IRISH WATER

LEAD IN DRINKING WATER MITIGATION PLAN – 217 SWINFORD WSZ

SCREENING TO INFORM APPROPRIATE ASSESSMENT

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GLOSSARY OF TERMS & ABBREVIATIONS

Appropriate Assessment: An assessment of the effects of a plan or project on European Sites.

Biodiversity: Word commonly used for biological diversity and defined as assemblage of living organisms from all habitats including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part.

Birds Directive: Council Directive of 2nd April 1979 on the conservation of wild birds (79/409/EEC) as codified by Directive 2009/147/EC.

Geographical Information System (GIS): A GIS is a computer-based system for capturing, storing, checking, integrating, manipulating, analysing and displaying data that are spatially referenced.

Habitats Directive: European Community Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna and has been transposed into Irish law by the Planning and Development Act 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011). It establishes a system to protect certain fauna, flora and habitats deemed to be of European conservation importance.

Mitigation measures: Measures to avoid/prevent, minimise/reduce, or as fully as possible, offset/compensate for any significant adverse effects on the environment, as a result of implementing a plan or project.

Natura 2000: European network of protected sites, which represent areas of the highest value for natural habitats and species of plants and animals, which are rare, endangered or vulnerable in the European Community. The Natura 2000 network of sites will include two types of area. Areas/ European Sites may be designated as Special Areas of Conservation (SAC) where they support rare, endangered or vulnerable natural habitats and species of plants or animals (other than birds). Where areas support significant numbers of wild birds and their habitats, they may become Special Protection Areas (SPA). SACs are designated under the Habitats Directive and SPAs are classified under the Birds Directive. In some situations, there may be overlap in extent of SAC and SPA.

Scoping: The process of deciding the content and level of detail to be included in the Screening for AA, including the key environmental issues, likely significant environmental effects and alternatives which need to be considered, the assessment methods to be employed, and the structure and contents of the Appropriate Assessment Screening Report.

Screening: The determination of whether implementation of a plan or project would be likely to have significant environmental effects on the Natura 2000 network.

Special Area for Conservation (SAC): An SAC designation is an internationally important site, protected for its habitats and species. It is designated, as required, under the EC Habitats Directive (1992).

Special Protection Area (SPA): An SPA is a site of international importance for breeding, feeding and roosting habitat for bird species. It is designated under the EC Birds Directive (1979).

Statutory Instrument: Any order, regulation, rule, scheme or byelaw made in exercise of a power conferred by statute.

1. INTRODUCTION

Ryan Hanley was commissioned by Irish Water (IW) to undertake Screening for Appropriate Assessment (AA) for the proposed orthophosphate (OP) dosing (herein referred to as the Project) of drinking water supplied by of drinking water supplied by Swinford WTP in Co. Mayo to the Swinford Water Supply Scheme Water Supply Zone (WSZ) (2200PUB1024).

This report comprises information in support of the Screening of the Project in line with the requirements of Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (hereafter referred to as the Habitats Directive). The report assesses the potential for significant effects resulting from the additional phosphorus (P) load to environmental receptors, resulting from OP dosing being undertaken to mitigate against consumer exposure to lead in drinking water. It is therefore necessary to consider the sources, pathways and receptors in relation to added P.

1.1 PURPOSE OF THIS REPORT

Screening for AA, as a first step in determining the requirement for AA, is to determine whether the Project is likely to have a significant effect on any European Site within the zone of influence (ZoI) of the Water Supply Zone (WSZ), either individually or in combination with other plans or projects, in view of the sites qualifying interests and conservation objectives. This Screening Report complies with the requirements of Article 6 of the Habitats Directive transposed in Ireland principally through the Planning and Development Act 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended). In the context of the proposed project, the governing legislation is the Birds and Habitats Regulations 2011 and the "public authority" is Irish Water, specifically:

"The public authority shall determine that an Appropriate Assessment of a plan or project is not required where the plan or project is not directly connected with or necessary to the management of the site as a European Site and if it can be excluded on the basis of objective scientific information following screening under this Regulation, that the plan or project, individually or in combination with other plans or projects, will have a significant effect on a European site."

1.2 THE PLAN

Irish Water, as the national public water utility, prepared a Lead in Drinking Water Mitigation Plan (LDWMP) in 2016 (here after referred to as the Plan). The Plan provides a framework of measures for implementation to effectively address the currently elevated levels of lead in drinking water experienced by some IW customers as a result of lead piping. The Plan was prepared in response to the recommendations in the *National Strategy to reduce exposure to Lead in Drinking Water* which was published by the Department of Environment, Community and Local Government[1] and Department of Health in June 2015.

The overall objective of the Plan is to effectively address the risk of failure to comply with the drinking water quality standard for lead due to lead pipework in as far as is practical within the areas of IW's responsibility. Lead in drinking water is derived from lead pipes that are still in place in the supply network. These pipes are mostly in old shared connections or in the short pipes connecting the (public) water main to the (private) water supply pipes (IW, 2016[2]). Problems can also be caused by lead leaching from domestic plumbing components made of brass and from lead-containing solder, with the

[1] Now known as the Department of Housing, Planning and Local Government (DHPLG).
[2] Irish Water (IW) (2016) Lead in Drinking Water Mitigation Plan. https://www.water.ie/projects-plans/lead-mitigation-plan/Lead-in-Drinking-Water-Mitigation-Plan.pdf

most significant portion of the lead pipework lying outside of IW's ownership in private properties (IW, 2016). Lead can be dissolved in water as it travels through lead supply pipes and internal lead plumbing. When lead is in contact with water it can slowly dissolve, a process known as plumbosolvency. The degree to which lead dissolves varies with the length of lead pipe, local water chemistry, temperature and the amount of water used at the property.

Health studies have identified risks to human health from ingestion of lead. In December 2013, the acceptable limit for lead in drinking water was reduced to 10 micrograms per litre (µg/l) as per the European Union (Drinking Water) Regulations. From 2003 to 2013, the limit was 25 µg/l, which was a reduction on the previous limit (i.e. pre 2003) of 50 µg/l.

The World Health Organisation (WHO), Environmental Protection Agency (EPA) and Health Service Executive (HSE) recommend lead pipe replacement (both lead service connections in the public supply, and lead supply pipes and internal plumbing in private properties) as the ultimate goal in reducing long-term exposure to lead. It is recognised that this will inevitably take a considerable period of time. In recognition of this, short to medium term proposals to mitigate the risk are being examined.

The Plan sets out the short, medium and longer term actions that IW intends to undertake, subject to the approval of the economic regulator, the Commission for Regulation of Utilities (CRU). It is currently estimated that 85% to 95% of properties meet the lead compliance standards when sampled at the customer's tap. The goal is to increase this compliance rate to 98% by end of 2021 and 99% by the end of 2027 (IW, 2016). This is subject to a technological alternative to lead replacement being deemed environmentally viable.

The permanent solution to the lead issue is to replace all water mains that contain lead. IW proposes that a national programme of replacement of public lead service pipes is required. However, replacing the public supply pipe or the private pipe on its own will not resolve the problem. Research indicates that unless both are replaced, lead levels in the drinking water could remain higher than the Regulation standards. Where lead pipework or plumbing fittings occur within a private property, it is the responsibility of the property owner to replace it.

The Plan assesses a number of other lead mitigation options available to IW. Other measures, including corrective water treatment in the form of pH adjustment and OP treatment, are being considered as an interim measure for the reduction of lead concentrations in drinking water in some WSZs.

IW proposes to introduce corrective water treatment at up to 400 WTPs. This would be rolled out over an accelerated 3-year programme, subject to site-specific environmental assessments. The corrective water treatment will reduce plumbosolvency risk over the short to medium term in high risk water supplies where it is technically, economically and environmentally viable to do so. This practice is now the accepted method of lead mitigation in many countries e.g. Great Britain and Northern Ireland. The dosing would be required to continue whilst lead pipework is still in use, subject to annual review on a scheme by scheme basis.

Orthophosphate (OP) is added in the form of Phosphoric acid - a clear, odourless liquid that is safe for human consumption. Phosphoric acid is already approved for use as a food additive (E338) in dairy, cereals, soft drinks, meat and cheese. The average adult person consumes between 1,000 and 1,500 milligrams (mg) of P every day as part of the normal diet. The OP dose rate for Swinford WSZ will be 1.0 mg/l P for treated water supplied from the Swinford WTP to Swinford WSZ.

1.3 PROJECT BACKGROUND

Phosphorus (P) can influence water quality status through the process of nutrient enrichment and promotion of excessive plant growth (eutrophication). It is therefore necessary to quantify any potential environmental impact and the pathways by which the added (OP) may reach environmental receptors and to evaluate the significance of any such effects on European Sites. To facilitate the assessment of any significant effects to the receiving environment an Environmental Assessment Methodology (EAM) has been developed based on a conceptual model of P transfer (from the water distribution and wastewater collection systems), using the source-pathway-receptor framework.

The first step of Screening for AA is to identify the European sites that are in close proximity to or have a hydrological or hydrogeological connectivity to the WSZs affected by the proposed OP dosing. The Screening recognises that for those European Sites with nutrient sensitive Qualifying Interests (habitats and species) which have connectivity to the WSZ, there are pathways for effects which require further evaluation. The Screening Report applies objective scientific information from the EAM as outlined in this document and evaluates whether the proposed dosing will give rise to significant effects on any of these European Sites, in the context of the Site Specific Conservation Objectives (SSCO) as published on the NPWS website.

2. APPROPRIATE ASSESSMENT METHODOLOGY

2.1 LEGISLATIVE CONTEXT

Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora better known as the "Habitats Directive" provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of European Sites. These are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79/409/ECC) as codified by Directive 2009/147/EC.

The scope of the assessment is confined to the effects upon habitats and species of European Sites. As part of the assessment, a key consideration is 'in combination' effects with other plans or projects.

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to affect European Sites (Annex 1.1). Article 6(3) establishes the requirement for AA:

"*Any plan or project not directly connected with or necessary to the management of the [European] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*".

Article 6(4) states:

"*If, in spite of a negative assessment of the implications for the [European] site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted*".

Over time legal interpretation has been sought on the practical application of the legislation concerning AA, as some terminology has been found to be unclear. European and National case law has clarified a number of issues and some aspects of European Commission (EC) published guidance documents have been superseded by case law.

2.2 GUIDANCE FOR THE APPROPRIATE ASSESSMENT PROCESS

The assessment completed in this Screening, had regard to the following legislation and guidance documents:

European and National Legislation:

- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (also known as the 'Habitats Directive');
- Council Directive 2009/147/EC on the conservation of wild birds, codified version, (also known as the 'Birds Directive');
- European Communities (Birds and Natural Habitats) Regulations 2011 to 2015; and
- Planning and Development Act 2000 (as amended).

Guidance / Case Law:

- *Article 6 of the Habitats Directive – Rulings of the European Court of Justice*. Final Draft September 2014;
- *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities*. DEHLG (2009, revised 10/02/10);
- *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*. European Commission (2002);
- *Communication from the Commission on the Precautionary Principle*. European Commission (2000b);
- *EC study on evaluating and improving permitting procedures related to Natura 2000 requirements under Article 6.3 of the Habitats Directive 92/43/EEC*. European Commission (2013);
- *Guidance Document on Article 6(4) of the 'Habitats Directive' 92/43/EEC. Clarification of the concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission*. European Commission (2007); and
- *Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*. European Commission (2000a).

Departmental/NPWS Circulars:

- *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities*. Circular NPWS 1/10 and PSSP 2/10. (DEHLG, 2010);
- *Appropriate Assessment of Land Use Plans*. Circular Letter SEA 1/08 & NPWS 1/08;
- *Water Services Investment and Rural Water Programmes – Protection of Natural Heritage and National Monuments*. Circular L8/08;

- *Guidance on Compliance with Regulation 23 of the Habitats Directive*. Circular Letter NPWS 2/07; and
- *Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites*. Circular Letter PD 2/07 and NPWS 1/07.

2.3 STAGES OF THE APPROPRIATE ASSESSMENT PROCESS

According to European Commission Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive, the assessment requirements of Article 6 establish a four-staged approach as described below. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required. The four stages are as follows:

- Stage 1 – Screening of the proposed plan or project for AA;
- Stage 2 – An AA of the proposed plan or project;
- Stage 3 – Assessment of alternative solutions; and
- Stage 4 – Imperative Reasons of Overriding Public Interest (IROPI)/ Derogation.

Stages 1 and 2 relate to Article 6(3) of the Habitats Directive; and Stages 3 and 4 to Article 6(4).

Stage 1: Screening for a likely significant effect

The aim of screening is to assess firstly if the plan or project is directly connected with or necessary to the management of European Site(s); or in view of best scientific knowledge, if the plan or project, individually or in combination with other plans or projects, is likely to have a significant effect on a European site. This is done by examining the proposed plan or project and the conservation objectives of any European Sites that might potentially be affected. If screening determines that there is potential for significant effects or there is uncertainty regarding the significance of effects then it will be recommended that the plan is brought forward to full AA.

Stage 2: Appropriate Assessment (Natura Impact Statement or NIS):

The aim of Stage 2 of the AA process is to identify any adverse impacts that the plan or project might have on the integrity of relevant European Sites. As part of the assessment, a key consideration is 'in combination' effects with other plans or projects. Where adverse impacts are identified, mitigation measures can be proposed that would avoid, reduce or remedy any such negative impacts and the plan or project should then be amended accordingly, thereby avoiding the need to progress to Stage 3.

Stage 3: Assessment of Alternative Solutions

If it is not possible during the Stage 2 to reduce impacts to acceptable, non-significant levels by avoidance and/or mitigation, Stage 3 of the process must be undertaken which is to objectively assess whether alternative solutions exist by which the objectives of the plan or project can be achieved. Explicitly, this means alternative solutions that do not have negative impacts on the integrity of a European Site. It should also be noted that EU guidance on this stage of the process states that, 'other assessment criteria, such as economic criteria, cannot be seen as overruling ecological criteria' (EC, 2002). In other words, if alternative solutions exist that do not have negative impacts on European Sites; they should be adopted regardless of economic considerations.

Stage 4: Imperative Reasons of Overriding Public Interest (IROPI)/Derogation

This stage of the AA process is undertaken where no alternative solutions exist and where adverse impacts remain. At this stage of the AA process, it is the characteristics of the plan or project itself that will determine whether or not the competent authority can allow it to progress. This is the determination of 'over-riding public interest'.

It is important to note that in the case of European Sites that include in their qualifying features 'priority' habitats or species, as defined in Annex I and II of the Directive, the demonstration of 'over-riding public interest' is not sufficient and it must be demonstrated that the plan or project is necessary for 'human health or safety considerations'. Where plans or projects meet these criteria, they can be allowed, provided adequate compensatory measures are proposed. Stage 4 of the process defines and describes these compensation measures.

2.4 INFORMATION SOURCES CONSULTED

To inform the assessment for the Project and preparation of this Screening Report, the following key sources of information have been consulted, however it is noted this is not an exhaustive list and does not reflect liaison and/ or discussion with technical and specialist parties from IW, RPS, NPWS, IFI, EPA etc. as part of Plan development.

- Information provided by IW as part of the project;
- Environmental Protection Agency – Water Quality www.epa.ie and www.catchments.ie;
- Geological Survey of Ireland – Geology, Soils and Hydrogeology www.gsi.ie;
- Information on the conservation status of birds in Ireland (Colhoun & Cummins 2013);
- National Parks and Wildlife Service – online Natura 2000 network information www.npws.ie;
- National Biodiversity Action Plan 2017 - 2021 (DCHG 2017);
- Article 17 Overview Report Volume 1 (NPWS, 2013a);
- Article 17 Habitat Conservation Assessments Volume 2 (NPWS, 2013b);
- Article 17 Species Conservation Assessment Volume 3 (NPWS, 2013c);
- EPA Qualifying Interests database, (EPA, 2015) and updated EPA Characterisation Qualifying Interests database (EPA/RPS, September 2016);
- River Basin Management Plan for Ireland 2018 - 2021 - www.housing.gov.ie;
- Ordnance Survey of Ireland – Mapping and Aerial photography www.osi.ie;
- National Summary for Article 12 (NPWS, 2013d); and
- Format for a Prioritised Action Framework (PAF) for Natura 2000 (2014) www.npws.ie/sites/default/files/general/PAF-IE-2014.pdf.

2.5 EVALUATION OF THE RECEIVING ENVIRONMENT

Ireland has obligations under EU law to protect and conserve biodiversity. This relates to habitats and species both within and outside designated sites. Nationally, Ireland has developed a National Biodiversity Plan (DCHG, 2017) to address issues and halt the loss of biodiversity, in line with international commitments. The vision for biodiversity is outlined: "*That biodiversity and ecosystems in Ireland are conserved and restored, delivering benefits essential for all sectors of society and that Ireland*

contributes to efforts to halt the loss of biodiversity and the degradation of ecosystems in the EU and globally".

Ireland aims to conserve habitats and species, through designation of conservation areas under both European and Irish law. The focus of this Screening is on those habitats and species designated pursuant to the EU Birds and EU Habitats Directives in the first instance, however it is recognised that wider biodiversity features have a supporting role to play in many cases where the Conservation Objectives of designated sites is to be maintained/restored.

2.5.1 Identification of European Sites

Current guidance (DEHLG, 2010) on the ZoI to be considered in any Screening for AA process states the following:

"*A distance of 15km is currently recommended in the case of plans, and derives from UK guidance (Scott Wilson et al., 2006). For projects, the distance could be much less than 15km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in-combination effects*".

A buffer of 15 km is typically taken as the initial ZoI extending beyond the reach of the footprint of a plan, although there may be scientifically appropriate reasons for extending this ZoI further depending on pathways for potential effects. With regard to the current project, the 15 km distance is considered inappropriate to screen all likely pathways for to European Sites in view of all hydrological and hydrogeological connections to aquatic and water dependant receptors. Therefore, the ZoI for this project includes all of the hydrologically connected surface water sub catchments and groundwater bodies within the WSZ.

2.5.2 Conservation Objectives

Article 6(3) of the Habitats Directive states 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 of the site in view of the site's ***conservation objectives.***

Qualifying Interests (QIs)/ Special Conservation Interests (SCIs) are annexed habitats and annexed species of community interest for which an SAC or SPA has been designated respectively. The Conservation Objectives (COs) for European Sites are set out to ensure that the QIs/ SCIs of that site are maintained or restored to a favourable conservation condition. Maintenance of favourable conservation condition of habitats and species at a site level in turn contributes to maintaining or restoring favourable conservation status of habitats and species at a national level and ultimately at the Natura 2000 Network level.

In Ireland 'generic' COs have been prepared for all European Sites, while 'site specific' COs (SSCOs) have been prepared for a number of individual Sites to take account of the specific QIs/ SCIs of that Site. Both the COs and SSCOs aim to define favourable conservation condition for habitats and species at the site level.

Generic COs which have been developed by NPWS encompass the spirit of SSCOs in the context of maintaining and restoring favourable conservation condition as follows:

For SACs:

- '*To maintain or restore the favourable conservation condition of the Annex I habitats and/or Annex II species for which the SAC has been selected*'.

For SPAs:

- '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for the SPA*'.

Favourable Conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, are stable or increasing;
- 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".

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;
- 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.

A full listing of the COs and QIs/ SCIs for each European Site, as well as the attributes and targets to maintain or restore the QIs/ SCIs to a favourable conservation condition, are available from the NPWS website www.npws.ie. COs for the European Sites relevant for this Screening Report, are included in **Appendix A**.

2.5.3 Existing Threats and Pressures to EU Protected Habitats and Species

Given the nature of the proposed project, a review has been undertaken of those QIs/SCIs which have been identified as having sensitivity to orthophosphate loading. Information has been extracted primarily from a number of NPWS authored reports, including recently available statutory assessments on the conservation status of habitats and species in Ireland namely; The status of EU protected Habitats and Species in Ireland (NPWS 2013 a, b &c) and on information contained in Ireland's most recent Article 12 submission to the EU on the Status and trends of Birds species (NPWS 2013d). Water dependent species were identified as having the greatest connectivity and thus highest sensitivity to the proposed dosing activity, and the Water Framework Directive SAC water dependency list (NPWS, December 2015), was used as part of the criteria for screening of European Sites.

3. DESCRIPTION OF THE PROJECT

3.1 DESCRIPTION OF THE PROPOSAL

The Swinford Water Treatment Plant, located south east of the town, supplies the Swinford Water Supply Zone (2200PUB1024) with an average of 750 m^3/day (approximately 56% of the flow is accounted for). Treated water is distributed through a single reservoir, located at the water treatment plant. Raw water is sourced from a surface water spring source at Carrowcanada and undergoes coagulation, filtration (DAFF) and clarification at the treatment plant.

Based on an assessment of the risk of lead exceedances, the Plumbosolvency Control Plan for Swinford WSZ recommends that all water from the Swinford WTP will be OP dosed at a dose rate of 1.0 mg/l P.

Figure 1 Location of the Swinford Water Treatment Plant site, Co. Mayo

The Swinford WSZ is serviced by Swinford WWTP. There are an estimated 242 properties across the WSZ that are serviced by Domestic Waste Water Treatment Systems (DWWTS i.e. septic tanks). The Swinford WWTP agglomeration is licenced in accordance with the requirements of the Waste Water Discharge (Authorisation) Regulations 2007 as amended and the impact of the OP on the emission limit values and the receiving water body downstream of the point of discharge are assessed.

3.1.1 Construction Works

The Plumbosolvency Control Plan Report has proposed that a bunded phosphoric acid storage tank (with capacity for a minimum of 60 days dosing of phosphoric acid at 75% concentration into supply) and

dosing installations housed in kiosks, will be installed on constructed concrete ground slabs, located within the site of the Swinford Water Treatment Plant. The required 60 days storage volume at the WTP Site corresponds to 0.2 m^3.

Facilities to raise the pH of the water to the recommended pH of 8.0 will also be installed at the WTP entirely within the WTP site boundary. These facilities will consist of three free standing storage/ dilution tanks (with capacity for a minimum of 60 days dosing of sodium hydroxide/ sodium carbonate) with dosing pumps and control panel and an allowance for dry product storage (pallets / silos of approximately 9,600 kg) plus conveying equipment. Tanks will hold 2.5 m^3 each.

The scope of the **construction** works for the Swinford WTP site will include:

- Initial site assessment, and site investigation works to determine existing conditions, services and pipe cable duct layouts at the site;

- Installation of pH correction facilities with an area of approximately 30 m^2 (a typical installation is shown in Figure 2). Exact locations will be confirmed following initial site assessment and investigations, however the works will be confined to the existing WTP site boundary.

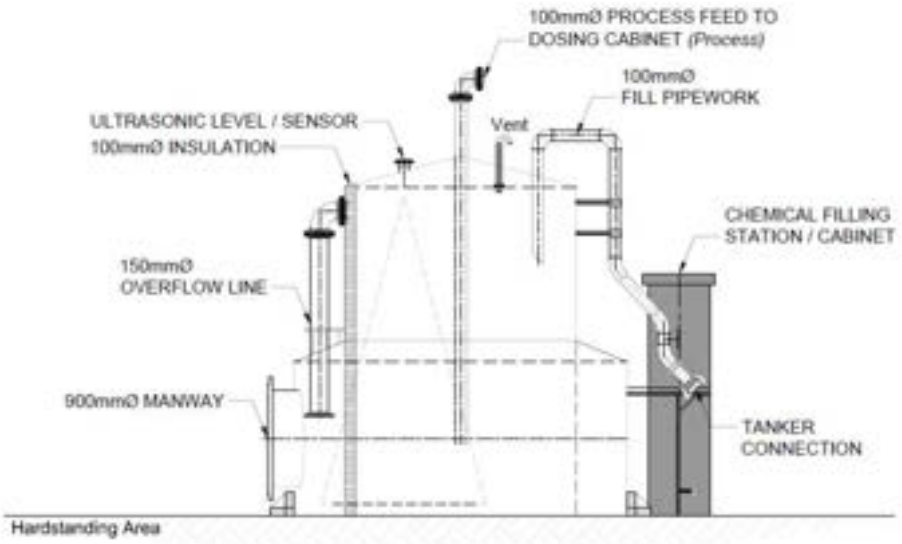

Figure 2 Sectional view of typical circular free standing chemical storage tank.

- Installation of OP dosing units with an area of approximately 15 m^2 (a typical dosing unit is shown in Figure 3 and Figure 4). Exact locations will be confirmed following initial site assessment and investigations. Kiosks will be required to house the OP dosing unit as there is insufficient storage space within the existing buildings. Kiosks will be housed on concrete ground slabs, located within the WTP Site. A 1.0 m wide concrete apron shall extend around the kiosk;

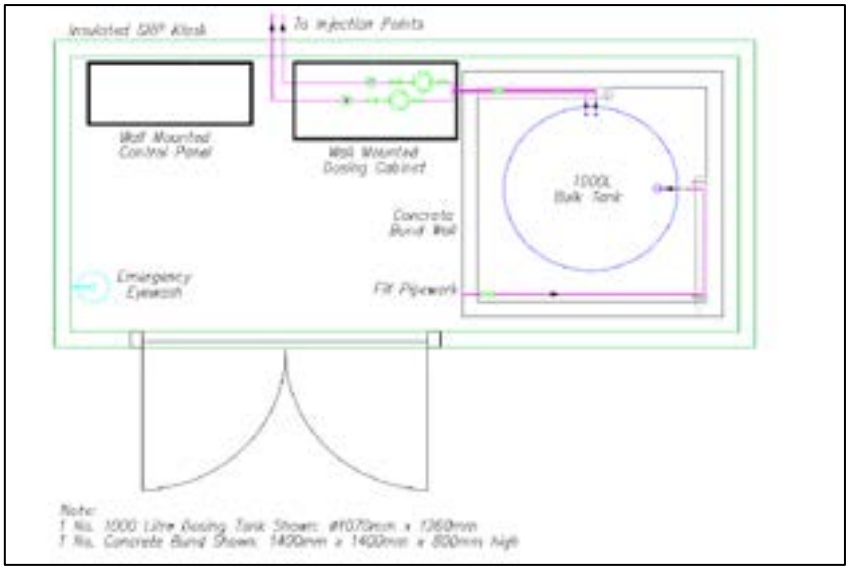

Figure 3 IW schematic of a bulk tank kiosk layout in H3PO4 Installation with 500 litres< bulk storage ≤ 6,000 litres.

