water Valley/ Carton SAC or any other European Site. There is no potential for cumulative impacts on the Rye Water Valley/ Carton SAC from a combination of the Project and any other plans or projects. Based on the above, it can be concluded, in view of best scientific knowledge, and on the basis of objective information, and having regard to the conservation objectives, that the Project, either individually or in combination with other plans and projects, is not likely to have any significant effects on the Rye Water Valley/ Carton SAC and there is no doubt in that conclusion.

6.0 CONCLUSION

In accordance with Article 6(3) of the Habitats Directive, Regulations 42 of the Habitats Regulations, Part XAB of the P&D Act, the relevant case law, established best practice and the Precautionary Principle; this AA Screening Report has considered the Project and the potential for the Project to have likely significant effects on the relevant Natura 2000 sites, i.e. the Rye Water Valley/ Carton SAC. The report has analysed the potential for likely significant effects of the Project on the Qualifying Interests of the Rye Water Valley/ Carton SAC in view of the Conservation Objectives of these Qualifying Interests.

Following the assessment detailed in this AA Screening Report, it can be concluded that the Project, either individually or in combination with other plans or projects, does not give rise to any likely significant effects on the Qualifying Interests of the Rye Water Valley/ Carton SAC and their respective Conservation Objectives. This conclusion was reached on the basis of objective scientific information and in view of best scientific knowledge and the sites' Conservation Objectives. There is no doubt as to the conclusion reached.

In light of this conclusion, it is the considered opinion of ROD that the Competent Authority, in completing its AA Screening in respect of the Project, should find that the Project, either individually or in combination with other plans and projects, does not give rise to any likely significant effects on the Qualifying Interests of the Rye Water Valley/ Carton SAC and their respective Conservation Objectives on the basis of objective scientific information and in view of the best scientific knowledge and the sites' Conservation Objectives.

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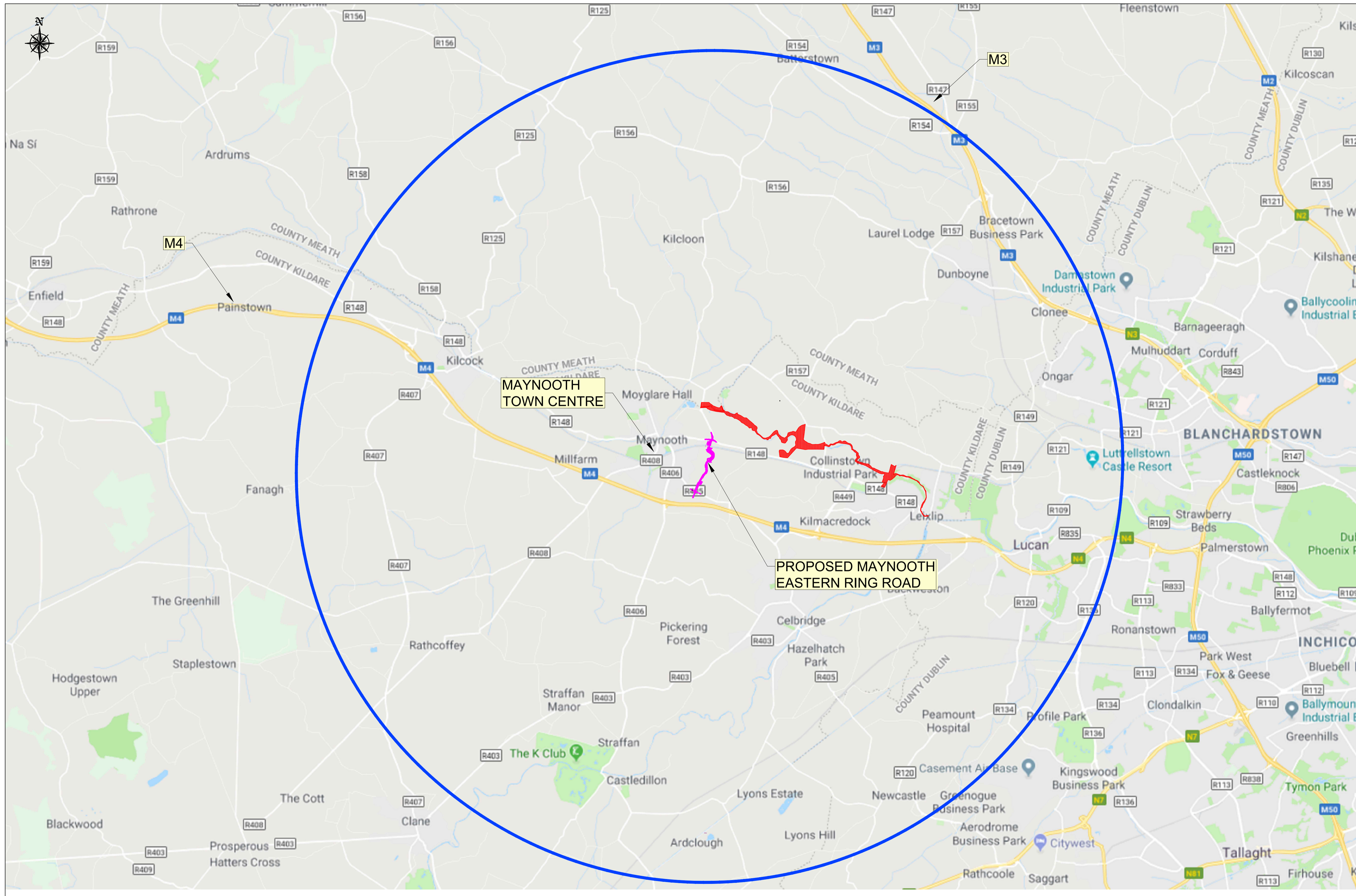
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NPWS (2014) Natura 2000 Standard Data Form for the Rye Water Valley/ Carton SAC [001398]. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.


NPWS (2015) Conservation objectives for the Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]. Generic Version 5.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.


NPWS (2017) *Online Map Viewer* <<http://webgis.npws.ie/npwsviewer/>> [Accessed 20/11/2017]. National Parks & Wildlife Service, Department of Arts, Heritage, Regional Rural and Gaeltacht Affairs, Dublin.


APPENDIX A
PROJECT DRAWING



Legend

SAC 

10km Zone of Impact 




Roads Transportation and Public Safety Dept.
Roads Design Office

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P01	Issued For Approval	29/04/2019	PC	IF	SMG



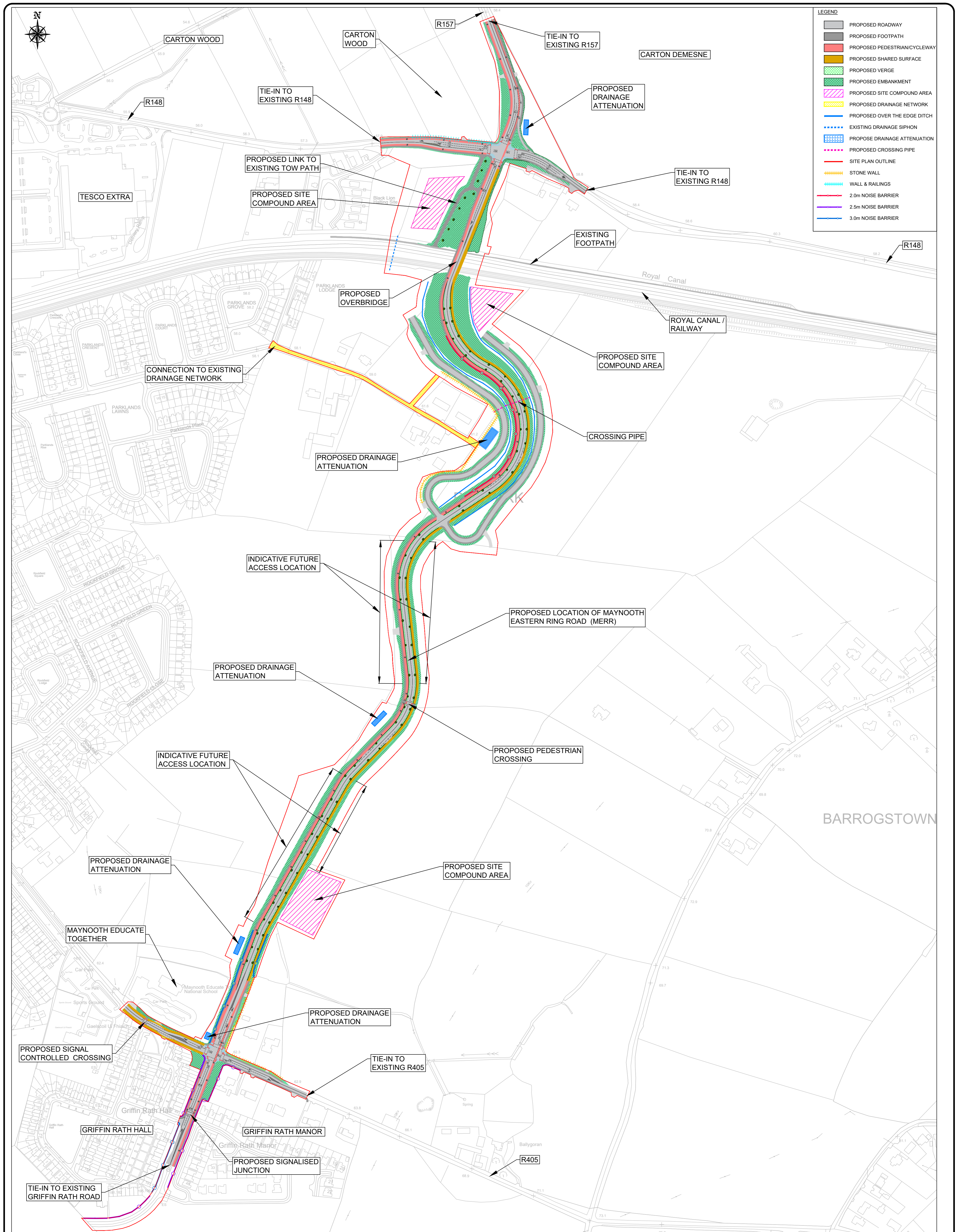
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Drawn	Designed	Checked	Approved	Suitability Code - Description
PC	IF	HOS	JT	S2 - Information/Planning

Project Stage	AA Report
Project Title	Maynooth Eastern Ring Road
Drawing Title	Likely Zone of Impact Appropriate Assessment
Drawing Number	MERR - ROD - EGN - SW_AE - DR - EN - 40001
Scale (A1)	1:50000
Date	May 2019
Job No.	18.109
Rev.	P01



LEGEND

- PROPOSED ROADWAY
- PROPOSED FOOTPATH
- PROPOSED PEDESTRIAN/CYCLEWAY
- PROPOSED SHARED SURFACE
- PROPOSED VERGE
- PROPOSED EMBANKMENT
- PROPOSED SITE COMPOUND AREA
- PROPOSED DRAINAGE NETWORK
- PROPOSED OVER THE EDGE DITCH
- EXISTING DRAINAGE SIPHON
- PROPOSED DRAINAGE ATTENUATION
- PROPOSED CROSSING PIPE
- SITE PLAN OUTLINE
- STONE WALL
- WALL & RAILINGS
- 2.0m NOISE BARRIER
- 2.5m NOISE BARRIER
- 3.0m NOISE BARRIER




Roads Transportation and Public Safety Dept.
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No.	Revision	Date	By	Chk'd	App'd
P01	Issued For Approval	29/03/2019	PC	IF	SMG



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Drawn	Designed	Checked	Approved	Suitability Code - Description
PC	IF	SMG	MK	S2 - Information/Planning

Project Stage	AA Report				
Project Title	Maynooth Eastern Ring Road				
Drawing Title	Location Plan Appropriate Assessment				
Drawing Number	Project	Originator	Volume	Location	Type Role Number
	MERR	ROD	EGN	SW_AE	- DR - CH - 40002
Scale (A1)	1:2500	Date:	May 2019	Job No:	18.109
				Rev:	P01

APPENDIX B

CONSERVATION OBJECTIVES

National Parks and Wildlife Service

Conservation Objectives Series

Slieve Tooley/Tormore Island/Loughros Beg Bay
SAC 000190



An Roinn
Ealaíon, Oidhreachta agus Gaeltachta

Department of
Arts, Heritage and the Gaeltacht



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Citation:

**NPWS (201) Conservation Objectives: Slieve Tooley/Tormore Island/Loughros
Beg Bay SAC 000190. Version 1. National Parks and Wildlife Service,
Department of Arts, Heritage and the Gaeltacht.**

**Series Editor: Rebecca Jeffrey
ISSN 2009-4086**

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

000190	Slieve Tooley/Tormore Island/Loughros Beg Bay SAC
1014	Narrow-mouthed Whorl Snail <i>Vertigo angustior</i>
1230	Vegetated sea cliffs of the Atlantic and Baltic coasts
1355	Otter <i>Lutra lutra</i>
1364	Grey Seal <i>Halichoerus grypus</i>
2110	Embryonic shifting dunes
2120	Shifting dunes along the shoreline with <i>Cladonia</i> (white dunes)
2140	Decalcified fixed dunes with <i>Cladonia</i> E
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)E
4060	Alpine and Boreal heaths
7130	Blanket bogs (* if active bog)

Please note that this SAC overlaps with West Donegal Coast SPA (004150) and it adjoins Slieve League SAC (000189). See map 2. The conservation objectives for this site should be used in conjunction with those for overlapping and adjacent sites as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	1990
Title :	A survey to locate lowland blanket bogs of scientific interest in county Donegal and upland blanket bogs in counties Cavan, Leitrim and Roscommon
Author :	Douglas, C.; Dunnells, D.; Scally, L.; Wyse Jackson, M.
Series :	Unpublished report to NPWS
Year :	2004
Title :	Harbour seal population assessment in the Republic of Ireland: August 2003
Author :	Cronin, M.; Duck, C.; O Cadhla, O.; Nairn, R.; Strong, D.; O'Keeffe, C.
Series :	Irish Wildlife Manual No. 11
Year :	2004
Title :	Summary of National Parks and Wildlife Service surveys for common (harbour) seals (<i>Phoca vitulina</i>) and grey seals (<i>Halichoerus grypus</i>), 1978 to 2003
Author :	Lyons, D.O.
Series :	Irish Wildlife Manual No. 13
Year :	2004
Title :	Aerial surveying of grey seal breeding colonies on the Blasket Islands, Co. Kerry, the Inishkea Group, Co. Mayo and the Donegal coast during the 2003 breeding season
Author :	Cronin, M.; Ó Cadhla, O.
Series :	Unpublished report to NPWS
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manual No. 23
Year :	2007
Title :	Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents. Article 17 forms and supporting maps
Author :	NPWS
Series :	Unpublished report to NPWS
Year :	2007
Title :	Grey seal moult population survey in the Republic of Ireland, 2007
Author :	Ó Cadhla, O.; Strong, D.
Series :	Unpublished report to NPWS
Year :	2007
Title :	Management prescriptions for <i>Vertigo angustior</i> at cSAC sites for the species in the Republic of Ireland
Author :	Moorkens, E.
Series :	Unpublished report to NPWS
Year :	2008
Title :	An assessment of the breeding population of grey seals in the Republic of Ireland, 2005
Author :	O Cadhla, O.; Strong, D.; O'Keeffe, C.; Coleman, M.; Cronin, M.; Duck, C.; Murray, T.; Dower, P.; Nairn, R.; Murphy, P.; Smiddy, P.; Saich, C.; Lyons, D.O.; Hiby, L.
Series :	Irish Wildlife Manual No. 34
Year :	2009
Title :	Coastal Monitoring Project 2004-2006
Author :	Ryle, T.; Murray, A.; Connolly, K.; Swann, M.
Series :	Unpublished report to NPWS

Year :	2011
Title :	National survey and assessment of the conservation status of Irish sea cliffs
Author :	Barron, S.J.; Delaney, A.; Perrin, P.M.; Martin, J.; O'Neill, F.
Series :	Irish Wildlife Manual No. 53
Year :	2011
Title :	Monitoring and condition assessment of populations of <i>Vertigo geyeri</i> , <i>Vertigo angustior</i> and <i>Vertigo moulinsiana</i> in Ireland
Author :	Moorkens, E.; Killeen, I.
Series :	Irish Wildlife Manual No. 55
Year :	2013
Title :	National otter survey of Ireland 2010/12
Author :	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravallo, S.; McDonald, R.A.; Montgomery, W.I.
Series :	Irish Wildlife Manual No. 76
Year :	2013
Title :	Monitoring of the breeding population of grey seals in Ireland, 2009 - 2012
Author :	Ó Cadhla, O.; Keena, T.; Strong, D.; Duck, C.; Hiby, L.
Series :	Irish Wildlife Manual No. 74
Year :	2013
Title :	Monitoring survey of Annex I sand dune habitats in Ireland
Author :	Delaney, A.; Devaney, F.M; Martin, J.M.; Barron, S.J.
Series :	Irish Wildlife Manual No. 75
Year :	2013
Title :	An aerial survey of harbour seals in Ireland. Part 1: Lough Foyle to Galway Bay. August 2011
Author :	Duck, C.; Morris, C.
Series :	Unpublished report to NPWS
Year :	2014
Title :	Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland, Version 2.0
Author :	Perrin, P.M.; Barron, S.J.; Roche, J.R.; O'Hanrahan, B.
Series :	Irish Wildlife Manual No. 79
Year :	2015
Title :	Slieve Tooley/Tormore Island/Loughros Beg Bay SAC (site code: 190) Conservation objectives supporting document- coastal habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2015
Title :	Slieve Tooley/Tormore Island/Loughros Beg Bay SAC (site code: 190) Conservation objectives supporting document- marine species V1
Author :	NPWS
Series :	Conservation objectives supporting document

Other References

Year :	1982
Title :	Otter survey of Ireland
Author :	Chapman, P.J.; Chapman, L.L.
Series :	Unpublished report to Vincent Wildlife Trust

Year : 1983
Title : The grey seal (*Halichoerus grypus*) in Ireland
Author : Summers, C.F.
Series : Unpublished Report to the Minister for Fisheries, Forestry and Wildlife

Year : 1991
Title : The spatial organization of otters (*Lutra lutra*) in Shetland
Author : Kruuk, H.; Moorhouse, A.
Series : J. Zool, 224: 41-57

Year : 1998
Title : Population biology of grey seals (*Halichoerus grypus*, Fabricius 1791) in western Ireland
Author : Kiely, O.R.M.
Series : Unpublished PhD thesis, National University of Ireland, University College Cork

Year : 1999
Title : Diet of otters (*Lutra lutra*) on Inishmore, Aran Islands, west coast of Ireland
Author : Kingston, S.; O'Connell, M.; Fairley, J.S.
Series : Biol & Environ Proc R Ir Acad B 99B:173-182

Year : 2006
Title : Otters - ecology, behaviour and conservation
Author : Kruuk, H.
Series : Oxford University Press

Year : 2007
Title : Interpretation manual of European Union habitats- EUR 27
Author : European Commission, DG Environment
Series : Reference document

Year : 2007
Title : Aerial surveying of grey seal breeding colonies on the Blasket Islands, Co. Kerry, the Inishkeas group, Co. Mayo and the Donegal coast, Ireland
Author : Cronin, M.A.; Duck, C.D.; Ó Cadhla, O.
Series : J. Nat. Conserv. 15(2): 77-83

Year : 2008
Title : The phytosociology and conservation value of Irish sand dunes
Author : Gaynor, K.
Series : Unpublished PhD thesis, National University of Ireland, Dublin

Year : 2010
Title : Otter tracking study of Roaringwater Bay
Author : De Jongh, A.; O'Neill, L.
Series : Unpublished draft report to NPWS

Spatial data sources

Year :	2011
Title :	National Survey and assessment of the conservation status of Irish sea cliffs
GIS Operations :	Clipped to SAC boundary
Used For :	1230 (map 3)
Year :	2009
Title :	Coastal Monitoring Project 2004-2006. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary; overlapping regions with Saltmarsh CO data investigated and resolved with expert opinion used
Used For :	2110, 2120 2140, 2150 (map 4)
Year :	2013
Title :	Sand Dune Monitoring Project 2011. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary; overlapping regions with Saltmarsh CO data investigated and resolved with expert opinion used
Used For :	2110, 2120 2140, 2150 (map 4)
Year :	2012
Title :	NPWS rare and threatened species database
GIS Operations :	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
Used For :	1014, 1364 (maps 5 and 7)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	Creation of an 80m buffer on the marine side of the high water mark (HWM); creation of a 10m buffer on the terrestrial side of the HWM; combination of 80m and 10m HWM buffer datasets; creation of a 10m buffer on the terrestrial side of the river banks data; creation of 20m buffer applied to canal centreline data. These datasets are combined with the derived EPA WDF Waterbodies data for the 1355 CO. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising. Creation of 250m buffer on marine side of HWM to highlight potential commuting points
Used For :	1355 (map 6)
Year :	2010
Title :	EPA WFD Waterbodies data
GIS Operations :	Creation of a 20m buffer applied to river and stream centreline data; creation of 80m buffer on the aquatic side of lake data; creation of 10m buffer on the terrestrial side of lake data. These datasets are combined with the derived OSi data for the 1355 CO. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (map 6)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	High Water Mark (HWM) polyline feature class converted into polygon feature class; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1364 (map 7)

Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

1230 Vegetated sea cliffs of the Atlantic and Baltic coasts

To maintain the favourable conservation condition of Vegetated sea cliffs of the Atlantic and Baltic coasts in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat length	Kilometres	Area stable, subject to natural processes, including erosion. For sub-sites mapped from desktop survey: Drumirrin - 2.95km; Glenlough - 27.63km; Malinmore - 2.41km. See map 3	Based on data from the Irish Sea Cliff Survey (ISCS) (Barron et al., 2011). Cliffs are linear features and are therefore measured in kilometres. Three sub-sites were identified using a combination of aerial photos and the DCENR helicopter viewer. The length of each cliff was measured (in some cases the cliff was measured in sections) to give a total estimated area of 32.99km
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 3	Sea cliffs are distributed throughout the coastline of this SAC. Both hard and soft cliffs are present, with hard cliffs more common (Browne, 2005; Barron et al., 2011). See coastal habitats supporting document for further details
Physical structure: functionality and hydrological regime	Occurrence of artificial barriers	No alteration to natural functioning of geomorphological and hydrological processes due to artificial structures	Based on data from Barron et al. (2011). Maintaining natural geomorphological processes including natural erosion is important for the health of a vegetated sea cliff. Hydrological processes maintain flushes and in some cases tufa formations that can be associated with sea cliffs. Hydrological features such as gullies, streams or cascades were identified by the ISCS as occurring at Malinmore and Drumirrin sub-sites. Streams or cascades were also noted at the Glenlough sub-site. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of sea cliff habitat zonations including transitional zones, subject to natural processes including erosion and succession	Based on data from Barron et al. (2011). Adjacent habitats in this SAC include sand dune systems, heath, exposed rock, littoral rock and littoral sediment. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on data from Barron et al. (2011). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain range of sub-communities with typical species listed in the Irish Sea Cliff Survey (Barron et al., 2011)	Rare plant species such as roseroot (<i>Rhodiola rosea</i>) and purple saxifrage (<i>Saxifraga oppositifolia</i>) were noted on low cliffs in this SAC. See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Barron et al. (2011). See coastal habitats supporting document for further details
Vegetation composition: bracken and woody species	Percentage	Cover of bracken (<i>Pteridium aquilinum</i>) on grassland and/or heath less than 10%. Cover of woody species on grassland and/or heath less than 20%	Based on data from Barron et al. (2011). See coastal habitats supporting document for further details

Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

2110 Embryonic shifting dunes

To maintain the favourable conservation condition of Embryonic shifting dunes in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Glen Bay - 0.13ha; Maghera - 4.75ha; Maghera Island - 0.44ha. See map 4	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009) and the Sand Dunes Monitoring Project (SDM) (Delaney et al., 2013). Habitat was recorded from three sub-sites, giving a total estimated area of 5.32ha. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 4 for known distribution	Based on data from Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Dunes are naturally dynamic systems that require continuous supply and circulation of sand. At Glen Bay there is a dynamic band of fore dune development at the northwest tip of the dunes. At Maghera Island there is a good band of embryo and mobile dunes on the more sheltered side where there is ongoing accretion. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al. (2009) and Delaney et al. (2013). A range of coastal habitats including saltmarshes occur at both Glen Bay and Maghera. See coastal habitats supporting document for further details
Vegetation composition: plant health of foredune grasses	Percentage cover	More than 95% of sand couch grass (<i>Elytrigia juncea</i>) and/or lyme grass (<i>Leymus arenarius</i>) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities with typical species: sand couch grass (<i>Elytrigia juncea</i>) and/or lyme grass (<i>Leymus arenarius</i>)	Based on data from Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-native species) to represent less than 5% cover	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. See coastal habitats supporting document for further details

Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. For sub-sites mapped: Glen Bay - 0.88ha; Maghera - 7.11ha; Maghera Island - 0.50ha. See map 4	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009) and Sand Dunes Monitoring Project (SDM) (Delaney et al., 2013). Habitat was mapped at three sub-sites to give a total estimated area of 8.48ha. Habitat is very difficult to measure in view of its dynamic nature. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 4 for known distribution	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Shifting dunes were recorded from both Glen Bay and Maghera. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Marram grass (<i>Ammophila arenaria</i>) reproduces vegetatively and requires constant accretion of fresh sand to maintain active growth encouraging further accretion. At Glen Bay the CMP noted a dynamic zone of fore dune development at northwest tip of dunes. Habitat noted to be accreting at Maghera by CMP and SDM. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al. (2009) and Delaney et al. (2013). A range of coastal habitats including saltmarshes occur at both Glen Bay and Maghera. See coastal habitats supporting document for further details
Vegetation composition: plant health of dune grasses	Percentage cover	More than 95% of marram grass (<i>Ammophila arenaria</i>) and/or lyme-grass (<i>Leymus arenarius</i>) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities dominated by marram grass (<i>Ammophila arenaria</i>) and/or lyme-grass (<i>Leymus arenarius</i>)	Based on data from Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. See coastal habitats supporting document for further details

Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

2140 Decalcified fixed dunes with *Empetrum nigrum*

To maintain the favourable conservation condition of Decalcified fixed dunes with *Empetrum nigrum* in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009) and the Sand Dunes Monitoring Project (SDM) (Delaney et al., 2013). Habitat only recorded at Maghera (0.47ha) sub-site by CMP, but was not recorded by SDM who reclassified the same area as 2150 or 2130. Current status of this habitat in Ireland is unclear and is under review. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes	See note for area above and coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Gaynor (2008), Ryle et al. (2009) and Delaney et al. (2013). A range of coastal habitats including saltmarshes occurs at Maghera. See coastal habitats supporting document for further details
Vegetation composition: sward height	Centimeters	Maintain structural variation within sward	Based on data from Gaynor (2008), Ryle et al. (2009) and Delaney et al. (2013). At Maghera there is some sheep grazing in the heath habitat, though some areas are undergrazed. See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain range of sub-communities with typical species listed in Ryle et al. (2009)	Based on data from Gaynor (2008), Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. Bracken (<i>Pteridium aquilinum</i>) is an issue at Maghera in the heath habitat where in places it forms patches with hazel (<i>Corylus avellana</i>) and may have spread in to areas that were originally dune heath. See coastal habitats supporting document for further details
Vegetation composition: scrub/trees	Percentage cover	No more than 5% cover or under control	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Hazel (<i>Corylus avellana</i>) and bramble (<i>Rubus fruticosus</i>) were recorded in dune heath habitat at Maghera. See coastal habitats supporting document for further details

Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

2150 Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)

To maintain the favourable conservation condition of Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. For sub-site mapped: Maghera - 13.14ha. See map 4	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009) and the Sand Dunes Monitoring Project (SDM) (Delaney et al., 2013). Habitat was recorded at one sub-site giving a total estimated area of 13.14ha. Habitat is difficult to map as it occurs in mosaics. Maghera represents the best known site in Ireland (other than Murlough in County Down) for this habitat. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 4 for known distribution	Based on data from the Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Gaynor (2008), Ryle et al. (2009) and Delaney et al. (2013). See coastal habitats supporting document for further details
Vegetation composition: sward height	Centimeters	Maintain structural variation within sward	Based on data from Gaynor (2008), Ryle et al. (2009) and Delaney et al. (2013). At Maghera there is some sheep grazing in the dune heath habitat. See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain range of sub-communities with typical species listed in Ryle et al. (2009)	Based on data from Gaynor (2008), Ryle et al. (2009) and Delaney et al. (2013). The dune heath at Maghera is the best example of classic dune heath formation in Ireland. The back of the site consists of a dense canopy of bog myrtle (<i>Myrica gale</i>), ling (<i>Calluna vulgaris</i>), cross-leaved heath (<i>Erica tetralix</i>), purple moorgrass (<i>Molinia caerulea</i>) and creeping willow (<i>Salix repens</i>) in association with marram grass (<i>Ammophila arenaria</i>) and sand sedge (<i>Carex arenaria</i>). See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. The spread of bracken (<i>Pteridium aquilinum</i>) is an issue in the dune heath habitat. See coastal habitats supporting document for further details
Vegetation composition: scrub/trees	Percentage cover	No more than 5% cover or under control	Based on data from Ryle et al. (2009) and Delaney et al. (2013). Hazel (<i>Corylus avellana</i>) and bramble (<i>Rubus fruticosus</i>) were recorded in dune heath habitat at Maghera. See coastal habitats supporting document for further details

Conservation Objectives for : Slieve Tooye/Tormore Island/Loughros Beg Bay SAC [000190]

4060 Alpine and Boreal heaths

To restore the favourable conservation condition of Alpine and Boreal heaths in Slieve Tooye/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Alpine and Boreal heaths has not been mapped in detail for this SAC and thus total area of the qualifying habitat is unknown. It occurs in association with other habitats, including vegetated sea cliffs (1230), other heath types and acid grassland (NPWS internal files)
Habitat distribution	Occurrence	No decline, subject to natural processes	See note on area above
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	Relevant nutrients and their natural ranges are yet to be defined. However, nitrogen deposition is noted as being relevant to this habitat in NPWS (2013)
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014)
Vegetation composition: lichens and bryophytes	Number of species at a representative number of 2m x 2m monitoring stops	Number of bryophyte or non-crustose lichen species present at each monitoring stop is at least three	Attribute and target based on Perrin et al. (2014)
Vegetation composition: positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of positive indicator species at least 66%	Attribute and target based on Perrin et al. (2014) where the list of positive indicator species for this habitat is also given
Vegetation composition: dwarf-shrub species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of dwarf-shrub species at least 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 10%	Attribute and target based on Perrin et al. (2014) where the list of negative indicator species for this habitat is also given
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: signs of grazing	Percentage of leaves browsed at a representative number of 2m x 2m monitoring stops	Less than 10% collectively of the live leaves of specific graminoids showing signs of grazing	Attribute and target based on Perrin et al. (2014)
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Less than 33% collectively of the last complete growing season's shoots of ericoids and crowberry (<i>Empetrum nigrum</i>) showing signs of browsing	Attribute and target based on Perrin et al. (2014)
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning within the habitat	Attribute and target based on Perrin et al. (2014)
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014)

Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species listed in the Flora (Protection Order 2015 and/or the red data book (Curtis and McGough, 1988))
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Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

7130 Blanket bogs (* if active bog)

To restore the favourable conservation condition of Blanket bogs in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Stable or increasing, subject to natural processes	Blanket bogs has not been mapped in detail for this SAC and thus total area of the qualifying habitat is unknown. It occurs in mosaic with other habitats, such as heath habitats (Douglas et al., 1990; NPWS internal files)
Habitat distribution	Occurrence	No decline	See note on area above
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	Relevant nutrients and their natural ranges are yet to be defined. However, nitrogen deposition is noted as being relevant to this habitat in NPWS (2013)
Ecosystem function: peat formation	Active blanket bog as a proportion of the total area of Annex I blanket bog habitat	At least 99% of the total Annex I blanket bog area is active bog	Blanket bogs are considered active when "still supporting a significant area of vegetation that is normally peat forming" (EC, 2007)
Ecosystem function: hydrology	Flow direction, water levels, occurrence of drains and erosion gullies	Natural hydrology unaffected by drains and erosion	Drains and erosion gullies can affect the natural hydrological processes of blanket bog
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014). Douglas et al. (1990) describes the habitat in this SAC
Vegetation composition: positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	Number of positive indicator species at each monitoring stop is at least seven	Attribute and target based on Perrin et al. (2014) where the list of positive indicator species for this habitat is also given
Vegetation composition: lichens and bryophytes	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of bryophytes or lichens, excluding <i>Sphagnum fallax</i> , at least 10%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: potential dominant species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of each of the potential dominant species less than 75%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014) where the list of negative indicator species for this habitat is also given
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014)
Vegetation composition: native trees and scrub	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: <i>Sphagnum</i> condition	Condition of <i>Sphagnum</i> at a representative number of 2m x 2m monitoring stops	Less than 10% of the <i>Sphagnum</i> cover is crushed, broken and/or pulled up	Attribute and target based on Perrin et al. (2014)

Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Last complete growing season's shoots of ericoids, crowberry (<i>Empetrum nigrum</i>) and bog-myrtle (<i>Myrica gale</i>) showing signs of browsing collectively less than 33%	Attribute and target based on Perrin et al. (2014)
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas, into the moss, liverwort or lichen layer or exposure of peat surface due to burning	Attribute and target based on Perrin et al. (2014) where the list of sensitive areas is also presented
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014)
Physical structure: drainage	Occurrence in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014)
Physical structure: erosion	Occurrence in local vicinity of a representative number of monitoring stops	Less than 5% of the greater bog mosaic comprises erosion gullies and eroded areas	Attribute and target based on Perrin et al. (2014). The greater bog mosaic incorporates the blanket bog itself and associated vegetation types as well as non-vegetation cover types that appear to have been derived from former blanket bog including gravel, rock and running water
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species listed in the Flora (Protection) Order 2015 and/or the red data book (Curtis and McGough, 1988)

Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

1014 Narrow-mouthed Whorl Snail *Vertigo angustior*

To maintain the favourable conservation condition of Narrow-mouthed Whorl Snail in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied sites	Number	No decline. There is one known site in the SAC at Glencolumbcille in grid square G5285. See map 5	From Moorkens (2000, 2007); Moorkens and Killeen (2011) (site code VaCAM4)
Occurrence in suitable habitat	Percentage positive records in a representative number of samples	A minimum of 25% positive samples in areas of habitat that are at least sub-optimal	Target based on Moorkens and Killeen (2011). Positive samples mean the confirmed presence of snails (living or recently dead adults and/or juveniles). See habitat extent target below for definition of optimal and sub-optimal habitat
Habitat quality	Metres along transect; percentage of representative number of samples	90m of the established monitoring transect assessed as at least sub-optimal or at least 60% of samples within suitable habitat polygon at least sub-optimal	Transect established as part of condition assessment monitoring by Moorkens and Killeen (2011). See habitat extent target below for definition of optimal and sub-optimal habitat
Optimal soil wetness	Metres along transect; percentage of representative number of samples	90m of the established monitoring transect assessed as optimal wetness or at least 60% of sampling stops assessed as optimal wetness	Optimal wetness is defined by Moorkens and Killeen (2011)
Habitat extent	Hectares	Area of suitable habitat stable or increasing subject to natural processes and at least 7.1ha	From Moorkens and Killeen (2011). Optimal habitat is defined as fixed dune, species-rich grassland dominated by red fescue (<i>Festuca rubra</i>), with sparse marram grass (<i>Ammophila arenaria</i>), birds-foot trefoil (<i>Lotus corniculatus</i>), thyme (<i>Thymus praecox</i>), ribwort plantain (<i>Plantago lanceolata</i>), kidney vetch (<i>Anthyllis vulneraria</i>), white clover (<i>Trifolium repens</i>), lady's bedstraw (<i>Galium verum</i>) and other low growing herbs in vegetation with height between 10-30cm, growing on damp, friable soil covered with a layer of humid, open structured thatch. Sub-optimal habitat is as above but either vegetation height is less than 10cm or between 30 and 50cm, or the soil is dry and sandy, or the thatch is wetter, or the thatch has either a very dense structure, or the thatch is very sparse

Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC [000190]

1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

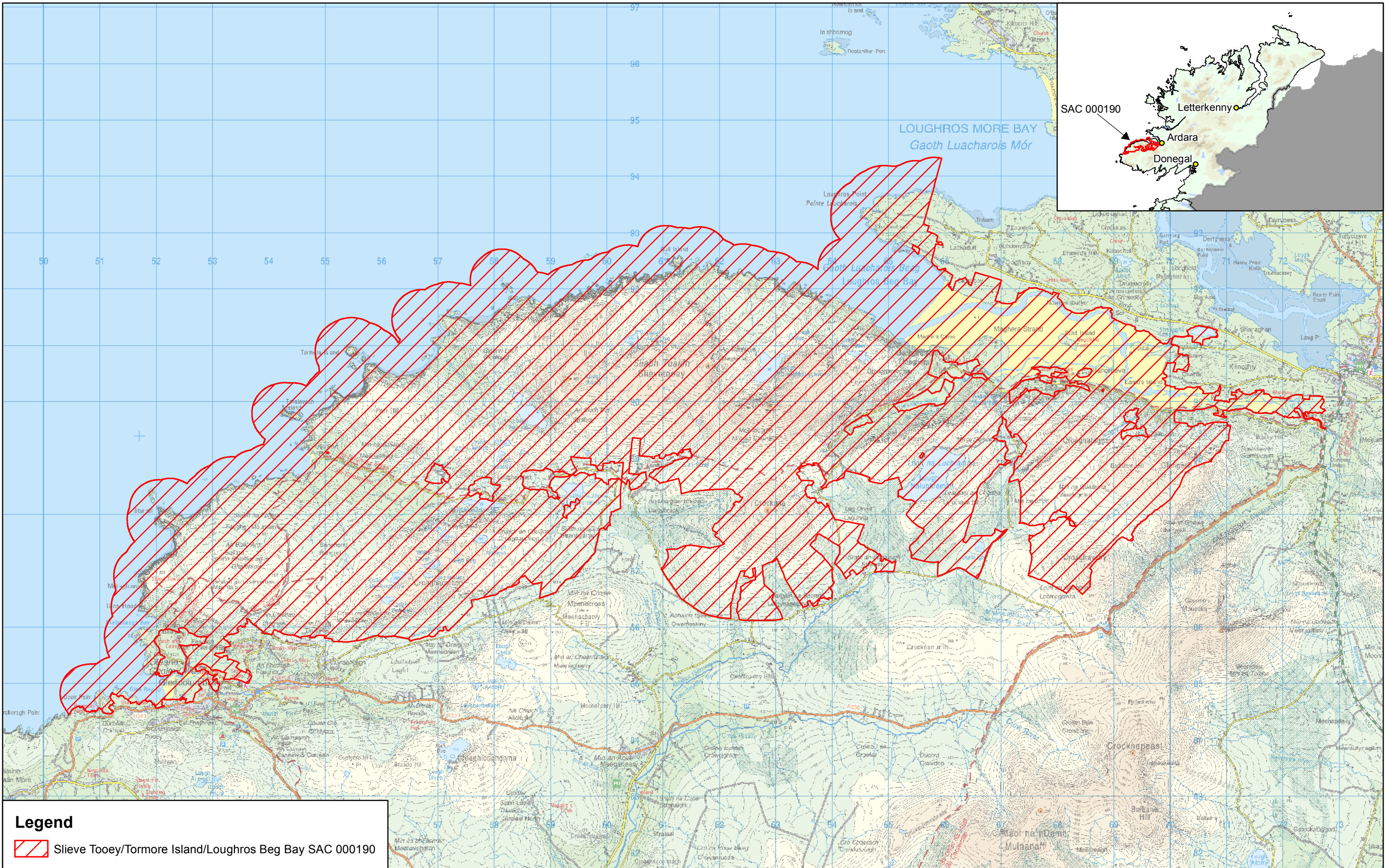
Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. FCS target, based on 1980/81 survey findings, is 88% in SACs. Current range is estimated as 93.6% (Reid et al., 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 272.4ha	No field survey. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as 523.9ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (NPWS, 2007; Kruuk, 2006)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 93.9km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake/lagoon) habitat	Hectares	No significant decline. Area mapped and calculated as 107.2ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk, 2006; Kruuk and Moorhouse, 1991)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006; Reid et al., 2013) and wrasse and rockling in coastal waters (Kingston et al., 1999)
Barriers to connectivity	Number	No significant increase. For guidance, see map 6	Otters will regularly commute across stretches of open water up to 500m e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed

**Conservation Objectives for : Slieve Tooley/Tormore Island/Loughros Beg Bay SAC
[000190]**


1364 Grey Seal *Halichoerus grypus*


To maintain the favourable conservation condition of Grey Seal in Slieve Tooley/Tormore Island/Loughros Beg Bay SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Access to suitable habitat	Number of artificial barriers	Species range within the SAC should not be restricted by artificial barriers to site use. See map 7	See marine supporting document for further details
Breeding behaviour	Breeding sites	Conserve the breeding sites in a natural condition. See map 7 for known sites	Attribute and target based on background knowledge of Irish breeding populations, a preliminary survey in 2003 (Cronin and Ó Cadhla, 2004; Cronin et al., 2007), comprehensive breeding surveys in 2005 (Ó Cadhla et al., 2008) and 2012 (Ó Cadhla et al., 2013) and unpublished NPWS records including those reported by Summers (1983) and Lyons (2004). See marine supporting document for further details
Moulting behaviour	Moult haul-out sites	Conserve the moult haul-out sites in a natural condition. See map 7 for known sites	Attribute and target based on background knowledge of Irish populations, on review of data from Kiely (1998) and Lyons (2004), a national moult survey (Ó Cadhla & Strong, 2007) and unpublished NPWS records. See marine supporting document for further details
Resting behaviour	Resting haul-out sites	Conserve the resting haul-out sites in a natural condition. See map 7 for known sites	Attribute and target based on review data from Lyons (2004), Cronin et al. (2004), Duck and Morris (2013) and unpublished NPWS records. See marine supporting document for further details
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the grey seal population at the SAC	See marine supporting document for further details



Legend

 Slieve Tooley/Tormore Island/Loughros Beg Bay SAC 000190



An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

MAP 1:
**SLIEVE TOOHEY/TORMORE ISLAND/LOUGHROS
BEG BAY SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE:
SAC 000190; version 3. CO. DONEGAL

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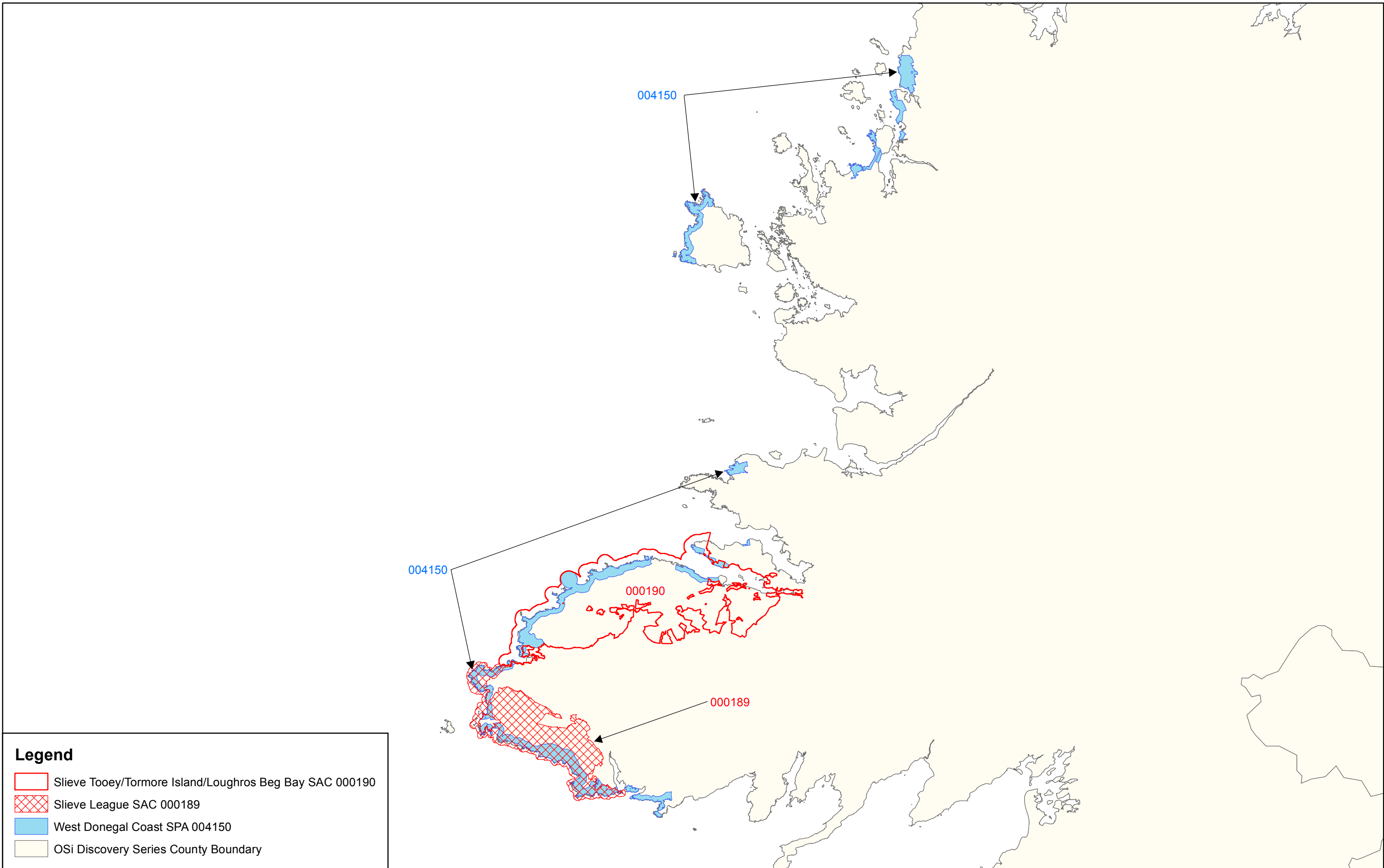
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.
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Níl sna teorainneacha ar na léarscáileanna ach nod garshuimhach ginearálta. Féadfar athbheithnithe a déanamh ar theorainneacha na gceantar comharthaíthe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas Uimh EN 0059214. © Suirbhéarachta Ordonáis na hÉireann Rialtas na hÉireann