Figure 4 Typical orthophosphate dosing unit

3.1.2 Operational Works

The scope of the **operational** works includes the dosing of OP to treated water at a rate of 1.0 mg/l P for treated water from Swinford WTP to Swinford WSZ in a process similar to the addition of chlorine for disinfection. pH correction will involve dosing NaOH/Na_2CO_3 to treated water.

3.2 LDWMP APPROACH TO ASSESSMENT

3.2.1 Work Flow Process

In line with the relevant guidance, the Screening Report to inform AA comprises two main steps:

- **Impact Prediction** – where the likely potential impacts of this project (impact source and impact pathways) are examined.
- **Assessment of Effects** - where project impacts are assessed on the basis of best scientific knowledge (the EAM); in order to identify whether they are likely to give rise to a significant effect on any European sites, in view of their COs;

At the early stages of consideration, IW identified the pathways by which the added OP may reach and / or affect environmental receptors including European Sites. In order to carry out a robust and defensible environmental assessment and to ensure a transparent and consistent approach, IW devised a conceptual model based on the 'source – pathway – receptor' framework. This sets out a specific environmental risk assessment of any proposed OP treatment and provides a methodology to determine the risk to the receiving environment of this corrective water treatment.

This conceptual Environmental Assessment Model (EAM), has been discussed with the EPA and has been developed using EPA datasets including the OP susceptibility output mapping for subsurface pathways; the nutrient risk assessment for waterbodies; water quality information; available low flow estimation for gauged and ungauged catchments; and a new methodology which has been developed for the assessment of water quality risk from domestic wastewater treatment systems.

Depending on the potential impacts identified, appropriate measures may be built into the project proposal, as part of an iterative process, to avoid / reduce those potential impacts for the orthophosphate treatment being proposed. Project measures adopted within the overall design proposal, as influenced by the Plumbosolvency Report and EAM output, may include selected placement of the orthophosphate treatment point within the WSZ; enhanced wastewater treatment (to potentially remove equivalent phosphorus levels related to the orthophosphate treatment at the WTP); reduced treatment rate; and water network leakage control. The EAM will be the basis of the decision support matrix to inform any programmes developed as part of the LDWMP. Further detail on the model is presented in **Section 3.2.2** below.

3.2.2 Environmental Assessment Methodology

The EAM has been developed based on a conceptual model of P transfer (see **Figure 5**), based on the source-pathway-receptor model, from the water distribution and wastewater collection systems.

- The *source* of phosphorus is defined as the OP dosing at water treatment plants which will be dependent on the water chemistry of the raw water quality, the integrity of the distribution network and the extent of lead piping.
- *Pathways* include discharges from the wastewater collection system (WWTP discharges and intermittent discharges – Storm Water Overflows (SWOs)), leakage from the distribution system and small point source discharges from Domestic Wastewater Treatment Systems (DWWTS).
- *Receptors*, and their sensitivity, is of key consideration in the EAM. A waterbody may be more sensitive to additional phosphorus loadings where it has a low capacity for assimilating the load e.g. high status sites, such as the habitat of the freshwater pearl mussel or oligotrophic lakes. Where an SAC/SPA is hydrologically connected to dosing from more than one WSZ, the potential for cumulative impacts on OP indicative water quality are considered in the EAM.

A flow chart of the methodology applied in the EAM is provided in **Figure 6** and illustrates the importance of the European Sites in the process. In all instances where nutrient sensitive qualifying features within the Natura 2000 network are hydrologically linked with the WSZ, a Screening to inform AA will be required in the first instance. For each WSZ where orthophosphate treatment is proposed the conceptual model allows the quantification of loads in a mass balance approach to identify potentially significant pathways, as part of the risk assessment process.

A summary report outlining the EAM is available in **Appendix C**, which further outlines P dynamics and the consideration of P trends and capacity in receiving waters and the potential for any impacts on OP indicative quality status from an increase in OP loading arising from OP dosing.

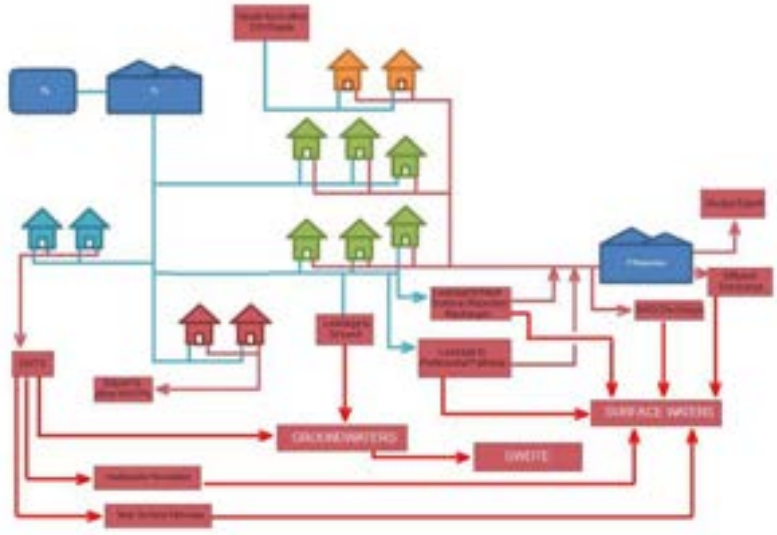

Figure 5 Conceptual Model of P Transfer

Diagrammatic layout of P transfers from drinking water source (top left), through DW distribution (blue), wastewater collection (brown) and treatment systems to environmental receptors (red). P transfers that by-pass the WWTP (leakages, storm overflows, discharges to ground, and misconnections) are also indicated.

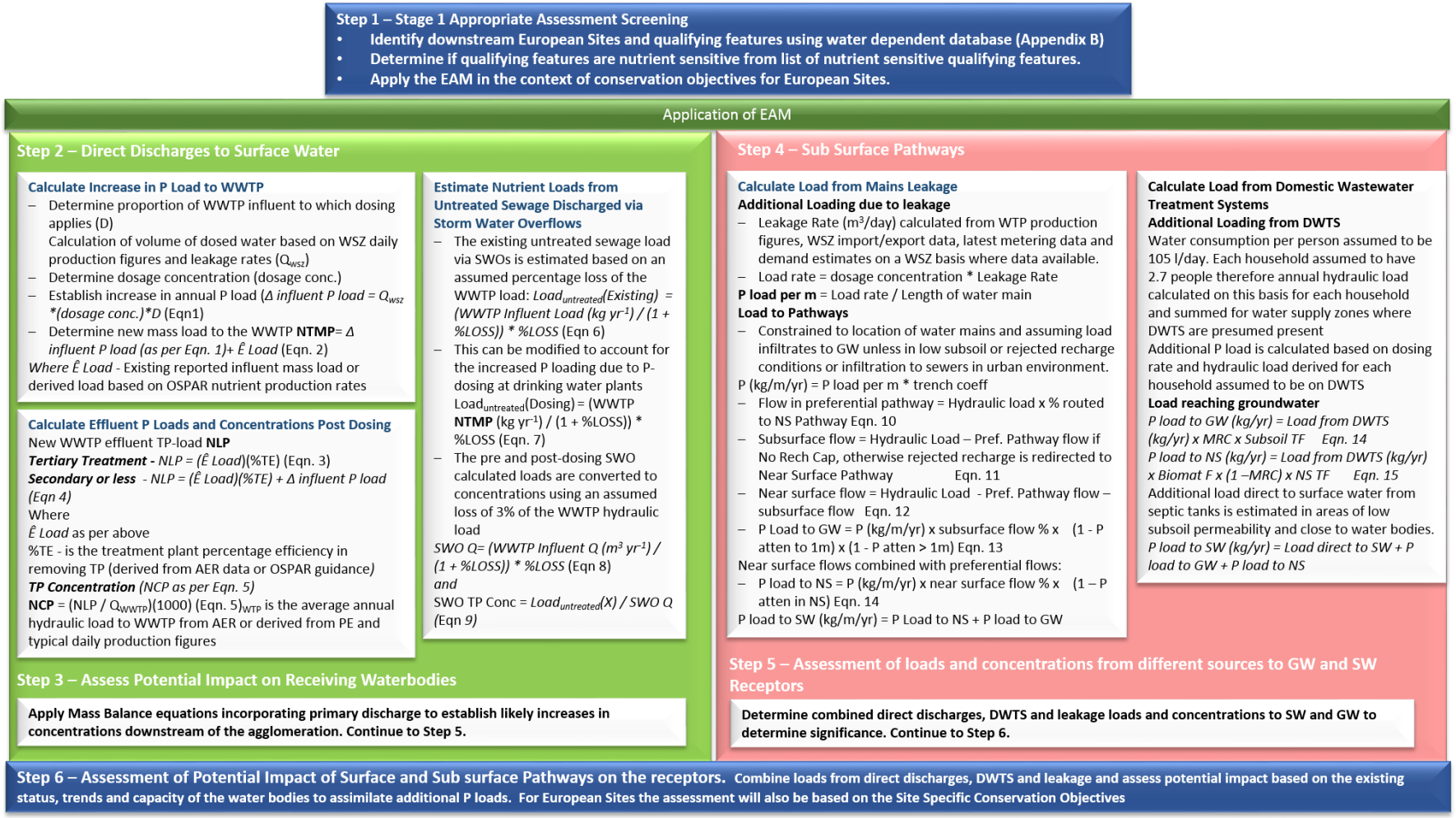

Figure 6 Stepwise Approach to the Environmental Assessment Methodology

4. PROJECT CONNECTIVITY TO EUROPEAN SITES

4.1 OVERVIEW OF THE PROJECT ZONE OF INFLUENCE

4.1.1 Construction Phase

Swinford WTP is located approximately 3 km from a European Site (River Moy SAC). The site is located on the Kilbride Road (L1303) to the east of town and surrounded by agricultural lands. There is no watercourse in proximity to the plant (>700 m from the Swinford River) and no above ground hydrological links to the European Site. Given the location (outside of any European Site boundary and away from watercourse), and scale of the construction of the OP and pH dosing units for the proposed scheme located entirely within the existing WTP site boundary, there is no potential for direct and indirect construction impacts to cause a significant effect on any European Site, and are henceforth screened out (Figure 7). Consideration of potential impact is in the absence of mitigation and with the acknowledgement that the Dosing Units are within the existing IW site and the construction elements do not include any designated European Sites within the Zone of Influence. Therefore potential construction impacts are not assessed further.

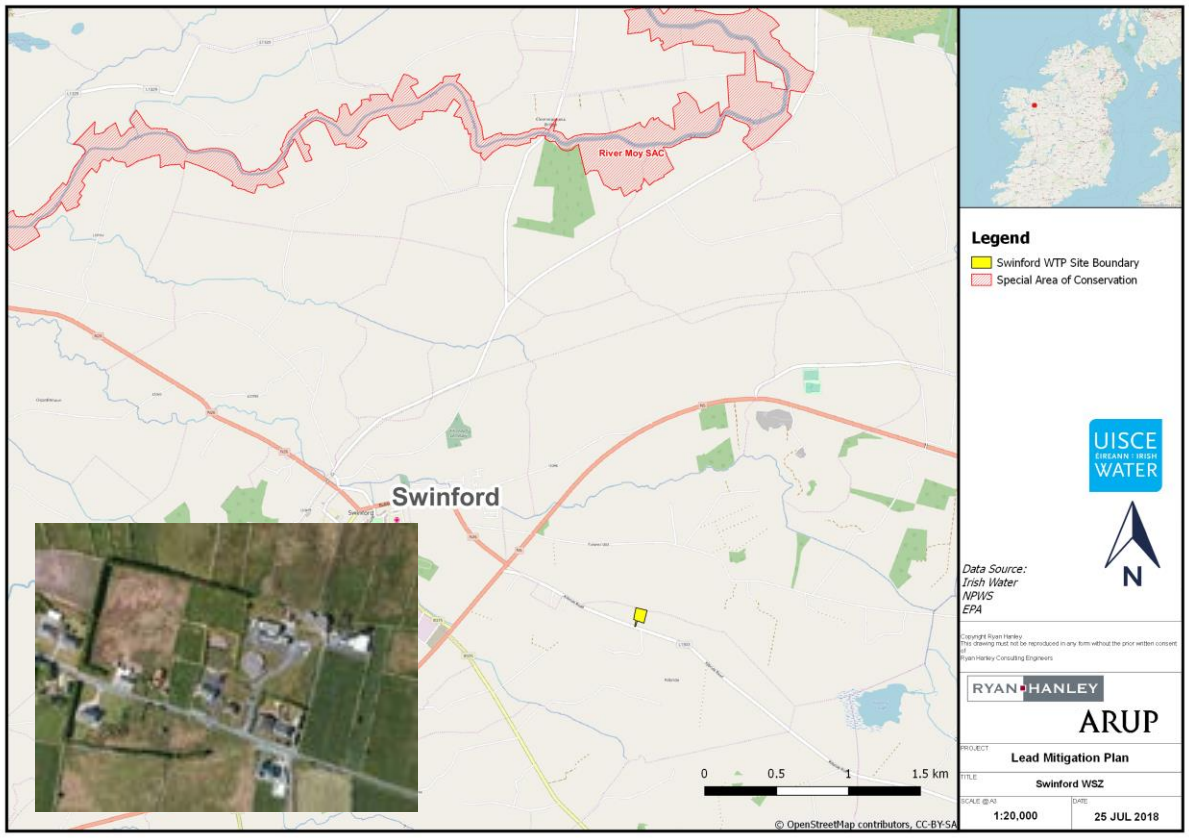

Figure 7 Location of the Swinford Water Treatment Plant site with respect to European Sites

4.1.2 Operational Phase

With regard to the operation of the proposed project, the pathways by which the added OP may reach and / or affect environmental receptors is considered by means of an operational activities ZoI, which was determined by establishing the potential for hydrological and hydrogeological connectivity between the Swinford WTP and associated WSZ and European Sites. This operational ZoI was therefore defined

by the surface water sub-catchments and groundwater bodies that are hydrologically and hydrogeologically connected with the Project. European Sites within the operational ZoI are listed in **Table 1** and are displayed in **Figure 8**.

The EAM process identified 4 river waterbodies, a transitional waterbody and a coastal waterbody potentially impacted following OP dosing of drinking water. This AA Screening identifies the connectivity between EAM identified surface waterbodies and downstream receiving waterbodies and European Sites:

- Moy_070 (IE_WE_34MO20500), Swinford_010 (IE_WE_34SO50300) and Spaddagh_010 (IE_WE_34SO30200) river waterbodies flowing into the Moy_080 (IE_WE_34MO20650), the Moy_090, the Moy_100, the Moy_110, the Moy_120 river waterbodies and into the Moy Estuary (IE_WE_420_0200) transitional waterbody and Killala Bay (IE_WE_420_0000) coastal waterbody.

The EAM process identified 4 groundwater bodies. Groundwater bodies touching or intersecting the WSZs, are also included in the ZoI. Hydrogeological linkages in karst areas are taken into account:

- **Swinford (IE_WE_G_0033);**
- **Foxford (IE_WE_G_0034);**
- **Swinford Gravels (IE_WE_G_0108);**
- **Kilkelly Charlestown (IE_WE_G_0032).**

In terms of groundwater flow paths, the characterisation reports by Geological Survey of Ireland (2004) has identified that the Foxford GWB (IE_WE_G_0034) flow paths are likely to be up to 150 m, and in the Kilkelly Charlestown GWD (IE_WE_G_0032) flow paths are likely to be up to 300 m, with groundwater discharging rapidly to nearby streams and small springs. As a result of this, only those European Sites within a 150 m radius of Foxford and those within a 300 m radius of Kilkelly Charlestown are considered in the ZOI. European Sites within the ZoI are listed in **Table 1** and are displayed in **Figure 8**.

Table 1: European Sites within the ZoI of the Proposed Project

Site Name	SAC/ SPA Code	Water Dependent Species/Habitats	Nutrient Sensitive	Potential Hydrological/ Hydrogeological Connectivity
Killala Bay/ Moy Estuary SAC	000458	Yes	Yes	Yes
Balla Turlough SAC	000463	Yes	Yes	Yes
Lackan Saltmarsh and Kilcummin Head SAC	000516	Yes	Yes	Yes
Urlaur Lakes SAC	001571	Yes	Yes	Yes
Ballinafad SAC	002081	No	Yes	No
River Moy SAC	002298	Yes	Yes	Yes
Killala Bay/ Moy Estuary SPA	004036	Yes	Yes	Yes

4.2 IDENTIFICATION OF RELEVANT EUROPEAN SITES

Each European Site was assessed for the presence of water dependent habitats and species, nutrient sensitivity and hydrological/hydrogeological connectivity (operational ZoI). A number of sites have been excluded from further assessment in Section 5 and 6, due to the absence of hydrological/hydrogeological connectivity to at least one nutrient sensitive and water-dependant QI or SCI. The remaining sites are included for further assessment in order to determine whether the Project is likely to give rise to significant effects; these sites are detailed in **Table 2**

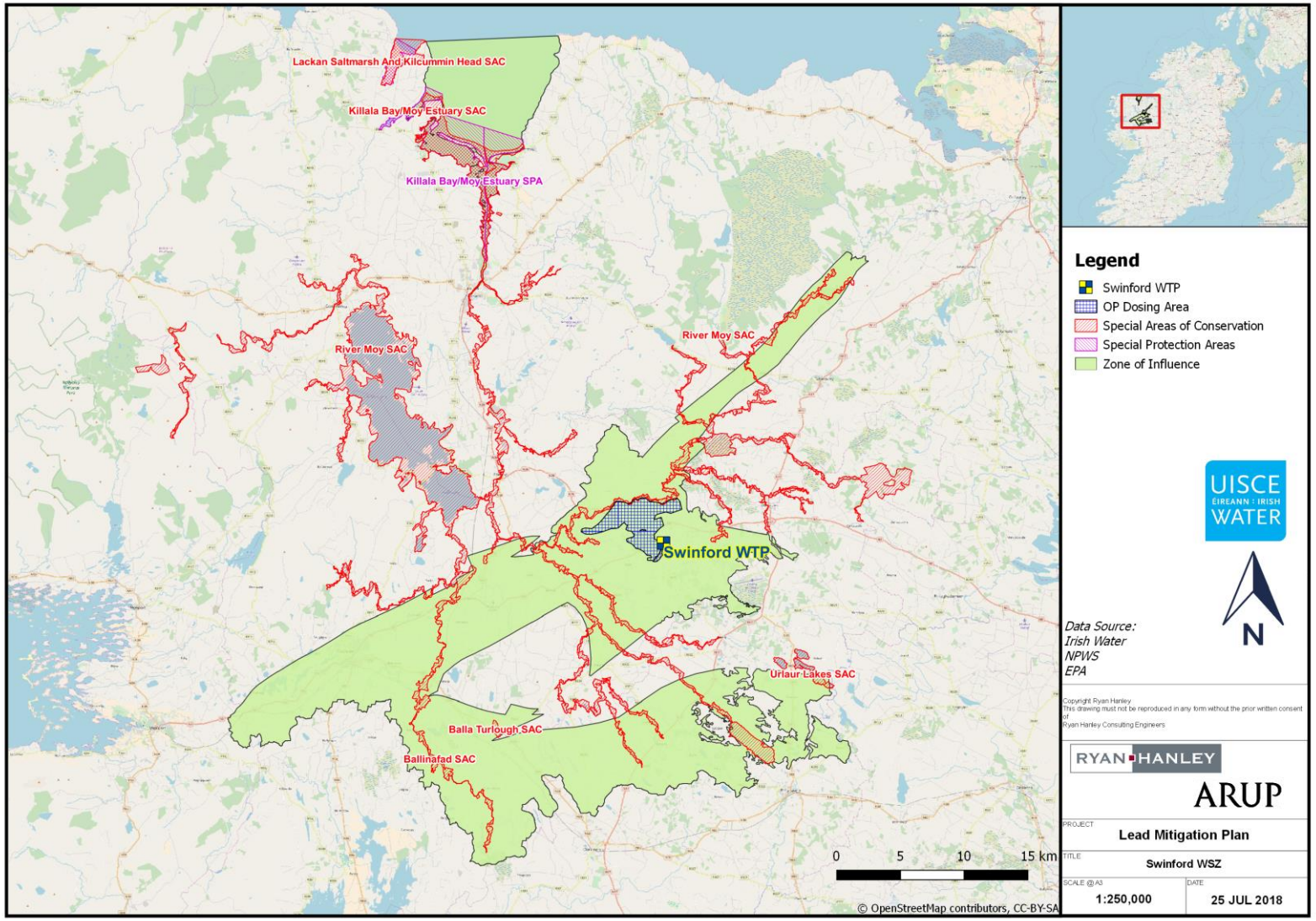

Figure 8 European Sites within the ZoI of the Proposed Project

Table 2: European Sites Hydrologically Connected to or Downstream of the WTP and WSZ

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/ Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
Killala Bay/ Moy Estuary	**SAC 000458**	**31st Oct 2012**	1014	Narrow-mouthed Whorl Snail (*Vertigo angustior*)	Yes	Yes	Yes for operational activities
			1095	Sea Lamprey *Petromyzon marinus*	Yes	Yes	
			1130	Estuaries	Yes	Yes	
			1140	Mudflats and sandflats	Yes	Yes	
			1210	Annual vegetation of drift lines	Yes	Yes	
			1310	*Salicornia* and other annuals colonising mud and sand	Yes	Yes	
			1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Yes	Yes	
			1365	Harbour Seal *Phoca vitulina*	Yes	Yes	
			2110	Embryonic shifting dunes	Yes	Yes	
			2120	Shifting dunes	Yes	Yes	
			2130	*Fixed coastal dunes	Yes	Yes	
			2190	Humid dune slacks	Yes	Yes	
Balla Turlough	**SAC 000463**	**15th August 2016**	3180	Turloughs	Yes	Yes	Yes for operational activities
Lackan Saltmarsh & Kilcummin Head	**SAC 000516**	**22nd December 2016**	1310	*Salicornia* and other annuals colonising mud and sand	Yes	Yes	Yes for operational activities
			1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Yes	Yes	
			1410	Mediterranean salt meadows (*Juncetalia maritimi*)	Yes	Yes	
			2120	Shifting dunes	Yes	Yes	
			2130	Fixed coastal dunes	Yes	Yes	
Urlaur Lakes SAC	**SAC 001571**	**15th December 2017**	3140	Hard oligo-mesotrophic waters	Yes	Yes	Yes for operational activities
River Moy	**SAC 002298**	**03rd Aug 2016**	1092	White-clawed Crayfish *Austropotamobius pallipes*	Yes	Yes	Yes for operational activities
			1095	Sea Lamprey *Petromyzon marinus*	Yes	Yes	
			1096	Brook Lamprey *Lampetra planeri*	Yes	Yes	
			1106	Salmon *Salmo salar*	Yes	Yes	
			1355	Otter *Lutra lutra*	Yes	Yes	
			7110	Active raised bogs*	Yes	Yes	
			7120	Degraded raised bogs	Yes	Yes	
			7150	Depressions on peat substrates of the Rhynchosporion	Yes	Yes	
			7230	Alkaline fens	Yes	Yes	

Site Name	SAC/ SPA Code	Conservation Objectives Establishment Date	Feature Code	Qualifying Interests / Special Conservation Interests	Water Dependent Species/ Habitats	Nutrient Sensitive	Potential hydrological/ hydrogeological Connectivity
			91A0	Old sessile oak woolands	No	Yes	
			91E0	Alluvial woodland*	Yes	Yes	
Killala Bay/ Moy Estuary	**SPA 004036**	**28th May 2013**	A137	Ringed Plover *Charadrius hiaticula*	Yes	Yes	Yes for operational activities
			A140	Golden Plover *Pluvialis apricaria*	Yes	Yes	
			A141	Grey Plover *Pluvialis squatarola*	Yes	Yes	
			A144	Sanderling *Calidris alba*	Yes	Yes	
			A149	Dunlin *Calidris alpina alpina*	Yes	Yes	
			A157	Bar-tailed Godwit *Limosa lapponica*	Yes	Yes	
			A160	Curlew *Numenius arquata*	Yes	Yes	
			A162	Redshank *Tringa totanus*	Yes	Yes	
			A999	Wetlands	Yes	Yes	

* indicates a priority habitat under the Habitats Directive

5. EVALUATION OF POTENTIAL IMPACTS

5.1 CONTEXT FOR IMPACT PREDICTION

The methodology for the assessment of impacts is derived from the *Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites* (EC, 2002). When describing changes/activities and impacts on ecosystem structure and function, the types of impacts that are commonly presented include:

- Direct and indirect impacts;
- Short and long-term impacts;
- Construction, operational and decommissioning impacts; and
- Isolated, interactive and cumulative impacts.

5.2 IMPACT IDENTIFICATION

Operational Phase

In considering the potential for impacts from implementation of the Project, a "source–pathway–receptor" approach has been applied.

The AA has considered the potential for the following significant effects to occur:

- Altered structure and functions relating to the physical components of a habitat ("structure") and the ecological processes that drive it ("functions"). For aquatic habitats these include attributes such as vegetation and water quality.
- Altered species composition due to changes in abiotic conditions such as water quality;
- Reduced breeding success (e.g. due to disturbance, habitat alteration, pollution) possibly resulting in reduced population viability; and
- Impacts to surface water and groundwater and the species they support (changes to key indicators).

The source-pathway-receptor approach has identified a number of impact pathways associated with the orthophosphate dosing. These will be evaluated in relation to the potential for significant effects to any European Site with regard to:

- Excessive phosphate within an aquatic ecosystem may lead to eutrophication; with a corresponding reduction in oxygen levels, reduction in species diversity and subsequent impacts on animal life;
- Groundwater dependent habitats include both surface water habitats (e.g. hard oligo-mesotrophic lakes) and Groundwater Dependent Terrestrial Ecosystems (GWDTEs, e.g. alkaline fens). Any change in the water quality of these systems may have subsequent effects on these habitats and species; and therefore will be subject to an evaluation of the significance of any such effect;
- The discharge of additional P loads to the environment (through surface and sub surface pathways) may have implications for nutrient sensitive species such as the freshwater pearl mussel, Atlantic salmon and the white-clawed crayfish.
- Phosphorus (P) in wastewater collection systems is the result of drinking water and derived from a number of other sources, including P imported from areas outside the agglomeration through import of sludges or leachates for treatment at the plant. The disposal and use of P removed in

wastewater sludge is regulated (i.e. through nutrient management plans) and should not pose further threat of environmental impact;

- Leakage of phosphates from the drinking water supply network to the environment from use of OP;
- Direct discharges of increased P to waterbodies from the wastewater treatment plant licensed discharges; and
- Potential discharges to waterbodies of untreated effluent potentially high in OP Storm Water Overflows (SWOs).

5.3 ASSESSMENT OF IMPACTS RELATING TO OPERATIONAL ACTIVITIES

Article 6 of the Habitats Directive states 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 of the site in view of the site's conservation objectives.

The focus of this section of the Screening to inform AA is the potential for significant effects arising from the additional OP load due to OP dosing at Swinford WTP. The conceptual model developed for OP transfer identified the surface and groundwater bodies that have the potential to be impacted by the OP dosing and which could provide a hydrological or hydrogeological pathway to the European Sites. These waterbodies are listed in **Table 3.** The table identifies the following:

- European sites included for assessment;
- Waterbodies hydrologically or hydrogeologically connected to the European Sites;
- Existing OP indicative water quality and trend of each waterbody;
- The baseline OP concentration of each waterbody;
- 75% of the upper threshold;
- Cumulative OP load to surface from leakage, DWWTS and agglomerations;
- The modelled OP concentration following dosing at the WTP; and,
- The OP potential baseline concentration (mg/l) following dosing at the WTP.

The EAM has been completed assuming the capacity of a waterbody is a measure of its ability to absorb extra pressures before its status changes. For example, a river waterbody at Good Status will have mean phosphate values in the range 0.025 to 0.035 mg/l P. River waterbodies with mean phosphate concentrations of 0.0275 mg/l P have 75% capacity left, i.e. high capacity, while river waterbodies with a mean of 0.0325 mg/l P have lower capacity (25%) as the concentrations are closer to the Good/Moderate Status boundary. In assessing the additional loads from the proposed orthophosphate dosing, the capacity of the water will be assessed. This information is available on the WFD App on a national basis using the "Distance to Threshold" parameter, where waterbodies with high capacity are termed "Far" from the threshold and those with low capacity are "Near" the threshold.

It is predicted that OP dosing will not have a significant impact on Orthophosphate indicative water quality (or the Conservation Objectives of a European Site) where it does not cause the P concentration to increase to a level within 25% of the remaining capacity left within the existing status band, i.e. cause a change in the distance to threshold from far to near. This assessment will be supported by trend analysis as outlined below to ensure the additional OP dosing and statistically significant trends for a waterbody will not result in deterioration in status by 2021 even where the distance to threshold is currently assessed to be far. Where the waterbody baseline concentration is "Near" to the threshold before the effect of

OP dosing is considered, this does not cause an automatic fail for this test. If the predicted increase in concentration due to OP is very low (i.e. below 5%/ <0.00125 mg/l P of the High/Good status) this test will pass as the OP dosing itself is not having a significant impact on the Orthophosphate indicative water quality and thus not having the potential for significant effects on connected European Sites in terms of aquatic and water dependant Qis/SCIs and their conservation objectives.

The identification of statistically and environmentally significant trends for waterbodies is a specific requirement of the WFD and the Groundwater Daughter Directive. Guidance on trends in groundwater assessments (UKTAG 2009, EPA 2010) indicates that trends are environmentally significant if they indicate that the Good Status will not be achieved within two future river basin cycles, i.e. within the next 12 years.

An additional test for groundwater bodies states that downward trends should not be reversed as a result of pollution impact. This test applies to GWB with statistically significant trends according to the WFD App and the Sens Slope provided is used to assess direction and strength of trend. If the trend is negative and the predicted increase in orthophosphate concentration is lower than the absolute value of the Sens Slope, then the test passes. This assessment has used the EPA WFD App data relating to waterbody monitoring and characterisation downloaded in December 2021.

Baseline OP monitoring data and associated thresholds were not available for Moy_070, Moy_080, Moy_090, Moy_100, Moy_110, Moy_120, Spaddagh_010 RWB, and so a surrogate status is derived from the OP indicative quality of adjacent RWBs. The mid-range of the surrogate status is used as the baseline concentration

Table 3: Surface and groundwater bodies within the WSZ with a hydrological or hydrogeological connection to European Sites

Site Name (Code)	Contributing WB Code_Name	WB Type[3]	P Status[4] and Trends[5]	Baseline[6] P Conc.[7] (mg/l)	75% of Status Threshold (mg/l)	Cumulative Ortho P load to SW and GW[8]	Modelled Conc.[9] (mg/l)	Potential Baseline Conc. @ 1.0 mg/l dosage rate	Evaluation
Killala Bay/ Moy Estuary SAC (000458)	IE_WE_420_0300 Moy Estuary	TWB	High	Summer 0.0110/ Winter 0.0150	0.0188	221.1	0.0001	0.0111/ 0.0151	No risk of deterioration to OP indicative WQ.
	IE_WE_420_0000 Killala Bay	CWB	High	Summer 0.0125/ Winter 0.0125	0.0188	221.1	0.0001	0.0126	No risk of deterioration to OP indicative WQ.
Balla Turlough SAC (000463)	IE_WE_G_0033 Swinford	GWB	Good	0.0070	0.0263	2.4	0.00001	0.0070	No risk of deterioration to OP indicative WQ.
Lackan Saltmarsh & Kilcummin Head SAC (000516)	IE_WE_420_0000 Killala Bay	CWB	High	Summer 0.0125/ Winter 0.0125	0.0188	221.1	0.0001	0.0126	No risk of deterioration to OP indicative WQ.
Urlaur Lakes SAC (001571)	IE_WE_G_0033 Swinford	GWB	Good	0.0070	0.0263	2.4	0.00001	0.0070	No risk of deterioration to OP indicative WQ.
River Moy SAC (002298)	IE_WE_G_0032 Kilkelly Charlestown	GWB	Good	0.0050	0.0263	0.2	0.00001	0.0050	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0033 Swinford	GWB	Good	0.0070	0.0263	2.4	0.00001	0.0070	No risk of deterioration to OP indicative WQ.
	IE_WE_G_0034 Foxford	GWB	Good	0.0050	0.0263	0.6	0.00001	0.0050	No risk of deterioration to OP indicative WQ.

[3] Monitoring period is annual unless specified.
[4] Surrogate Status indicated in italic.
[5] Distance to threshold in parentheses.
[6] Baseline year is 2014.
[7] Surrogate concentration is given in italic mg/l
[8] Cumulative Ortho P load to SW and GW from upstream dosing areas, leakage, DWWTS and agglomerations (kg/yr).
[9] Values above 5% of Good / High boundary (0.00125 mg/l) for SW or 5% of Good / Fail boundary (0.00175 mg/l) for GW highlighted in yellow.

	IE_WE_G_0108 Swinford Gravels	GWB	Good	0.0175	0.0263	0.1	0.000005	0.0175	No risk of deterioration to OP indicative WQ.
	IE_WE_34M020500 Moy_070	RWB	High	0.0086	0.0188	196.2	0.0004	0.0090	No risk of deterioration to OP indicative WQ.
	IE_WE_34M020650 Moy_080	RWB	High	0.101	0.0188	221.1	0.0003	0.0104	No risk of deterioration to OP indicative WQ.
	IE_WE_34M020750 Moy_090	RWB	High	0.0118	0.0188	208.6	0.0003	0.0121	No risk of deterioration to OP indicative WQ.
	IE_WE_34M020800 Moy_100	RWB	High	0.0074	0.0188	372.1	0.0002	0.0076	No risk of deterioration to OP indicative WQ.
	IE_WE_34M020850 Moy_110	RWB	High	0.0125	0.0188	372.6	0.0002	0.0127	No risk of deterioration to OP indicative WQ.
	IE_WE_34M021100 Moy_120	RWB	High	0.0069	0.0188	409.1	0.0002	0.0071	No risk of deterioration to OP indicative WQ.
	IE_WE_34S030200 Spaddagh_010	RWB	High	0.0068	0.0188	0.1	0.000004	0.0068	No risk of deterioration to OP indicative WQ.
	IE_WE_34S050300 Swinford_010	RWB	High	0.0108	0.0188	5.2	0.0004	0.0112	No risk of deterioration to OP indicative WQ.
Killala Bay/ Moy Estuary SPA (004036)	IE_WE_420_0300 Moy Estuary	TWB	High	Summer 0.0110/ Winter 0.0150	0.0188	221.1	0.0001	0.0111/ 0.0151	No risk of deterioration to OP indicative WQ.
	IE_WE_420_0000 Killala Bay	CWB	High	Summer 0.0125/ Winter 0.0125	0.0188	221.1	0.0001	0.0126	No risk of deterioration to OP indicative WQ.

5.3.1 Assessment of direct impact from WWTPs and Storm Water Overflows

The conceptual model developed for P transfer identifies a number of pathways by which OP can reach receptors. In the case of these pathways, factors contributing to the potential direct impacts are:

- the quantitative increase in P loading to wastewater collecting systems;
- the efficiency of P removal at WWTPs;
- the increased P loading to surface waters via storm water overflows; and
- the sensitivity of receptors.

For the purposes of assessing the potential impact on the receiving environment within the EAM, a number of scenarios have been assessed at the agglomerations which receive water from the WSZ (**Table 4**). The baseline OP indicative water quality in the existing situation prior to OP dosing is established and compared to the potential loading to the receiving waters post-dosing. In-combination impacts of the operation of the SWO and the continuous discharge from the WWTP were also assessed within the EAM.

The pre-dosing scenario is based on a mass balance calculation of both the intermittent SWO discharges, in combination with the continuous discharge from the WWTP. A comparison of the pre- and post-dosing scenarios is made to identify changes in predicted concentrations downstream of the point of discharge. A summary of the results and evaluation of orthophosphate dosing downstream of each agglomeration is provided below.

Table 4 provides the data used for the WWTP continuous discharge, and the SWO intermittent discharge, to compare with the emission limit values (ELVs) from the waste water discharge licence (WWDL) (if it has been set) that are applicable to the agglomeration discharge to transitional waters or freshwaters.

Table 4: Increased loading/concentration due to Orthophosphate Dosing – Dosing rate = 1.0 mg/l P

Agglom. & Discharge Type	ELV from WWDL		TP Load Kg/yr	Ortho P Concentration mg/l *TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)*		
				0.5	*0.4*	*0.68*
Swinford Primary Discharge	**Ortho-P 0.15 mg/l**	**Existing**	89	0.09	0.07	0.12
		Post Dosing	89	0.09	0.07	0.12
		% Increase	0%	0%	0%	0%
Swinford SWOs (1 No.)		**Existing**	89	0.44	0.35	0.60
		Post Dosing	93	0.46	0.37	0.62

Swinford WWTP Agglomeration

Swinford WWTP Agglomeration provides tertiary treatment, i.e. chemical dosing for Phosphorus removal. The ELV set for this agglomeration is 0.15 mg/l of OP. This ELV is not exceeded by the current effluent concentrations and therefore, as outlined in the EAM methodology, it has been assumed that the additional P load to the plant from OP dosing can be completely removed. Swinford agglomeration discharges into Swinford_010 river waterbody which is hydrologically connected to River Moy SAC. The SWO concentration increases from 0.44 mg/l P to 0.46 mg/l P (4%) as a result of the OP dosing.

5.3.2 Combined assessment of direct and indirect impacts to receiving waterbodies

This section presents the results of the EAM regarding the combined loading as a result of increased OP load from the WWTP discharge, seepage from mains and DWWTS. There are upstream and

downstream dosing areas to Swinford WTP, and the cumulative impacts have been considered for these areas in the EAM (Appendix C) and are assessed herein for the downstream waterbodies.

River waterbodies

- Spaddagh_010 (IE_WE_34S30200), Swinford_010 (IE_WE_34S050300), Moy_070 (IE_WE_34M020500), Moy_080 (IE_WE_34M020650), Moy_090 (IE_WE_34M020750), Moy_100 (IE_WE_34M020800), Moy_110 (IE_WE_34M020850) and Moy_120 (IE_WE_34M021100) are hydrologically connected to the **River Moy SAC**.

A significant proportion of the OP loading to river waterbodies arises from primary discharges and SWOs from WWTPs and mains seepage through the preferential pathway. The increase in OP concentrations in river waterbodies following dosing is up to 0.0004 mg/l P (**Table 3; Appendix C**). All RWBs have predicted dosing concentrations below the 5% of Good/ High boundary (0.00125mg/l P) and within the 75% of upper threshold; and there is no disk of deterioration in the OP indicative water quality of any RWBs.

Groundwater bodies

- Swinford groundwater body (IE_WE_G_0033) is hydrologically connected to **Balla Turlough SAC, Urlaur Lakes SAC** and the **River Moy SAC**.

- Kilkelly Charlestown (IE_WE_G_0032) groundwater body is hydrologically connected to **Balla Turlough SAC** and the **River Moy SAC**.

The increase in OP concentration in the downstream transitional and coastal waterbodies as a result of the OP dosing is up to 0.00001 mg/l P. All GWBs have predicted dosing concentrations below the 5% of Good/ Fail boundary (0.00175 mg/l P) and within the 75% of upper threshold and therefore there is no risk of deterioration in the OP indicative water quality of this waterbody or any other GWBs.

Transitional

- Moy Estuary (IE_WE_420_0300) transitional waterbody is hydrologically linked to **Killala Bay/ Moy Estuary SPA** and **Killala Bay/ Moy Estuary SAC**.

The increase in OP concentration in the downstream transitional waterbodies as a result of the OP dosing is up to 0.0001 mg/l P. Predicted dosing concentrations from this project are below the 5% Good/ High boundary (0.00125 mg/l P) and within the 75% of upper threshold and therefore there is no risk of deterioration in the OP indicative water quality of these transitional waterbodies.

Coastal waterbodies

- Killala Bay (IE_WE_420_0000) coastal waterbody is hydrologically linked to **Killala Bay/ Moy Estuary SPA, Killala Bay/ Moy Estuary SAC** and **Lackan Saltmarsh and Kilcummin Head SAC**.

The increase in OP concentration in the downstream transitional and coastal waterbodies as a result of the OP dosing is up to 0.0001 mg/l P. Predicted dosing concentrations from this project are below the 5% Good/ High boundary (0.00125 mg/l P) and within the 75% of upper threshold and therefore there is no risk of deterioration in the OP indicative water quality of these transitional and coastal waterbodies.

5.3.3 Conclusions

The EAM model data identifies that additional OP dosing as part of this Project does not cause a deterioration in the OP indicative water quality of any river waterbody or groundwater body listed in **Table 3**. Concentrations from other dosing areas with regard to cumulative loading on downstream waterbodies has been considered in this assessment. Section 6 evaluates the 'no deterioration' in the context of AA and the QIs of the European Sites.

6. EVALUATION OF POTENTIAL FOR SIGNIFICANT EFFECTS

The key pressure associated with the proposed OP dosing is the potential for increased OP levels in the receiving waters and the connectivity to the qualifying interests (habitats and species) identified in **Table 2** that are both water dependent and nutrient sensitive (**Appendix B**). Six European sites remain for evaluation of potential for significant effect: **Killala Bay/ Moy Estuary SAC (000458)**, **Balla Turlough SAC (000463)**, **Lackan Saltmarsh and Kilcummin Head SAC (000516)**, **Urlaur Lakes SAC (001571)**, **River Moy SAC (002298)** and **Killala Bay/ Moy Estuary SPA (004036)**. The potential for the proposed OP dosing to give rise to significant effects on these habitats and species, in view of their conservation objectives, are assessed in detail below.

6.1 KILLALA BAY/ MOY ESTUARY SAC 000458

6.1.1 (1014) Narrow-mouthed whorl snail (*Vertigo angustior*)

Vertigo angustior is a terrestrial groundwater-dependant species. There is one known site for this species in this SAC occurring in an area of wet marsh. This site represents one of the few remaining examples of *Vertigo angustior* in its marsh "phase" and the snail has been known at this site for over 100 years. The target is to ensure 'no decline'. A review of the SSCOs targets and measures for *Vertigo angustior* found no nutrient specific targets for the species (NPWS, 2012a[10]). However, the IUCN Red List[11] of threatened species lists eutrophication as a 'main threat' to this species. Increases in P levels would allow higher vegetation to grow and outcompete the yellow sedge and moss habitat that is required by the snail.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to Narrow-mouthed whorl snail in the Killala Bay/ Moy Estuary SAC. Killala Bay/ Moy Estuary SAC is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary transitional water body has a 'high' OP indicative water quality, a baseline concentration of 0.0110 mg/l P in summer and 0.0150 mg/l P in winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0111mg/l P in summer and 0.0151 mg/l P in winter following dosing, and a 'high' OP indicative water quality following dosing.

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of transitional and coastal waterbodies, connected to the Narrow-mouthed whorl snail habitat in Killala Bay/ Moy Estuary SAC. Therefore, potential for significant effects on this species in Killala Bay/ Moy Estuary SAC can be excluded.

[10] NPWS (2012a) Conservation Objectives: Killala Bay/Moy Estuary SAC 000458. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
[11] Moorkens, E., Killeen, I., Seddon, M. (2012). *Vertigo angustior*. The IUCN Red List of Threatened Species 2012: e.T22935A16658012.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the species / no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these waterbodies has been demonstrated.

6.1.2 (1095) Sea Lamprey (*Petromyzon marinus*)

This SAC only covers the estuarine portion of the River Moy, the river section is dealt with in **Section 6.4** River Moy SAC. The estuary is generally in a natural state and is considered to be one of the best examples of a largely unpolluted system in Ireland. A review of the SSCOs (NPWS, 2012a[9]) for the site found no nutrient specific targets for this habitat. Adult sea lamprey spawn in open channel areas of large rivers. Young adult sea lamprey can be found migrating downriver to estuarine waters in late autumn/ winter. Young adult sea lamprey reportedly feed in estuarine waters (NPWS, 2013c[12]). Deterioration in water quality has the potential for a detrimental effect on feeding habitats, particularly where nutrient conditions result in excessive algal growth and macrophyte abundance, leading to smothering, shading effects, alteration of macroinvertebrate communities and silt deposition.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to sea lamprey in the Killala Bay/ Moy Estuary SAC. Killala Bay/ Moy Estuary SAC is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary transitional water body has a 'high' OP indicative water quality, a baseline concentration of 0.0110 mg/l P in summer and 0.0150 mg/l P in winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0111mg/l P in summer and 0.0151 mg/l P in winter following dosing, and a 'high' OP indicative water quality following dosing.

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of transitional and coastal waterbodies, connected to sea lamprey and their habitat in Killala Bay/ Moy Estuary SAC. Therefore potential for significant effects on this species in Killala Bay/ Moy Estuary SAC can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the species / no deterioration of its favourable conservation condition is identified as no change to the WFD OP indicative water quality for these waterbodies has been demonstrated.

6.1.3 (1130) Estuaries and (1140) Mudflats and sandflats not covered by seawater at low tide

'Estuaries' habitats are defined as the downstream part of a river valley, subject to the tide and extending from the limit of brackish water with a significant freshwater influence. 'Mudflats and sandflats not covered by seawater at low tide' are found exclusively between the low water and mean high water marks and contain sediment ranging from around 1 µ to 2 mm. Finer silt and clay sediments are dominant

[12] NPWS (2013c) The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3. Version 1.0. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

in mud flats and associated with rivers and the larger sand fractions are associated with areas exposed to significant wave energy.

The attributes and targets set out in the SSCO are: to maintain the extent of Zostera-dominated community, to conserve the high quality of the Zostera-dominated community and to conserve community types (Muddy sand to fine sand dominated by *Hydrobia ulvae*, *Pygospio elegans* and *Tubificoides benedii* community complex; Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex; and Fine sand dominated by *Nephtys cirrosa* community complex) in a natural condition (NPWS, 2012a[9]). Pressures and threats to this habitat associated with the current project include nutrient/ P enrichment which can be associated with accelerated growth of macroalgae/ phytoplankton or reduced concentrations of dissolved oxygen.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to estuarine and mudflat habitat in Killala Bay/ Moy Estuary SAC. Killala Bay/ Moy Estuary SAC is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary transitional water body has a 'high' OP indicative water quality, a baseline concentration of 0.0110 mg/l P in summer and 0.0150 mg/l P in winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0111mg/l P in summer and 0.0151 mg/l P in winter following dosing, and a 'high' OP indicative water quality following dosing.

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of transitional and coastal waterbodies, connected to estuarine and mudflat habitat in Killala Bay/ Moy Estuary SAC. Therefore potential for significant effects on these habitats in Killala Bay/ Moy Estuary SAC can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of these habitats / no deterioration of their favourable conservation condition is identified as no change to the OP indicative water quality for these waterbodies has been demonstrated.

6.1.4 (1210) Annual vegetation of drift lines

This type of vegetation occurs on sandy, shingle or stony substrate at the upper part of the strand, around the high tide mark. Water-borne material including organic matter is deposited on the shore and provides nutrients and a seed source for vegetation. Attributes and targets set out in the SSCO relevant to the proposed project are: to maintain the presence of species-poor communities with typical species: sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*), prickly saltwort (*Salsola kali*) and Orache (*Atriplex* spp.); and that negative indicator species inclusive of species indicative of changes in nutrient status, are to represent < 5% cover (NPWS, 2012a[9]).

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to annual vegetation of drift lines habitat in Killala Bay/ Moy Estuary SAC. Killala Bay/ Moy Estuary SAC is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary transitional water body has a 'high' OP indicative water quality, a baseline concentration of 0.0110 mg/l P in summer and 0.0150 mg/l P in winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0111mg/l P in summer and 0.0151 mg/l P in winter following dosing, and a 'high' OP indicative water quality following dosing.

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of transitional and coastal waterbodies, connected to annual vegetation of drift lines habitat in Killala Bay/ Moy Estuary SAC. Therefore potential for significant effects on this habitat in Killala Bay/ Moy Estuary SAC can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat / no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these waterbodies has been demonstrated.

6.1.5 (1310) Salicornia and other annuals colonising mud and sand; and (1330) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Saltmarshes are stands of vegetation that occur along sheltered coasts, mainly on mud or sand, and are flooded periodically by the sea. They are restricted to the area between mid-neap tide level and high water spring tide level. Salicornia and other annuals colonising mud and sand is a pioneer saltmarsh community that can occur on muddy sediment seaward of established saltmarsh, or form patches within other saltmarsh communities where the elevation is suitable and there is regular tidal inundation (NPWS, 2012b[13]). Two out of four sub-sites that were surveyed had this habitat present. However, further surveyed areas maybe present within the site in suitable areas. Atlantic salt meadows is the dominant saltmarsh habitat at the site with four sub-sites mapped and further potential sites being noted. The SSCO supporting document on coastal habitats for Killala Bay/ Moy Estuary SAC states that the target is to ensure that the hydrological regime continues to function naturally and that there are no increased nutrient inputs in the groundwater.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to 1310 and 1330 habitat in Killala Bay/ Moy Estuary SAC. Killala Bay/ Moy Estuary SAC is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary transitional water body has a 'high' OP indicative water quality, a baseline concentration of 0.0110 mg/l P in summer and 0.0150 mg/l P in winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0111mg/l P in summer and 0.0151 mg/l P in winter following dosing, and a 'high' OP indicative water quality following dosing.