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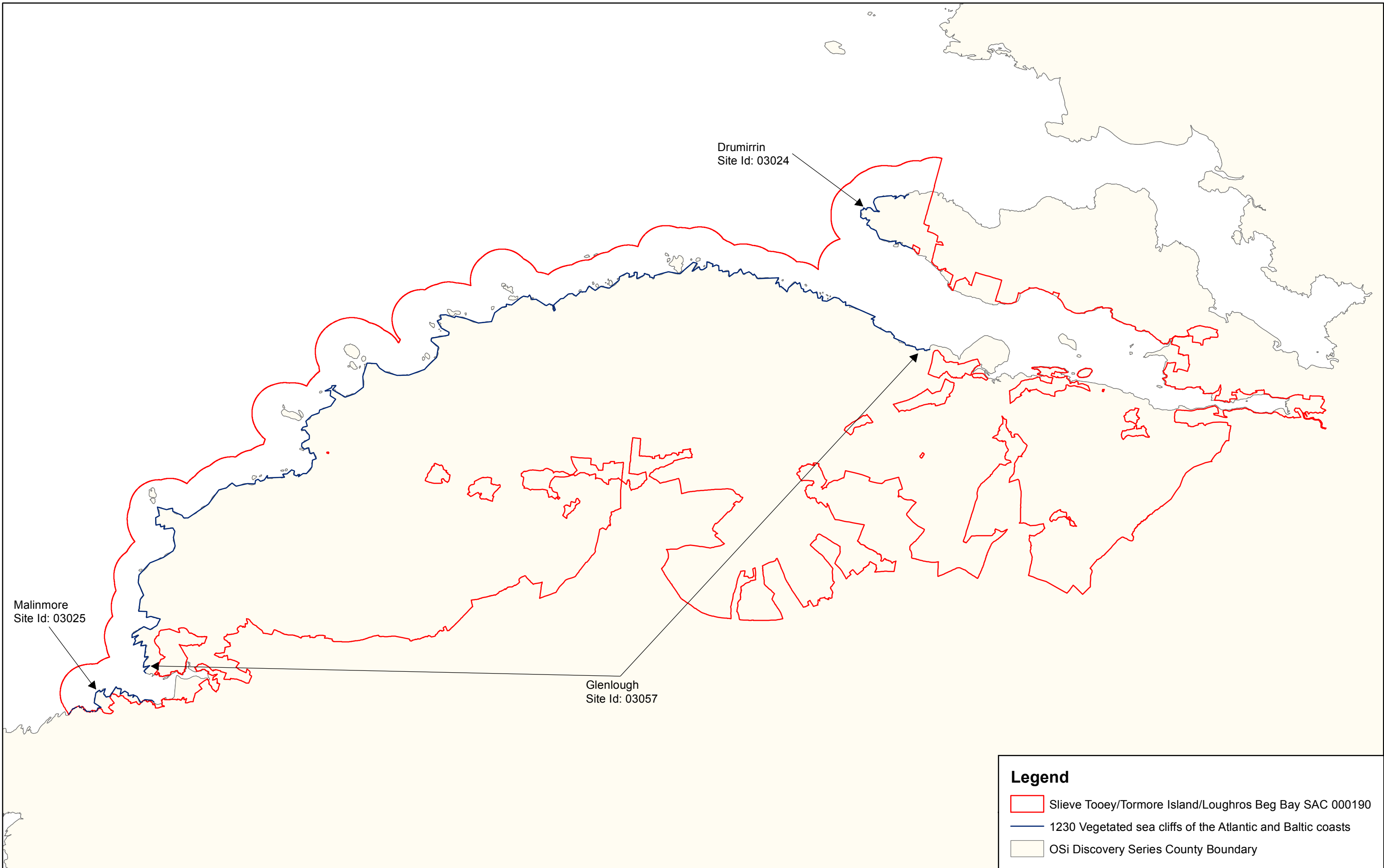


Map Version 1
Date: May 2015



Legend

- Slieve Tooley/Tormore Island/Loughros Beg Bay SAC 000190
- Slieve League SAC 000189
- West Donegal Coast SPA 004150
- OSi Discovery Series County Boundary



Legend

- Slieve Tooley/Tormore Island/Loughros Beg Bay SAC 000190
- 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
- OSi Discovery Series County Boundary

Legend

- Slieve Tooley/Tormore Island/Loughros Beg Bay SAC 000190
- OSi Discovery Series County Boundary
- CMP: 146 Coastal Monitoring Project Site Codes
- SDM: 147 Sand Dunes Monitoring Project Site Codes

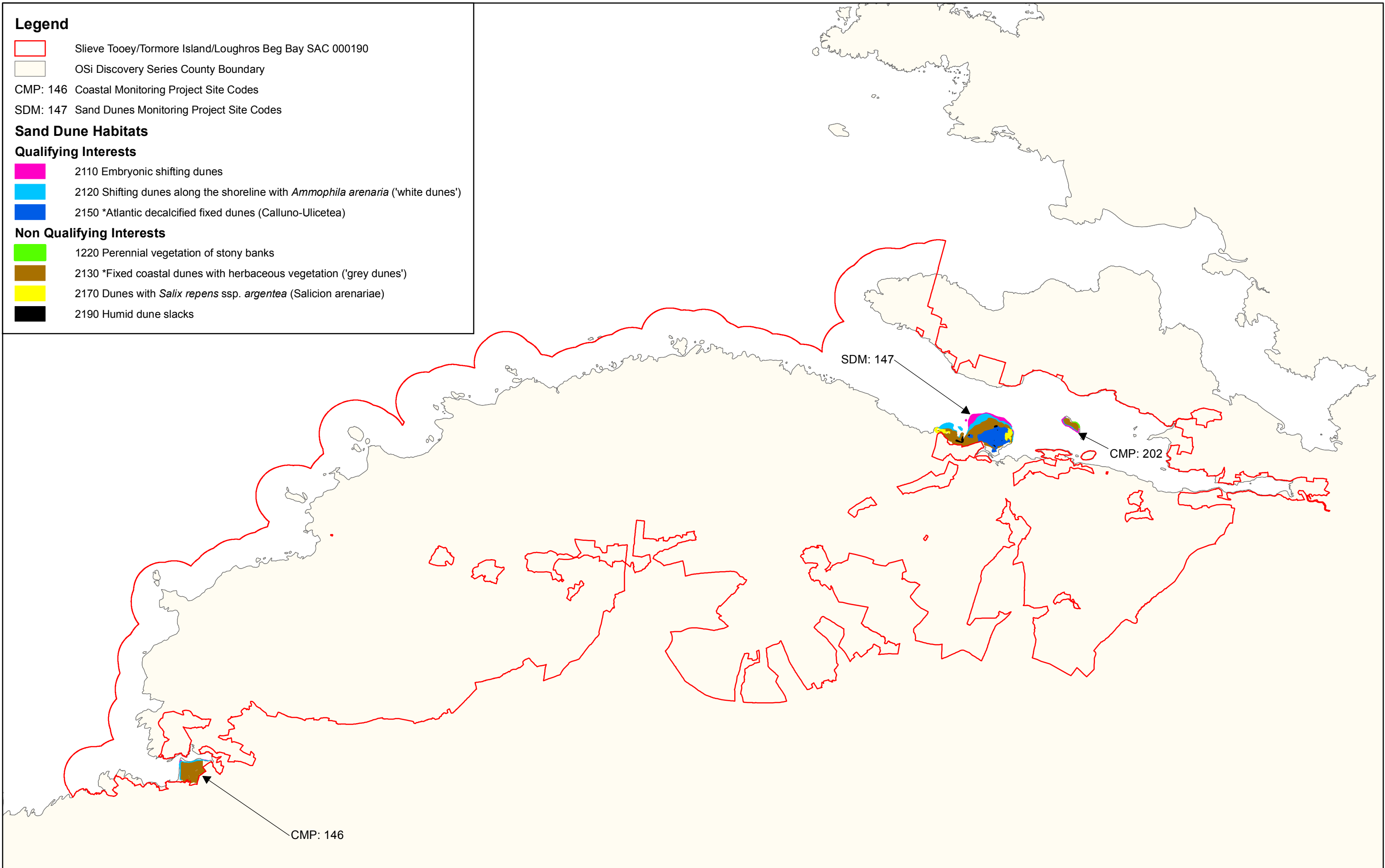
Sand Dune Habitats

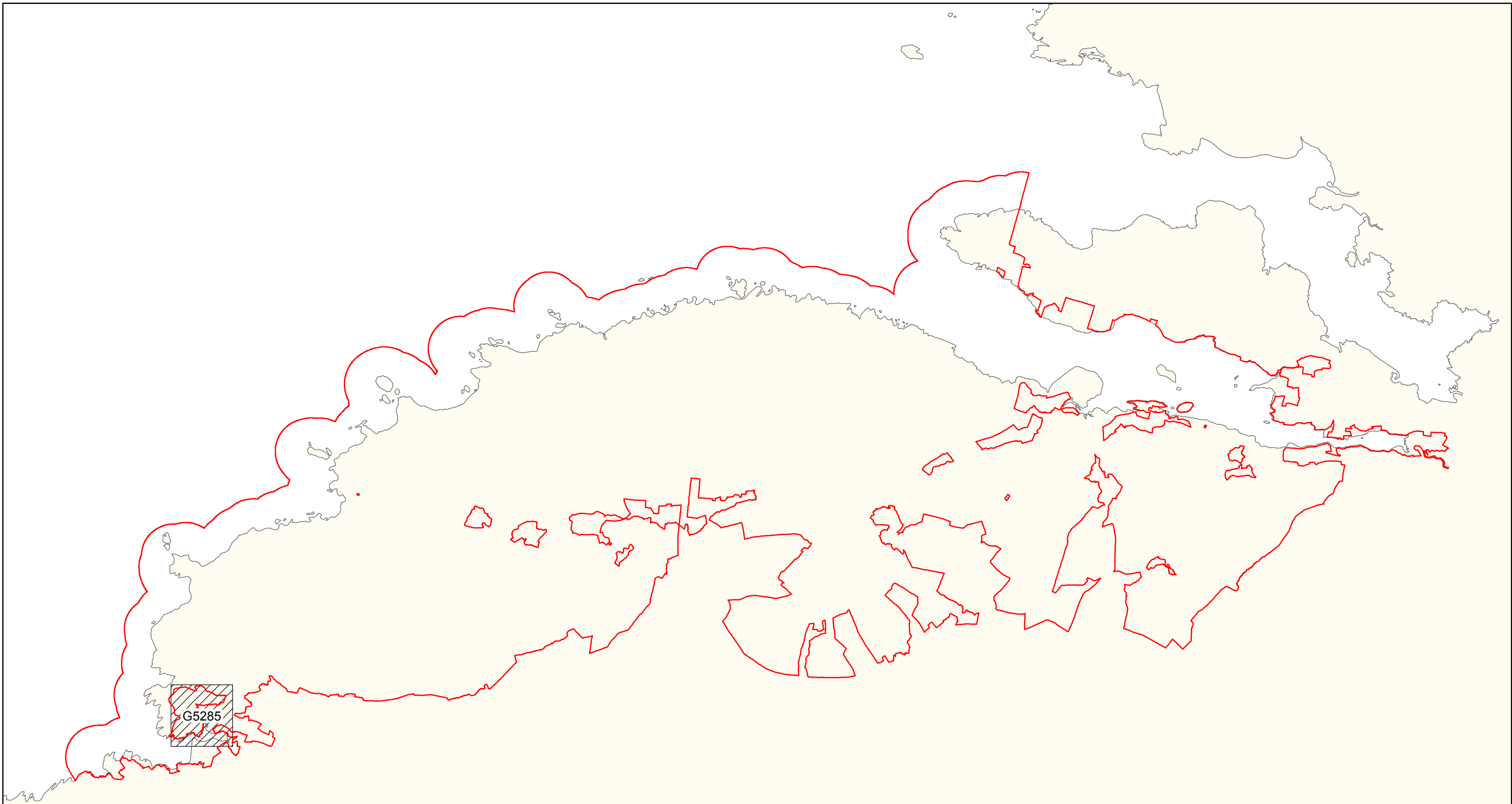
Qualifying Interests

- 2110 Embryonic shifting dunes
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
- 2150 *Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)

Non Qualifying Interests

- 1220 Perennial vegetation of stony banks
- 2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')
- 2170 Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)
- 2190 Humid dune slacks





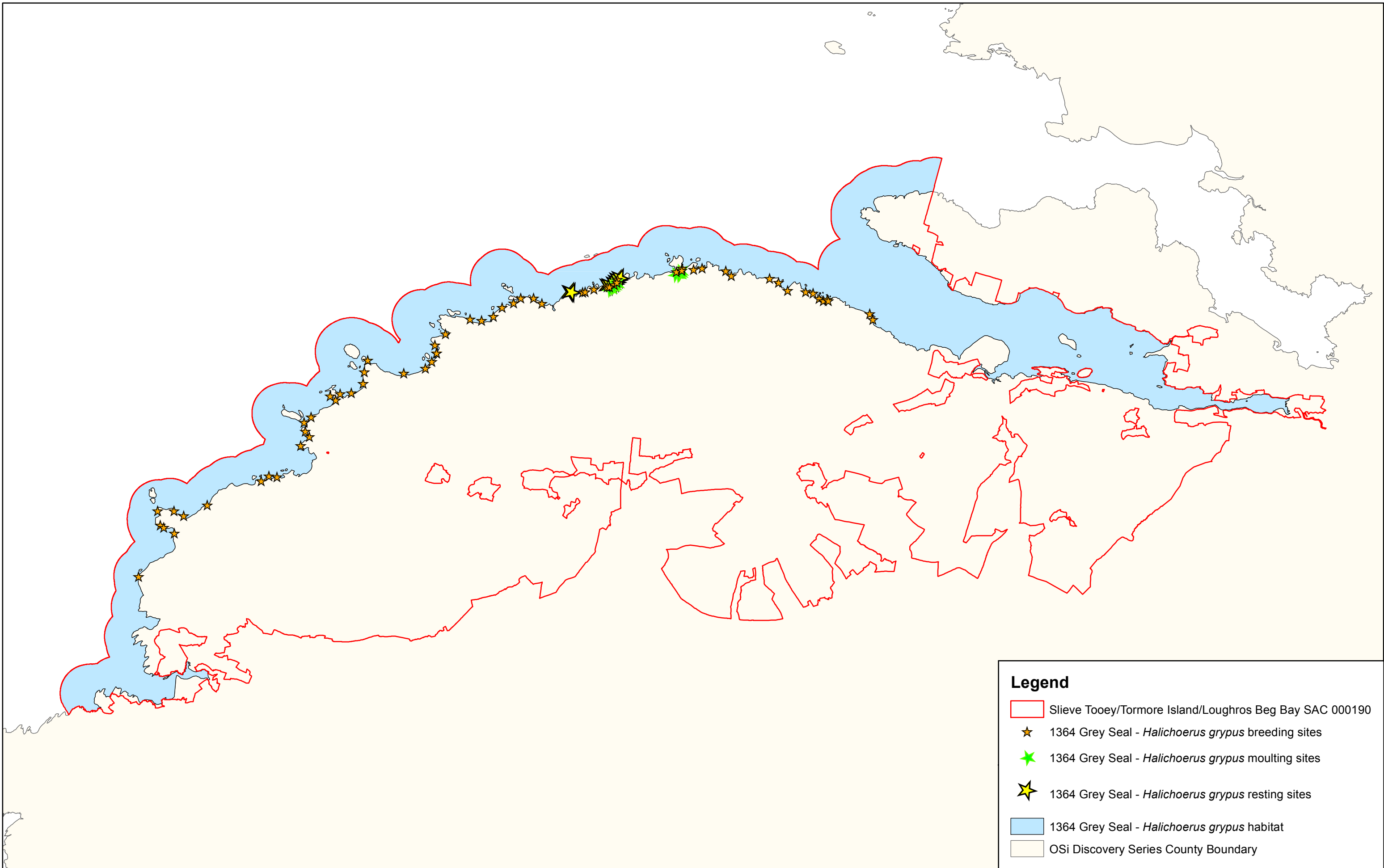
Legend

- Slieve Tooley/Tormore Island/Loughros Beg Bay SAC 000190
- 1014 Narrow-Mouthed Whorl Snail - *Vertigo angustior*
- OSi Discovery Series County Boundary



Legend

- Slieve Tooley/Tormore Island/Loughros Beg Bay SAC 000190
- 1355 Otter - *Lutra lutra* Commuting 250m buffer
- OSi Discovery Series County Boundary



Legend

- Slieve Tooley/Tormore Island/Loughros Beg Bay SAC 000190
- ★ 1364 Grey Seal - *Halichoerus grypus* breeding sites
- ★ 1364 Grey Seal - *Halichoerus grypus* moulting sites
- ★ 1364 Grey Seal - *Halichoerus grypus* resting sites
- 1364 Grey Seal - *Halichoerus grypus* habitat
- OSi Discovery Series County Boundary

National Parks and Wildlife Service

Conservation Objectives

River Barrow and River Nore SAC 002162



*An Roinn
Ealaíon, Oidhreachta agus Gaeltachta*
*Department of
Arts, Heritage and the Gaeltacht*

Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

002162 River Barrow and River Nore SAC

QI	Description
1016	Desmoulin's whorl snail <i>Vertigo moulinsiana</i>
1029	Freshwater pearl mussel <i>Margaritifera margaritifera</i>
1092	White-clawed crayfish <i>Austropotamobius pallipes</i>
1095	Sea lamprey <i>Petromyzon marinus</i>
1096	Brook lamprey <i>Lampetra planeri</i>
1099	River lamprey <i>Lampetra fluviatilis</i>
1103	Twaite shad <i>Alosa fallax</i>
1106	Atlantic salmon (<i>Salmo salar</i>) (only in fresh water)
1130	Estuaries
1140	Mudflats and sandflats not covered by seawater at low tide
1310	<i>Salicornia</i> and other annuals colonizing mud and sand
1330	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)
1355	Otter <i>Lutra lutra</i>
1410	Mediterranean salt meadows (<i>Juncetalia maritimi</i>)
1421	Killarney fern <i>Trichomanes speciosum</i>
1990	Nore freshwater pearl mussel <i>Margaritifera durrovensis</i>
3260	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation
4030	European dry heaths
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
7220	* Petrifying springs with tufa formation (<i>Cratoneurion</i>)
91A0	Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles
91E0	* Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>)

Supporting documents, relevant reports & publications (listed by date)

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

-
- Title:** Desmoulin's whorl snail (*Vertigo moulinsiana* - 1016) Conservation Status Assessment Report
Year: 2011
Author: Moorkens, E. ; Killeen, I.
Series: Unpublished Report to NPWS
-
- Title:** River Barrow and River Nore SAC (002162): Conservation objectives supporting document - woodland habitats [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS
-
- Title:** River Barrow and River Nore SAC (002162): Conservation objectives supporting document - coastal habitats [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS
-
- Title:** River Barrow and River Nore SAC (002162): Conservation objectives supporting document - marine habitats [Version 1]
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS
-
- Title:** Second Draft Nore Freshwater Pearl Mussel Sub-basin Management Plan (2009-2015)
Year: 2010
Author: DEHLG
Series: Unpublished Report to NPWS
-
- Title:** Site investigations for *Sabellaria alveolata* (Honey-comb worm) biogenic reefs in Ireland
Year: 2010
Author: NPWS
Series: Unpublished Report to NPWS
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- Title:** Irish Semi-natural Grasslands Survey. Annual report no. 3: Counties Donegal, Dublin, Kildare & Sligo
Year: 2010
Author: O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; McNutt, K.E.; Perrin, P.M. ; Delaney, A.
Series: Unpublished Report to NPWS
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- Title:** A provisional inventory of ancient and long-established woodland in Ireland
Year: 2010
Author: Perrin, P.M.; Daly, O.H.
Series: Irish Wildlife Manuals No. 46
-
- Title:** Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland [Version 1.0]
Year: 2010
Author: Perrin, P.M.; Barron, S.J.; Roche, J.R.; O'Hanrahan, B.
Series: Irish Wildlife Manuals No. 48
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Title:	A technical manual for monitoring white-clawed crayfish <i>Austropotamobius pallipes</i> in Irish lakes
Year:	2010
Author:	Reynolds, J.D.; O'Connor, W.; O'Keeffe, C.; Lynn, D.
Series:	Irish Wildlife Manuals No. 45
Title:	Report of the standing scientific committee to the DCENR. The status of Irish salmon stocks in 2010 and precautionary catch advice for 2011
Year:	2010
Author:	SSC
Series:	Unpublished Report to DCENR
Title:	The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009. [S.I. 296 of 2009]
Year:	2009
Author:	Government of Ireland
Series:	Irish Statute Book
Title:	The European Communities Environmental Objectives (Surface Water) Regulations 2009. [S.I. 272 of 2009]
Year:	2009
Author:	Government of Ireland
Series:	Irish Statute Book
Title:	Saltmarsh Monitoring Report 2007-2008
Year:	2009
Author:	McCorry, M.; Ryle, T.
Series:	Unpublished Report to NPWS
Title:	<i>Margaritifera durrovensis</i> Survey of Nore River. June – July 2009. NS 2 project
Year:	2009
Author:	Moorkens, E. A.
Series:	Unpublished Report to NPWS
Title:	Benthic Biotope classification of subtidal sedimentary habitats in the Lower River Suir candidate Special Area of Conservation and the River Nore and River Barrow candidate Special Area of Conservation
Year:	2008
Author:	ARMS
Series:	Unpublished Report to NPWS
Title:	A survey of mudflats and sandflats in Ireland. An intertidal soft sediment survey of Waterford Estuary
Year:	2008
Author:	ASU
Series:	Unpublished Report to NPWS
Title:	Assessment of the Risk of Barriers to Fish Migration in the Nore Catchment, Southern Regional Fisheries Board
Year:	2008
Author:	CFB; Compass Informatics
Series:	Unpublished Report to CFB

Title: Poor water quality constrains the distribution and movements of Twaite shad *Alosa fallax fallax* (Lacepede, 1803) in the watershed of river Scheldt

Year: 2008

Author: Maas, J.; Stevens, M. ; Breine, J.