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential

[13] NPWS (2012b) Killala Bay/ Moy Estuary SAC (site code: 458). Conservation objectives supporting document – coastal habitats Version 1.

concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of transitional and coastal waterbodies, connected to 1310 and 1330 habitat in Killala Bay/ Moy Estuary SAC. Therefore potential for significant effects on these habitats in Killala Bay/ Moy Estuary SAC can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of these habitats/ no deterioration of their favourable conservation condition is identified as no change to the OP indicative water quality for these waterbodies has been demonstrated.

6.1.6 (1365) Harbour seal (*Phoca vitulina*)

The harbour seal is the smaller of two species of the Phocidae genus that commonly breed around the coast of Ireland and has a preference for inhabiting enclosed sheltered coastal bays and estuaries. 102 seals were counted in 2010 in the Moy estuary. Attributes and targets set out by the SSCO which bear specific relevance to this project are: to conserve the breeding sites in a natural condition; to conserve the moult haul-out sites in a natural condition; to conserve the resting haul-out sites in a natural condition; and that human activities should occur at levels that do not affect the harbour seal population at the site. The orthophosphate dosing has the potential to alter the natural condition of the sites by increasing the P concentrations.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to harbour seal in Killala Bay/ Moy Estuary SAC. Killala Bay/ Moy Estuary SAC is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary transitional water body has a 'high' OP indicative water quality, a baseline concentration of 0.0110 mg/l P in summer and 0.0150 mg/l P in winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0111mg/l P in summer and 0.0151 mg/l P in winter following dosing, and a 'high' OP indicative water quality following dosing.

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of transitional and coastal waterbodies, connected to harbour seal in Killala Bay/ Moy Estuary SAC. Therefore potential for significant effects on this species in Killala Bay/ Moy Estuary SAC can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the species / no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these waterbodies has been demonstrated.

6.2 BALLA TURLOUGH SAC 000463

6.2.1 (3180) Turloughs

Balla Turlough has a considerable accumulation of peat in its basin, marl deposits are present and water is more permanent in its southern end with water in the western side fluctuating. It is one of the very few turloughs in the Moy catchment. It has high ecological value due to its unusual topographic features and vegetation communities (Amphibious Bistort and sedges in wet grassland and Mat-grass and Quaking-grass in drier areas). It is considered an important example of an unusual turlough in a very natural condition.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to Balla Turlough (SAC). Balla Turlough mostly overlies Swinford groundwater body but has a very small portion overlying Kilkelly Charlestown groundwater body also. Given the short flowpaths (~300m) within the Kilkelly Charlestown groundwater body and its distance from the dosing area there is no potential for hydrological connectivity to the Balla Turlough SAC via this groundwater body. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Swinford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0070 mg/l P, a cumulative load of 2.4 kg/yr, a potential concentration following dosing of up to 0.0070 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of groundwater bodies connected to Balla Turlough (SAC). Therefore potential for significant effects on this habitat can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat / no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these groundwater bodies has been demonstrated.

6.3 LACKAN SALTMARSH AND KILCUMMIN HEAD SAC 000516

6.3.1 *Salicornia* and other annuals colonising mud and sand [1310], Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330], Mediterranean salt meadows (*Juncetalia maritimi*) [1410]

Saltmarshes are stands of vegetation that occur along sheltered coasts, mainly on mud or sand, and are flooded periodically by the sea. They are restricted to the area between mid-neap tide level and high water spring tide level. *Salicornia* and other annuals colonising mud and sand is a pioneer saltmarsh community that can occur on muddy sediment seaward of established saltmarsh, or form patches within other saltmarsh communities where the elevation is suitable and there is regular tidal inundation About 0.001 ha, 28.27 ha and 66 ha of area has been estimated for 1310, 1330 and 1410 respectively in Lackan Saltmarsh and Kilcummin Head SAC (NPWS, 2016)[14]. The SSCO supporting document on coastal habitats for Lackan Saltmarsh and Kilcummin Head SAC states that negative indicators include non-native species (e.g. *Hippophae rhamnoides*), species indicative of changes in nutrient status (e.g. *Urtica dioica*) and species not considered characteristic of the habitat. Sea buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. Additionally, changes in nutrient gradient can alter vegetation composition and structure, and therefore there should be no increases in nutrient inputs.

[14] NPWS (2016) Lackan Saltmarsh and Kilcummin Head SAC (site code: 516). Conservation objectives supporting document –coastal habitats Version 1.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to saltmarsh habitats in Lackan Saltmarsh and Kilcummin Head SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality status of Killala Bay coastal waterbody, connected to saltmarsh habitats in in Lackan Saltmarsh and Kilcummin Head SAC. Therefore potential for significant effects on these habitats in Lackan Saltmarsh and Kilcummin Head SAC can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of these habitats / no deterioration of their favourable conservation condition is identified as no change to the OP indicative water quality for these waterbodies has been demonstrated.

6.3.2 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120], Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]

Sand dunes are hills of wind-blown sand that have become progressively more stabilised by a cover of vegetation. In general, most sites display a progression through strandline, foredunes, mobile dunes and fixed dunes. Where the sandy substrate is decalcified, fixed dunes may give way to dune heath. Wet hollows, or dune slacks, occur where the dunes have been eroded down to the level of the water table. Transitional communities can occur between dune habitats and they may also form mosaics with each other. Dune systems are in a constant state of change and maintaining this natural dynamism is essential to ensure that all of the habitats present at a site achieve favourable conservation condition (NPWS, 2016). The two dune habitats listed as qualifying interests for Lackan Saltmarsh and Kilcummin Head SAC include mobile areas at the front as well as more stabilised parts of dune systems. Nutrient poor status is crucial for the survival of certain vegetation types that exist here and therefore there should be no increases in nutrient inputs arising from this project.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to dune habitats in Lackan Saltmarsh and Kilcummin Head SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of Killala Bay coastal waterbody, connected to dune habitats in Lackan Saltmarsh and Kilcummin Head SAC. Therefore potential for significant effects on these habitats in Lackan Saltmarsh and Kilcummin Head SAC can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of these habitats / no deterioration of their favourable conservation condition is identified as no change to the OP indicative water quality for this waterbody has been demonstrated.

6.4 URLAUR LAKES SAC 001571

6.4.1 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3140]

Urlaur lakes contains three marl lakes with habitat 3140. After having been assessed in 2012, the vegetation was reported as being in poor condition. SSCOs (NPWS, 2017[15]) are to 'restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species. Specifically, the SSCOs for this habitat identify that the annual average TP concentration should be ≤10 µg/l TP.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to Urlaur Lakes SAC. Urlaur Lakes SAC overlies Swinford and Kilkelly Charlestown groundwater bodies. Given the short flowpaths (~300m) within the Kilkelly Charlestown groundwater body and its distance from the dosing area there is no potential for hydrological connectivity to the Balla Turlough SAC via this groundwater body. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Swinford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0070 mg/l P, a cumulative load of 2.4 kg/yr, a potential concentration following dosing of up to 0.0070 mg/l P and an unchanged OP indicative water quality, i.e. 'good'

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of groundwater bodies connected to Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. in Urlaur Lakes SAC. Therefore potential for significant effects on this habitat can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the habitat / no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these groundwater bodies has been demonstrated.

6.5 RIVER MOY SAC 002298

6.5.1 (1092) White-clawed crayfish (*Austropotamobius pallipes*)

White-clawed crayfish are widespread in the upper tributaries of the River Moy and the rivers that feed Lough Conn and Lough Cullin. It is absent from the main River Moy. A review of the targets and measures outlined in SSCO (NPWS, 2016b[16]) identified a water quality target of at least Q3-Q4 for White-clawed crayfish populations in the River Moy, which equates to moderate ecological status or better, therefore any reduction in water quality as a result of P loading would be contrary to the conservation objectives for this species.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to River Moy SAC. River Moy

[15] NPWS (2017) Conservation Objectives: Urlaur Lakes SAC 001571. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.
[16] NPWS (2016b) Conservation Objectives: River Moy SAC 002298. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

SAC overlies Swinford, Foxford, Swinford Gravels and Kilkelly Charlestown groundwater bodies. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Spaddagh_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0068 mg/l P, a cumulative load of 0.1 kg/yr, a baseline following dosing of up to 0.0068 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Swinford_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0108 mg/l P, a cumulative load of 5.2 kg/yr, a baseline following dosing of up to 0.0112 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_070 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0086 mg/l P, a cumulative load of 196.2 kg/yr, a baseline following dosing of up to 0.0090 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_080 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0101 mg/l P, a cumulative load of 221.1 kg/yr, a baseline following dosing of 0.0104 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_090 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0118 mg/l P, a cumulative load of 208.6 kg/yr, a baseline following dosing of up to 0.0121 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_100 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0074 mg/l P, a cumulative load of 372.1 kg/yr, a baseline following dosing of up to 0.0076 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_110 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative load of 372.6 kg/yr, a baseline following dosing of up to 0.0127 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_120 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0069 mg/l P, a cumulative load of 409.1 kg/yr, a baseline following dosing of up to 0.0071 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of surface and groundwater bodies connected to White-clawed crayfish populations and their habitats in the River Moy SAC. Therefore potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the white-clawed crayfish / no deterioration of its favourable conservation condition in the River Moy SAC is identified as no change to the OP indicative water quality for these surface water and groundwater bodies has been demonstrated.

6.5.2 (1095) Sea lamprey (*Petromyzon marinus*), (1096) Brook Lamprey (*Lampetra planeri*) (1106) Atlantic salmon (*Salmo salar*)

Water quality is a particular threat to all fish fauna listed as qualifying interests. The latest Red List of Irish amphibians, reptiles & freshwater fish (King et al., 2011[17]) highlights the deterioration in water quality and ongoing point and diffuse sources of pollution as a key threat to these species and includes the potential effects from municipal discharges. The SSCO (NPWS, 2016b[20]) for these fish species requires that the spawning habitat should not be reduced. A deterioration in water quality has the potential for a detrimental effect on spawning habitats, particularly where nutrient conditions result in excessive algal growth and macrophyte abundance, leading to smothering, shading effects, alteration of macroinvertebrate communities and silt deposition. The SSCO (NPWS, 2016b[20]) for salmon requires a Q value of at least 4, which equates to good ecological status.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to the above listed fish fauna in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Spaddagh_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0068 mg/l P, a cumulative load of 0.1 kg/yr, a baseline following dosing of up to 0.0068 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Swinford_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0108 mg/l P, a cumulative load of 5.2 kg/yr, a baseline following dosing of up to 0.0112 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_070 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0086 mg/l P, a cumulative load of 196.2 kg/yr, a baseline following dosing of up to 0.0090 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_080 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0101 mg/l P, a cumulative load of 221.1 kg/yr, a baseline following dosing of 0.0104 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_090 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0118 mg/l P, a cumulative load of 208.6 kg/yr, a baseline following dosing of up to 0.0121 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_100 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0074 mg/l P, a cumulative load of 372.1 kg/yr, a baseline following dosing of up to 0.0076 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_110 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative load of 372.6 kg/yr, a baseline following dosing of up to 0.0127 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

[17] King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

- Moy_120 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0069 mg/l P, a cumulative load of 409.1 kg/yr, a baseline following dosing of up to 0.0071 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of surface and groundwater bodies connected to lamprey spp. and Atlantic salmon populations and their habitat in the River Moy SAC. Therefore potential for significant effects on these species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the Atlantic salmon and lamprey species populations in the River Moy SAC / no deterioration of their favourable conservation condition is identified as no change to the OP indicative water quality for these surface water and groundwater bodies has been demonstrated.

6.5.6 (1355) Otter (*Lutra lutra*)

A review of the CO (NPWS, 2016b[20]) highlighted potential habitat for Otter to include a 10m terrestrial buffer along lake shorelines and river banks as the critical area but no specific attributes or targets relating to water quality. However the National Parks & Wildlife Service's Threat Response Plan for the Otter (NPWS, 2009[16]), a review of and response to the pressures and threats to otters in Ireland, categorized three principal risks to otters: i) habitat destruction and degradation; ii) water pollution; and, iii) accidental death and/or persecution.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to otter in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Spaddagh_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0068 mg/l P, a cumulative load of 0.1 kg/yr, a baseline following dosing of up to 0.0068 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Swinford_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0108 mg/l P, a cumulative load of 5.2 kg/yr, a baseline following dosing of up to 0.0112 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_070 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0086 mg/l P, a cumulative load of 196.2 kg/yr, a baseline following dosing of up to 0.0090 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_080 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0101 mg/l P, a cumulative load of 221.1 kg/yr, a baseline following dosing of 0.0104 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_090 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0118 mg/l P, a cumulative load of 208.6 kg/yr, a baseline following dosing of up to 0.0121 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_100 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0074 mg/l P, a cumulative load of 372.1 kg/yr, a baseline following dosing of up to 0.0076 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_110 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative load of 372.6 kg/yr, a baseline following dosing of up to 0.0127 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_120 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0069 mg/l P, a cumulative load of 409.1 kg/yr, a baseline following dosing of up to 0.0071 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of surface and groundwater bodies connected to otter habitat in the River Moy SAC. Therefore potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the otter / no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these surface water and groundwater bodies has been demonstrated.

6.5.7 (7110) Active raised bogs*, (7120) Degraded raised bogs still capable of natural regeneration; (7150) Depressions on peat substrates of the Rhynchosporion

Raised bogs are identified at 5 locations throughout the SAC. The bogs of the River Moy SAC are examples of raised bogs at the north-western edge of its range. Ombrotophic peat waters found on the surface of raised bogs are characterised by low pH values and have low values of electrical conductivity (EC). Raised bog systems mainly derives its mineral supply from precipitation, which is usually acidic and low in nutrients. Hydrochemistry data has been reported from two of the bogs within the River Moy SAC; Derrynabrock Bog and Tawnaghbeg Bog. The hydrochemistry survey at Derrynabrock identified relatively low EC values in drains within the cutover to the south of the bog suggesting little if any mineral ground water influence. At Tawnaghbeg Bog, the hydrochemistry survey identified relatively low EC values in drains on the high bog and in drains along the east of the bog. However, more elevated EC values were recorded in the main channels draining the bog suggesting some mineral enriched groundwater influence in these channels. The SSCO target for the attribute water quality is: Water quality on the high bog and in transitional areas close to natural reference conditions (NPWS, 2016b[19]).

Peatlands are highly sensitive to air pollution, in particular nitrogen deposition, which can result in nutrient enrichment and a decline in species that are sensitive to these conditions. Nitrogen is commonly a limiting terrestrial nutrient. In the case of this SAC nitrogen deposition should not exceed 5kg N/ha/yr. Total N deposition in the vicinity of the bogs in the River Moy Sac is reported as 8.5kg N/ha/yr. Eutrophication due to Nitrogen deposition in combination with eutrophication due to water quality may have a potential impact on the site.

COs of degraded raised bogs and for Depressions on peat substrates of the Rhynchosporion are the same as those above for raised bogs. Similarly, the system is largely influenced by atmospheric inputs (rainwater). However, as for raised bogs, within the soak systems, water chemistry is affected by other inputs including groundwater. Targets for nitrogen deposition, which can influence nutrient concentrations in the system, are as for raised bogs above. Depressions on peat substrate habitats are dependent on the success of raised bog habitats.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to raised bog habitat in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality conditions on:

- Swinford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0070 mg/l P, a cumulative load of 2.4 kg/yr, a potential concentration following dosing of up to 0.0070 mg/l P and an unchanged WFD OP indicative water quality, i.e. 'good'.

- Kilkelly Charlestown groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0050 mg/l P, a cumulative load of 0.2 kg/yr, a potential concentration following dosing of up to 0.0050 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Foxford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0050 mg/l P, a cumulative load of 0.6 kg/yr, a potential concentration following dosing of up to 0.0050 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Swinford Gravels groundwater body has a surrogate 'good' indicative OP indicative water quality, a baseline concentration of 0.0175 mg/l P, a cumulative load of 0.1 kg/yr, a potential concentration following dosing of 0.0175 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Spaddagh_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0068 mg/l P, a cumulative load of 0.1 kg/yr, a baseline following dosing of up to 0.0068 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Swinford_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0108 mg/l P, a cumulative load of 5.2 kg/yr, a baseline following dosing of up to 0.0112 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_070 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0086 mg/l P, a cumulative load of 196.2 kg/yr, a baseline following dosing of up to 0.0090 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_080 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0101 mg/l P, a cumulative load of 221.1 kg/yr, a baseline following dosing of 0.0104 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_090 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0118 mg/l P, a cumulative load of 208.6 kg/yr, a baseline following dosing of up to 0.0121 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_100 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0074 mg/l P, a cumulative load of 372.1 kg/yr, a baseline following dosing of up to 0.0076 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_110 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative load of 372.6 kg/yr, a baseline following dosing of up to 0.0127 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_120 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0069 mg/l P, a cumulative load of 409.1 kg/yr, a baseline following dosing of up to 0.0071 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of surface and groundwater bodies connected to raised bog and peat habitat in the River Moy SAC. Therefore potential for significant effects on these habitats can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of raised bog and peat habitats/ no deterioration of their favourable conservation condition is identified as no change to the OP indicative water quality for these surface water and groundwater bodies has been demonstrated.

6.5.10 (7230) Alkaline fens

Alkaline fens are known to occur as part of the wetland complex on the Glore River, north-west of Ballyhaunis. However, it's likely this habitat occurs in other areas. The habitat is influenced by groundwater and surface water flows. Fens are generally poor in nitrogen and phosphorus and phosphorus is a limiting nutrient. The target identified in the SSCOs is to provide the appropriate water quality to support the natural structure and functioning of the habitat.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Swinford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0070 mg/l P, a cumulative load of 2.4 kg/yr, a potential concentration following dosing of up to 0.0070 mg/l P and an unchanged WFD OP indicative water quality, i.e. 'good'.

- Kilkelly Charlestown groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0050 mg/l P, a cumulative load of 0.2 kg/yr, a potential concentration following dosing of up to 0.0050 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Foxford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0050 mg/l P, a cumulative load of 0.6 kg/yr, a potential concentration following dosing of up to 0.0050 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Swinford Gravels groundwater body has a surrogate 'good' indicative OP indicative water quality, a baseline concentration of 0.0175 mg/l P, a cumulative load of 0.1 kg/yr, a potential concentration following dosing of 0.0175 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Spaddagh_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0068 mg/l P, a cumulative load of 0.1 kg/yr, a baseline following dosing of up to 0.0068 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Swinford_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0108 mg/l P, a cumulative load of 5.2 kg/yr, a baseline following dosing of up to 0.0112 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_070 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0086 mg/l P, a cumulative load of 196.2 kg/yr, a baseline following dosing of up to 0.0090 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_080 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0101 mg/l P, a cumulative load of 221.1 kg/yr, a baseline following dosing of 0.0104 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_090 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0118 mg/l P, a cumulative load of 208.6 kg/yr, a baseline following dosing of up to 0.0121 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_100 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0074 mg/l P, a cumulative load of 372.1 kg/yr, a baseline following dosing of up to 0.0076 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_110 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative load of 372.6 kg/yr, a baseline following dosing of up to 0.0127 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_120 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0069 mg/l P, a cumulative load of 409.1 kg/yr, a baseline following dosing of up to 0.0071 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of surface and groundwater bodies connected to alkaline fen habitat in the River Moy SAC. Therefore, potential for significant effects on this species can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the alkaline fen habitat / no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these surface water and groundwater bodies has been demonstrated.

6.5.11 (91E0) Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*

An Alluvial forest site is identified within the River Moy SAC at Prospect on the western shores of Lough Conn. However, there are likely to be more sites within the SAC. Changes in nutrient levels may result in increase to the trophic status of the wood.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to alluvial woodland habitat in the River Moy SAC. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Swinford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0070 mg/l P, a cumulative load of 2.4 kg/yr, a potential concentration following dosing of up to 0.0070 mg/l P and an unchanged WFD OP indicative water quality, i.e. 'good'.

- Kilkelly Charlestown groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0050 mg/l P, a cumulative load of 0.2 kg/yr, a potential concentration following dosing of up to 0.0050 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Foxford groundwater body has a 'good' OP indicative water quality, a baseline concentration of 0.0050 mg/l P, a cumulative load of 0.6 kg/yr, a potential concentration following dosing of up to 0.0050 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Swinford Gravels groundwater body has a surrogate 'good' indicative OP indicative water quality, a baseline concentration of 0.0175 mg/l P, a cumulative load of 0.1 kg/yr, a potential concentration following dosing of 0.0175 mg/l P and an unchanged OP indicative water quality, i.e. 'good'.

- Spaddagh_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0068 mg/l P, a cumulative load of 0.1 kg/yr, a baseline following dosing of up to 0.0068 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Swinford_010 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0108 mg/l P, a cumulative load of 5.2 kg/yr, a baseline following dosing of up to 0.0112 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_070 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0086 mg/l P, a cumulative load of 196.2 kg/yr, a baseline following dosing of up to 0.0090 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_080 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0101 mg/l P, a cumulative load of 221.1 kg/yr, a baseline following dosing of 0.0104 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_090 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0118 mg/l P, a cumulative load of 208.6 kg/yr, a baseline following dosing of up to 0.0121 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_100 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0074 mg/l P, a cumulative load of 372.1 kg/yr, a baseline following dosing of up to 0.0076 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_110 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0125 mg/l P, a cumulative load of 372.6 kg/yr, a baseline following dosing of up to 0.0127 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

- Moy_120 river waterbody has 'high' OP indicative water quality, a baseline concentration of 0.0069 mg/l P, a cumulative load of 409.1 kg/yr, a baseline following dosing of up to 0.0071 mg/l P and a 'high' OP status following dosing, i.e. no change in OP indicative water quality.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of surface and groundwater bodies connected to Alluvial woodland habitat in the River Moy SAC. Therefore potential for significant effects on this habitat can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of Alluvial woodland/ no deterioration of its favourable conservation condition is identified as no change to the OP indicative water quality for these surface water and groundwater bodies has been demonstrated.

6.6 KILLALA BAY/ MOY ESTUARY SPA 004036

The SSCOs for Killala Bay/ Moy Estuary SPA (NPWS, 2013f[18]) list targets for each species (A137) Ringed Plover (*Charadrius hiaticula*), (A140) Golden Plover (*Pluvialis apricaria*), (A141) Grey Plover (*Pluvialis squatarola*), (A144) Sanderling (*Calidris alba*), (A149) Dunlin (*Calidris alpina alpine*), (A157) Bar-tailed Godwit (*Limosa lapponica*), (A160) Curlew (*Numenius arquata*), and (A162) Redshank (*Tringa tetanus*), specifically:

- Population trend: long term population trends should be stable or increasing; and
- Distribution: there should be no significant decrease in the range, timing or intensity of use of areas by the listed species, other than that occurring from natural patterns of variation.

Furthermore, the permanent area occupied by the wetland habitat (A999 – Wetlands) should be stable and not significantly lessened, other than that occurring from natural patterns of variation.

Changes in organic and nutrient loading to an estuary may have various consequences for the ecology of the estuarine system including changes in the abundances of some benthic invertebrates that form prey species for water birds (e.g. Burton et al. 2002[19]). This could have knock-on effects upon water bird foraging distribution, prey intake rates, and ultimately upon survival and fitness.

Table 3 identifies the surface and groundwater bodies that are hydrologically or hydrogeologically connected to the proposed OP dosing and which are further connected to the above listed bird species in Killala Bay/ Moy Estuary SPA. Killala Bay/ Moy Estuary SPA is situated downstream of the OP dosing area. The EAM (**Table 3; Appendix C**) has assessed the potential for impact on OP indicative water quality on:

- Moy Estuary transitional water body has a 'high' OP indicative water quality, a baseline concentration of 0.0110 mg/l P in summer and 0.0150 mg/l P in winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0111mg/l P in summer and 0.0151 mg/l P in winter following dosing, and a 'high' OP indicative water quality following dosing.

- Killala Bay coastal waterbody has a 'High' OP indicative water quality, a baseline concentration of 0.0125 mg/l P in summer and winter, a cumulative load of 221.1 kg/yr, a potential concentration of up to 0.0126 mg/l P in summer and winter following dosing, and a 'high' OP indicative water quality following dosing.

The EAM assessment results which evaluate the additional OP loading from dosing at Swinford WTP have demonstrated that there will be no change in the OP indicative water quality of transitional and coastal waterbodies, connected to the above listed bird species in Killala Bay/ Moy Estuary SPA. Therefore potential for significant effects on these species in Killala Bay/ Moy Estuary SPA can be excluded.

Furthermore, dosing will not prevent the maintenance of the favourable conservation condition of the bird species listed as qualifying interests for this SPA / no deterioration of their favourable conservation

[18] NPWS (2013) Conservation Objectives: Killala Bay/Moy Estuary SPA 004036. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

[19] Burton, N.H.K., Paipai, E., Armitage, M.J.S., Maskell, J.M., Jones, E.T., Struve, J., Hutchings, C.J. & Rehfisch, M.M. (2002) Effects of reductions in organic and nutrient loading on bird populations in estuaries and coastal waters of England and Wales. Phase 1 Report. BTO Research Report, No. 267 to English Nature, the Countryside Council for Wales and the Environment Agency. BTO. Thetford, UK.

condition is identified as no change to the OP indicative water quality for these waterbodies has been demonstrated.