Series: Hydrobiologia 602, 129 - 143

Title: All Ireland Species Action Plan - Killarney fern

Year: 2008

Author: NPWS ; EHS-NI

Series: Unpublished Report to NPWS & EHS-NI

Title: National Survey of Native Woodlands 2003-2008

Year: 2008

Author: Perrin, P.; Martin, J.; Barron, S.; O'Neill, F.; McNutt, K.; Delaney, A.

Series: Unpublished Report to NPWS

Title: Saltmarsh Monitoring Report 2006

Year: 2007

Author: McCorry, M.

Series: Unpublished Report to NPWS

Title: Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents, Article 17 forms and supporting maps

Year: 2007

Author: NPWS

Series: Unpublished Report to NPWS

Title: A Survey of Juvenile Lamprey Populations in the Corrib and Suir Catchments

Year: 2007

Author: O'Connor, W.

Series: Irish Wildlife Manuals No. 26

Title: Assessment of fish passage and the ecological impact of migration barriers on the River Nore catchment

Year: 2007

Author: Sullivan, A.

Series: Nore Suir Rivers Trust & OPW

Title: Otter Survey of Ireland 2004/2005

Year: 2006

Author: Bailey, M.; Rochford, J.

Series: Irish Wildlife Manuals No. 23

Title: The status of host fish populations and fish species richness in European freshwater pearl mussel (*Margaritifera margaritifera*) streams

Year: 2006

Author: Geist, J.; Porkka, M.; Kuehn, R.

Series: Aquatic Conservation: Marine and Freshwater Ecosystems 16, 251–266

Title: The distribution of Lamprey in the River Barrow SAC

Year: 2006

Author: King, J.J.

Series: Irish Wildlife Manuals No. 21

- Title:** Otters - ecology, behaviour and conservation
Year: 2006
Author: Kruuk, H.
Series: Oxford University Press
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- Title:** The ecology and conservation of the gametophyte generation of the Killarney Fern (*Trichomanes speciosum* Willd.) in Ireland
Year: 2005
Author: Kingston, N. ; Hayes, C.
Series: Biology and Environment: Proceedings of the Royal Irish Academy 105B(2): 71-79
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- Title:** Pilot Project for Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Nore River SAC, Counties Laois and Kilkenny
Year: 2004
Author: Moorkens, E. A.
Series: Unpublished Report to NPWS
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- Title:** Monitoring the river, sea and brook lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*
Year: 2003
Author: Harvey, J.; Cowx, I.
Series: Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough
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- Title:** Ecology of Watercourses Characterised by *Ranunculion fluitantis* and *Callitriche-Batrachion* Vegetation
Year: 2003
Author: Hatton-Ellis, T.W.; Grieve, N.
Series: Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.
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- Title:** Ecology of the Allis and Twaite shad
Year: 2003
Author: Maitland, P.S.; Hatton-Ellis, T.W.
Series: Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough
-
- Title:** A survey of the white-clawed crayfish, *Austropotamobius pallipes* (Lereboullet) and of water quality in two catchments of Eastern Ireland
Year: 2002
Author: Demers, A.; Reynolds, J. D.
Series: Bulletin Français de la Pêche et de la Pisciculture, 367: 729-740
-
- Title:** Reversing the habitat fragmentation of British woodlands
Year: 2002
Author: Peterken, G.
Series: WWF-UK, London
-
- Title:** A survey of broadleaf woodlands in 3 SACs: Barrow-Nore, River Unshin & Lough Forbes
Year: 2000
Author: Browne, A.; Dunne, F.; Roche, N.
Series: Unpublished Report to NPWS
-
- Title:** Diet of Otters *Lutra lutra* on Inishmore, Aran Islands, west coast of Ireland
Year: 1999
Author: Kingston, S.; O'Connell, M.; Fairley, J.S.
Series: Biol & Environ Proc R Ir Acad B 99B:173-182

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- Title:** Conservation Management of the White-clawed Crayfish, *Austropotamobius pallipes*
Year: 1998
Author: Reynolds, J.D.
Series: Irish Wildlife Manuals No. 1
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- Title:** Studies on the biology and ecology of Margaritifera in Ireland
Year: 1996
Author: Moorkens, E.A.
Series: Unpublished PhD thesis, University of Dublin, Trinity College.
-
- Title:** Imminent extinction of the Nore freshwater pearl mussel *Margaritifera durrovensis* Phillips: a species unique to Ireland
Year: 1994
Author: Moorkens, E.A. ; Costello, M.J.
Series: Aquatic Conservation: Marine and Freshwater Ecosystems 4,363-365
-
- Title:** The spatial organization of otters (*Lutra lutra*) in Shetland
Year: 1991
Author: Kruuk, H.; Moorhouse, A.
Series: J. Zool, 224: 41-57
-
- Title:** The vegetation of Irish rivers
Year: 1987
Author: Heuff, H.
Series: Unpublished Report
-
- Title:** Otter survey of Ireland
Year: 1982
Author: Chapman, P.J.; Chapman, L.L.
Series: Unpublished Report to Vincent Wildlife Trust
-

Spatial data sources

Year:	2010
Title:	EPA transitional waterbody data
GIS operations:	Clipped to SAC boundary
Used for:	1130 (map 2)
Year:	Interpolated 2011
Title:	Intertidal and subtidal surveys 2008 & 2010
GIS operations:	Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data
Used for:	Marine community types, 1140 (maps 3 & 4)
Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	High water mark (HWM) and low water mark (LWM) polyline feature classes converted into polygon feature classes and combined; Saltmarsh and Sand Dune datasets erased out if applicable
Used for:	Marine community types base data (map 4)
Year:	Revision 2010
Title:	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS operations:	QIs selected; clipped to SAC boundary; overlapping regions with Sand Dune data investigated and resolved with expert opinion used
Used for:	1310, 1330, 1410 (map 5)
Year:	Derived 2011
Title:	Internal NPWS files
GIS operations:	Dataset created from spatial reference contained in files
Used for:	7220 (map 6)
Year:	Revision 2010
Title:	National Survey of Native Woodlands 2003-2008. Version 1
GIS operations:	QIs selected; clipped to SAC boundary
Used for:	91A0, 91E0 (map 6)
Year:	2011
Title:	NPWS rare and threatened species database
GIS operations:	Dataset created from spatial references in database records
Used for:	1016, 1092, 1421, 1990 (map 7)
Year:	2005
Title:	OSi Discovery series vector data
GIS operations:	Creation of an 80m buffer on the marine side of the high water mark (HWM); creation of a 10m buffer on the terrestrial side of the HWM; combination of 80m and 10m HWM buffer datasets; creation of a 10m buffer on the landward side of the river banks data; creation of a 20m buffer applied to river centerline and stream data; combination of 10m river banks and 20m river and stream centerline buffer datasets; combined river and stream buffer dataset clipped to HWM; combination of HWM buffer dataset with river and stream buffer dataset; overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary
Used for:	1355 (no map)

1016 Desmoulin's whorl snail *Vertigo moulinsiana*

To maintain the favourable conservation condition of Desmoulin's whorl snail in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: occupied sites	Number	No decline. Two known sites: Borris Bridge, Co. Carlow S711503; Boston Bridge, Kilnaseer S338774, Co. Laois. See map 7	Data from NPWS rare and threatened species database
Population size: adults	Number per positive sample	At least 5 adults snails in at least 50% of samples	Attribute and target from Moorkens and Killeen (2011)
Population density	Percentage positive samples	Adult snails present in at least 60% of samples per site	Attribute and target from Moorkens and Killeen (2011)
Area of occupancy	Hectares	Minimum of 1ha of suitable habitat per site	Attribute and target from Moorkens and Killeen (2011)
Habitat quality: vegetation	Percentage of samples with suitable vegetation	90% of samples in habitat classes I and II as defined in Moorkens & Killeen (2011)	Attribute and target from Moorkens and Killeen (2011)
Habitat quality: soil moisture levels	Percentage of samples with appropriate soil moisture levels	90% of samples in moisture class 3-4 as defined in Moorkens & Killeen (2011)	Attribute and target from Moorkens and Killeen (2011)

1029 Freshwater pearl mussel *Margaritifera margaritifera*

The status of the freshwater pearl mussel (*Margaritifera margaritifera*) as a qualifying Annex II species for the River Barrow and River Nore SAC is currently under review. The outcome of this review will determine whether a site-specific conservation objective is set for this species. Please note that the Nore freshwater pearl mussel (*Margaritifera durrovensis*) remains a qualifying species for this SAC. This document contains a conservation objective for the latter species.

1092 White-clawed crayfish *Austropotamobius pallipes*

To maintain the favourable conservation condition of White-clawed crayfish in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Occurrence	No reduction from baseline. See map 7	The crayfish is present almost throughout this SAC. The records extend as far downstream as Thomastown on the Nore and Graiguenamanagh on the Barrow
Population structure: recruitment	Percentage occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in at least 50% of positive samples	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as major direct threat to this species and as disease vector. See Reynolds (1998) for further details
Disease	Occurrence	No instances of disease	Disease is identified as major threat and has occurred in Ireland even in the absence of alien vectors. See Reynolds (1998) for further details
Water quality	EPA Q value	At least Q3-4 at all sites sampled by EPA	Target taken from Demers and Reynolds (2002). Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)
Habitat quality: heterogeneity	Occurrence of positive habitat features	No decline in heterogeneity or habitat quality	Crayfish need high habitat heterogeneity. Larger crayfish must have stones to hide under, or an earthen bank in which to burrow. Hatchlings shelter in vegetation, gravel and among fine tree-roots. Smaller crayfish are typically found among weed and debris in shallow water. Larger juveniles in particular may also be found among cobbles and detritus such as leaf litter. These conditions must be available on the whole length of occupied habitat

1095 Sea lamprey *Petromyzon marinus*

To restore the favourable conservation condition of Sea lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on data from Harvey and Cowx (2003) and O'Connor, (2007). King (2007) provides survey information for the Barrow
Juvenile density in fine sediment	Juveniles/m ²	Juvenile density at least 1/m ²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003)
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1096 Brook lamprey *Lampetra planeri*

To restore the favourable conservation condition of Brook lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	% of river accessible	Access to all watercourses down to first order streams	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of brook/river lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m ²	Mean catchment juvenile density of brook/river lamprey at least 2/m ²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m ² in optimal conditions and more than 2/m ² on a catchment basis
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1099 River lamprey *Lampetra fluviatilis*

To restore the favourable conservation condition of River lamprey in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem and major tributaries down to second order accessible from estuary	Artificial barriers can block lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Population structure of juveniles	Number of age/size groups	At least three age/size groups of river/brook lamprey present	Attribute and target based on data from Harvey and Cowx (2003). King (2007) provides survey information for the Barrow. It is impossible to distinguish between brook and river lamprey juveniles in the field, hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m ²	Mean catchment juvenile density of brook/river lamprey at least 2/m ²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m ² in optimal conditions and more than 2/m ² on a catchment basis
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning beds	Attribute and target based on spawning bed mapping by Inland Fisheries Ireland (IFI). Lampreys spawn in clean gravels. Artificial barriers are currently preventing lamprey from accessing suitable spawning habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information
Availability of juvenile habitat	Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Artificial barriers are currently preventing juvenile lampreys from accessing the full extent of suitable habitat. See King (2006), Sullivan (2007) and CFB and Compass Informatics (2008) for further information

1103 Twaite shad *Alosa fallax*

To restore the favourable conservation condition of Twaite shad in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	In some catchments, artificial barriers block twaite shads' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas
Population structure: age classes	Number of age classes	More than one age class present	Regular breeding has been confirmed in the River Barrow in recent years, but not in the Nore
Extent and distribution of spawning habitat	m ² and occurrence	No decline in extent and distribution of spawning habitats	
Water quality: oxygen levels	Milligrammes per litre	No lower than 5mg/l	Attribute and target based on Maas, Stevens and Briene (2008)
Spawning habitat quality: Filamentous algae; macrophytes; sediment	Occurrence	Maintain stable gravel substrate with very little fine material, free of filamentous algal (macroalgae) growth and macrophyte (rooted higher plants) growth	See Maitland and Hatton-Ellis (2003) for further information

Conservation objectives for: River Barrow and River Nore SAC [002162]

1106 Atlantic salmon (*Salmo salar*) (only in fresh water)

To restore the favourable conservation condition of Salmon in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmon's upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See Sullivan (2007) and CFB and Compass Informatics (2008) for further information on artificial barriers
Adult spawning fish	Number	Conservation Limit (CL) for each system consistently exceeded	A conservation limit is defined by the North Atlantic Salmon Conservation Organisation (NASCO) as "the spawning stock level that produces long-term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship". The target is based on the Standing Scientific Committee of the National Salmon Commission's annual model output of CL attainment levels. See SSC (2010). Stock estimates are either derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance counts. The Nore is currently exceeding its CL, while the Barrow is below its CL
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	Target is threshold value for rivers currently exceeding their conservation limit (CL)
Out-migrating smolt abundance	Number	No significant decline	Smolt abundance can be negatively affected by a number of impacts such as estuarine pollution, predation and sea lice (<i>Lepeophtheirus salmonis</i>)
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	Salmon spawn in clean gravels. Artificial barriers are currently preventing salmon from accessing suitable spawning habitat
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA	Q values based on triennial water quality surveys carried out by the Environmental Protection Agency (EPA)

1130 Estuaries

To maintain the favourable conservation condition of Estuaries in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 2	Habitat area was estimated using OSI data and the defined Transitional Water Body area under the Water Framework Directive as 3856ha. See marine supporting document for further details
Community distribution	Hectares	The following sediment communities should be maintained in a natural condition: Muddy estuarine community complex; Sand to muddy fine sand community complex; Fine sand with <i>Fabulina fabula</i> community. See map 4	The likely area of sediment communities was derived from a combination of intertidal and subtidal surveys undertaken in 2008 (ARMS, 2008; ASU, 2008). See marine supporting document for further details
Community extent	Hectares	Maintain the natural extent of the <i>Sabellaria alveolata</i> reef, subject to natural process. See map 4	The likely area of this community is derived from a survey undertaken in 2010 (NPWS, 2010). See marine supporting document for further details

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of the Mudflats and sandflats not covered by seawater at low tide in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 3	Habitat area was estimated using OSI data as 926ha. See marine supporting document for further details
Community distribution	Hectares	The following sediment communities should be maintained in a natural condition: Muddy estuarine community complex; Sand to muddy fine sand community complex. See map 4	The likely area of sediment communities was derived from a combination of intertidal and subtidal surveys undertaken in 2008 (ARMS, 2008; ASU, 2008). See marine supporting document for further details

1310 Salicornia and other annuals colonizing mud and sand

To maintain the favourable conservation condition of *Salicornia* and other annuals colonizing mud and sand in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For the one sub-site mapped: Ringville - 0.03ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). The Ringville sub-site was mapped and no additional areas of potential <i>Salicornia</i> mudflat were identified from an examination of aerial photographs, giving a total estimated area of 0.03ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain or where necessary restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated.	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009).	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: <i>Spartina anglica</i>	Hectares	No significant expansion of <i>Spartina</i> . No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

To restore the favourable conservation condition of Atlantic salt meadows in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Dunbrody Abbey - 1.25ha, Killowen - 2.59ha, Rochestown - 17.50ha, Ringville - 6.70ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Four sub-sites were mapped and additional areas of potential saltmarsh were identified from an examination of aerial photographs, giving a total estimated area of Atlantic salt meadow of 35.07ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: <i>Spartina anglica</i>	Hectares	No significant expansion of <i>Spartina</i> . No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1355 Otter *Lutra lutra*

To restore the favourable conservation condition of Otter in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. FCS target, based on 1980/81 survey findings, is 88% in SACs. Current range in south-east estimated at 73% (Bailey and Rochford, 2006)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 122.8ha above high water mark (HWM); 1136.0ha along river banks / around ponds	No field survey. Areas mapped to include 10m terrestrial buffer along shoreline (above HWM and along river banks) identified as critical for otters (NPWS, 2007)
Extent of marine habitat	Hectares	No significant decline. Area mapped and calculated as 857.7ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (NPWS, 2007; Kruuk, 2006)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 616.6km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 2.6ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk, 2006; Kruuk and Moorhouse, 1991)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006) and wrasse and rockling in coastal waters (Kingston et al., 1999)

1410 Mediterranean salt meadows (*Juncetalia maritimi*)

To restore the favourable conservation condition of Mediterranean salt meadows in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-sites mapped: Dunbrody Abbey - 0.08ha, Rochestown - 0.04ha, Ringville - 6.70ha. See map 5	Based on data from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009). Three sub-sites were mapped and no additional areas of potential saltmarsh were identified from an examination of aerial photographs, giving a total estimated area of Mediterranean salt meadow of 6.82ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain or where necessary restore natural circulation of sediments and organic matter, without any physical obstructions	See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitat zonations including transitional zones, subject to natural processes including erosion and succession. See map 5	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated.	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Saltmarsh Monitoring Project (McCorry & Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species: <i>Spartina anglica</i>	Hectares	No significant expansion of <i>Spartina</i> . No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on McCorry and Ryle (2009). See coastal habitats supporting document for further details

1421 Killarney fern *Trichomanes speciosum*

To maintain the favourable conservation condition of Killarney Fern in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Location	No decline. Three locations known, with three colonies of gametophyte and one sporophyte colony. See map 7	Data from NPWS rare and threatened species database
Population size	Number	Maintain at least three colonies of gametophyte, and at least one sporophyte colony of over 35 fronds	Data from NPWS rare and threatened species database
Population structure: juvenile fronds	Occurrence	At least one of the locations to have a population structure comprising sporophyte, unfurling fronds, 'juvenile' sporophyte and gametophyte generations	'Juvenile' sporophytes, which appear as small entire fronds, are known from this site. However, it is unknown whether they are due to apogamous growth or sexual reproduction. Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Habitat extent	m ²	No loss of suitable habitat, such as shaded rock crevices, caves or gullies in or near to, known colonies. No loss of woodland canopy at or near to known locations	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Hydrological conditions: visible water	Occurrence	Maintain hydrological conditions at the locations so that all colonies are in dripping or damp seeping habitats, and water is visible at all locations	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Hydrological conditions: humidity	Number of dessicated fronds	No increase. Presence of dessicated sporophyte fronds or gametophyte mats indicates conditions are unsuitable	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Light levels: shading	Percentage	No changes due to anthropogenic impacts	Based on Kingston and Hayes (2005) and Ni Dhuill (pers. Comm.)
Invasive species	Occurrence	Absent or under control	NPWS and EHS-NI (2008) provides further details

1990 Nore freshwater pearl mussel *Margaritifera durrovensis*

To restore the favourable conservation condition of the Nore freshwater pearl mussel in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Kilometres	Maintain at 15.5km. See map 7	The population stretches from Poorman's Bridge (S407859) to Lismaine Bridge (S442660), with most of the population found between Poorman's Bridge and the Avonmore Creamery above Ballyragget (S 440 722) (Moorkens, 1996)
Population size: adult mussels	Number	Restore to 5,000 adult mussels	The extant wild population of Nore freshwater pearl mussel is estimated as 300 adult individuals (Moorkens, 2009)
Population structure: recruitment	Percentage per size class	Restore to at least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length	Mussels of no more than 65mm are considered 'young mussels' and may be found buried in the substratum and/or beneath adult mussels. Mussels of no more than 30mm are 'juvenile mussels' and are always buried in the substratum. This species is known not to have reproduced successfully in the River Nore since 1970 (Moorkens and Costello, 1994; Moorkens, 2004; Government of Ireland, 2009 [S.I. 272 of 2009])
Population structure: adult mortality	Percentage	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	5% is considered the cut-off between the combined errors associated with natural fluctuations and sampling methods and evidence of true population decline. 1% of dead shells is considered to be indicative of natural losses
Habitat extent	Kilometres	Restore suitable habitat in length of river corresponding to distribution target (15.5km; see map 7) and any additional stretches necessary for salmonid spawning	The species habitat is a stretch of large lowland river and is a combination of 1) the area of habitat adult and juvenile mussels can occupy and 2) the area of spawning and nursery habitats the host fish can occupy. Fish nursery habitat typically overlaps with mussel habitat. Fish spawning habitat is generally adjacent mussel habitat, but may lie upstream of the generalised mussel distribution. Only those salmonid spawning areas that could regularly contribute juvenile fish to the areas occupied by adult mussels should be considered. The availability of mussel habitat and fish spawning and nursery habitats are determined by flow and substratum conditions. The habitat for the species is currently unsuitable for the survival of adult mussels or the recruitment of juveniles

Conservation objectives for: River Barrow and River Nore SAC [002162]

1990 Nore freshwater pearl mussel *Margaritifera durrovensis*

To restore the favourable conservation condition of the Nore freshwater pearl mussel in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Water quality: Macroinvertebrates and phytobenthos (diatoms)	Ecological quality ratio (EQR)	Restore water quality-macroinvertebrates: EQR greater than 0.90; phytobenthos: EQR greater than 0.93	These EQRs correspond to high ecological status for these two Water Framework Directive biological quality elements. They represent high water quality with very low nutrient concentrations (oligotrophic conditions). The habitat of the Nore pearl mussel failed both standards during 2009 sampling for the Sub-basin Management Plan (DEHLG, 2010). See also The European Communities Environmental Objectives (Surface Water Objectives) Regulations 2009
Substratum quality: Filamentous algae (macroalgae), macrophytes (rooted higher plants)	Percentage	Restore substratum quality-filamentous algae: absent or trace (<5%); macrophytes: absent or trace (<5%)	High abundance of macroalgae was recorded during 2009 sampling for the Sub-basin Management Plan (DEHLG, 2010). Recruitment of juvenile mussels is being prevented by the poor quality of the river substrate
Substratum quality: sediment	Occurrence	Restore substratum quality-stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	The habitat for the species is currently unsuitable for the survival of adult mussels or the recruitment of juveniles owing to sedimentation of the substratum. Significant sedimentation has been recorded during all recent mussel monitoring surveys. Recruitment of juvenile mussels is being prevented by the poor quality of the river substrate
Substratum quality: oxygen availability	Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	Differences in redox potential between the water column and the substrate correlate with differences in oxygen levels. Juvenile mussels require full oxygenation while buried in gravel. In suitable habitat, there should be very little loss of redox potential between the water column and underlying gravels. The redox potential loss in 2009 was 58-64% at 5cm depth (DEHLG, 2010)
Hydrological regime: flow variability	Metres per second	Restore appropriate hydrological regimes	The availability of suitable Nore freshwater pearl mussel habitat is largely determined by flow (catchment geology being the other important factor). In order to restore the habitat for the species, flow variability over the annual cycle must be such that: 1) high flows can wash fine sediments from the substratum, 2) low flows do not exacerbate the deposition of fines and 3) low flows do not cause stress to mussels in terms of exposure, water temperatures, food availability or aspects of the reproductive cycle

1990 Nore freshwater pearl mussel *Margaritifera durrovensis*

To restore the favourable conservation condition of the Nore freshwater pearl mussel in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Host fish	Number	Maintain sufficient juvenile salmonids to host glochidial larvae	Salmonid fish are host to the larval form of freshwater pearl mussels and thus, they are essential to the completion of the life cycle. 0+ and 1+ fish are typically used, both because of the habitat overlaps and the development of immunity with age in the fish. Fish presence is considered sufficient, as higher densities and biomass of fish is indicative of enriched conditions in mussel rivers. Geist et al. (2006) found that higher densities of host fish coincided with eutrophication, poor substrate quality for pearl mussels and a lack of pearl mussel recruitment, while significantly lower densities and biomass of host fish were associated with high numbers of juvenile mussels. Fish movement patterns must be such that 0+ fish in the vicinity of the mussel habitat remain in the mussel habitat until their 1+ summer. As native brown trout appear to be favoured by the Nore freshwater pearl mussel, it is particularly important that these are not out-competed by stocked fish

3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline, subject to natural processes	The full distribution of this habitat and its sub-types in this site is currently unknown. The basis of the selection of the SAC for the habitat is the presence of an excellent example of the vegetation community (nutrient-rich type) associated with extensive tufa deposits on the river bed in the Kings tributary of the Nore (Heuff, 1987). Other examples of this or other sub-types may be present within the SAC
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	The full extent of this habitat in this site is currently unknown. See above
Hydrological regime: river flow	Metres per second	Maintain appropriate hydrological regimes	Due to regular disturbance (through variations in flow), river macrophytes rarely reach a climax condition but frequently occur as transient communities. A natural (relatively unmodified) flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For most of the sub-types of this habitat, high flows are required to maintain the substratum (see below) necessary for the characteristic species. Flow variation is particularly important, with high and flood flows being critical to the hydromorphology
Hydrological regime: groundwater discharge	Metres per second	The groundwater flow to the habitat should be permanent and sufficient to maintain tufa formation	This attribute refers to sub-types with tufa formations. Groundwater discharges to this habitat throughout the year
Substratum composition: particle size range	Millimetres	The substratum should be dominated by large particles and free from fine sediments	The tufaceous sub-types develop on relatively stable substrata such as bedrock, boulders and cobbles, where tufa can deposit and accumulate. Tufa deposition is believed to be biologically mediated, by algae and bryophytes. The substratum must remain free of fine sediments such as clay, silt and fine sand, which would adversely affect the growth of algae and mosses

3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Water chemistry: minerals	Milligrammes per litre	The groundwater and surface water should have sufficient concentrations of minerals to allow deposition and persistence of tufa deposits	The tufaceous sub-types require mineral- (typically calcium-) rich groundwaters to allow deposition of tufa. Surface water must also be sufficiently base-rich to prevent chemical erosion. Alkalinity and/or total hardness data may also be relevant
Water quality: suspended sediment	Milligrammes per litre	The concentration of suspended solids in the water column should be sufficiently low to prevent excessive deposition of fine sediments	See substratum composition above. Turbidity data may also be relevant
Water quality: nutrients	Milligrammes per litre	The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition	Phosphorus (MRP) is typically the limiting nutrient, however increased nitrogen (NO ₃ ⁻) negatively impacts upon the N-fixing blue-green algal communities that frequently contribute to tufa deposition. Nutrient enrichment of the habitat typically leads to increased filamentous-green-algal biomass, and consequent changes in other algae, bryophyte and macrophyte species composition and abundance. Water quality should reach a minimum of Water Framework Directive good status, in terms of nutrient standards, and macroinvertebrate and phytobenthos quality elements
Vegetation composition: typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	The sub-types of this habitat are poorly understood and their typical species have not yet been defined. Typical species and appropriate targets may emerge to be site-specific. The typical species of the tufaceous sub-type in the Kings tributary of the Nore are identified in Heuff (1987). The typical species may include higher plants, bryophytes, macroalgae and microalgae
Floodplain connectivity	Area	The area of active floodplain at and upstream of the habitat should be maintained	River connectivity with the floodplain is essential for the functioning of this habitat. The site of the tufaceous sub-type in the King's River is within an area of floodplain, with further large floodplains upstream. Floodplains regulate fine sediment deposition within the channel. See substratum composition above

4030 European dry heaths

To maintain the favourable conservation condition of European dry heaths in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline from current habitat distribution, subject to natural processes	Spatial extent currently unmapped but indicated as occurring on the steep, free-draining, river valley sides especially the Barrow and tributaries in the foothills of the Blackstairs Mountains (based on NPWS NHA Survey - 1997/98 Site Notes; Natura 2000 Form Explanatory Notes - May 2006; The above NHA survey was prior to the extensions to the SAC that included river habitat and estuary at Ballyhack which may have incorporated additional dry heath habitat)
Habitat area	Hectares	Area stable or increasing, subject to natural processes. Habitat area is not known but estimated as less than 400ha of the area of the SAC, occurring in dispersed locations	Based on NPWS NHA Survey Site Notes (1997/98); Natura 2000 Form Explanatory Notes - May 2006
Physical structure: free-draining, acid, low nutrient soil; rock outcrops	Occurrence	No significant change in soil nutrient status, subject to natural processes. No increase or decrease in area of natural rock outcrop	Based on NPWS NHA Survey Site Notes - 1997/98; Natura 2000 Form Explanatory Notes - May 2006
Vegetation structure: sub-shrub indicator species	Percentage cover	Cover of characteristic sub-shrub indicator species at least 25%: gorse (<i>Ulex europaeus</i>) and where rocky outcrops occur bilberry (<i>Vaccinium myrtillus</i>) and woodrush (<i>Luzula sylvatica</i>). Some rock outcrops support English stonecrop (<i>Sedum anglicum</i>), sheep's bit (<i>Jasione montana</i>) and wild madder (<i>Rubia peregrina</i>) as well as important moss and lichen assemblages	Dry heath in this SAC occurs on free-draining nutrient poor soils and is often characterised by gorse and open acid grassland areas. A characteristic coastal dry heath of the southeast also occurs. Several rare plants occur including two species listed in the Red Data Book (Curtis and McGough, 1988). The species occurring on the site are listed in NPWS NHA Survey Site Notes - 1997/98. A brief overview of the principal characteristics of the dry heath habitat of this SAC is given in the Natura 2000 Explanatory Notes - May 2006
Vegetation structure: senescent gorse	Percentage cover	Cover of senescent gorse less than 50%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath condition assessment methodology of Perrin et al. (2010)
Vegetation structure: browsing	Percentage cover	Long shoots of bilberry with signs of browsing collectively less than 33%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath condition assessment methodology of Perrin et al. (2010)

4030 European dry heaths

To maintain the favourable conservation condition of European dry heaths in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: native trees and shrubs	Percentage cover	Cover of scattered native trees and shrub less than 20%	Based on NPWS NHA Survey Site Notes - 1997/98; Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010). From the NHA survey notes the main threats appear to be reclamation or invasion by scrub woodland
Vegetation composition: positive indicator species	Number	Number of positive indicator species at least 2 e.g. gorse and associated dry heath/ acid grassland flora	Dry heath in this SAC occurs on free-draining nutrient poor soils and is characterised by gorse and acid grassland areas. It corresponds to Annex I sub-type "heaths rich in gorse (<i>Ulex</i>) of the Atlantic margins" (European Commission, 2007). Based on NPWS NHA Survey Site Notes -1997/98; Natura 2000 Form Explanatory Notes - May 2006 and a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation structure: positive indicator species	Percentage cover	Cover of positive indicator species at least 60%. This should include plant species characteristic of dry heath in this SAC including gorse, bilberry and associated acid grassland flora	Dry heath in this SAC is characterised by gorse and acid grassland areas and locally bilberry and woodrush. Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: bryophyte and non-crustose lichen species	Number	Number of bryophyte or non-crustose lichen species present at least 2	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. 2010
Vegetation composition: bracken (<i>Pteridium aquilinum</i>)	Percentage cover	Cover of bracken less than 10% - however see 'Notes'	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010). Bracken appears to be quite dense in places and before any management action is considered its rate of spread needs to be established as well as its threat, if any, to other dry heath species and its potential value to important fauna (e.g. Twite)

4030 European dry heaths

To maintain the favourable conservation condition of European dry heaths in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: weedy negative indicator species	Percentage cover	Cover of agricultural weed species (negative indicator species) less than 1%	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: non-native species	Percentage cover	Cover of non-native species less than 1%.	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation composition: rare/scarce heath species	Location, area and number	No decline in distribution or population sizes of rare, threatened or scarce species, including Greater Broomrape (<i>Orobanche rapum-genistae</i>) and the legally protected clustered clover (<i>Trifolium glomeratum</i>)	Broomrape is dependent on gorse at this site as it is parasitic on gorse roots. It is recorded as occurring on steep slopes above New Ross. A small area of excellent dry coastal heath at Ballyhack is interspersed with patches rock and of dry lowland grassland and has a high species diversity. Notably there is an excellent range of Clover (<i>Trifolium</i>) species including the legally protected clustered clover, a species known only from one other site in Ireland. Also <i>T. ornithopodioides</i> , <i>T. striatum</i> and <i>Torilus nodosa</i> . Based on Natura 2000 Form Explanatory Notes May 2006, Irish Red Data Book (Curtis and Mc Gough, 1988) and on the NPWS database of rare and threatened vascular plants. Other areas of coastal heath may also occur
Vegetation structure: disturbed bare ground	Percentage cover	Cover of disturbed bare ground less than 10% (but if peat soil less than 5%)	Based on NPWS NHA Survey Site Notes and Natura 2000 Form Explanatory Notes - May 2006 and on a modified version of the dry heath habitat condition assessment methodology of Perrin et al. (2010)
Vegetation structure: burning	Occurrence	No signs of burning within sensitive areas	Perrin et al. (2010) defines sensitive areas

6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

To maintain the favourable conservation condition of Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat distribution	Occurrence	No decline, subject to natural processes	Distribution of this habitat in this site is currently unknown. Considered to occur in association with some riverside woodlands, unmanaged river islands and in narrow bands along the floodplain of slow-flowing stretches of river (Natura 2000 Form Explanatory Notes)
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Extent of this habitat in this site is currently unknown. See above
Hydrological regime: Flooding depth/height of water table	Metres	Maintain appropriate hydrological regimes	This habitat requires winter inundation, which results in deposition of naturally nutrient-rich sediment
Vegetation structure:sward height	Centimetres	30-70% of sward is between 40 and 150cm in height	Bare ground, due to natural inundation processes, may often be present. Attribute and target based on the Irish Semi-natural Grassland Survey (O'Neill et al., 2010)
Vegetation composition: broadleaf herb: grass ratio	Percentage	Broadleaf herb component of vegetation between 40 and 90%	Attribute and target based on O'Neill et al. (2010)
Vegetation composition: typical species	Number	At least 5 positive indicator species present	List of positive indicator species identified by O'Neill et al. (2010)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control- NB Indian balsam (<i>Impatiens glandulifera</i>), monkeyflower (<i>Mimulus guttatus</i>), Japanese knotweed (<i>Fallopia japonica</i>) and giant hogweed (<i>Heracleum mantegazzianum</i>)	Species listed as being present in the site (Natura 2000 Form Explanatory Notes)

7220 * Petrifying springs with tufa formation (*Cratoneurion*)

To maintain the favourable conservation condition of Petrifying springs with tufa formation (*Cratoneurion*) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Square metres	Area stable or increasing, subject to natural processes	Extent of this habitat in this site is currently unknown. An area ("Tens of square metres") has been described at one location (Natura 2000 Form Explanatory Notes; internal NPWS files), see below
Habitat distribution	Occurrence	No decline. See map 6 for recorded location	Full distribution of this habitat in this site is currently unknown. It has been described in woodlands at Dysart, between Thomastown and Inistioge (Natura 2000 Form Explanatory Notes; internal NPWS files). NB further areas are likely to occur within the site
Hydrological regime: height of water table; water flow	Metres; metres per second	Maintain appropriate hydrological regimes	Current hydrological regimes are unknown. Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources
Water quality	Water chemistry measures	Maintain oligotrophic and calcareous conditions	Water chemistry is currently unknown. Water supply to petrifying springs is characteristically oligotrophic and calcareous
Vegetation composition: typical species	Occurrence	Maintain typical species	The bryophytes <i>Cratoneurion commutatum</i> and <i>Eucladium verticillatum</i> are diagnostic of this habitat. Both are found at the location described above. Natura 2000 Form Explanatory Notes and internal NPWS files also list other typical species

91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

To restore the favourable conservation condition of Old oak woodland with *Ilex* and *Blechnum* in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, at least 85.08ha for sub-sites surveyed: see map 6	Minimum area, based on 13 sites surveyed by Perrin et al. (2008) - site codes 14, 20, 49, 73, 125, 508, 509, 510, 514, 515, 518, 519, 521, and other sources. NB further unsurveyed areas maybe present within the site
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 6	Distribution based on Perrin et al. (2008). NB further unsurveyed areas maybe present within the site
Woodland size	Hectares	Area stable of increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). Topographical and land ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Oak regenerates poorly. In suitable sites ash can regenerate in large numbers although few seedlings reach pole size
Woodland structure: dead wood	m ³ per hectare; number per hectare	At least 30m ³ /ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem.
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources

91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

To restore the favourable conservation condition of Old oak woodland with *Ilex* and *Blechnum* in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) list sites 14, 20, 73, 125, 508, 509, 510, 514, 515, 518, 521 as potential ancient/long established woodlands
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (<i>Quercus petraea</i>) and birch (<i>Betula pubescens</i>)	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: beech (<i>Fagus sylvatica</i>), rhododendron (<i>Rhododendron ponticum</i>), cherry laurel (<i>Prunus laurocerasus</i>)

Conservation objectives for: River Barrow and River Nore SAC [002162]

91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

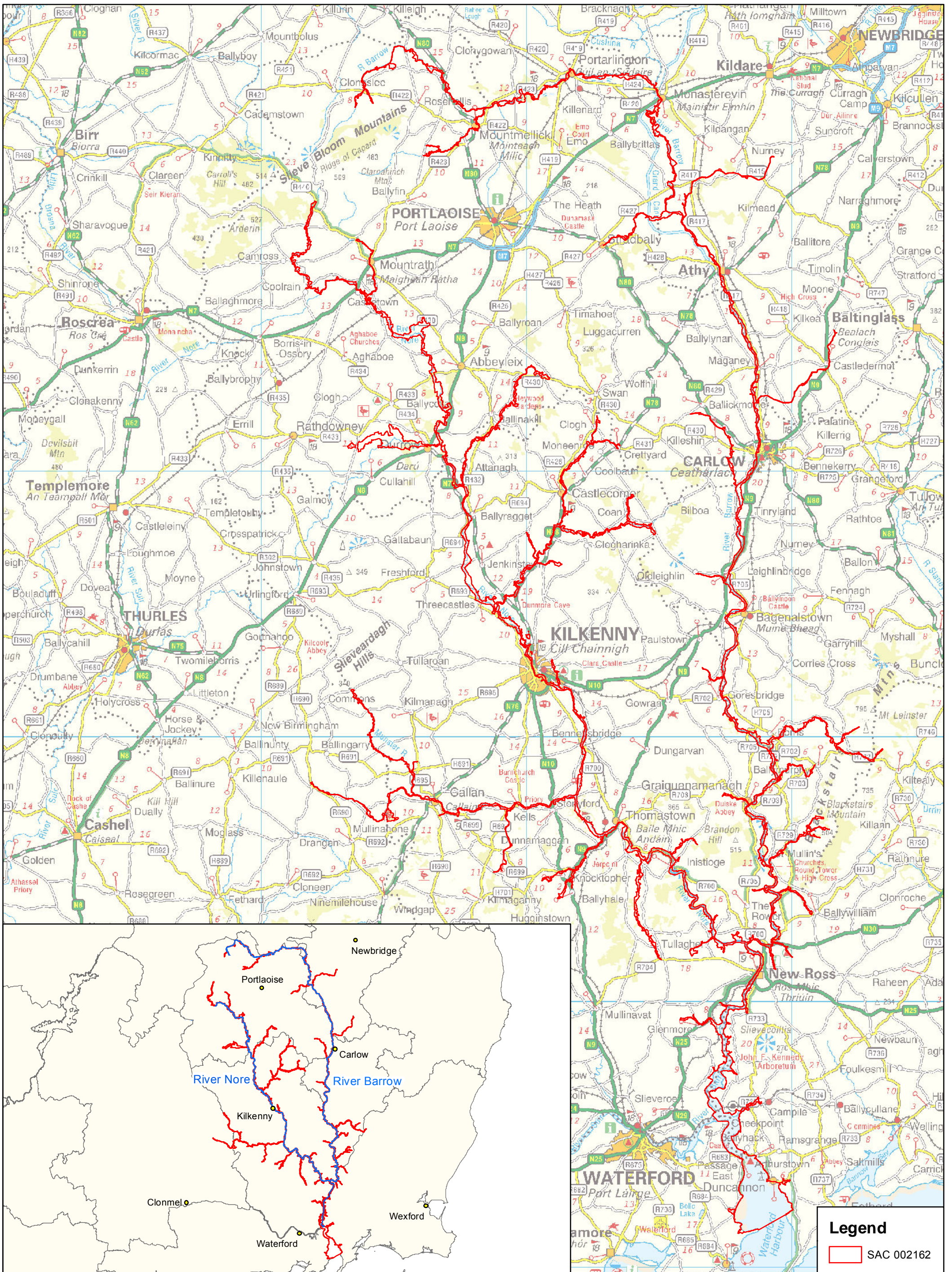
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, at least 181.54ha for sites surveyed: see map 6	Minimum area, based on 16 sites surveyed by Perrin et al. (2008) - site codes 10, 15, 17, 126, 127, 262, 282, 287, 511, 516, 517, 518, 520, 608, 1021; Coillte LIFE project and other sources. NB further unsurveyed areas maybe present within the SAC
Habitat distribution	Occurrence	No decline. Surveyed locations shown on map 6	Distribution based on Perrin et al. (2008). NB further unsurveyed areas maybe present within the site
Woodland size	Hectares	Area stable of increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	The sizes of at least some of the existing woodlands need to be increased in order to reduce habitat fragmentation and benefit those species requiring 'deep' woodland conditions (Peterken, 2002). Topographical and land ownership constraints may restrict expansion
Woodland structure: cover and height	Percentage and metres	Diverse structure with a relatively closed canopy containing mature trees; subcanopy layer with semi-mature trees and shrubs; and well-developed herb layer	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008); Browne et al. (2000). See woodland habitats supporting document for further details
Woodland structure: natural regeneration	Seedling:sapling:pole ratio	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	Alder and oak regenerate poorly. Ash often regenerates in large numbers although few seedlings reach pole size
Hydrological regime: Flooding depth/height of water table	Metres	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	Periodic flooding is essential to maintain alluvial woodlands along river flood plains but not for woodland around springs/seepage areas
Woodland structure: dead wood	m ³ per hectare; number per hectare	At least 30m ³ /ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder)	Dead wood is a valuable resource and an integral part of a healthy, functioning woodland ecosystem

Conservation objectives for: River Barrow and River Nore SAC [002162]

91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)

To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) in the River Barrow and River Nore SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Woodland structure: veteran trees	Number per hectare	No decline	Mature and veteran trees are important habitats for bryophytes, lichens, saproxylic organisms and some bird species. Their retention is important to ensure continuity of habitats/niches and propagule sources
Woodland structure: indicators of local distinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-listed and other rare or localised species. Perrin and Daly (2010) list sites 10, 15, 17, 127, 282, 516, 517, 518, 608 as potential ancient/long established woodlands
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including ash (<i>Fraxinus excelsior</i>) alder (<i>Alnus glutinosa</i>), willows (<i>Salix</i> spp) and locally, oak (<i>Quercus robur</i>)	Species reported in Perrin et al. (2008); Browne et al. (2000)
Vegetation composition: negative indicator species	Occurrence	Negative indicator species, particularly non-native invasive species, absent or under control	The following are the most common invasive species in this woodland type: sycamore (<i>Acer pseudoplatanus</i>), beech (<i>Fagus sylvatica</i>), rhododendron (<i>Rhododendron ponticum</i>), cherry laurel (<i>Prunus laurocerasus</i>), dogwood (<i>Cornus sericea</i>), Himalayan honeysuckle (<i>Leycesteria formosa</i>) and Himalayan balsam (<i>Impatiens grandiflora</i>)



Legend

SAC 002162

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 Department of Arts, Heritage and the Gaeltacht