6.7 ASSESSMENT OF IN-COMBINATION EFFECTS WITH OTHER PLANS OR PROJECTS

In order to ensure all potential effects upon European sites within the project's ZoI were considered, including those direct and indirect impact pathways that are a result of cumulative or in-combination effects, the following steps were completed:

1. Identify projects/ plans which might act in combination: identify all possible sources of effects from the project or plan under consideration, together with all other sources in the existing environment and any other effects likely to arise from other proposed projects or plans;
2. Impacts identification: identify the types of impacts that are likely to affect aspects of the structure and functions of the site vulnerable to change;
3. Define the boundaries for assessment: define boundaries for examination of cumulative effects; these will be different for different types of impact and may include remote locations;
4. Pathway identification: identify potential cumulative pathways (e.g., via water, air, etc.; accumulations of effects in time or space);
5. Prediction: prediction of magnitude/ extent of identified likely cumulative effects, and
6. Assessment: comment on whether or not the potential cumulative effects are likely to be significant.

A search of Mayo County Council planning enquiry system was conducted for developments that may have in-combination effects on European Sites with the ZoI. Plans relevant to the area were searched in order to identify any elements of the plans that may act cumulatively or in-combination with the proposed development.

Based on this search and the Project Teams knowledge of the study area a list of those projects and Plans which may potentially contribute to cumulative or in-combination impacts with the proposed project was generated and listed in **Table 5** below.

Table 5: In-Combination Impacts with Other Plans, Programmes and Policies

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects
Mayo County Council Development Plan 2022 – 2028 (Incorporating variation No. 1 made on the 13th of July 2015 and No. 2 made on the 16th of January 2017) The policies, objectives and zonings of relevance in the Mayo County Development Plan include under Infrastructure and Water Services: WS-01 It is an objective of the Council to ensure the provision of an adequate level of water services infrastructure throughout the County to meet domestic, commercial, industrial and other needs, having regard to the Core Strategy and Settlement Strategy of this Plan, the Water Services Investment Programme, the Rural Water Programme and Table 3 above and where it can be demonstrated that the development will not have significant effects on the environment including the integrity of the Natura 2000 network. WS-02 It is an objective of the Council to ensure a safe and secure water supply is provided in the County. WS-04 It is an objective of the Council to ensure that water services requirements of all new developments will not exceed existing water services infrastructural capacity available unless additional capacity is provided. Under Environment, Heritage & Amenity Strategy and Water Quality: WQ-01 It is an objective of the Council to implement the Western River Basin District Management Plan "Water Matters" 2009-2015 to ensure the protection, restoration and sustainable use of all waters in the County, including rivers, lakes, ground water, coastal and transitional waters, and to restrict development likely to lead to deterioration in water quality or quantity. WQ-02 It is an objective of the Council to require development in an unsewered area which includes a septic tank/proprietary effluent treatment unit and percolation area to be rigorously assessed in accordance with the accepted EPA Code of Practice for single houses or small communities, business, leisure centres and hotels, taking into account the cumulative effects of existing and proposed developments in the area. Any planning applications for development which require such systems shall be accompanied with an assessment carried out and certified by a suitably qualified person (i.e. the holder of an EPA FETAC certificate or equivalent) with professional indemnity insurance.	▪ N/A	The Mayo County Council Development Plan 2022 – 2028 emphasises the objectives of its water services which include enhancement and improved quality of the service to its customers. The plan also outlines the importance of compliance with the Western River Basin Management Plan (now replaced by the National Plan 2018-2011[20]), and emphasises compliance with environmental objectives. There is no potential for cumulative effects with these plans.

[20] DHPLG (2016) Public Consultation on the River Basin Management Plan for Ireland (2018-2021)

WQ-03 It is an objective of the Council to require any new development to connect to a public water supply or Group Water Scheme. Connections to wells for individual housing units in unserviced rural areas will only be considered where there is no public water main or Group Water Scheme serving the site and where it can be demonstrated that connection to the proposed well will not have significant effects on water quality or water quantity in the area and can provide a potable water supply in accordance with EU Drinking Water standards.		
River Basin Management Plan For Ireland 2022 – 2027 Public Consultation on the River Basin Management Plan (RBMP) for Ireland (2022 – 2027), began in February 2017. The document (Chapter 4) sets out the condition of Irish waters, and a summary of statuses for all monitored waters in the 2013 – 2015 period, including a description of the changes since 2007 – 2009. Nationally, both monitored river waterbodies and lakes at 'high' or 'good' ecological status, appear to have declined by 3% since 2007 – 2009; nevertheless, this figure does not reflect a significant number of improvements and dis-improvements across these waters since 2009. Provisional figures from the EPA suggest that approximately 900 river waterbodies and lakes have either improved or dis-improved. In addition, the previously observed long term trend of decline in the number of high status river sites has continued. Chapter 5 of the RBMP presents results of the catchment characterisation process, which identifies the significant pressures on each water body that is *At Risk* of not meeting the environmental objectives of the WFD. Importantly, the assessment includes a review of trends over time to see if conditions were likely to remain stable, improve or deteriorate by 2021. This work was presented in the RBMP for 81% of water bodies nationally, which had been characterised at the time. 1,517 waterbodies were classed *At Risk* out of a total of 4,775, or 32%. An assessment of significant environmental pressures found that agriculture was the most significant pressure in 729 river and lake water bodies that are *At Risk*. Urban waste water, hydromorphology and forestry were also significant pressures amongst others.	▪ N/A	The objectives of the RBMP are to: ▪ Prevent deterioration; ▪ Restore good status; ▪ Reduce chemical pollution; and ▪ Achieve water related protected areas objectives. The implementation of the RBMP seeks compliance with the environmental objectives set under the plan, which will be documented for each waterbody. This includes compliance with the European Communities (Surface Waters) Regulations S.I. No. 272 of 2009 (as amended). The implementation of this plan will have a positive impact on biodiversity and the Project will not affect the achievement of the RBMP objectives.
Catchment based Flood Risk Assessment and Management (CFRAM) Programme, under the Floods Directive The Office of Public Works (OPW) is responsible for the implementation of the Floods Directive 2007/60/EC which is being carried out through a Catchment based Flood Risk Assessment and Management (CFRAM) Programme. As part of the directive Ireland is required to undertake a Preliminary Flood Risk Assessment, to identify areas of existing or potentially significant future flood risk and to prepare flood hazard and risk maps for these areas. Following this, flood risk management plans are developed for these areas setting objectives for managing the flood risk and setting out a prioritised set of measures to achieve	▪ Habitat loss or destruction; ▪ Habitat fragmentation or degradation; ▪ Alterations to water quality and/or water movement;	CFRAM Studies and their product Flood Risk Management Plans, will each undergo appropriate assessment. Any future flood plans will have to take into account the design and implementation of water management infrastructure as it has the potential to impact on hydromorphology and potentially on the ecological status and favourable conservation status of water bodies. The establishment of how flooding may be contributing to deterioration in water quality in areas where other relevant pressures are absent is a significant consideration in terms of achieving the objectives of the WFD. The AA of the plans will need to consider the potential for

the objectives. The CFRAM programme is currently being rolled out and Draft Flood Risk Management Plans have been prepared. These plans have been subject AA.	▪ Disturbance; and ▪ In-combination impacts within the same scheme	impacts from hard engineering solutions and how they might affect hydrological connectivity and hydromorphological supporting conditions for protected habitats and species. There is no potential for cumulative effects with the CFRAMS programme as no infrastructure is proposed as part of this project.
Foodwise 2025 Foodwise 2025 strategy identifies significant growth opportunities across all subsectors of the Irish agri-food industry. Growth Projection includes increasing the value added in the agri-food, fisheries and wood products sector by 70% to in excess of €13 billion.	▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition; and ▪ Disturbance to habitats / species	Foodwise 2025 was subject to its own AA[21]. Growth is to be achieved through sustainable intensification to maximise production efficiency whilst minimising the effects on the environment however there is increased risk of nutrient discharge to receiving waters and in turn a potential risk to biodiversity and Europe Sites if not controlled. With the required mitigation in the Food Wise Plan, no significant in-combination effects are predicted. Mitigation measures included cross compliance with 13 Statutory Management Requirements, EIA Agricultural Regulations 2011, GLAS, and AA Screening of licencing and permitting in the forestry and seafood sectors.
Rural Development Programme 2021 – 2025 The agricultural sector is actively enhancing competitiveness whilst trying to achieve more sustainable management of natural resources. The common set of objectives, principles and rules through which the European Union co-ordinates support for European agriculture is outlined in the Rural Development Programme (RDP) 2021-2025 under the Common Agricultural Policy. The focus of the programme is to assist with the sustainable development of rural communities and while improvements are sought in relation to water management. Within the RDP are two targeted agri-environment schemes; Green Low Carbon Agri-Environment Scheme (GLAS) and Targeted Agriculture Modernisation Scheme (TAMS). They provide the role of a supportive measure to improve water quality and thus provide direct benefits in achieving the measures within the RBMP. The achievement of the objectives outlined within GLAS, to improve water quality, mitigate against climate change and promote biodiversity will be of direct positive benefit in achieving the measures within the RBMP and the goals of the Natura Directives. The scheme has an expected participation for 2012-2025 of 50,000 farmers which have to engage in specific training and tasks in order to	▪ Overgrazing; ▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition; and ▪ Disturbance to habitats / species;	The RDP for 2021 – 2025 has been subject to SEA[22], and AA[23]. The AA assessed the potential for impacts from the RDP measures e.g. for the GLAS scheme to result in inappropriate management prescriptions; minimum stocking rates under the Areas of Natural Constraints measure leading to overgrazing in sensitive habitats with dependent species, and TAMS supporting intensification. Mitigation included project specific AA for individual building, tourism or agricultural reclamation projects, consultations with key stakeholders during detailed measure development, and site-based monitoring of the effects of RDP measures. With such measures in place, it was concluded that there would be no significant in-combination effects on Natura 2000 sites.

[21] http://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/environmentalanalysis/AgriFoodStrategy2025NISDRAFT300615.pdf

[22] https://www.agriculture.gov.ie/media/migration/ruralenvironment/ruraldevelopment/ruraldevelopmentprogramme2014-2020/StrategEnvironmAssessSumState090615.pdf

[23] https://www.agriculture.gov.ie/media/migration/agarchive/ruralenvironment/preparatoryworkfortherdp2014-2020/RDP20142020DraftAppropriateAssessmentReport160514.pdf

receive full payment. Farmers within the scheme must have a nutrient management plan which is a strategy for maximising the return from on and off-farm chemical and organic fertilizer resources. This has a direct positive contribution towards protecting waterbodies from pollution through limiting the amount of fertiliser that is placed on the land. The scheme prioritises farms in vulnerable catchments with 'high status' waterbodies and also focuses on educating farmers on best practices to try and improve efficiency along with environmental outcomes. The TAMS scheme is open to all farmers and is focused on supporting productive investment for modernisation. This financial grant for farmers is focused on the pig and poultry sectors, dairy equipment and the storage of slurry and other farmyard manures. Within the TAMS scheme are two further schemes; the Animal Welfare, Safety and Nutrient Storage Scheme and the Low Emission Slurry Spreading Scheme. Both schemes are focused on productivity for farmers but have the ability to contribute towards a reduction in point and diffuse source pollution through improved nutrient management.		
National Nitrates Action Programme Ireland is obliged under the Nitrates Directive 91/676/EEC to prepare a National Nitrates Action Programme which is designed to prevent pollution of surface and ground waters from agricultural sources. This will directly contribute to the improvement of water quality and thus the objectives within the RBMP. Ireland's third Nitrates Action Programme came into operation in 2014 and has a timescale up to 2017. The Agricultural Catchments Programme is an ongoing programme that monitors the efficiency of various measures within the nitrate regulations. It is spread across six catchments and encompasses approximately 300 farmers.	▪ Land use change or intensification; ▪ Water pollution; ▪ Nitrogen deposition; and ▪ Disturbance to habitats / species	This programme has been subject to a Screening for Appropriate Assessment and it concluded that the NAP will not have a significant effect on the Natura 2000 network and a Stage 2 AA was not required[24]. It concluded that the NAP was an environmental programme which imposes environmental constraints on all agricultural systems in the state. It therefore benefits Natura 2000 sites and their species. In terms of in-combination effects, it stated that the Food Wise 2025 strategy would have to operate within the constraints of the NAP.
Forest Policy Review: Forests, Products and People – A Renewed Vision (2014) / Forestry Programme 2014 – 2020 (Extended to End 2022) Ireland's forestry sector is striving to increase forestry cover and one of the recommended policy actions in the Forest Policy Review: Forests, Products and People – A Renewed Vision (2014) is to increase the level of afforestation annually over time and support afforestation and mobilisation measures under the Forestry Programme 2014-2020. Two key objectives within the Forestry Programme 2014-2020 that will influence the RBMP are to increase Ireland's forest cover to 18% and to establish 10,000 ha of new forests and woodlands per annum. As part of this programme there are a number of schemes that promote sustainable forest management and they include the Afforestation	▪ Habitat loss or destruction; ▪ Habitat fragmentation or degradation; ▪ Water quality changes; and ▪ Disturbance to species.	Ireland's Forestry Programme 2014 – 2020 has undergone AA[25]. A key recommendation is that all proposed forestry projects should be subject to an assessment of their impacts and the proximity of Natura 2000 habitats and species should be taken into account when proposals are generated. In-combination effects will therefore be assessed at the project specific scale. Adherence to this recommendation will ensure that there is no potential for cumulative effects with the proposed project.

[24] http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/Environment/Water/FileDownLoad,35218,en.PDF

[25] https://www.agriculture.gov.ie/media/migration/forestry/publicconsultation/newforestryprogramme2014-2020/nis/ForestryProgrammeNaturalImpactStatement290914.pdf

Scheme, the Woodland Improvement Scheme, the Forest Road Scheme and the Native Woodland Conservation Scheme. Under the Native Woodland Conservation Scheme funding is provided to restore existing native woodland which promotes Ireland's native woodland resource and associated biodiversity. Native woodlands provide wider ecosystem functions and services which once restored can contribute to the protection and enhancement of water quality and aquatic habitats. New guidance and plans are also being developed to address forestry adjacent to water bodies, Freshwater Pearl Mussel Plans for 8 priority catchments and a Hen Harrier Threat Response Plan (NPWS). The mitigation measures within these plans will be particularly important in terms of protecting sensitive habitats and species from such forestry increases.		
Water Services Strategic Plan (WSSP, 2015) Irish Water has prepared a Water Services Strategic Plan (WSSP, 2015), under Section 33 of the Water Service No. 2 Act of 2013 to address the delivery of strategic objectives which will contribute towards improved water quality and WFD requirements. The WSSP forms the highest tier of asset management plans (Tier 1) which Irish Water prepare and it sets the overarching framework for subsequent detailed implementation plans (Tier 2) and water services projects (Tier 3). The WSSP sets out the challenges we face as a country in relation to the provision of water services and identifies strategic national priorities. It includes Irish Water's short, medium and long term objectives and identifies strategies to achieve these objectives. As such, the plan provides the context for subsequent detailed implementation plans (Tier 2) which will document the approach to be used for key water service areas such as water resource management, wastewater compliance and sludge management. The WSSP also sets out the strategic objectives against which the Irish Water Capital Investment Programme is developed. The current version of the CAP outlines the proposals for capital expenditure in terms of upgrades and new builds within the Irish Water owned asset and this is a significant piece of the puzzle in terms of the expected improvements from the RBMP.	▪ Habitat loss and disturbance from new / upgraded infrastructure; ▪ Species disturbance; ▪ Changes to water quality or quantity; and ▪ Nutrient enrichment /eutrophication.	The overarching strategy was subject to AA and highlighted the need for additional plan/project environmental assessments to be carried out at the tier 2 and tier 3 level. Therefore, no likely significant in-combination effects are envisaged.
National Wastewater Sludge Management Plan (2016) The National Wastewater Sludge Management Plan was prepared in 2015, outlining the measures needed to improve the management of wastewater sludge.	▪ Habitat loss and disturbance from new / upgraded infrastructure; ▪ Species disturbance; ▪ Changes to water quality or quantity; and	The plan was subject to both AA and SEA and includes a number of mitigation measures which were identified in relation to transport of materials, land spreading of sludge and additional education and research requirements. This plan does not specifically address domestic wastewater loads, only those relating to Irish Water facilities. In relation to the plan as it stands, no in-combination effects are expected with the implementation of proposed mitigation measures.

	▪ Nutrient enrichment /eutrophication.	
Lead Mitigation Plan (2016) Included in the WSSP (2015) is the strategy WS1e – Prepare and implement a "Lead in Drinking Water Mitigation Plan" to effectively address the risk of failure to comply with the drinking water quality standard for lead due to lead pipework. This strategy has been realised in the 2016 Lead Mitigation Plan.	▪ Changes to water quality or quantity; and ▪ Nutrient enrichment /eutrophication.	The plan is subject to SEA and AA which have also been published and are available at http://www.water.ie. There is no OP dosing upstream of Swinford WTP and the cumulative effect of dosing from Lough Mask RWSS and subsequent dosing projects has been taken into account on the River Moy Catchment and downstream transitional and coastal waterbodies for this supply zone.

7. SCREENING CONCLUSION STATEMENT

This Screening for AA has considered the potential for significant effects on European Sites arising from the proposed OP dosing at Swinford WTP, within the Swinford PWS and the ZoI. The potential for significant effects are evaluated with regard to the qualifying interests/species of conservation interests and associated conservation status.

The potential for direct, indirect and cumulative impacts affecting **Killala Bay/ Moy Estuary SAC (000458), Balla Turlough SAC (000463), Lackan Saltmarsh and Kilcummin Head SAC (000516), Urlaur Lakes SAC (001571), River Moy SAC (002298)** and **Killala Bay/ Moy Estuary SPA (004036)** has been assessed. The appraisal undertaken in this Screening report has been informed by an EAM (see **Appendix C**) with reference to the ecological communities and habitats. The Screening for AA has determined that there is no potential for significant direct, indirect or cumulative impacts which could affect the qualifying interests/special conservation interests of the European sites within the study area. It is therefore concluded, beyond reasonable scientific doubt, that the proposed project will not give rise to significant effects, either individually or in combination with other plans and projects, within the identified European Site(s).

On the basis of objective scientific information, this Screening has therefore excluded the potential for the proposed project, individually or in combination with other plans or projects, to give rise to any significant effect on a European Site. It is concluded that an AA is not required.

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NPWS (2012b) Killala Bay/ Moy Estuary SAC (site code: 458). Conservation objectives supporting document –coastal habitats Version 1.

NPWS (2013a) Article 17 Overview Report (Vol. 1) The Status of EU Protected Habitats and Species in Ireland.

NPWS (2013b) Article 17 Habitat Conservation Assessments (Vol. 2) Version 1.1. The Status of EU Protected Habitats and Species in Ireland.

NPWS (2013c) Article 17 Species Conservation Assessments (Vol. 3) Version 1.1. The Status of EU Protected Habitats and Species in Ireland.

NPWS (2013) Ireland's Summary Report for the period 2008 – 2012 under Article 12 of the Birds Directive. https://circabc.europa.eu/sd/a/a211d525-ff4d-44f5-a360-e82c6b4d3367/IE_A12NatSum_20141031.pdf

NPWS (2013f) Conservation Objectives: Killala Bay/Moy Estuary SPA 004036. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

NPWS (2015) Water Framework Directive Annex IV Protected Areas: Water Dependent Habitats and Species and High Status Sites.

NPWS (2016b) Conservation Objectives: River Moy SAC 002298. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

NPWS (2017) Conservation Objectives: Urlaur Lakes SAC 001571. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

NPWS (2018) Conservation objectives for Balla Turlough SAC [000463]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.

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http://www.wfduk.org/resources%20/reporting-confidence-groundwater-status-ssessments

Appendix A

European Sites - Conservation Objectives

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National Parks and Wildlife Service

Conservation Objectives Series

Killala Bay/Moy Estuary SAC 000458

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

National Parks and Wildlife Service,
Department of Arts, Heritage and the Gaeltacht,

7 Ely Place, Dublin 2, Ireland.

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E-mail: nature.conservation@ahg.gov.ie

Citation:
NPWS (2012) Conservation Objectives: Killala Bay/Moy Estuary SAC 000458. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

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ISSN 2009-4086

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***

000458	Killala Bay/Moy Estuary SAC
1014	Narrow-mouthed Whorl Snail *Vertigo angustior*
1095	Sea Lamprey *Petromyzon marinus*
1130	Estuaries
1140	Mudflats and sandflats not covered by seawater at low tide
1210	Annual vegetation of drift lines
1310	Salicornia and other annuals colonizing mud and sand
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
1365	Harbour Seal *Phoca vitulina*
2110	Embryonic shifting dunes
2120	Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
2130	*Fixed coastal dunes with herbaceous vegetation ('grey dunes')
2190	Humid dune slacks

Please note that this SAC overlaps with Killala Bay/Moy Estuary SPA (004036) and is adjacent to River Moy SAC (002298). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping and adjacent sites as appropriate.

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

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

Title: Harbour seal pilot monitoring project, 2011
Year: 2012
Author: NPWS
Series: Unpublished Report to NPWS

Title: Killala Bay/Moy Estuary SAC (000458). Conservation objectives supporting document - marine habitats and species. [Version 1]
Year: 2012
Author: NPWS
Series: Unpublished Report to NPWS

Title: Killala Bay/Moy Estuary SAC (000458). Conservation objectives supporting document - coastal habitats. [Version 1]
Year: 2012
Author: NPWS
Series: Unpublished Report to NPWS

Title: Subtidal Benthic Investigations in Killala Bay/Moy Estuary cSAC (Site Code: IE000458) Co. Sligo/Mayo
Year: 2011
Author: Aquafact
Series: Unpublished Report to NPWS & MI

Title: A survey of mudflats and sandflats in Ireland An intertidal soft sediment survey of Killala Bay
Year: 2011
Author: ASU
Series: Unpublished Report to NPWS & MI

Title: Monitoring and Condition Assessment of Populations of *Vertigo geyeri*, *Vertigo angustior* and *Vertigo moulinsiana* in Ireland
Year: 2011
Author: Moorkens, E.A.; Killeen, I.J.
Series: Irish Wildlife Manuals, No. 55

Title: Harbour seal pilot monitoring project, 2010
Year: 2011
Author: NPWS
Series: Unpublished Report to NPWS

Title: Harbour seal population monitoring 2009-2012: Report no. 1. Report on a pilot monitoring study carried out in southern and western Ireland, 2009
Year: 2010
Author: NPWS
Series: Unpublished Report to NPWS

Title: Saltmarsh Monitoring Report 2007-2008
Year: 2009
Author: McCorry, M.; Ryle, T.
Series: Unpublished Report to NPWS

Title: Coastal Monitoring Project 2004-2006

Year: 2009

Author: Ryle, T.; Murray, A.; Connolly, C.; Swann, M.

Series: Unpublished Report to NPWS

Title: The phytosociology and conservation value of Irish sand dunes

Year: 2008

Author: Gaynor, K.

Series: Unpublished PhD thesis, National University of Ireland, Dublin

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Title: Saltmarsh Monitoring Report 2006

Year: 2007

Author: McCorry, M.

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: Harbour seal population assessment in the Republic of Ireland: August 2003

Year: 2004

Author: Cronin, M.; Duck, C.; Ó Cadhla, O.; Nairn, R.; Strong, D.; O'Keeffe, C.

Series: Irish Wildlife Manuals No. 11

Title: Summary of National Parks & Wildlife Service surveys for common (harbour) seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*), 1978 to 2003

Year: 2004

Author: Lyons, D.O.

Series: Irish Wildlife Manuals No. 13

Title: A survey of juvenile lamprey populations in the Moy catchment

Year: 2004

Author: O'Connor, W.

Series: Irish Wildlife Manuals No. 15

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: A survey of bottlenose dolphins (*Tursiops truncatus*) in the Shannon Estuary

Year: 2000

Author: Rogan, E.; Ingram, S.; Holmes, B.; O'Flanagan, C.

Series: Marine Institute Marine Resource Series No. 9

Title: 1989 survey of breeding herds of common seal *Phoca vitulina* with reference to previous surveys

Year: 1990

Author: Harrington, R.

Series: Unpublished Report to Wildlife Service

Title: An assessment of the status of the common seal *Phoca vitulina vitulina* in Ireland

Year: 1980

Author: Summers, C.F.; Warner, P.J; Nairn, R.G.W.; Curry, M.G.; Flynn, J.