MAP 1: RIVER BARROW AND RIVER NORE CONSERVATION OBJECTIVES SAC DESIGNATION

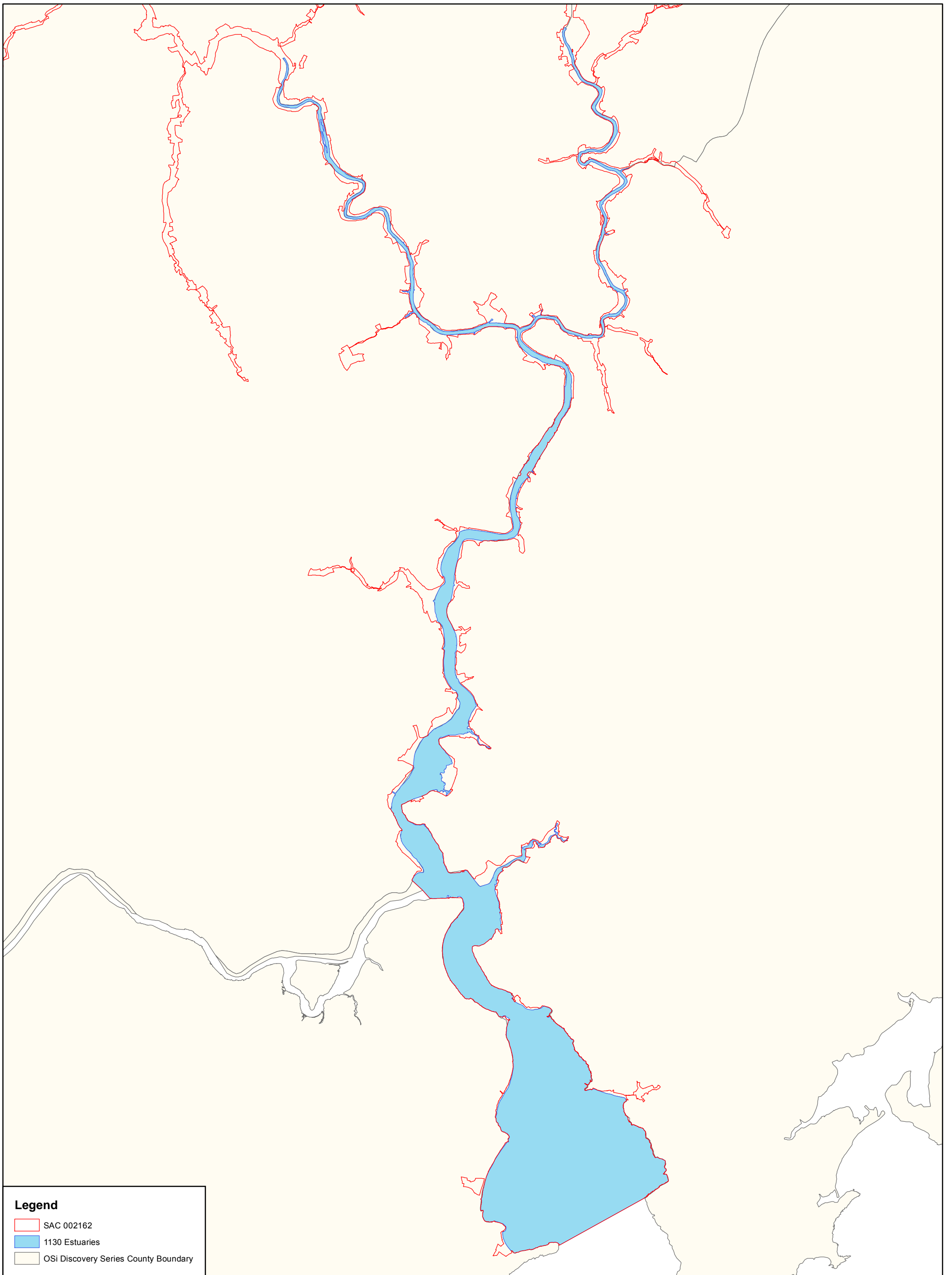
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 002162
 CO. CARLOW; version 1.03, CO. KILDARE; version 1.04,
 CO. KILKENNY; version 1.1, CO. LAOIS; version 1.07,
 CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01,
 CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01

0 5 10 15 km

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Map Version 1
Date: April 2011



Legend

- SAC 002162
- 1130 Estuaries
- OSi Discovery Series County Boundary

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**MAP 2:
RIVER BARROW AND RIVER NORE
CONSERVATION OBJECTIVES
ESTUARIES**

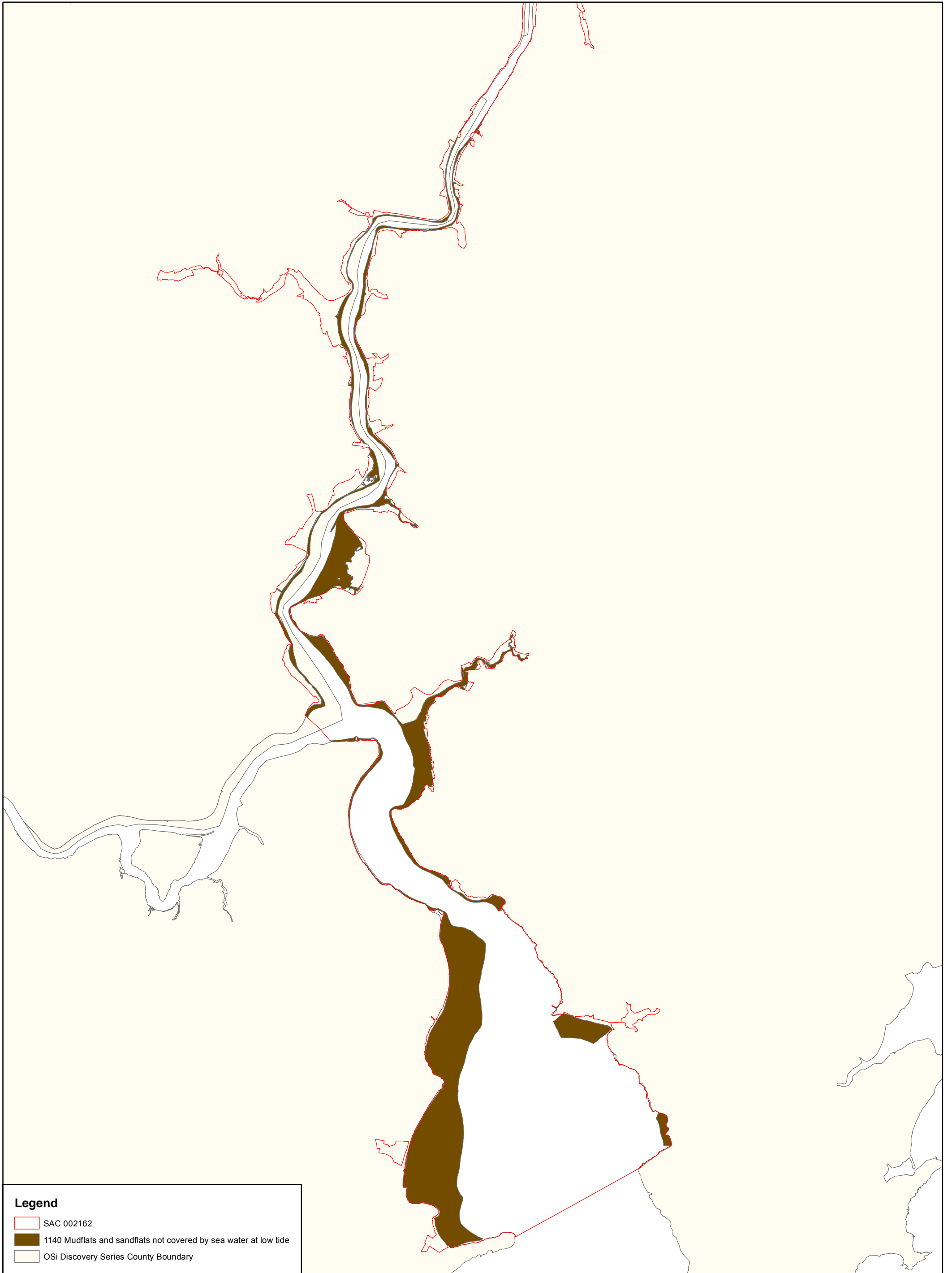
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 002162
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CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01,
CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01

0 1 2 3 4 5 km

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**Map Version 1
Date: April 2011**



Legend

- SAC 002162
- 1140 Mudflats and sandflats not covered by sea water at low tide
- OSi Discovery Series County Boundary

**MAP 3:
RIVER BARROW AND RIVER NORE
CONSERVATION OBJECTIVES
TIDAL MUDFLATS AND SANDFLATS**

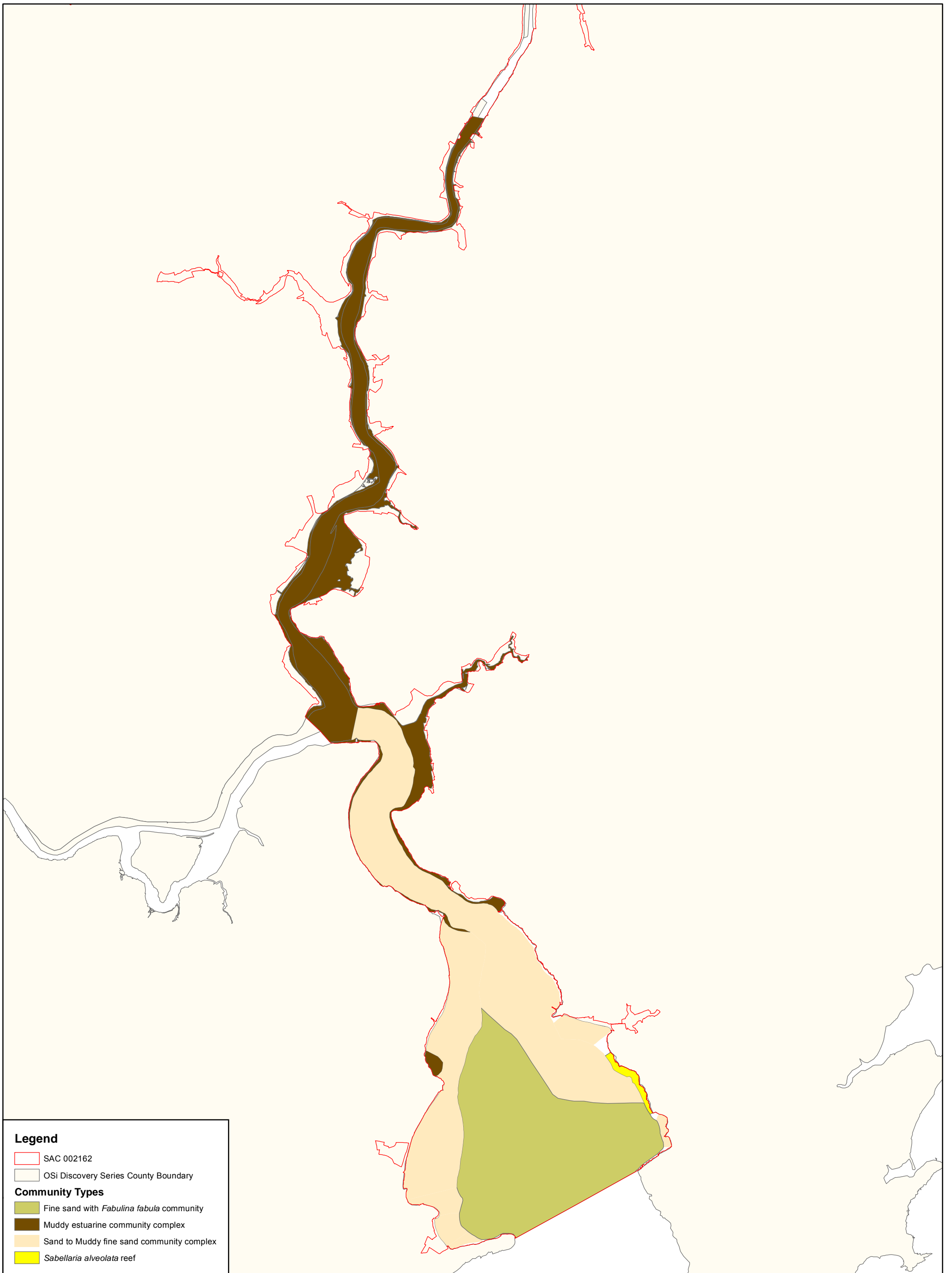
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 002162
CO. CARLOW; version 1.03, CO. KILDARE; version 1.04,
CO. KILKENNY; version 1.1, CO. LAOIS; version 1.07,
CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01,
CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01



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Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macsamhail d'ábhar na Suirbhéarachta Ordonáis
le chead ón Rialtas (Ceadúnas Uimh. EN 0059208)



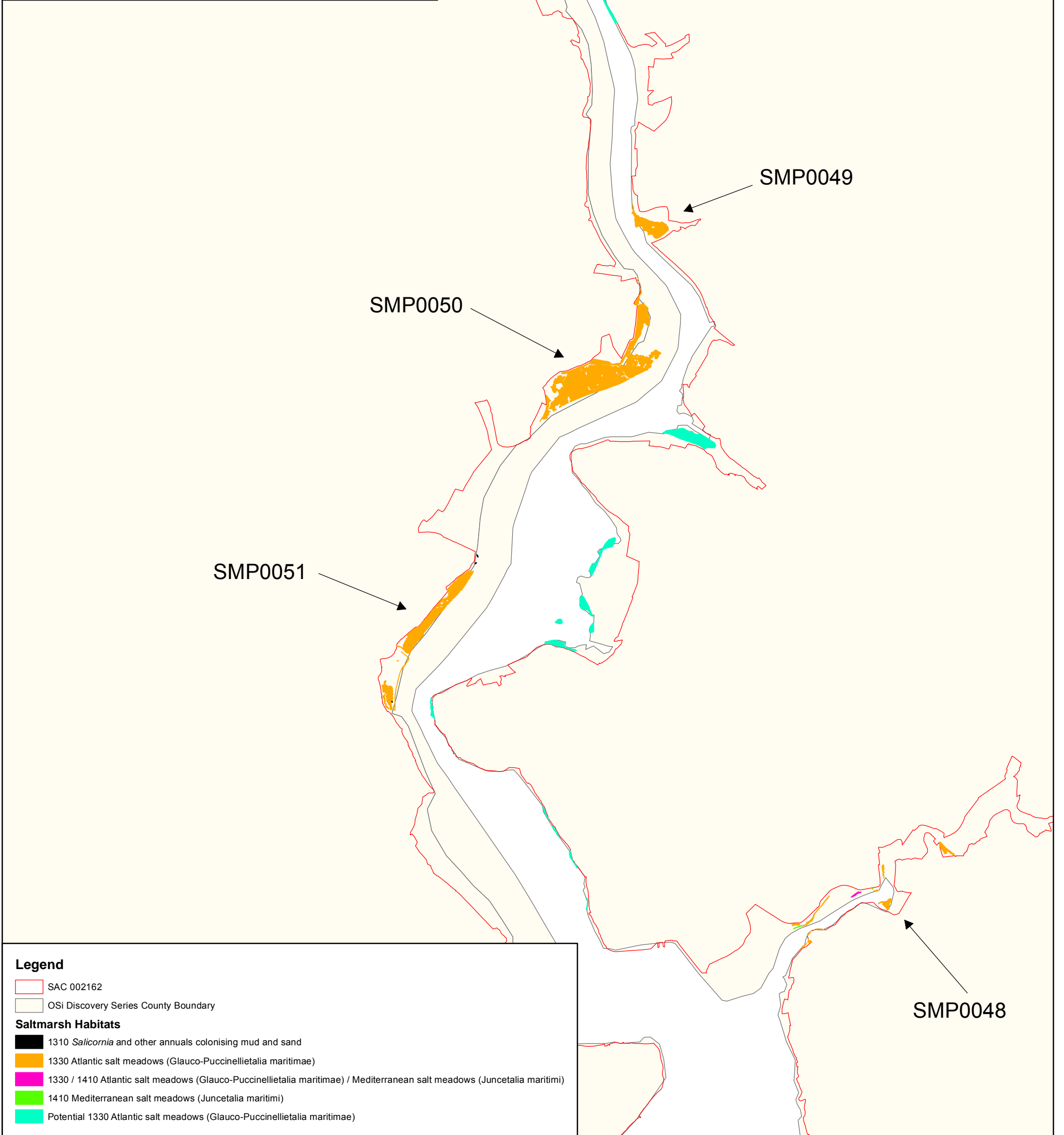
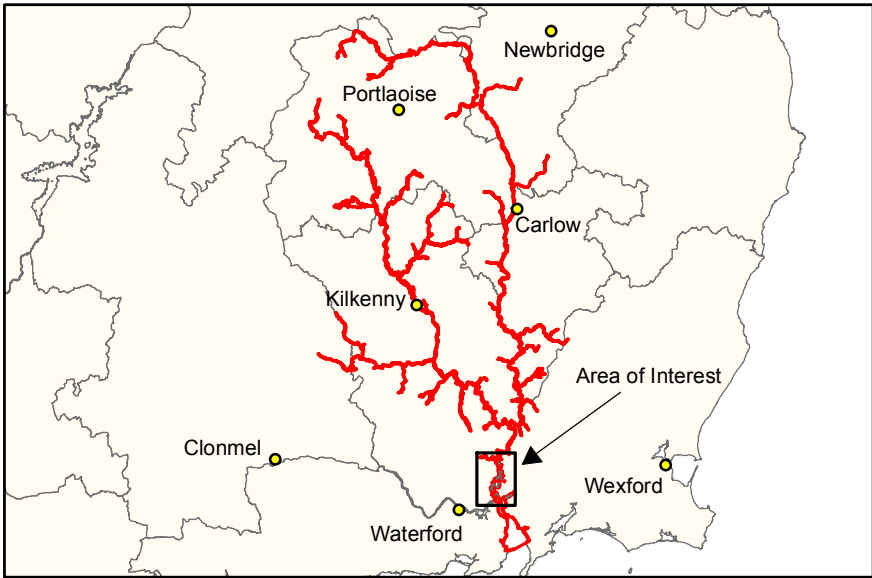


Legend

- SAC 002162
- OSi Discovery Series County Boundary

Community Types

- Fine sand with *Fabulina fabula* community
- Muddy estuarine community complex
- Sand to Muddy fine sand community complex
- Sabellaria alveolata* reef

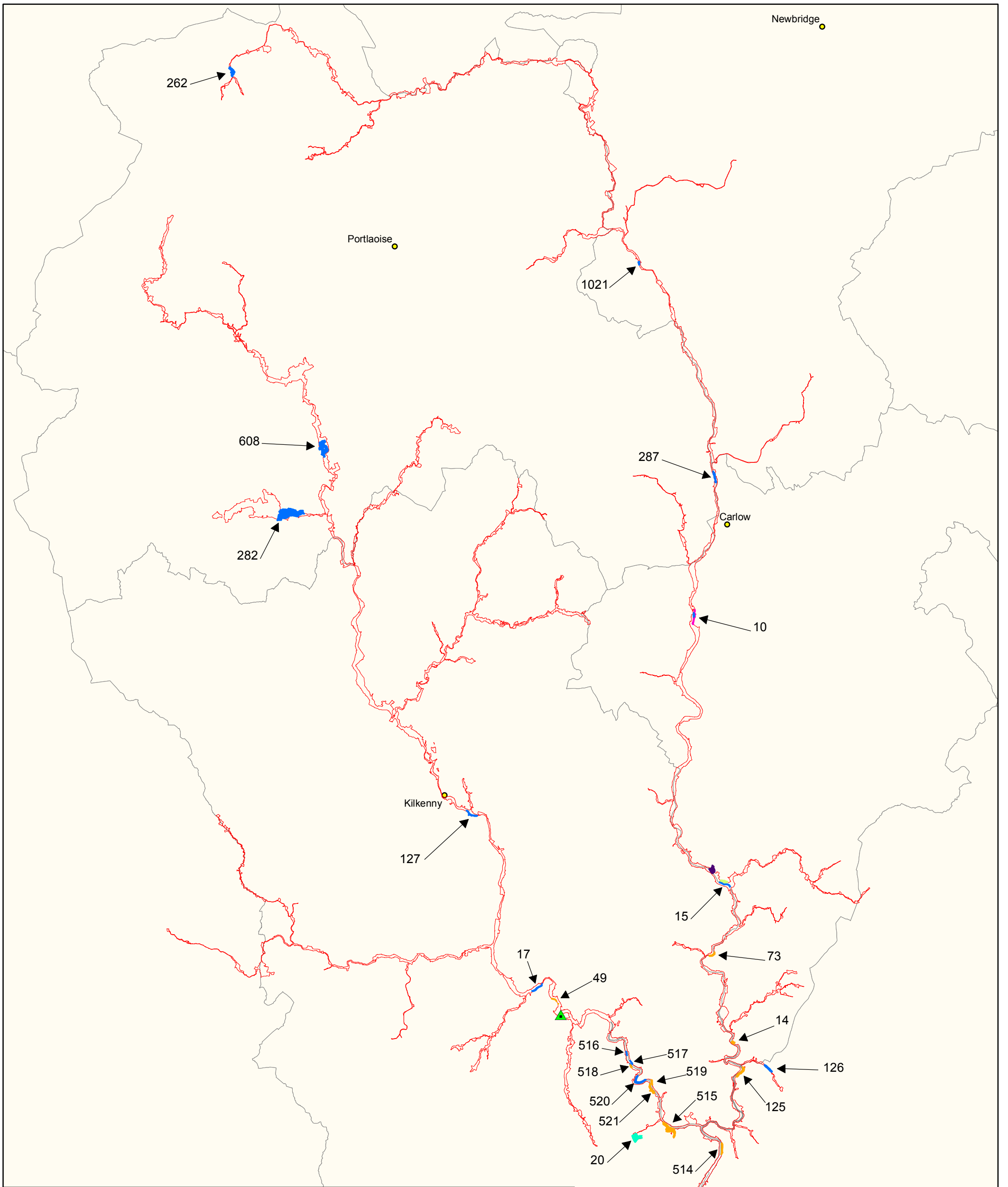


Legend

- SAC 002162
- OSi Discovery Series County Boundary

Saltmarsh Habitats

- 1310 *Salicornia* and other annuals colonising mud and sand
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 1330 / 1410 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) / Mediterranean salt meadows (*Juncetalia maritimi*)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- Potential 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

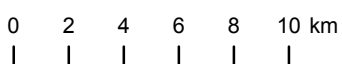


- Legend**
- SAC 002162
 - OSI Discovery Series County Boundary
 - ▲ 7220 *Petrifying springs with tufa formation (Cratoneurion)
- Woodland Habitats**
- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
 - 91E0 *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)
 - 91A0 / 91E0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles / *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-padion, Alnion incanae, Salicion albae)
 - WD1 (Mixed) broadleaved woodland
 - WN2 / WD1 Oak-ash-hazel woodland / (Mixed) broadleaved woodland
 - WN2 / WN6 Oak-ash-hazel woodland / Wet willow-alder-ash woodland

**MAP 6:
RIVER BARROW AND RIVER NORE
CONSERVATION OBJECTIVES
OLD OAK WOODLANDS, ALLUVIAL
FORESTS & PETRIFYING SPRINGS**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