Series: Biological Conservation 17: 115-123

Spatial data sources

Year:	2010
Title:	EPA WFD transitional waterbody data
GIS operations:	Clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used for:	1130 (map 3)
Year:	Interpolated 2012
Title:	Mudflat and sandflat survey 2010; subtidal benthic survey 2010
GIS operations:	Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data. Expert opinion used as necessary to resolve any issues arising
Used for:	Marine community types, 1140 (maps 4 and 5)
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; EU Annex I Saltmarsh and Coastal data erased out if present
Used for:	Marine community types base data (map 5)
Year:	Revision 2010
Title:	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS operations:	QIs selected; clipped to SAC boundary; overlapping regions with Coastal CO data investigated and resolved with expert opinion used
Used for:	1310, 1330 (map 6)
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:	1210, 2110, 2120, 2130, 2190 (map 7)
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, 1365 (maps 8 and 9)
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:	1365 (map 9)

1014 Narrow-mouthed Whorl Snail *Vertigo angustior*

To maintain the favourable conservation condition of Narrow-mouthed Whorl Snail in Killala Bay/Moy Estuary 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 for this species in this SAC. See map 8	From Moorkens and Killeen (2011)
Presence on transect	Occurrence	Adult or sub-adult snails are present in at least 3 places on the transect where optimal or sub-optimal habitat occurs (minimum 5 samples)	Transect established as part of condition assessment monitoring at this site (Moorkens and Killeen, 2011). See habitat area target below for definition of optimal and sub-optimal habitat
Abundance	Number per sample	At least 2 samples on the transect have more than 10 *V. angustior* individuals (minimum 5 samples)	From Moorkens and Killeen (2011)
Transect habitat quality	Metres	More than 50m of habitat along the transect is classed as optimal or sub-optimal	From Moorkens and Killeen (2011). See habitat area target below for definition of optimal and sub-optimal habitat
Transect optimal wetness	Metres	Soils, at time of sampling, are damp (optimal wetness) and covered with a layer of humid thatch for more than 50m along the transect	From Moorkens and Killeen (2011)
Habitat area	Hectares	1.465ha of potential habitat (optimal and sub-optimal); Optimal habitat is defined as marsh with transition of ecotone between red fescue (*Festuca rubra*) and silverweed (*Potentilla anserina*) wet grassland and waterlogged marsh dominated by yellow iris (*Iris pseudacorus*) and low growing herbs. Vegetation height 20-40cm. Habitat growing on wet to saturated soil covered with a deep layer of mosses and humid, open structured thatch. Sub-optimal habitat is defined as for optimal habitat, but either vegetation height is less than 20cm, or between 40 and 50cm; or the soil is dry, or covered with standing water	From Moorkens and Killeen (2011)

1095 Sea Lamprey *Petromyzon marinus*

To maintain the favourable conservation condition of Sea Lamprey in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	% of estuary accessible	No barriers for migratory life stages of lamprey moving from freshwater to marine habitats and vice versa	This SAC only covers the estuarine portion of the River Moy. The adjacent River Moy SAC (site code: 2298) encompasses the freshwater elements of sea lamprey habitat. Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See O'Connor (2004) for further information on artificial barriers in the Moy catchment
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). Important juvenile habitat identified immediately downstream of Ballina (see O'Connor, 2004)
Juvenile density in fine sediment	Juveniles/m²	Juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003). Important juvenile habitat identified immediately downstream of Ballina (see O'Connor, 2004)

1130 Estuaries

To maintain the favourable conservation condition of Estuaries in Killala Bay/Moy Estuary 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 as 736ha using OSi data and the defined Transitional Water Body area under the Water Framework Directive
Community extent	Hectares	Maintain the extent of the *Zostera*-dominated community, subject to natural processes. See map 5	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community structure: *Zostera* density	Shoots per m^2	Conserve the high quality of the *Zostera*-dominated community, subject to natural processes	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community distribution	Hectares	Conserve the following community types in a natural condition: Muddy sand to fine sand dominated by *Hydrobia ulvae*, *Pygospio elegans* and *Tubificoides benedii* community complex; Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex; and Fine sand dominated by *Nephtys cirrosa* community complex. See map 5	Habitat structure was elucidated from intertidal and subtidal surveys undertaken in 2010 (Aquafact, 2011; ASU, 2011). 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 Mudflats and sandflats not covered by seawater at low tide in Killala Bay/Moy Estuary 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 4	Habitat area was estimated as 1,332ha using OSi data
Community extent	Hectares	Maintain the extent of the *Zostera*-dominated community, subject to natural processes. See map 5	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community structure: *Zostera* density	Shoots per m²	Conserve the high quality of the *Zostera*-dominated community, subject to natural processes	Estimated by EPA during 2011 intertidal survey. See marine supporting document for further details
Community distribution	Hectares	Conserve the following community types in a natural condition: Muddy sand to fine sand dominated by *Hydrobia ulvae, Pygospio elegans* and *Tubificoides benedii* community complex; Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex and Fine sand dominated by *Nephtys cirrosa* community complex. See map 5	Habitat structure was elucidated from intertidal survey undertaken in 2010 (ASU, 2011). See marine supporting document for further details

1210 Annual vegetation of drift lines

To maintain the favourable conservation condition of Annual vegetation of drift lines in Killala Bay/Moy Estuary 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: Bartragh Island-0.58ha. See map 7	Based on data from the Coastal Monitoring Project (Ryle et al. 2009). Habitat is very difficult to measure in view of its dynamic nature which means that it can appear and disappear within a site from year to year. This habitat was only recorded from Bartragh Island. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes	Based on data from Ryle et al. (2009). Two separate narrow strips of strandline habitat were recorded on the northern side of Bartragh Island. 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	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Accumulation of organic matter in tidal litter is essential for trapping sand and initiating dune formation. Sea defence/coastal protection works are present near the main access point to the beach at Inishcrone (Ryle et al. 2009). 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). At Bartragh Island there are transitions from sand dunes into saltmarsh habitats. 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 the presence of species-poor communities with typical species: sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*), prickly saltwort (*Salsola kali*) and Orache (*Atriplex* spp.)	Based on data from Ryle et al. (2009). 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	Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Based on data from Ryle et al. (2009). See coastal habitats 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 Killala Bay/Moy Estuary 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: Bartragh Island- 0.26ha, Ross- 0.29ha. See map 6	Based on data from Saltmarsh Monitoring Project (SMP) (McCorry, 2007). Habitat mapped at two of the four sub-sites surveyed, giving a total estimated area of 0.55ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on data from McCorry (2007). Salicornia is an annual species, so its distribution can vary significantly from year to year. See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry (2007). Sediment supply is particularly important for this pioneer saltmarsh community, as the distribution of this habitat depends on accretion rates. Accretion was noted at Ross and Bartragh Island. Old seawalls were recorded at Bartragh Island and some protection works were noted around buildings close to the shoreline at Ross. See coastal habitats backing document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry and Ryle (2009). Creeks deliver sediment throughout saltmarsh system. Creeks and pan structures are well developed at Ross. See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	This pioneer saltmarsh community requires regular tidal inundation. 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 McCorry (2007). Transitions to dune habitats are found at Bartragh Island and Ross. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimeters	Maintain structural variation within sward	Based on data from McCorry (2007). At Castleconor, grazing is absent. There are moderate levels of grazing at Rusheens, while grazing at Ross is heavy in places. Grazing intensity is low on Bartragh Island See coastal habitats 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 Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of the area outside of the creeks vegetated	Based on data from McCorry (2007). Castleconor and Rusheens are heavily poached in places. There are moderate levels of poaching at Bartragh Island and Ross. See coastal habitats supporting document for further details
Vegetation composition: typical species & sub-communities	Percentage cover	Maintain the presence of species-poor communities with typical species listed in the Saltmarsh Monitoring Project (McCorry and Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species-*Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1%	Based on data from McCorry (2007). See coastal habitats supporting document for further details

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

To maintain the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia*) in Killala Bay/Moy Estuary 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: Bartragh Island- 29.22ha, Ross- 14.95ha, Rusheens- 1.24ha, Castleconor - 1.61ha. See map 6	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry, 2007; McCorry and Ryle 2009). Four sub-sites that supported Atlantic salt meadow were mapped (47.02ha) and additional areas of potential ASM (3.34ha) were identified from an examination of aerial photographs, giving a total estimated area of 50.37ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on data from McCorry (2007). ASM is the dominant saltmarsh type with a wide distribution throughout the SAC. See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry and Ryle (2009). The SMP noted accretion at Ross and Bartragh Island. Old seawalls were recorded at Bartragh Island and there are some protection works around buildings close to the shoreline at Ross. See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure/ allow to develop, subject to natural processes, including erosion and succession	Based on data from McCorry and Ryle (2009). Creeks and pan structures are well developed at Ross. 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
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 McCorry (2007). Transitions to dune habitats are found at Bartragh Island and Ross. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimeters	Maintain structural variation within sward	Based on data from McCorry (2007). At Castleconor, grazing is absent. At Rusheens there are moderate levels of grazing. At Ross grazing is heavy in places. At Bartragh Island grazing intensity is low. See coastal habitats supporting document for further details

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

To maintain the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia*) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of the area outside of the creeks vegetated	Based on data from McCorry (2007). Castleconor and Rusheens are heavily poached in places. There are moderate levels of poaching at Bartragh Island and Ross. 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 and Ryle, 2009)	Based on data from McCorry and Ryle (2009). See coastal habitats supporting document for further details
Vegetation structure: negative indicator species-*Spartina anglica*	Hectares	No significant expansion of common cordgrass (*Spartina anglica*), with an annual spread of less than 1%	Based on data from McCorry (2007). See coastal habitats supporting document for further details

1365 Harbour Seal *Phoca vitulina*

To maintain the favourable conservation condition of Harbour Seal in Killala Bay/Moy Estuary 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 site should not be restricted by artificial barriers to site use. See map 9 for suitable habitat	See marine supporting document for further details
Breeding behaviour	Breeding sites	Conserve the breeding sites in a natural condition. See map 9	Attribute and target based on background knowledge of Irish breeding populations, review of data summarised by Summers et al. (1980), Harrington (1990), Lyons (2004) and unpublished National Parks and Wildlife Service records. 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 9	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004), Cronin et al. (2004), NPWS (2010), NPWS (2011), NPWS (2012) and unpublished National Parks and Wildlife Service 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 9	Attribute and target based on background knowledge of Irish populations, review of data from Lyons (2004), unpublished National Parks and Wildlife Service records and unpublished data collected by University College Cork/Inland Fisheries Ireland. See marine supporting document for further details
Disturbance	Level of impact	Human activities should occur at levels that do not adversely affect the harbour seal population at the site	See marine supporting document for further details

2110 Embryonic shifting dunes

To restore the favourable conservation condition of Embryonic shifting dunes in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Ross-0.81ha, Bartragh Island - 0.75ha. See map 7	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat is very difficult to measure in view of its dynamic nature and was only recorded at Bartragh Island and Ross, giving a total estimated area of 1.56ha. Accretion was noted from the western end of Bartragh Island. Embryo dune habitat is restricted to a small area on the seaward edge at Ross. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 7 for known distribution	Based on data from Ryle et al. (2009). 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	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Sea defence/coastal protection works are present near the main access point to the beach at Inishcrone (Ryle et al. 2009). 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) and Ryle et al. (2009). At Bartragh Island and Ross there are transitions from sand dunes into saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation composition: plant health of foredune grasses	Percentage cover	More than 95% of sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (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 the presence of species-poor communities with typical species: sand couch (*Elytrigia juncea*) and/or lyme-grass (*Leymus arenarius*)	Based on data from Ryle et al. (2009). 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). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. See coastal habitats supporting document for further details

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 Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes including erosion and succession. For sub-sites mapped: Ross- 1.58; Bartragh Island- 7.52ha ; Inishcrone- 3.65ha. See map 7	Habitat was mapped during the Coastal Monitoring Project (Ryle et al., 2009). Habitat was mapped at three sub-sites to give a total estimated area of 12.75ha. 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 7 for known distribution	Based on data from Ryle et al. (2009). Mobile dunes are well developed at Bartragh Island, while at Inishcrone they are patchy in distribution and eroded back to the fixed dune in places. 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	Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Marram (*Ammophila arenaria*) reproduces vegetatively and requires constant accretion of fresh sand to maintain active growth, thus encouraging further accretion. There are coastal protection works in place at Inishcrone. 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) and Ryle et al. (2009). At both Bartragh Island and Ross there are transitions from sand dune to saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation composition: plant health of dune grasses	Percentage cover	More than 95% of marram (*Ammophila arenaria*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (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 the presence of species-poor communities dominated by marram (*Ammophila areanaria*) and/or lyme-grass (*Leymus arenarius*)	Based on data from Ryle et al. (2009). Bartragh Island, Ross and Inishcrone all support a characteristic dune flora. See coastal habitats supporting document for further details

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 Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
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). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. The mobile dune habitat at Ross has a high cover of creeping thistle (*Cirsium arvense*) and common ragwort (*Senecio jacobaea)*. At Inishcrone and Bartragh Island, ragwort (*Senecio jacobaea*) is also common. See coastal habitats supporting document for further details

2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes including erosion and succession. For sub-site mapped: Ross - 100.79ha; Bartragh Island - 120.13ha; Inishcrone - 38.53ha. See map 7	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat mapped at three sub-sites to give a total estimated area of 259.46ha. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 7 for known distribution	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Fixed dune habitat is extensive at Bartragh Island. The extent of the fixed dune habitat is reduced at Inishcrone owing to presence of Enniscrone golf course. 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 the Coastal Monitoring Project (Ryle et al., 2009). Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. There are coastal protection works at the main access to the beach at Inishcrone. 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). At both Bartragh Island and Ross there are transitions from sand dune to saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes.	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: sward height	Centimeters	Maintain structural variation within sward.	Based on data from Gaynor (2008) and Ryle et al. (2009). Vegetation is quite rank in places at Ross, Inishcrone and Bartragh Island due to undergrazing. 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 Ryle et al. (2009)	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details

2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Vegetation composition: negative indicator species (including *Hippophae rhamnoides*)	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. Bracken (*Pteridium aquilinum*) was recorded at Bartragh Island. At Inishcrone, common ragwort (*Senecio jacobaea*), creeping thistle (*Cirsium vulgare*) and bramble (*Rubus fruticosus*) occur. At Ross, creeping thistle (*Cirsium arvense*), common ragwort (*Senecio jacobaea*) and hogweed (*Heracleum sphondylium*) occur. 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). Scattered shrubs and stunted trees occur at Ross, while occasional scrub occurs at Bartragh Island. See coastal habitats supporting document for further details

2190 Humid dune slacks

To maintain the favourable conservation condition of Humid dune slacks in Killala Bay/Moy Estuary 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: Ross: 3.87ha; Bartragh Island: 1.22ha. See map 6	Based on data from the Coastal Monitoring Project (Ryle et al., 2009). Habitat was mapped at two sub-sites, giving a total estimated area of 5.09ha. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on data from Ryle et al. (2009). Dune slacks at Bartragh Island are narrow linear features. See coastal habitats supporting document for further details.
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain 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
Physical structure: hydrological and flooding regime	Presence/ absence of water abstraction or drainage works	Maintain natural hydrological regime	Based on data from Gaynor (2008) and Ryle et al. (2009). 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). At both Bartragh Island and Ross sub-sites there are transitions from sand dune to saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 5% of dune slack habitat, with the exception of pioneer slacks which can have up to 20% bare ground.	Based on data from Gaynor (2008) and Ryle et al. (2009). At Ross, the dune slacks are poached by cattke in places. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimeters	Maintain structural variation within sward.	Based on data from Ryle et al. (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 Ryle et al. (2009)	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: cover of S. repens	% cover; centimeters	Maintain more than 40% cover of creeping willow (*Salix repens*)	Based on data from Ryle et al. (2009). Cover of creeping willow (*Salix repens*) needs to be controlled (e.g. through an appropriate grazing regime) to prevent the development of a coarse, rank vegetation cover. *Salix repens* ssp. *argentea* was noted at Bartragh Island, but its cover was only 10% and it was not widespread. See coastal habitats supporting document for further details

2190 Humid dune slacks

To maintain the favourable conservation condition of Humid dune slacks in Killala Bay/Moy Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
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). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. 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). See coastal habitats supporting document for further details

MAP 1:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

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

N

Map Version 1
Date: Aug 2012

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Legend

- SAC 000458 Killala Bay/Moy Estuary
- SAC 002298 River Moy
- SPA 004036 Killala Bay/Moy Estuary
- OSi Discovery Series County Boundaries

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

MAP 2:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
ADJOINING / OVERLAPPING DESIGNATIONS

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

SITE CODE:
SAC 000458 CO.MAYO; version 1.01, CO.SLIGO; version 1.01
SAC 002298 CO.MAYO; version 1.14, CO.SLIGO; version 1.09
SPA 004036 CO.MAYO; version 1.02, CO.SLIGO; version 1.02

0 2 4 6 8 10 km

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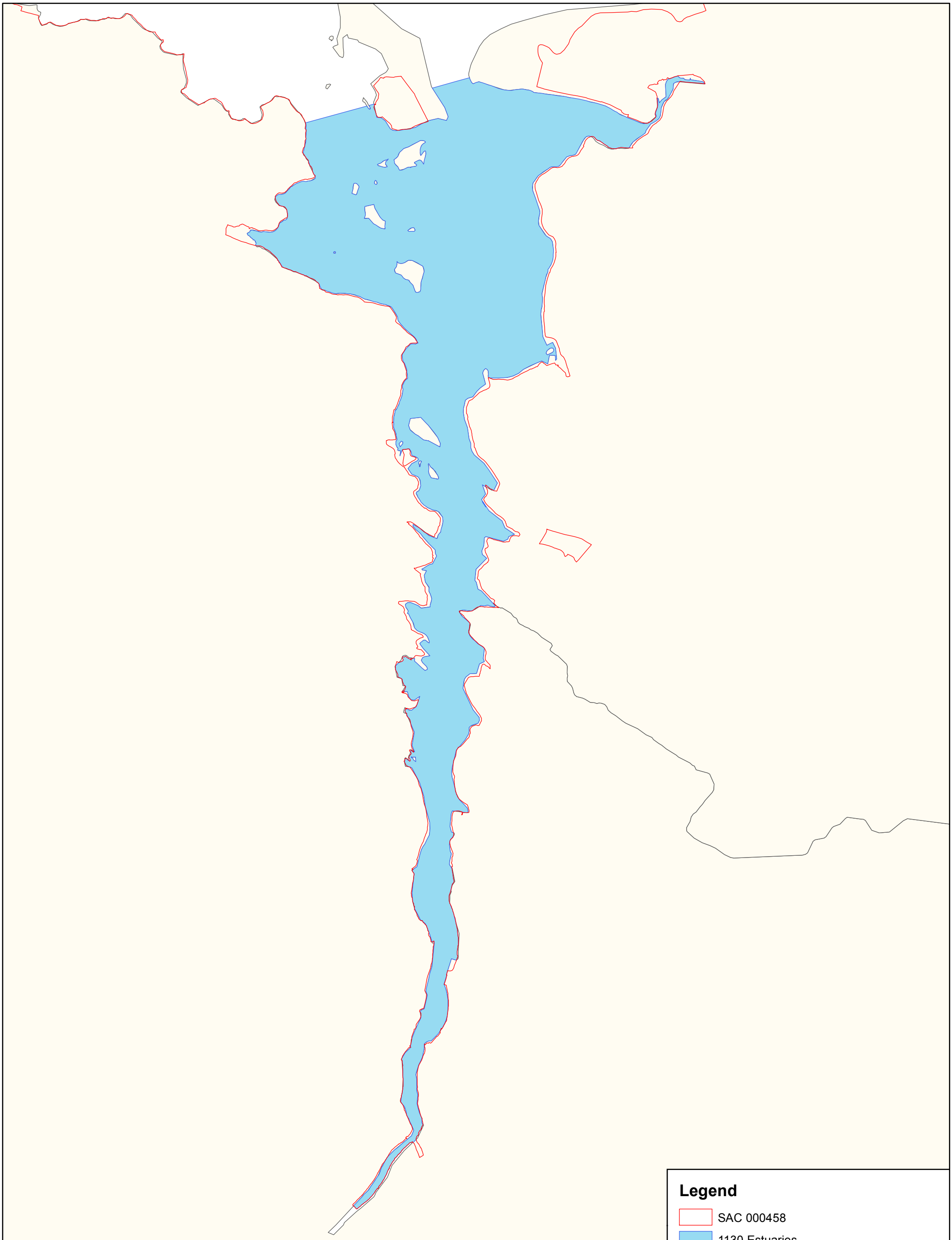
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadunas Uimh. EN 0059208)

N

Map Version 1
Date: Aug 2012



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Department of Arts, Heritage and the Gaeltacht

MAP 3:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
ESTUARIES

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.2 0.4 0.6 0.8 1 km

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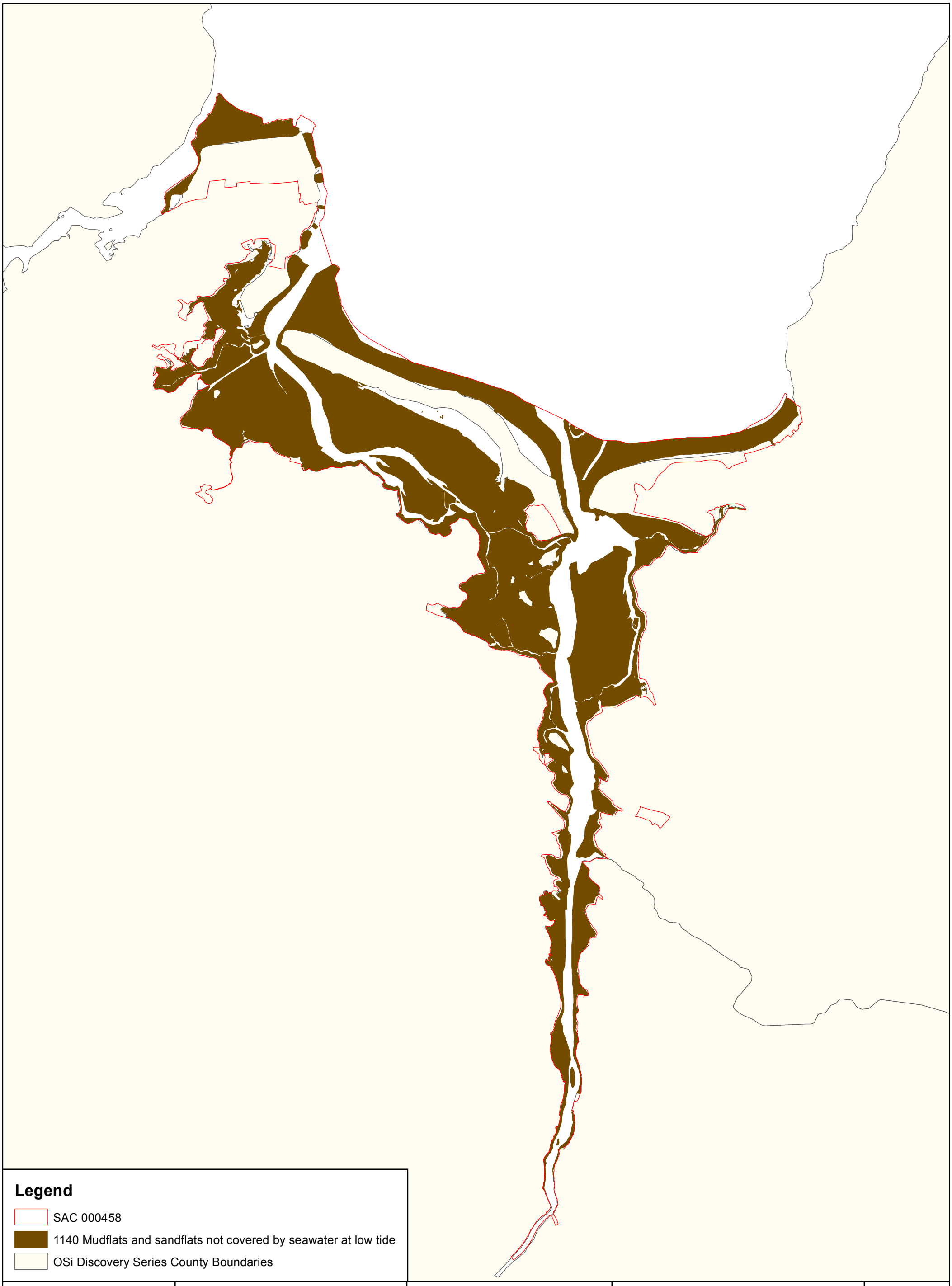
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis
le chead ón Rialtas (Ceadunas Uimh. EN 0059208)

N

Map Version 1
Date: Aug 2012



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Department of Arts, Heritage and the Gaeltacht

MAP 4:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
TIDAL MUDFLATS AND SANDFLATS

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

The mapped boundaries are of an indicative and general nature only.
Boundaries of designated areas are subject to revision.
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Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis
le chead ón Rialtas (Ceadunas Uimh. EN 0059208)

N

Map Version 1
Date: Aug 2012

Legend

- SAC 000458
- OSi Discovery Series County Boundaries

Marine Community Types

- Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex
- Fine sand dominated by *Nephtys cirrosa* community complex
- Muddy sand to fine sand dominated by *Hydrobia ulvae, Pygospio elegans* and *Tubificoides benedii* community complex
- River
- *Zostera*-dominated community

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MAP 5:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
MARINE COMMUNITY TYPES

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

The mapped boundaries are of an indicative and general nature only.
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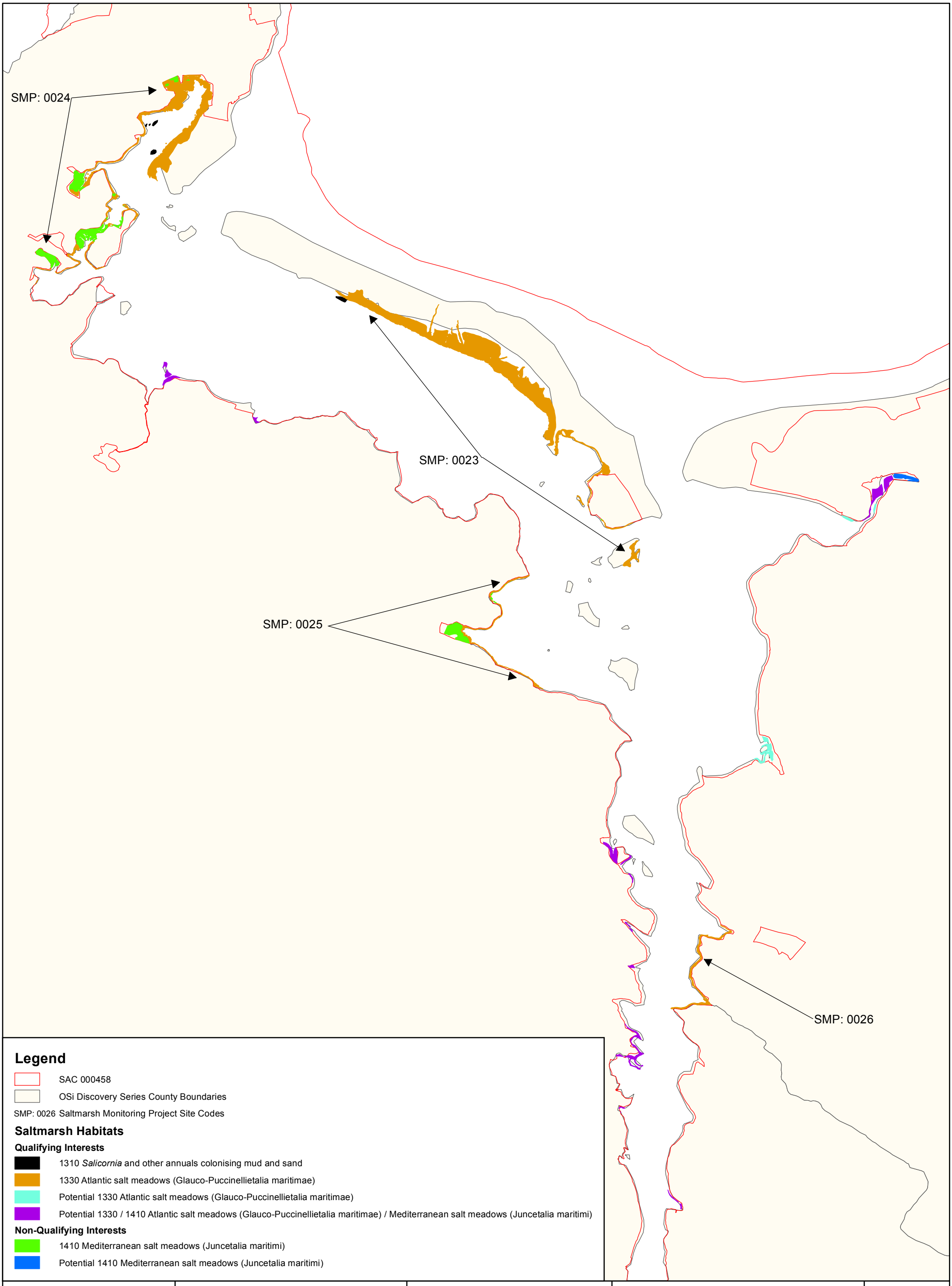
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta.
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar
comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis
le chead ón Rialtas (Ceadunas Uimh. EN 0059208)

N

Map Version 1
Date: Aug 2012



Legend

- SAC 000458
- OSi Discovery Series County Boundaries
- SMP: 0026 Saltmarsh Monitoring Project Site Codes

Saltmarsh Habitats

Qualifying Interests

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

Non-Qualifying Interests

- 1410 Mediterranean salt meadows (Juncetalia maritimi)
- Potential 1410 Mediterranean salt meadows (Juncetalia maritimi)

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Department of Arts, Heritage and the Gaeltacht

MAP 6:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
SALTMARSH HABITATS

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 km

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

N

Map Version 1
Date: Aug 2012

CMP: 130

CMP: 131

CMP: 132

Legend

SAC 000458

OSi Discovery Series County Boundaries

CMP: 131 Coastal Monitoring Project Site Codes

Qualifying Interests

1210 Annual vegetation of drift lines

2110 Embryonic shifting dunes

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

2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

2190 Humid dune slacks

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Department of Arts, Heritage and the Gaeltacht

MAP 7:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
SAND DUNE HABITATS

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 km

The mapped boundaries are of an indicative and general nature only.
Boundaries of designated areas are subject to revision.
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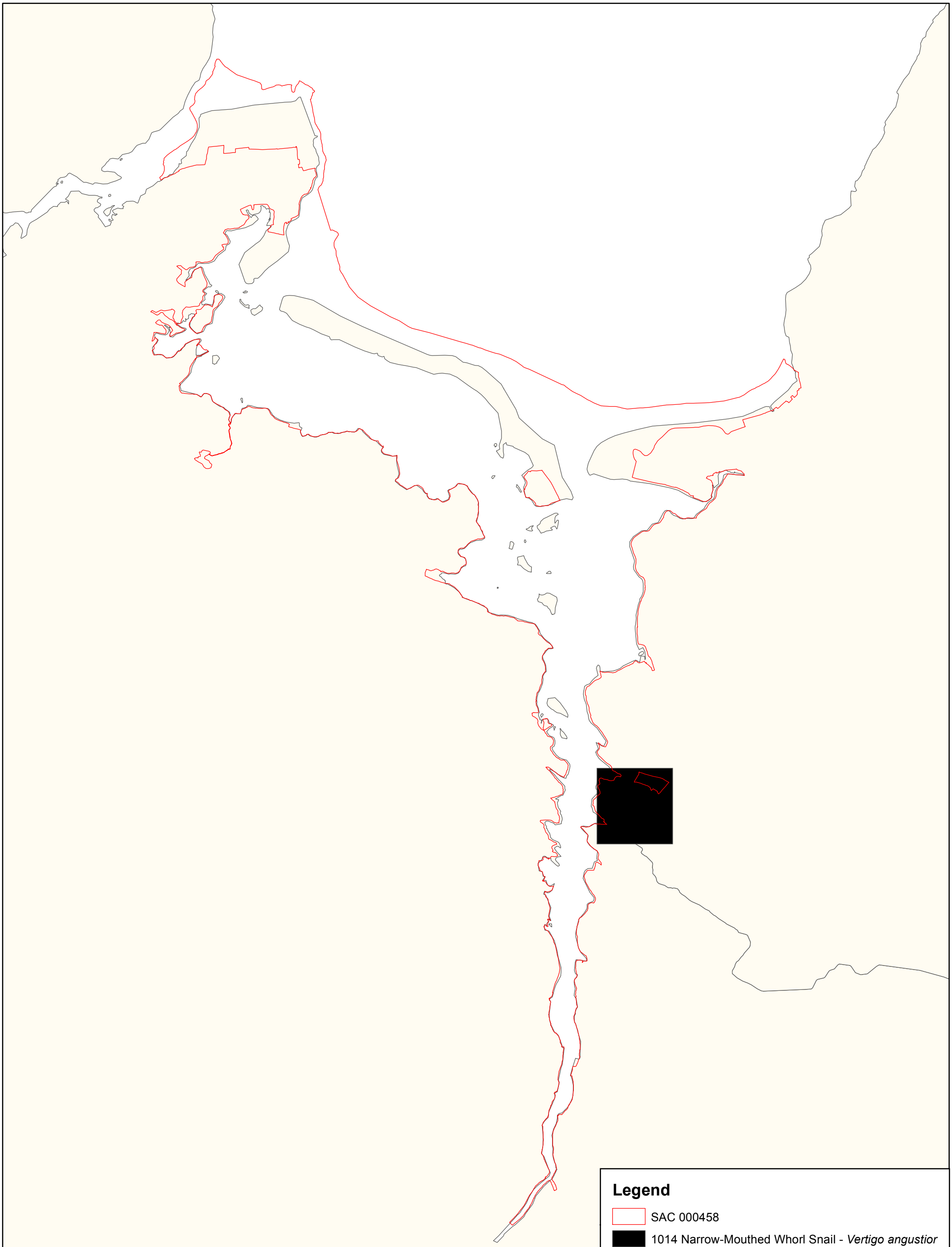
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta.
Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadunas Uimh. EN 0059208)

N

Map Version 1
Date: Aug 2012



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Department of Arts, Heritage and the Gaeltacht

MAP 8:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
NARROW-MOUTHED WHORL SNAIL

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

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

N

Map Version 1
Date: Aug 2012

Legend

- SAC 000458
- 1365 Harbour Seal - *Phoca vitulina* breeding sites
- 1365 Harbour Seal - *Phoca vitulina* moulting sites
- 1365 Harbour Seal - *Phoca vitulina* resting sites
- 1365 Harbour Seal - *Phoca vitulina* habitat
- OSi Discovery Series County Boundaries

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MAP 9:
KILLALA BAY / MOY ESTUARY SAC
CONSERVATION OBJECTIVES
HARBOUR SEAL

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

SITE CODE: SAC 000458
CO.MAYO; version 1.01, CO. SLIGO; version 1.01

0 0.5 1 1.5 2 km

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

N

Map Version 1
Date: Aug 2012

Conservation objectives for Balla Turlough SAC [000463]

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.

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.

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

Code	Description
3180	Turloughs*

* denotes a priority habitat

Citation: *NPWS (2018) Conservation objectives for Balla Turlough SAC [000463]. Generic Version 6.0. Department of Culture, Heritage and the Gaeltacht.*

ISSN 2009-4086

National Parks and Wildlife Service

Conservation Objectives Series

Lackan Saltmarsh and Kilcummin Head SAC 000516

An Roinn Ealaíon, Oidhreachta,
Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage,
Regional, Rural and Gaeltacht Affairs

National Parks and Wildlife Service,
Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs,

7 Ely Place, Dublin 2, Ireland.

Web: www.npws.ie
E-mail: nature.conservation@ahg.gov.ie

Citation:

NPWS (2016) Conservation Objectives: Lackan Saltmarsh and Kilcummin Head SAC 000516. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

Series Editor: Rebecca Jeffrey
ISSN 2009-4086

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***

000516	Lackan Saltmarsh and Kilcummin Head SAC
1310	*Salicornia* and other annuals colonising mud and sand
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
1410	Mediterranean salt meadows (Juncetalia maritimi)
2120	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)*

Please note that this SAC overlaps with Killala Bay/Moy Estuary SPA (004036). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping site 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 :	2007
Title :	Saltmarsh Monitoring Project 2006
Author :	McCorry, M.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Coastal Monitoring Project 2004-2006
Author :	Ryle, T.; Murray, A.; Connolly, K.; Swann, M.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Saltmarsh monitoring project 2007-2008
Author :	McCorry, M.; Ryle, T.
Series :	Unpublished report to NPWS
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 :	2016
Title :	Lacken Saltmarsh and Kilcummin Head SAC (site code: 516) Conservation objectives supporting document- coastal habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document

Other References

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

Spatial data sources

Year :	Revision 2010
Title :	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary; overlapping regions with Coastal CO data investigated and resolved with expert opinion used
Used For :	1310, 1330, 1410 (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 :	2120, 2130 (map 4)

1310 Salicornia and other annuals colonising mud and sand

To restore the favourable conservation condition of *Salicornia* and other annuals colonising mud and sand in Lackan Saltmarsh and Kilcummin Head 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 sub-site mapped: Lackan - 0.001ha	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry, 2007; McCorry and Ryle, 2009). *Salicornia* and other annuals colonising mud and sand was surveyed at the sub-site Lackan (site ID: SMP0022) to give a total estimated area of 0.001ha in Lackan Saltmarsh and Kilcummin Head SAC. This extent is too small to be mapped. NB further unsurveyed areas may be present within the SAC. See the Lackan Saltmarsh and Kilcummin Head SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes	Based on data from McCorry (2007) and McCorry and Ryle (2009). *Salicornia* is an annual species, so its distribution can vary significantly from year to year. See the 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	Based on data from McCorry (2007) and McCorry and Ryle (2009). Sediment supply is particularly important for this pioneer saltmarsh community, as its distribution depends on accretion rates. Within the estuary and along the margins of the Cloonalaghan River, sediments originating from the river have built up to form an extensive saltmarsh (Ryle et al., 2009). See the coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry (2007) and McCorry and Ryle (2009). Creeks deliver sediment throughout the saltmarsh system. At Lackan, the creek network is well-developed and many of the creeks contain very soft mud and are unusually deep. See the coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Based on data from McCorry (2007) and McCorry and Ryle (2009). This pioneer saltmarsh community requires regular tidal inundation. See the 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 McCorry (2007) and McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation within sward	Based on data from McCorry (2007) and McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% of the area outside of creeks vegetated	Based on data from McCorry (2007) and McCorry and Ryle (2009). See the coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover	Maintain the presence of species-poor communities with typical species listed in McCorry and Ryle (2009)	Based on data from McCorry (2007) and McCorry and Ryle (2009). There is frequent glasswort (*Salicornia* sp.) and occasional annual sea-blite (*Suaeda maritima*) associated with some areas. See the coastal habitats supporting document for further details
Vegetation composition: negative indicator species - *Spartina anglica*	Hectares	There is no record of common cordgrass (*Spartina anglica*) in the SAC and its establishment should be prevented	Based on data from McCorry (2007) and McCorry and Ryle (2009). No common cordgrass (*Spartina anglica*) was recorded in this habitat in the SAC. See the coastal habitats supporting document for further details

1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

To maintain the favourable conservation condition of Atlantic salt meadows (Glauco-Puccinellietalia maritimae) in Lackan Saltmarsh and Kilcummin Head 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 sub-site (Lackan) and potential areas mapped: 32.70ha. See map 3	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry, 2007; McCorry and Ryle, 2009). The sub-site Lackan (site ID: SMP0022) that supports Atlantic Salt Meadows (ASM) was mapped (32.43ha) and additional areas of potential ASM habitat (0.27ha) were identified from an examination of aerial photographs, giving a total estimated area of 32.70ha within Lackan Saltmarsh and Kilcummin Head SAC. NB further unsurveyed areas may be present within the SAC. See the Lackan Saltmarsh and Kilcummin Head SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 3 for known distribution	Based on data from McCorry (2007) and McCorry and Ryle (2009). The saltmarsh is mostly contained in one large main unit. A band of saltmarsh extends along the north-western and north-eastern shorelines of Lackan Bay, which eventually narrows out and transitions to sand dune and sandy beach habitats. NB further unsurveyed areas may be present within the SAC. See the coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry (2007) and McCorry and Ryle (2009). Erosion and accretion mainly affects the ASM at this SAC. See the coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry (2007) and McCorry and Ryle (2009). The original creek network has been affected by drainage and some of the channels in the mid-eastern part of the saltmarsh have been artificially deepened and straightened in the past. See the coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Based on data from McCorry (2007) and McCorry and Ryle (2009). There have been drainage and land reclamation works in the past with regularly-spaced drains across the north-western section of the saltmarsh linking with drains from adjacent wet grassland on slopes to the Cloonalaghan River. See the 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 McCorry (2007) and McCorry and Ryle (2009). Natural transitions occur between saltmarsh types as well as to other coastal habitats such as sand dunes. See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation within sward	Based on data from McCorry (2007) and McCorry and Ryle (2009). Sheep grazing has created a typical low sward (1-2cm high). See the coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% of the area outside of creeks vegetated	Based on data from McCorry (2007) and McCorry and Ryle (2009). There are vehicle tracks and wheel ruts on the ASM at the north-western and north-eastern corners of the saltmarsh where minor roads allow access to the sandflats and Lackan Bay. See the 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 McCorry and Ryle (2009)	Based on data from McCorry (2007) and McCorry and Ryle (2009). ASM vegetation is dominated by a thrift (*Armeria maritima*) and sea plantain (*Plantago maritima*) sward. See the coastal habitats supporting document for further details
Vegetation composition: negative indicator species - *Spartina anglica*	Hectares	There is no record of common cordgrass (*Spartina anglica*) in the SAC and its establishment should be prevented	Based on data from McCorry (2007) and McCorry and Ryle (2009). No common cordgrass (*Spartina anglica*) was recorded in this habitat in the SAC. See the coastal habitats supporting document for further details

1410 Mediterranean salt meadows (Juncetalia maritimi)

To restore the favourable conservation condition of Mediterranean salt meadows (Juncetalia maritimi) in Lackan Saltmarsh and Kilcummin Head 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 sub-site (Lackan): 65.03ha. See map 3	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry, 2007; McCorry and Ryle, 2009). The sub-site Lackan (site ID: SMP0022) that supports Mediterranean Salt Meadows (MSM) was mapped to give a total estimated area of 65.03ha within Lackan Saltmarsh and Kilcummin Head SAC. NB further unsurveyed areas may be present within the SAC. See the Lackan Saltmarsh and Kilcummin Head SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 3 for known distribution	Based on data from McCorry (2007) and McCorry and Ryle (2009). MSM habitat dominates the western side of Cloonalaghan River and the southern part of the saltmarsh. NB further unsurveyed areas may be present within the SAC. See the coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry (2007) and McCorry and Ryle (2009). Some minor erosion and accretion occurs within the MSM further up the Cloonalaghan River channel from the ASM habitat. See the coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from McCorry (2007) and McCorry and Ryle (2009). The creek and pan topography in the MSM is very well-developed with frequent pans and a dense network of creeks. See the coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Based on data from McCorry (2007) and McCorry and Ryle (2009). Mediterranean salt meadow is found high up in the saltmarsh but requires occasional tidal inundation. See the 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 McCorry (2007) and McCorry and Ryle (2009). Natural transitions occur between saltmarsh types as well as to other coastal habitats such as sand dunes. See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation in the sward	Based on data from McCorry (2007) and McCorry and Ryle (2009). The grazing level is low in the MSM as the dense patches of sea rush (*Juncus maritimus*) present protect the other vegetation. See the coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative number of monitoring stops	Maintain more than 90% of the area outside of creeks vegetated	Based on data from McCorry (2007) and McCorry and Ryle (2009). The MSM habitat has suffered some damage due to heavy cattle poaching. See the 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 McCorry and Ryle (2009)	Based on data from McCorry (2007) and McCorry and Ryle (2009). Sea rush (*Juncus maritimus*) occurs on slightly elevated sites and its sharp stems protect succulent plants such as common scurvygrass (*Cochlearia officinalis*) and sea aster (*Aster tripolium*) from grazing. Sea club-rush (*Bolboschoenus maritimus*) and common reed (*Phragmites australis*) are present in the ditches. This limited species diversity is typical of MSM habitat. See the coastal habitats supporting document for further details

Vegetation composition: negative indicator species - *Spartina anglica*	Hectares	There is no record of common cordgrass (*Spartina anglica*) in the SAC and its establishment should be prevented	Based on data from McCorry (2007) and McCorry and Ryle (2009). No common cordgrass (*Spartina anglica*) was recorded in this habitat in the SAC. See the coastal habitats supporting document for further details

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 Lackan Saltmarsh and Kilcummin Head SAC, which is defined by the following list of attributes and targets:

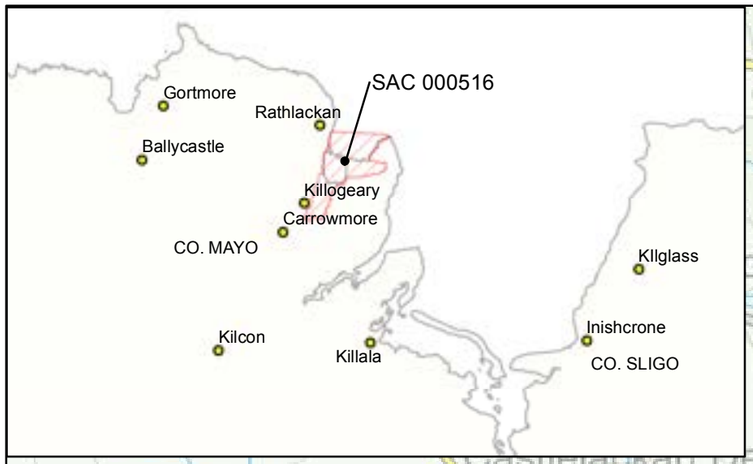
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For the sub-site mapped: Lackan (including Rathlackan) - 2.82ha. See map 4	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009). Shifting dunes along the shoreline with *Ammophila arenaria* was mapped at the sub-site Lackan (including Rathlackan; CMP site ID: 129) to give a total estimated area of 2.82ha within Lackan Saltmarsh and Kilcummin Head SAC. This habitat is very difficult to measure in view of its dynamic nature. See the Lackan Saltmarsh and Kilcummin Head SAC conservation objectives supporting document for coastal habitats 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). See the 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). Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Marram grass (*Ammophila arenaria*) reproduces vegetatively and requires constant accretion of fresh sand to maintain active growth encouraging further accretion. The sandhills at the Rathlackan sub-site, on the north-west side of Lackan Saltmarsh and Kilcummin Head SAC, are badly eroded, which has resulted in the availability of sediment that may be re-worked to form temporary foredune habitat. There appears to have been some attempts at dune protection through the planting of marram grass and lyme-grass (*Leymus arenarius*) on heaped banks of sand and cobbles. See the 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) and Ryle et al. (2009). Mobile dunes at Rathlackan extend around the seaward edge of the spit. Behind the dunes, there are sheltered intertidal sandflats which in turn are backed by extensive saltmarsh. See the coastal habitats supporting document for further details
Vegetation composition: plant health of dune grasses	Percentage cover	More than 95% of marram grass (*Ammophila arenaria*) and/or lyme-grass (*Leymus arenarius*) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on data from Ryle et al. (2009). Although mobile dunes occur along the full northern edge of the spit in the SAC, the characteristic vegetation of marram (*Ammophila arenaria*) is frequently quite sparse and/or has an unhealthy appearance, reflecting the general lack of sediment mobility along the seaward edge of the dunes. Only at the western tip of the spit, where accreting or locally recycled sediment accumulates, is there a substantial band of healthy marram. See the 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 (*Ammophila arenaria*) and/or lyme-grass (*Leymus arenarius*)	Based on data from Ryle et al. (2009). The mobile dune habitat at Rathlackan is characterised by the presence of marram grass (*Ammophila arenaria*). Lyme-grass (*Leymus arenarius*) is also present in places. See the 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). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. See the coastal habitats supporting document for further details

2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes)* in Lackan Saltmarsh and Kilcummin Head 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: Lackan (including Rathlackan) - 95.18ha. See map 4	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009). Fixed coastal dunes with herbaceous vegetation was mapped at the sub-site Lackan (including Rathlackan; CMP site ID: 129) to give a total estimated area of 95.18ha within Lackan Saltmarsh and Kilcummin Head SAC. See the Lackan Saltmarsh and Kilcummin Head SAC conservation objectives supporting document for coastal habitats 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). See the 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). Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. The north-facing (seaward) side of the Lackan dunes has a highly eroded dune face which, coupled with the lack of any substantially accreting habitat and no significant foredune development, suggests the system is being depleted of sediment. See the 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). The outer zone of Lackan Saltmarsh and Kilcummin Head SAC is dominated by a sand dune system and a sandy beach. The sand dunes are dominated by fixed dunes. Behind the dunes, there are sheltered intertidal sandflats which in turn are backed by extensive saltmarsh. See the coastal habitats supporting document for further details
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes	Based on data from Gaynor (2008) and Ryle et al. (2009). See the coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation within sward	Based on data from Gaynor (2008) and Ryle et al. (2009). Different levels of grazing have resulted in varying sward heights in the fixed dune habitat at this SAC. See the 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 range of sub-communities with typical species listed in Delaney et al. (2013)	Based on data from Gaynor (2008) and Ryle et al. (2009). The more commonly noted species in the fixed dunes included sand sedge (*Carex arenaria*), glaucous sedge (*C. flacca*), red fescue (*Festuca rubra*), lady's bedstraw (*Galium verum*), cat's ear (*Hypochaeris radicata*), common bird's-foot trefoil (*Lotus corniculatus*), field wood-rush (*Luzula campestris*), mouse-ear-hawkweed (*Pilosella officinarum*), ribwort plantain (*Plantago lanceolata*), yellow-rattle (*Rhinanthus minor*), wild thyme (*Thymus polytrichus*) and Germander speedwell (*Veronica chamaedrys*). See the 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 Gay nor (2008) and Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled. At Lackan Saltmarsh and Kilcummin Head SAC, the localised proliferation of species such as creeping thistle (*Cirsium arvense*), spear thistle (*C. vulgare*) and common ragwort (*Senecio jacobaea*) in the fixed dunes may be indicative of recent overgrazing and intensive management. See the 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). At Lackan Saltmarsh and Kilcummin Head SAC, there were occasional stunted hawthorn (*Crataegus monogyna*) shrubs in the fixed dune grassland, although the total shrub and tree cover was insignificant. See the coastal habitats supporting document for further details



Legend

Lackan Saltmarsh and Kilcummin Head SAC 000516

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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 1:
LACKAN SALTMARSH AND KILCUMMIN HEAD SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