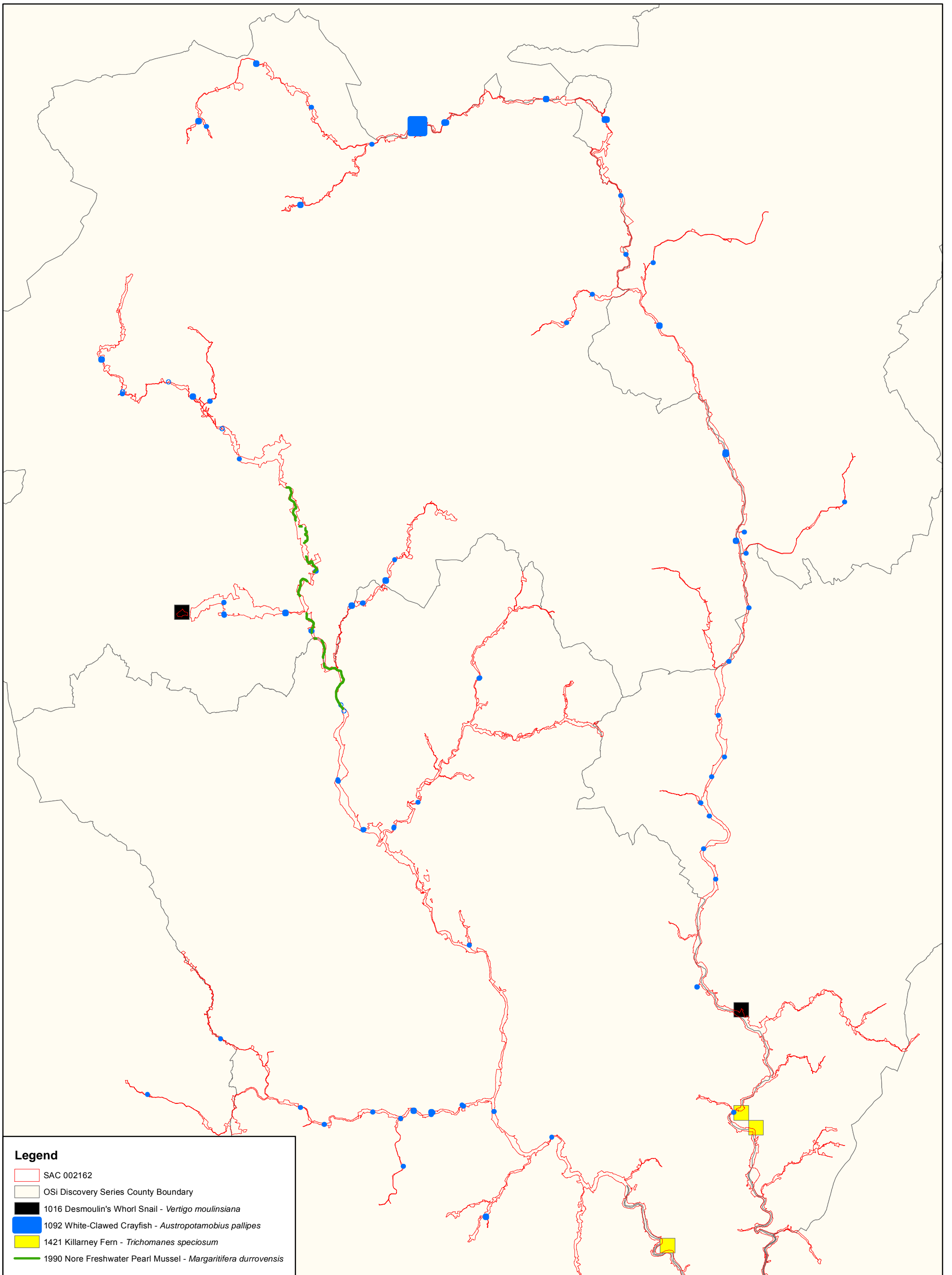
SITE CODE: SAC 002162
CO. CARLOW; version 1.03, CO. KILDARE; version 1.04,
CO. KILKENNY; version 1.1, CO. LAOIS; version 1.07,
CO. OFFALY; version 1.01, CO. TIPPERARY; version 1.01,
CO. WATERFORD; version 1.01, CO. WEXFORD; version 1.01



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Map Version 1
Date: April 2011



Legend

- SAC 002162
- OSI Discovery Series County Boundary
- 1016 Desmoulin's Whorl Snail - *Vertigo moulinsiana*
- 1092 White-Clawed Crayfish - *Austropotamobius pallipes*
- 1421 Killarney Fern - *Trichomanes speciosum*
- 1990 Nore Freshwater Pearl Mussel - *Margaritifera durrovensis*



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Department of
Arts, Heritage and the Gaeltacht

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APPENDIX C

GEOPHYSICAL REPORT



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**MAYNOOTH EASTERN RING ROAD
GROUND INVESTIGATION
GEOPHYSICAL SURVEY
REPORT No. P18247_Gp_Rp_D01**



REPORT CONTROL SHEET

Client	Kildare County Council					
Engineer Representative	Roughan & O'Donovan					
Project Name	MAYNOOTH EASTERN RING ROAD GROUND INVESTIGATION					
Document Name	Geophysical Survey Draft Report					
Project Number	P18247_Gp					
This Report Comprises of	TOC	Text	No. of Volume	No. of Appendices	Drawings	Electronic data
	1	16	1	1	1	*.dwg, *.pdf

Revision	Status	Author(s)	Approved By	Issue Date
D01	Draft	HP	GH	10/12/2018

Priority Geotechnical Ltd.

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A) Acronyms

bgl – below ground level

ERT – Electrical Resistivity Tomography

ITM – Irish Transverse Mercator

OD Malin – metres above Ordnance Datum Malin

PGL – Priority Geotechnical Ltd.

SRP – Seismic Refraction Profiling

B) Executive Summary

Priority Geotechnical Ltd. was instructed by Roughan & O'Donovan on behalf of Kildare County Council to undertake a geophysical investigation in conjunction with a site investigation project at Maynooth, Co. Kildare.

The survey consisted of seismic refraction and electrical resistivity surveying in accordance with BS5930 and BS7022 and the Geological Society Engineering Group Working Party Report on Engineering Geophysics. The survey locations are shown in Figure 1 below.

The survey was carried out from 12th through 15th November 2018.

This report contains no intrusive works and will be updated on receipt of logs and coordinates if necessary.

The survey positions, modelled profiles and geophysical interpretations are shown in APPENDIX A: Drawing No. P18247-GP-D01. This drawing is plotted at paper size ISO A1 and is supplied in AutoCAD format.

A contrast in bedrock resistivity is seen across the survey area with notable areas of low resistivity (50 - 500 ohm-m) contrasting with areas of higher resistivity (> 500 ohm-m generally c. 1000 ohm-m). This contrast is interpreted as a lithological change from clean limestone to more clay-rich shale bedrock. There is also a notable change in seismic velocity with S3, S8 and S9 showing notably lower velocities (c. 3000m/s) over areas of low resistivity whereas profiles over the higher resistivity bedrock zones show very high velocities (4000-6000m/s).

Depth to bedrock was generally c. 4m bgl for all profiles apart from R4 (S6 and S7) where bedrock is shallower at c. 1.5m bgl. Overburden thickness is also seen to thicken up to 8m along R6. All seismic velocities represent fresh unweathered bedrock.

C) Introduction

C.1) Scope of Works

Priority Geotechnical Ltd. was instructed by Roughan & O'Donovan on behalf of Kildare County Council to undertake a geophysical investigation in conjunction with a site investigation project at Maynooth, Co. Kildare.

The works are part of a project to inform development of the proposed Maynooth Eastern Ring Road and Bridge.

The survey consisted of seismic refraction and electrical resistivity surveying in accordance with BS5930 and BS7022 and the Geological Society Engineering Group Working Party Report on Engineering Geophysics. The survey locations are shown in Figure 1 below.

The survey was carried out from 12th through 15th November 2018.

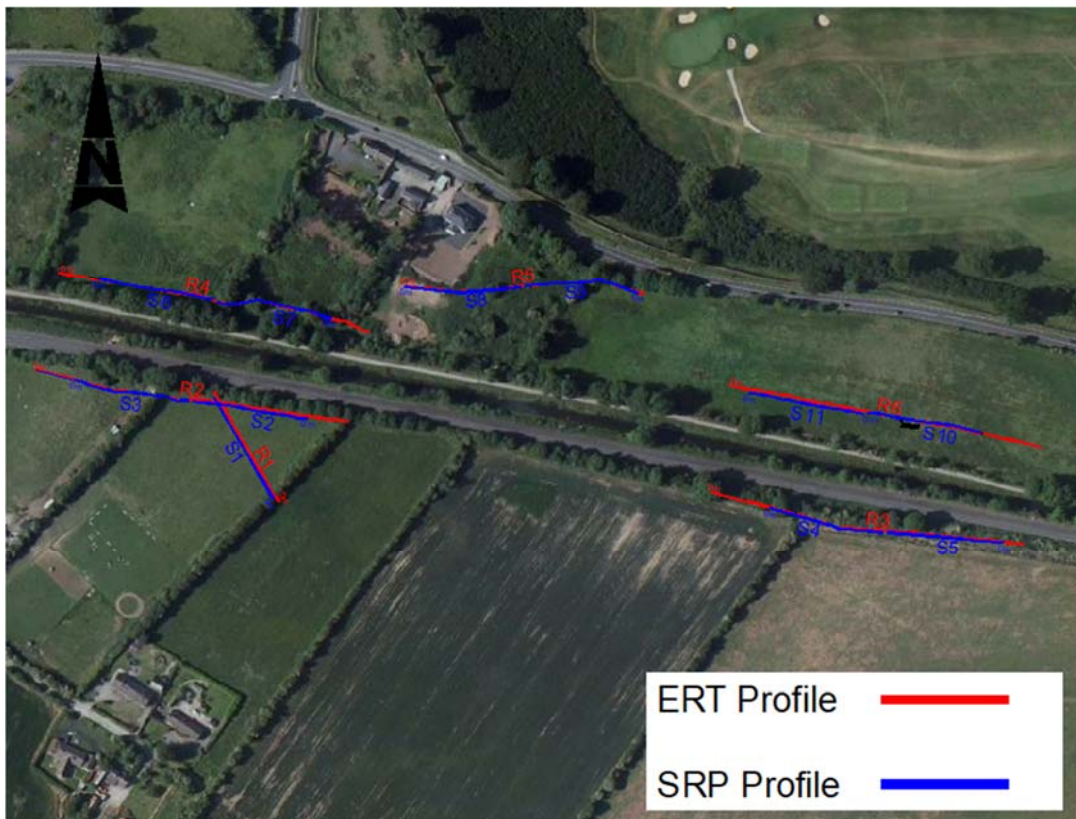


Figure 1: Satellite image showing surveyed geophysical profiles

C.2) Survey Objectives

The survey objectives were to provide information on the following:

- Lateral and vertical variations in overburden type and thickness beneath each profile.
- Depth to rockhead and mass characteristics of the rock, particularly rock quality and excavatability/rippability.
- Location and possible extent of buried sub-surface geologic and man-made features.

C.3) Site Topography

ERT profiles R1, R2 and R3 are situated in mostly flat, grassy fields. Profiles R4 and R5 are located mostly in rough ground including ditches, briar patches and wooded areas. Profile R6 is in a flat to gently rolling grassy field. The site is bounded by earthen ditches.

C.4) Coordinate System and Datum

All coordinates are given in Irish Transverse Mercator (ITM). All elevations are given in metres Ordnance Datum Malin (OD Malin).

C.5) Intrusive Works

This report considers all relevant site investigation results. All relevant site investigation results have been overlaid on the interpretive drawings.

In the case of this report no intrusive works have been conducted thus far, this report will be updated on receipt of logs and coordinates if necessary.

C.6) Site Geology

According to the GSI 100k Geology Map (see Fig. 2) the survey area is underlain by a formation of “unbedded Waulsortian Limestones” which is shown in blue colour, and the Tober Colleen Formation, which is described as “Calcareous Shale and Limestone Conglomerate” and shown in green. Northwest of the survey area lies the Lucan Formation, described as “Dark Limestone and Shale” and shown in light green. These formations are affected by a northwest-southeast fault to the north of the survey area.

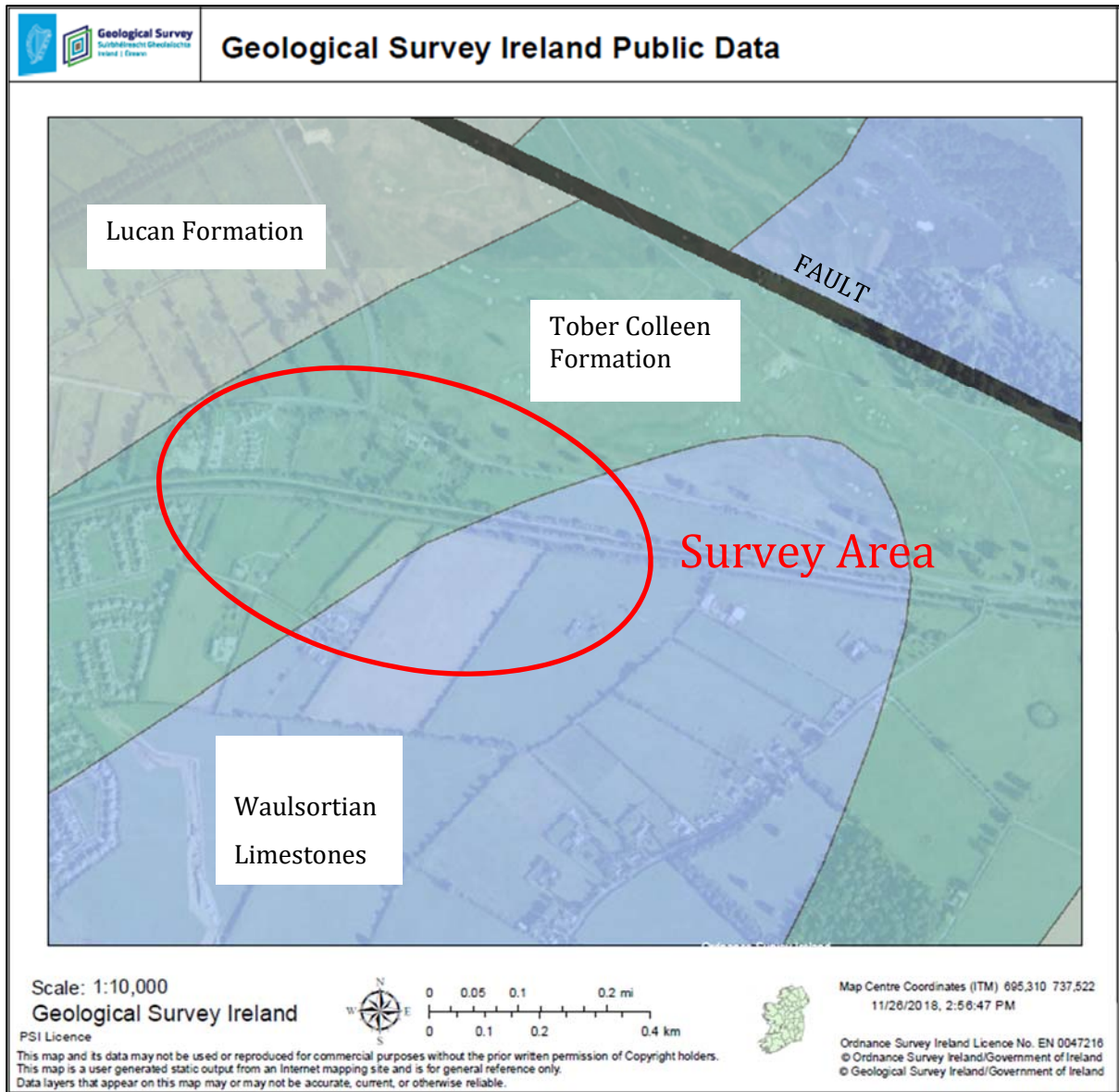


Figure 2: GSI 100k Bedrock Geology Map of the site.

According to the Quaternary Soils Map (see Fig. 3) the survey area is underlain by “Till derived from Limestones”, shown in blue. West of the survey area, in Maynooth town, the soils are described as “Urban”, and shown in cyan. Other sediments in the area are “Alluvium” shown in orange and “Lacustrine sediments” shown in cream.

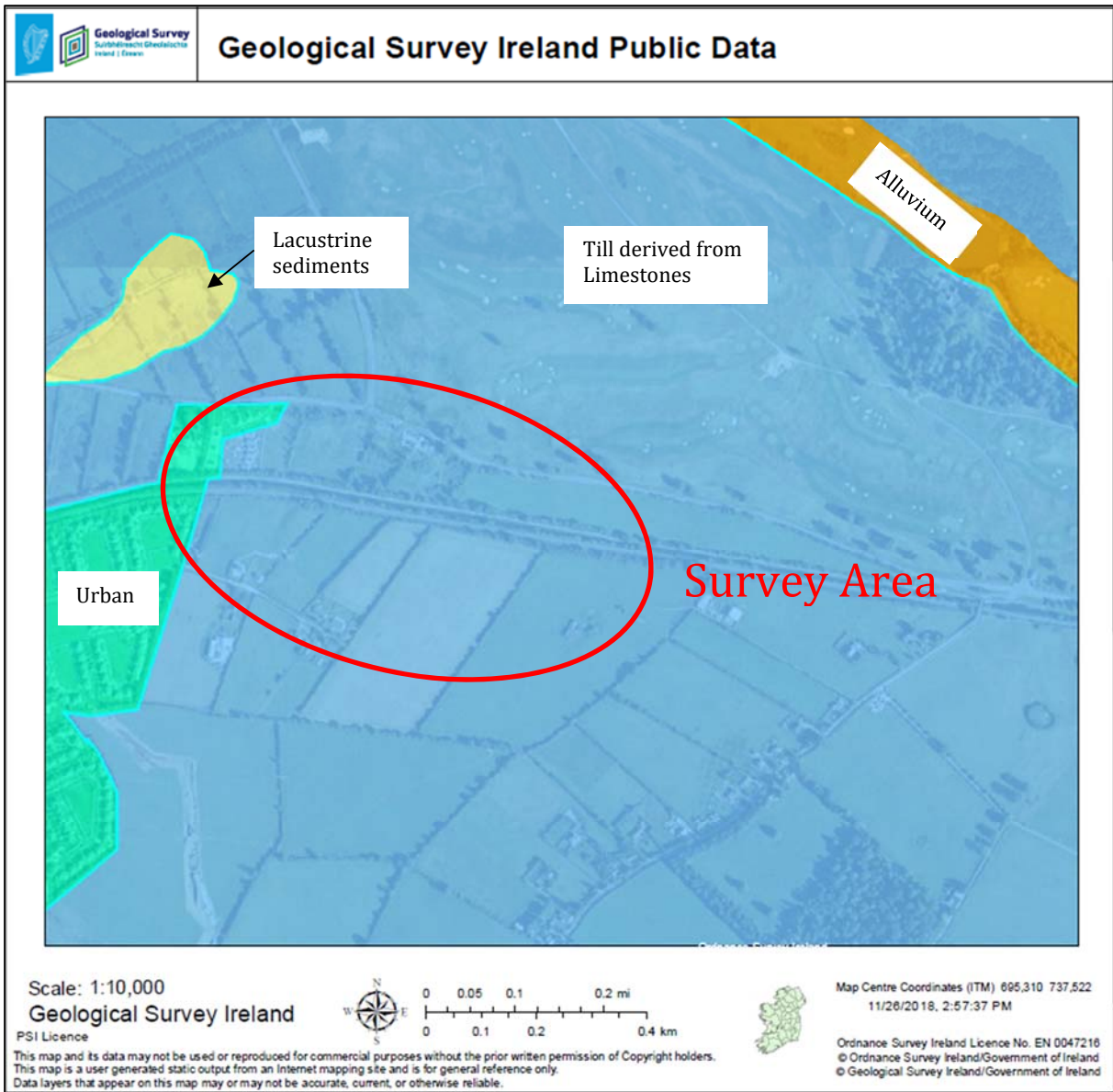


Figure 3: Quaternary Sediments Map of the site.

All above mapping is available for free viewing on the Geological Survey of Ireland website at <https://www.gsi.ie/en-ie/Pages/default.aspx>.

D) Methodology and Results

D.1) 2D Electrical Resistivity Tomography (ERT)

The geophysical survey comprised of 2D electrical resistivity tomography (ERT) to measure the ground resistivity distribution across the survey area.

The resistivity survey comprised of six profiles along pre-determined lines which were named R1 through R6. These profiles were collected with an electrode spacing of 3m spacing, and varied in length with R2, R3, R4 and R6 each measuring 189m, whereas R1 and R5 measured 75m and 144m respectively.

D.1.i) Data Acquisition

Survey data was collected using a 64 channel Tigre Resistivity Meter. The Tigre has a maximum power of 36 watts and maximum current output of 200mA. The receiver incorporates automatic gain steps providing a range of measurements from 0.001ohm to 360kohm.

Multicore resistivity cables with 32 take-outs were used with stainless steel electrodes. Contact resistivities were checked prior to running the survey, to ensure an adequate electrical contact between the ground and the electrodes were made. Electrodes with poor contacts were treated with saline solution and rechecked till an optimum contact resistance were obtained.

The Tigre was connected to a laptop running Imager Pro™ 2006 acquisition software (Campus International Products Ltd., 2006) and subsequently viewed and inverted using Res2DInv software. All data was checked on site and any spurious readings were repeated until satisfactory results were achieved.

D.1.ii) Array Type

The Wenner Alpha Array protocol was utilized during this survey. The Wenner Array uses four equally spaced electrodes. Current is injected through the two outer electrodes and the resulting voltage difference at two inner electrodes. From the current (I) and the voltage (V) an apparent resistivity (ρ_a) value is calculated.

$$\rho_a = k V/I$$

Where k is the geometric factor which depends on the arrangement of the 4 electrodes. This calculated resistivity value is not the true resistivity of the subsurface but an “apparent” resistivity value, i.e. the resistivity of a homogenous ground which would give the same resistance value for the same electrode arrangement. To determine “true” ground resistivity an inversion of the measured apparent resistivity is undertaken, in this case using Res2DInv software.

The Wenner array is relatively sensitive to vertical changes (i.e. horizontal structures), but relatively poor in detecting horizontal changes (i.e. narrow vertical structures). Among the common array types for ERT profiling the Wenner alpha array has the strongest signal strength (Loke, 2000).

D.1.iii) Data Processing

Survey data was processed using Res2DInv, where the raw files were edited and inverted. The software does this by first dividing the subsurface 2D model into rectangular blocks and then calculates the resistivity of these blocks such that the calculated apparent resistivity measurements of the blocks agree with the measured values from the field survey.

Up to 5 iterations of the inversion of the measured data were carried out for each profile to obtain a 2D pseudosection of the apparent resistivities. The least squares inversion was used to produce an apparent resistivity depth model.

A degree of fit between the measured apparent resistances and the inverted resistances is calculated by the program, allowing an assessment of the degree of confidence of the inverted data. A damping factor can be applied to smooth erroneous data points; however, resolution lessens with an increased damping factor. A moderate damping factor was used during all inversions. All of the ERT dataset inversions resulted in an RMS error of < 5% (R1 = 2.6%, R2 = 2.7%, R3 = 2.8%, R4 = 3.6%, R5 = 3.1%, R6 = 2.6%). This is indicative of good quality data.

Resistivity values in the inverted profiles varied from 50 to c.3000 Ohm-m.

D.2) Seismic Refraction Profiling (SRP)

PGL recorded 11 no. SRP profiles in total across the survey area along the pre-determined lines. SRP profiles are named S1 through S11 and each measured 69m in length. The geophone spacing used for this survey was 3m providing p-wave seismic velocities (V_p) for overburden and bedrock materials.

Seismic refraction measurements are made by measuring the travel time of direct and refracted acoustic waves as they travel from the surface through one layer to another and back to the surface where their arrival times are recorded. The travel time is a function of the seismic or acoustic velocity and geometry of the subsurface layers of soil and rock.

Modelled seismic velocities (V_p) ranged from 300 to 6000 m/s over two and sometimes three separate layers for the soil and bedrock materials. The resulting layer boundaries and seismic velocities are shown as thick dashed lines on cross sections in the attached drawings. The model was developed with average velocities and boundaries moved to minimise the model deviation.

D.2.i) Data Acquisition

A 24-channel Geometrics Geode seismic system was utilized with a 24-channel seismic multicore cable and 4.5Hz geophones. A sledge hammer and a HDPE plate were used as a seismic source. A geophone spacing of 3m was utilised during data acquisition resulting in a profile length of 69m.

Data was recorded using SGOS Seismodule Controller software. A total of 7 shots were undertaken on each seismic line; 2 end-shots, 2 off-shots and 3 mid-shots. To improve signal to noise ratio, individual hammer shots were stacked at each shot location where necessary.

D.2.ii) Data Processing

Data processing was undertaken utilizing Seisimager Seismic 2D software programs. Surveyed topography was input for each seismic spread. First breaks were picked after which a time term inversion was computed using travel-time computation via ray-tracing. Velocity modeling and travel time plots were constructed for each spread. Seismic velocity phases were picked and the thickness of each velocity unit calculated using the intercept-time method.

The below is a table of RMS errors involved in the inversions.

Seismic Profile	RMS Error Inversion (ms)	RMS Error Ray-Tracing (ms)
S1	0.20	1.32
S2	0.25	0.82
S3	0.45	0.90
S4	0.38	0.92
S5	0.67	1.02
S6	0.30	0.95
S7	0.40	0.80
S8	0.19	0.82
S9	0.55	1.40
S10	0.44	2.17
S11	0.37	1.18

Figure 4: RMS Errors for seismic refraction inversion through Plotrefa software

D.2.iii) Data Interpretation

It should be noted that when layer thicknesses are modelled from the seismic data the areas of greatest coverage (i.e. the centre of the spread) will have the greatest accuracy. At the edges of the spread less ray coverage reduces the accuracy of layer interpretation and thickness calculation.

Approximate errors for velocities are estimated to be +/-10%. Errors for the calculated layer thickness are of the order of +/-15%. Possible errors due to the “hidden layer” and “velocity” effects may also occur (Soske, 1959). Seismic refraction generally determines the depth to horizontal or near horizontal layers where the compaction/strength/rock quality changes. Where low velocity layers are present or where layers dip with more than 20 degrees angle the accuracy becomes less.

D.3) Spatial Relocation

Horizontal control and elevation were provided by a Trimble VRS (Real Time Kinematic/Virtual Reference Station) enabled GPS. Survey Controller software was used to provide high-accuracy, GNSS positioning. All positions are plotted in ITM. Elevations are to OD Malin using geoid model OSGM02.

E) Results and Interpretation

The survey positions, modelled profiles and geophysical interpretations are shown in APPENDIX A: Drawing No. P18247-GP-D01. This drawing is plotted at paper size ISO A1 and is supplied in AutoCAD format.

The ERT was used to interpret the overburden and bedrock material composition on all profiles on the following basis;

Resistivity (Ohm-m)	Interpretation
< 50 (near surface)	Sandy CLAY
50 – 250(near surface)	Sandy gravelly CLAY
250 – 500 (near surface)	Gravelly SAND
> 500 (near surface)	GRAVEL
50 - 500 (at depth)	SHALE bedrock
> 500 (at depth)	LIMESTONE bedrock

Table C.1: Interpretation based on electrical resistivity

A contrast in bedrock resistivity is seen across the survey area with notable areas of low resistivity (50 - 500 ohm-m) contrasting with areas of higher resistivity (> 500 ohm-m generally c. 1000 ohm-m). This contrast is interpreted as a lithological change from clean limestone to more clay-rich shale bedrock. There is also a notable change in seismic velocity with S3, S8 and S9 showing notably lower velocities (c. 3000m/s) over areas of low resistivity whereas profiles over the higher resistivity bedrock zones show very high velocities (4000-6000m/s).

Depth to bedrock was generally c. 4m bgl for all profiles apart from R4 (S6 and S7) where bedrock is shallower at c. 1.5m bgl. Overburden thickness is also seen to thicken up to 8m along R6. All seismic velocities represent fresh unweathered bedrock.

APPENDIX A: DRAWINGS

Drawing Number	Description	Scale
P18247-GP-D01	Cross Section and Interpretation	As stated at A1
P18247-GP-D02	Cross Section and Interpretation	As stated at A1

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

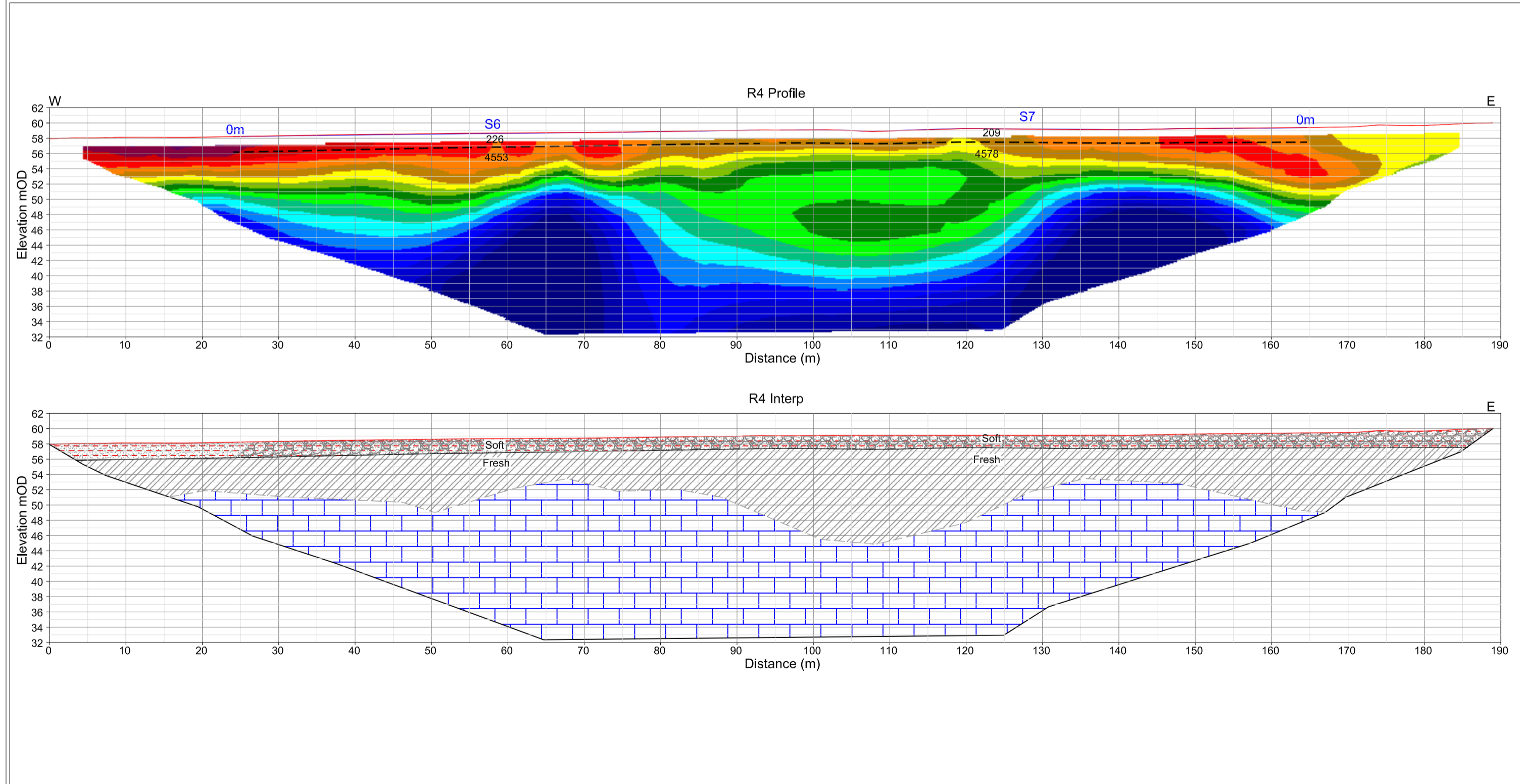
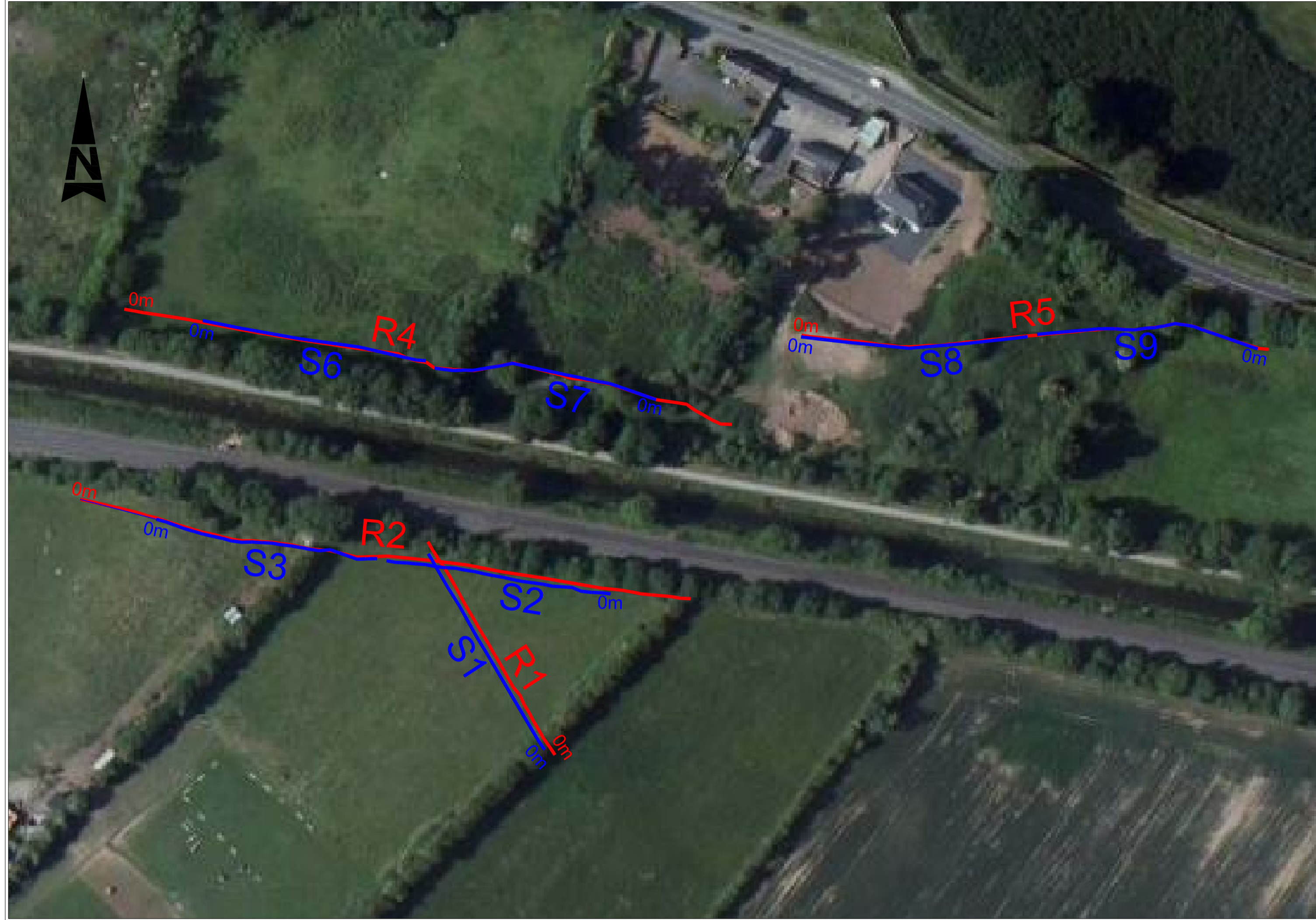
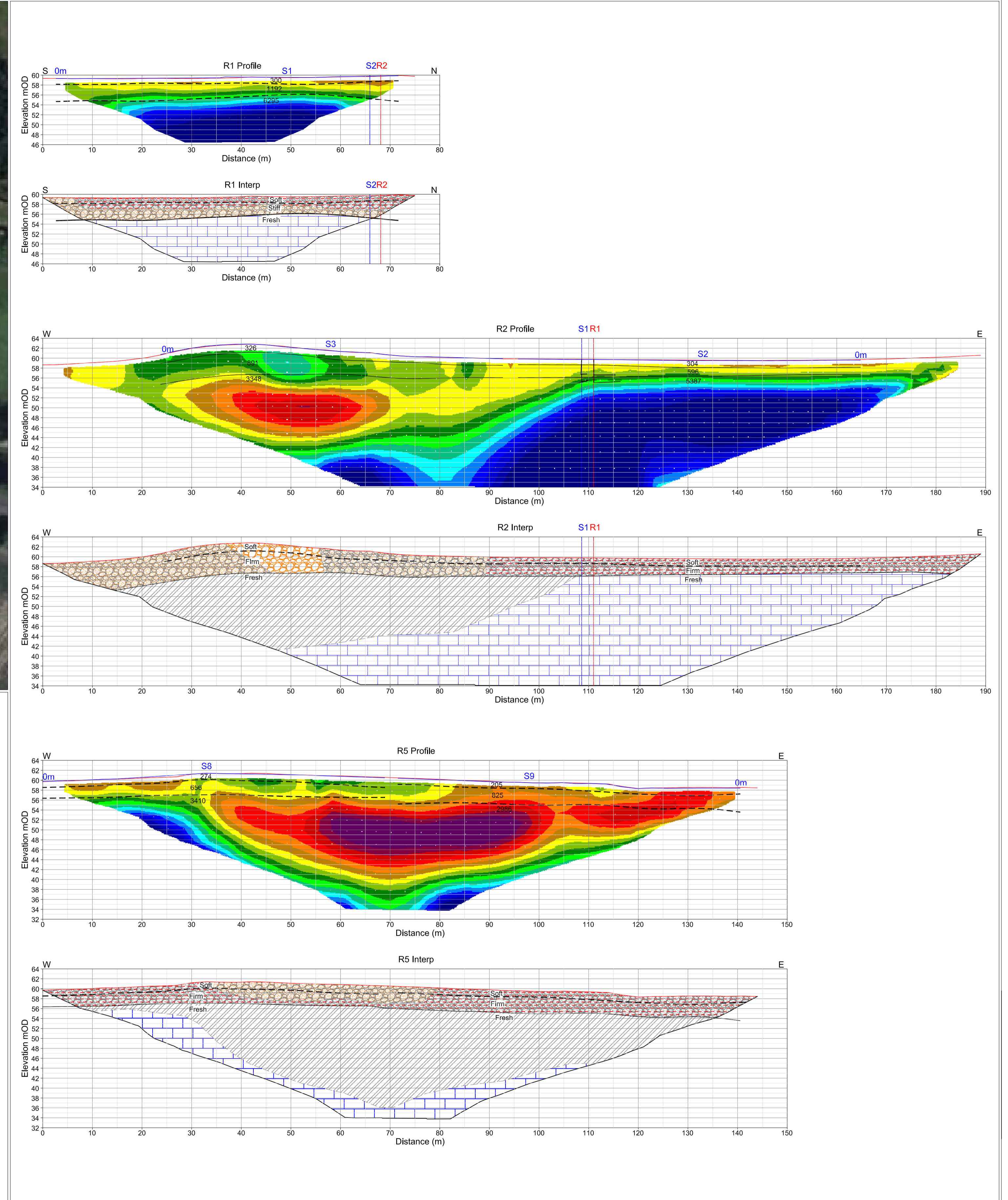


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500



PROJECT:
MAYNOOTH EASTERN
RING ROAD
GROUND INVESTIGATION
GEOPHYSICAL SURVEY

CONSULTING ENGINEERS:
Roughan & O'Donovan
Consulting Engineers

JOB NUMBER:
P18247

DRAWING NUMBER:
P18247_GP_D01

DRAWN BY:
HP

APPROVED:
GH

COORDINATE SYSTEM:
ITM

VERTICAL DATUM:
Malin

SCALE:
As specified @ A1

ISSUE DATE:
10/12/2018

REVISION:
D01

Legend:

Seismic refraction boundaries with P-wave velocities (m/s)

- 300 m/s - ground surface
- 1000 m/s - layer 1 / layer 2 boundary
- 3000 m/s - layer 2 / layer 3 boundary

ERT boundaries and colour scale

50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 180.0 190.0

Resistivity in ohm.m

Interpretation

- R6 Intersection of another named profile
- BH22 Approx location of named Site Investigation work
- Change in Overburden Boundary
- Rock surface Boundary
- Change in Rock Boundary

Overburden types

- Sand
- Gravel
- Clay
- Silt
- Sandy CLAY
- Sandy Gravel CLAY
- Gravelly SAND
- GRAVEL

Rock types

- Limestone
- Shale

Location Map

- Seismic Profile
- ERT Profile

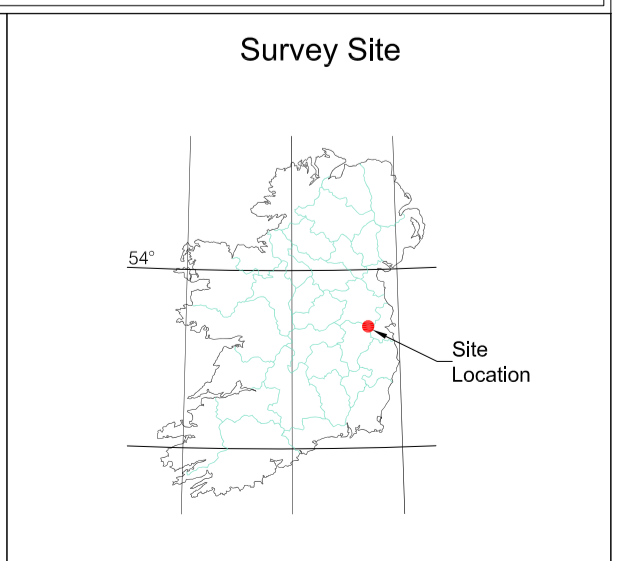
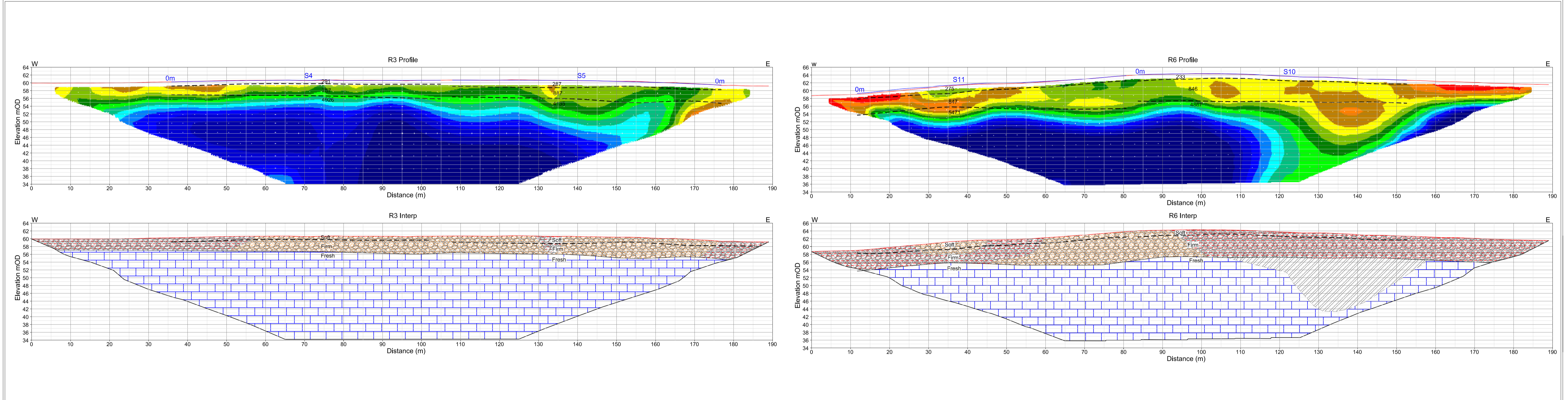


FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:500



FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500



<p>PROJECT: MAYNOOTH EASTERN RING ROAD GROUND INVESTIGATION GEOPHYSICAL SURVEY</p>	<p>CONSULTING ENGINEERS: Roughan & O'Donovan Consulting Engineers</p>	<p>JOB NUMBER: P18247</p>	<p>DRAWN BY: HP</p>	<p>APPROVED: GH</p>	<p>Legend:</p> <p>Seismic refraction boundaries with P-wave velocities (m/s)</p> <ul style="list-style-type: none"> — 300 m/s — ground surface - - - 1000 m/s - - - layer 1 / layer 2 boundary - - - 3000 m/s - - - layer 2 / layer 3 boundary <p>ERT boundaries and colour scale</p> <p>— 50.0 — 100.0 — 150.0 — 200.0 — 250.0 — 300.0 — 350.0 — 400.0 — 450.0 — 500.0 — 550.0 — 600.0 — 650.0 — 700.0 — 750.0 — 800.0 — 850.0 — 900.0 — 950.0 — 1000.0 — 1050.0 — 1100.0 — 1150.0 — 1200.0 — 1250.0 — 1300.0 — 1350.0 — 1400.0 — 1450.0 — 1500.0 — 1550.0 — 1600.0 — 1650.0 — 1700.0 — 1750.0 — 1800.0 — 1850.0 — 1900.0 — 1950.0 — 2000.0 — 2050.0 — 2100.0 — 2150.0 — 2200.0 — 2250.0 — 2300.0 — 2350.0 — 2400.0 — 2450.0 — 2500.0 — 2550.0 — 2600.0 — 2650.0 — 2700.0 — 2750.0 — 2800.0 — 2850.0 — 2900.0 — 2950.0 — 3000.0</p>	<p>Interpretation</p> <ul style="list-style-type: none"> R6 Intersection of another named profile I Approx location of named Site Investigation work <p>Overburden types</p> <ul style="list-style-type: none"> Sand Gravel Clay Silt Sandy CLAY Sandy Gravel CLAY Gravelly SAND GRAVEL <p>Rock types</p> <ul style="list-style-type: none"> Limestone Shale 	<p>Location Map</p> <ul style="list-style-type: none"> — Seismic Profile — ERT Profile 	<p>Survey Site</p>
<p>Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R3, R6</p>	<p>SURVEYED BY: PRIORITY GEOTECHNICAL LTD.</p>	<p>DRAWING NUMBER: P18247_GP_D02</p>	<p>SCALE: As specified @ A1</p>	<p>ISSUE DATE: 10/12/2018</p>				
<p>REVISION: D01</p>								

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