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

SITE CODE:
SAC 000516; version 3.
CO. MAYO

0 0.25 0.5 0.75 1 km

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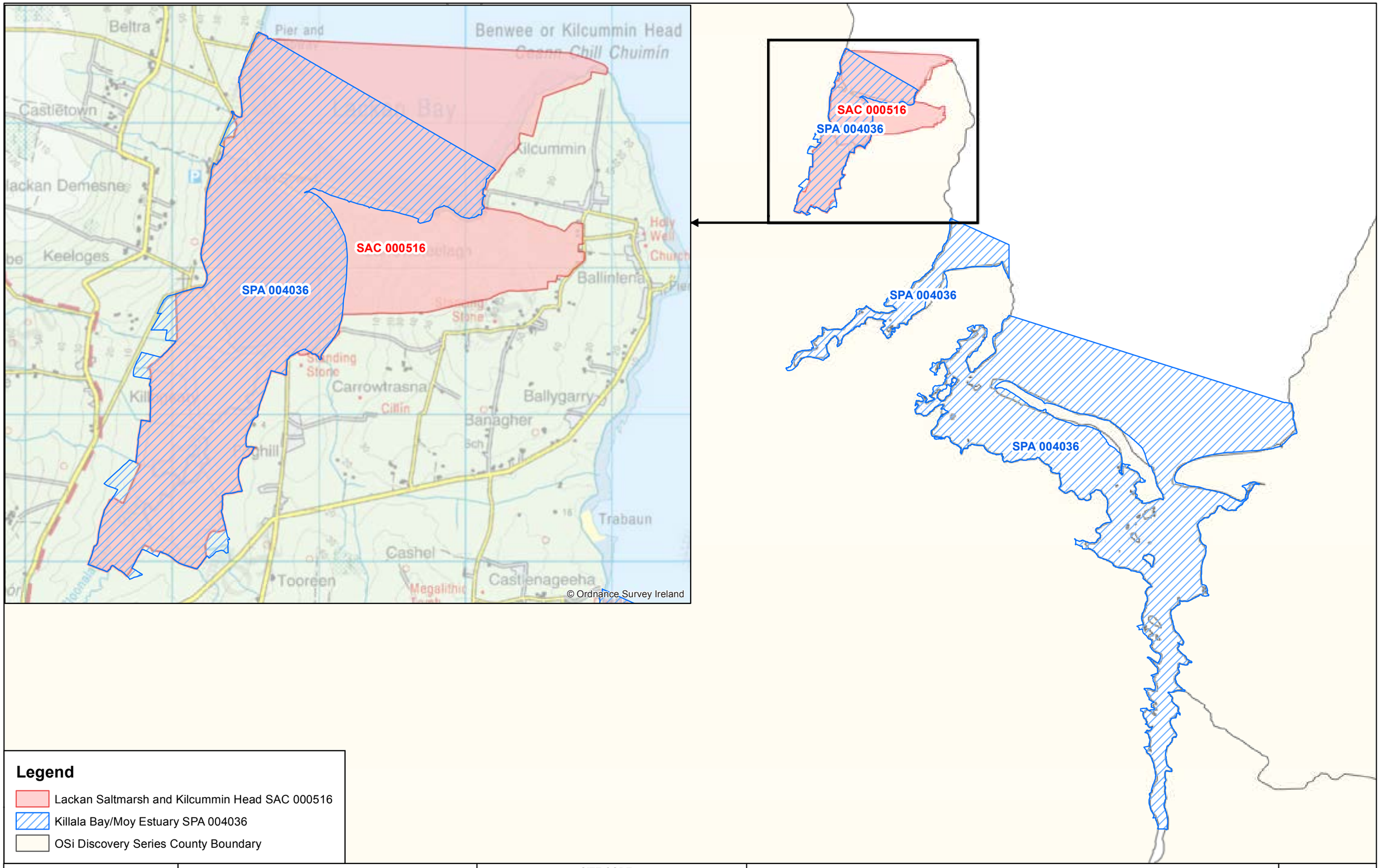
Map Version 1
Date: Oct 2016



Legend

- Lackan Saltmarsh and Kilcummin Head SAC 000516
- Killala Bay/Moy Estuary SPA 004036
- OSi Discovery Series County Boundary

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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 2:
LACKAN SALTMARSH AND KILCUMMIN HEAD SAC
CONSERVATION OBJECTIVES
OVERLAPPING DESIGNATIONS

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

SITE CODE:
SAC 000516; version 3. SPA 004036; version 3.
CO. MAYO

0 1 2 3 4 km

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Map Version 1
Date: Oct 2016

SMP Site Code: SMP0022

Legend

- Lackan Saltmarsh and Kilcummin Head SAC 000516
- Saltmarsh Monitoring Project Study Area
- 1330 / 1410 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) / Mediterranean salt meadows (*Juncetalia maritimi*)
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- Potential 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- OSi Discovery Series County Boundary

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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 3:
LACKAN SALTMARSH AND KILCUMMIN HEAD SAC
CONSERVATION OBJECTIVES
SALTMARSH HABITATS

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

SITE CODE:
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0 0.2 0.4 0.6 0.8 km

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Map Version 1
Date: Oct 2016

CMP Site Code: 129

CMP Site Code: 129

Legend

- Lackan Saltmarsh and Kilcummin Head SAC 000516
- Coastal Monitoring Project Survey Area

Qualifying Interests

- 2120, Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
- 2130, Fixed dunes with herbaceous vegetation ("grey dunes")

Non Qualifying Interests

- 2110 Embryonic shifting dunes
- OSi Discovery Series County Boundary

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MAP 4:
LACKAN SALTMARSH AND KILCUMMIN HEAD SAC
CONSERVATION OBJECTIVES
SAND DUNE HABITATS

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

SITE CODE:
SAC 000516; version 3.
CO. MAYO

0 0.15 0.3 0.45 0.6 km

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Map Version 1
Date: Oct 2016

ISSN 2009-4086

National Parks and Wildlife Service

Conservation Objectives Series

River Moy SAC 002298

An Roinn Ealaíon, Oidhreachta,
Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage,
Regional, Rural and Gaeltacht Affairs

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Series Editor: Rebecca Jeffrey
ISSN 2009-4086

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***

002298	River Moy SAC
1092	White-clawed Crayfish *Austropotamobius pallipes*
1095	Sea Lamprey *Petromyzon marinus*
1096	Brook Lamprey *Lampetra planeri*
1106	Salmon *Salmo salar*
1355	Otter *Lutra lutra*
7110	Active raised bogs*
7120	Degraded raised bogs still capable of natural regeneration
7150	Depressions on peat substrates of the Rhynchosporion
7230	Alkaline fens
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)*

Please note that this SAC overlaps with Killala Bay/Moy Estuary SPA (004036) and Lough Conn and Lough Cullin SPA (004228). It is adjacent to Killala Bay/Moy Estuary SAC (000458), Lough Hoe Bog SAC (000633), Bellacorick Bog Complex SAC (001922) and Ox Mountains Bogs SAC (002006). 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 :	1998
Title :	Conservation management of the white-clawed crayfish, (*Austropotamobius pallipes*)
Author :	Reynolds, J.D.
Series :	Irish Wildlife Manual No. 1
Year :	2004
Title :	The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs
Author :	King, J.J.; Linnane, S.M.
Series :	Irish Wildlife Manuals No. 14
Year :	2004
Title :	A survey of juvenile lamprey populations in the Moy catchment
Author :	O'Connor, W.
Series :	Irish Wildlife Manuals No. 15
Year :	2006
Title :	Otter survey of Ireland 2004/2005
Author :	Bailey, M.; Rochford, J.
Series :	Irish Wildlife Manual No. 23
Year :	2006
Title :	Assessment of impacts of turf cutting on designated raised bogs
Author :	Fernandez Valverde, F.; MacGowan, F.; Farrell, M.; Crowley, W.; Croal, Y.; Fanning, M.; McKee, A-M.
Series :	Unpublished report to NPWS
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 :	2008
Title :	National survey of native woodlands 2003-2008
Author :	Perrin, P.M.; Martin, J.; Barron, S.; O'Neill, F.H.; McNutt, K.E.; Delaney, A.
Series :	Unpublished Report to NPWS
Year :	2010
Title :	A provisional inventory of ancient and long-established woodland in Ireland
Author :	Perrin, P.M.; Daly, O.H.
Series :	Irish Wildlife Manual No. 46
Year :	2010
Title :	A technical manual for monitoring white-clawed crayfish (*Austropotamobius pallipes*) in Irish lakes
Author :	Reynolds, J., O'Connor, W., O'Keeffe, C.; Lynn, D.
Series :	Irish Wildlife Manual No.45
Year :	2012
Title :	Killala Bay/Moy Estuary SAC (00458) Coastal Supporting doc V1
Author :	NPWS
Series :	Conservation objectives supporting document

Year :	2012
Title :	Killala Bay/Moy Estuary SAC (000458) Marine supporting doc v.1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2013
Title :	National otter survey of Ireland 2010/12
Author :	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravalle, S.; McDonald, R.A.; Montgomery, W.I.
Series :	Irish Wildlife Manual No. 76
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 :	2014
Title :	Raised Bog Monitoring and Assessment Survey 2013
Author :	Fernandez, F.; Connolly K.; Crowley W.; Denyer J.; Duff K.; Smith G.
Series :	Irish Wildlife Manual No. 81
Year :	2014
Title :	National raised bog SAC management plan
Author :	Department of Arts, Heritage and the Gaeltacht
Series :	Draft for consultation. 15 January 2014
Year :	2014
Title :	Derrynabrock Bog (SAC 002298), Co.Roscommon/Mayo, Site Report
Author :	Fernandez, F.; Connolly, K.; Crowley, W.; Denyer J.; Duff K.; Smith G.
Series :	Raised bog monitoring and assessment survey 2013
Year :	2014
Title :	Tawnaghbeg Bog (SAC 002298), Co. Mayo, Site Report
Author :	Fernandez, F.; Connolly, K.; Crowley, W.; Denyer J.; Duff K.; Smith G.
Series :	Raised bog monitoring and assessment survey 2013
Year :	2016
Title :	River Moy SAC (site code: 2298) Conservation objectives supporting document- raised bog habitats 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 :	2002
Title :	Reversing the habitat fragmentation of British woodlands
Author :	Peterken, G.
Series :	WWF-UK, London

Year :	2003
Title :	Monitoring the river, sea and brook lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*
Author :	Harvey, J.; Cowx, I.
Series :	Conserving Natura 2000 Rivers Monitoring Series No. 5. English Nature, Peterborough
Year :	2003
Title :	Identifying lamprey. A field key for sea, river and brook lamprey
Author :	Gardiner, R.
Series :	Conserving Natura 2000 rivers, Conservation techniques No. 4. English Nature, Peterborough
Year :	2007
Title :	Evolutionary history of lamprey paired species *Lampetra fluviatilis* L. and *Lampetra planeri* Bloch as inferred from mitochondrial DNA variation
Author :	Espanhol, R.; Almeida, P.R.; Alves, M.J.
Series :	Molecular Ecology 16, 1909-1924
Year :	2010
Title :	Otter tracking study of Roaringwater Bay
Author :	De Jongh, A.; O'Neill, L.
Series :	Unpublished draft report to NPWS
Year :	2015
Title :	Behaviour of sea lamprey (*Petromyzon marinus* L.) at man-made obstacles during upriver spawning migration: use of telemetry to access efficacy of weir modifications for improved passage
Author :	Rooney, S.M.; Wightman, G.D.; O Conchuir, R.; King, J.J.
Series :	Biology and Environment: Proc. R. Ir. Acad. 115 B, 1-12
Year :	2015
Title :	River engineering works and lamprey ammocoetes; impacts, recovery, mitigation
Author :	King, J.J.; Wightman, G.D.; Hanna, G.; Gilligan, N.
Series :	Water and Environment Journal, 29, 482-488
Year :	2016
Title :	The status of Irish salmon stocks in 2015 with precautionary catch advice for 2016
Author :	Standing Scientific Committee on Salmon
Series :	Independent scientific report to Inland Fisheries Ireland

Spatial data sources

Year :	2014
Title :	Scientific Basis for Raised Bog Conservation in Ireland
GIS Operations :	RBSB13_SACs_ARB_DRB dataset, RBSB13_SACs_2012_HB dataset, RBSB13_SACs_DrainagePatterns_5k dataset and RBSB13_SAC_LIDAR_DTMs dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	Potential 7110; digital elevation model; drainage patterns (maps 3 and 5)
Year :	2013
Title :	Raised Bog Monitoring and Assessment Survey 2013
GIS Operations :	RBMA13_ecotope_map dataset clipped to SAC boundary. Appropriate ecotopes selected and exported to new dataset. Expert opinion used as necessary to resolve any issues arising
Used For :	7110 ecotopes (map 4)
Year :	Digitised 2003
Title :	Raised Bog Restoration Project 1999
GIS Operations :	Ecotope dataset clipped to SAC boundary. Appropriate ecotopes selected and exported to new dataset. Expert opinion used as necessary to resolve any issues arising
Used For :	7110 ecotopes (map 4)
Year :	Revision 2010
Title :	National Survey of Native Woodlands 2003-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	91A0, 91E0 (map 6)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	Creation of a 10m buffer on the terrestrial side of river banks data; creation of 20m buffer applied to canal centreline data. Creation of a 20m buffer applied to river and stream centreline data; These datasets combined with the derived OSI 1:5000 vector lake buffer data. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
Used For :	1355 (no map)
Year :	2010
Title :	OSi 1:5000 IG vector dataset
GIS Operations :	Creation of 80m buffer on the aquatic side of lake data; creation of 10m buffer on the terrestrial side of lake data. These datasets combined with the derived OSi Discovery Series river and canal datasets. 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 aquatic side of the lake boundary to highlight potential commuting points
Used For :	1355 (map 8)
Year :	2016
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 :	1092 (map 7)

7110 Active raised bogs

To restore the favourable conservation condition of Active raised bogs in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Restore area of active raised bog to 132.4ha, subject to natural processes	There are five raised bogs listed for River Moy SAC. The total area of Active Raised Bog (ARB) habitat for these five bogs was mapped at 45.3ha. Area of Degraded Raised Bog (DRB) on the High Bog (HB) has been modelled as 152.4ha. See map 3. However, it is estimated that only 82.1ha is potentially restorable to ARB by drain blocking. The total potential ARB on the HB is therefore estimated to be 127.4ha. Eco-hydrological assessments of the cutover estimates that an additional 5.0ha of bog forming habitats could be restored. The long term target for ARB is therefore 132.4ha. See raised bog supporting document for further details on this and following attributes
Habitat distribution	Occurrence	Restore the distribution and variability of active raised bog across the SAC. See map 4 for most recently mapped distribution	ARB occurs on most of the bogs in the River Moy SAC. DRB occurs on all five bogs in the River Moy SAC. There is also potential for ARB restoration on cutover areas surrounding the bogs (see area target above)
High bog area	Hectares	No decline in extent of high bog necessary to support the development and maintenance of active raised bog. See map 3	The area of high bog within the five raised bogs listed for River Moy SAC in 2012 (latest figure available) was 498.4ha (DAHG 2014)
Hydrological regime: water levels	Centimetres	Restore appropriate water levels throughout the site	For ARB, mean water level needs to be near or above the surface of the bog lawns for most of the year. Seasonal fluctuations should not exceed 20cm, and should only be 10cm below the surface, except for very short periods of time. Open water is often characteristic of soak systems
Hydrological regime: flow patterns	Flow direction; slope	Restore, where possible, appropriate high bog topography, flow directions and slopes. See map 5 for current situation	ARB depends on mean water levels being near or above the surface of bog lawns for most of the year. Long and gentle slopes are the most favourable to achieve these conditions. Changes to flow directions due to subsidence of bogs can radically change water regimes and cause drying out of high quality ARB areas and soak systems
Transitional areas between high bog and adjacent mineral soils (including cutover areas)	Hectares; distribution	Restore adequate transitional areas to support/protect active raised bog and the services it provides	ARB is threatened due to effects of past drainage and peat-cutting around the margins of the bogs within the River Moy SAC. Natural marginal habitats no longer exist. Eco-hydrological assessments have evaluated the potential for ARB restoration on cutover areas (see note for habitat area attribute above)
Vegetation quality: central ecotope, active flush, soaks, bog woodland	Hectares	Restore 66.2ha of central ecotope/active flush/soaks/bog woodland as appropriate	At least 50% of ARB habitat should be high quality (i.e. central ecotope, active flush, soaks, bog woodland). Target area of active raised bog for the site has been set at 132.4ha (see area target above)
Vegetation quality: microtopograph-ical features	Hectares	Restore adequate cover of high quality microtopographical features	High quality microtopography (hummocks, hollows and pools) is well developed in less disturbed parts of the bogs in River Moy SAC
Vegetation quality: bog moss (*Sphagnum*) species	Percentage cover	Restore adequate cover of bog moss (*Sphagnum*) species to ensure peat-forming capacity	*Sphagnum* cover varies naturally across Ireland with relatively high cover in the east to lower cover in the west. Hummock forming species such as *Sphagnum austinii* are particularly good peat formers. *Sphagnum* cover and distribution also varies naturally across a site

Typical ARB species: flora	Occurrence	Restore, where appropriate, typical active raised bog flora	Typical flora species include widespread species, as well as those with more restricted distributions but typical of the habitat's subtypes or geographical range
Typical ARB species: fauna	Occurrence	Restore, where appropriate, typical active raised bog fauna	Typical fauna species include widespread species, as well as those with more restricted distributions but typical of the habitat's subtypes or geographical range
Elements of local distinctiveness	Occurrence	Maintain features of local distinctiveness, subject to natural processes	An important feature of interest in relation to the raised bogs in the River Moy SAC is the fact that they occur at the north-western edge of the geographic range of the habitat in Ireland
Negative physical indicators	Percentage cover	Negative physical features absent or insignificant	Negative physical indicators include: bare peat, algae dominated pools and hollows, marginal cracks, tear patterns, subsidence features such as dry mineral mounds/ridges emerging or expanding and evidence of burning
Vegetation composition: native negative indicator species	Percentage cover	Native negative indicator species at insignificant levels	Disturbance indicators include species indicative of conditions drying out such as abundant bog asphodel (*Narthecium ossifragum*), deergrass (*Trichophorum germanicum*) and harestail cotton-grass (*Eriophorum vaginatum*) forming tussocks; abundant magellanic bog-moss (*Sphagnum magellanicum*) in pools previously dominated by *Sphagnum* species typical of very wet conditions (e.g. feathery bog-moss (*S. cuspidatum*)); and indicators of frequent burning events such as abundant *Cladonia floerkeana* and high cover of carnation sedge (*Carex panicea*) (particularly in true midlands raised bogs)
Vegetation composition: non-native invasive species	Percentage cover	Non-native invasive species at insignificant levels and not more than 1% cover	Most common non-native invasive species include lodgepole pine (*Pinus contorta*), rhododendron (*Rhododendron ponticum*), and pitcherplant (*Sarracenia purpurea*)
Air quality: nitrogen deposition	kg N/ha/year	Air quality surrounding bog close to natural reference conditions. The total N deposition should not exceed 5kg N/ha/yr	Change in air quality can result from fertiliser drift; adjacent quarry activities; or other atmospheric inputs. The critical load range for ombrotrophic bogs has been set as between 5 and 10kg N/ha/yr (Bobbink and Hettelingh, 2011). The latest N deposition figures for the area around the bogs in River Moy SAC suggests that the current level is approximately 8.5kg N/ha/yr (Henry and Aherne, 2014)
Water quality	Hydrochemical measures	Water quality on the high bog and in transitional areas close to natural reference conditions	Water chemistry within raised bogs is influenced by atmospheric inputs (rainwater). However, within soak systems, water chemistry is influenced by other inputs such as focused flow or interaction with underlying substrates. Water chemistry in areas surrounding the high bog varies due to influences of different water types (bog water, regional groundwater and run-off from surrounding mineral lands)

7120 Degraded raised bogs still capable of natural regeneration

The long-term aim for Degraded raised bogs still capable of natural regeneration is that its peat-forming capability is re-established; therefore, the conservation objective for this habitat is inherently linked to that of Active raised bogs (7110) and a separate conservation objective has not been set in River Moy SAC

Attribute	Measure	Target	Notes

7150	Depressions on peat substrates of the Rhynchosporion

Depressions on peat substrates of the Rhynchosporion is an integral part of good quality Active raised bogs (7110) and thus a separate conservation objective has not been set for the habitat in River Moy SAC

Attribute	Measure	Target	Notes

7230 Alkaline fens

To maintain the favourable conservation condition of Alkaline fens in River Moy 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	The full extent of of this habitat within the SAC is unknown. An extensive area is known to occur as part of a wetland complex on the Glore River, north-west of Ballyhaunis but there are likely to be other areas present in the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	Full distribution of the habitat in this SAC is currently unknown- see note above
Hydrological regime	Metres	Appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Maintenance of groundwater, surface water flows and water table levels within natural ranges is essential for this wetland habitat
Peat formation	Flood duration	Active peat formation, where appropriate	In order for peat to form, water levels need to be slightly below or above the soil surface for c.90% of the time (Jim Ryan, pers. comm.)
Water quality: nutrients	Water chemistry measures	Appropriate water quality to support the natural structure and functioning of the habitat	Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus with the latter tending to be tbe limiting nutrient
Vegetation structure: typical species	Percentage	Maintain vegetation cover of typical species including brown mosses and vascular plants	Mosses listed for fen in this SAC include *Campylium stellatum*, *Aneura pinguis* and *Scorpidium scorpioides* while vascular plants include long-stalked yellow sedge (*Carex lepidocarpa*), black bog rush (*Schoenus nigricans*), blunt-flowered rush (*Juncus subnodulosus*), purple moor-grass (*Molinia caerulea*), grass of Parnassus (*Parnassia palustris*), butterwort (*Pinguicula vulgaris*), marsh helleborine (*Epipactis palustris*) and meadow thistle (*Cirsium dissectum*) (internal NPWS files)
Vegetation composition: trees and shrubs	Percentage	Cover of scattered native trees and shrubs less than 10%	Scrub and trees will tend to invade if fen conditions become drier. Attribute and target based on upland habitat conservation assessment criteria (Perrin et al., 2014)
Physical structure: disturbed bare ground	Percentage	Cover of disturbed bare ground less than 10%. Where tufa is present, disturbed bare ground less than 1%	While grazing may be appropriate in this habitat, excessive areas of disturbed bare ground may develop due to unsuitable grazing regimes. Attribute and target based on upland habitat conservation assessment criteria (Perrin et al., 2014)
Physical structure: drainage	Percentage	Areas showing signs of drainage as a result of drainage ditches or heavy trampling less than 10%	Attribute and target based on upland habitat conservation assessment criteria (Perrin et al., 2014)

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

To maintain the favourable conservation condition of Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles in River Moy 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	Old sessile oakwoods are likely to occur as mosaics with other woodland types and the total extent within the SAC is unknown. Two sites (1763, 1800) in the SAC were surveyed as part of the the National Survey of Native Woodlands (NSNW) (Perrin et al., 2008). Site 1763 (Pontoon) is an extensive area of woodland and 106.3ha was mapped as this Annex I habitat type (or mosaics containing it). See map 6. NB further areas are likely to be present within the SAC
Habitat distribution	Occurrence	No decline. Woodlands surveyed as part of the NSNW are shown on map 6	The main location of this woodland type in the SAC is Pontoon Woods. See note on area above
Woodland size	Hectares	Area stable or 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)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008)
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 (*Quercus* spp.) regenerates poorly. In suitable sites ash (*Fraxinus excelsior*) 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
Woodland structure: indicators of local disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-data and other rare or localised species. Perrin and Daly (2010) list Pontoon Wood as possible ancient woodland
Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008)

Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including oak (*Quercus petraea*) and birch (*Betula pubescens*)	Species reported in Perrin et al. (2008)
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 (*Fagus sylvatica*), sycamore (*Acer psudoplatanus*), rhododendron (*Rhododendron ponticum*) and cherry laurel (*Prunus laurocerasus*)

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

To maintain the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) in River Moy 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	Total extent of this habitat within the SAC is unknown and it may occur in mosaics with other woodland types. Two sites (1763, 1800) within the SAC were surveyed as part of the the National Survey of Native Woodlands (NSNW) (Perrin et al., 2008). Map 6 shows surveyed woodlands including areas classified as 91E0 (2.76ha). NB areas mapped as other wet woodland types may also correspond with this Annex I woodland type. There are also likely to be additional areas of this Annex I woodland type within the SAC
Habitat distribution	Occurrence	No decline. Woodlands surveyed as part of the NSNW are shown on map 6	The area of this habitat identified by the NSNW occurs at Prospect (site 1800) on the western shore of Lough Conn. See note on area above
Woodland size	Hectares	Area stable or 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)
Woodland structure: community diversity and extent	Hectares	Maintain diversity and extent of community types	Described in Perrin et al. (2008)
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 (*Alnus glutinosa*) and oak (*Quercus* spp.) regenerate poorly. Ash (*Fraxinus excelsior*) 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 floodplains and lakeshores
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
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 disctinctiveness	Occurrence	No decline	Includes ancient or long-established woodlands, archaeological and geological features as well as red-data and other rare or localised species

Vegetation composition: native tree cover	Percentage	No decline. Native tree cover not less than 95%	Species reported in Perrin et al. (2008)
Vegetation composition: typical species	Occurrence	A variety of typical native species present, depending on woodland type, including including alder (*Alnus glutinosa*), willows (*Salix* spp.), oak (*Quercus robur*) and ash (*Fraxinus excelsior*)	Species reported in Perrin et al. (2008)
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 (*Acer pseudoplatanus*) and Himalayan balsam (*Impatiens glandulifera*). The NSNW notes rhododendron (*Rhododendron ponticum*) clearance in site 1800

1092 White-clawed Crayfish *Austropotamobius pallipes*

To maintain the favourable conservation condition of White-clawed Crayfish in River Moy 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 general distribution of white-clawed crayfish in the SAC is that it is widespread in the upper tributaries of the River Moy and the rivers which feed Loughs Conn and Cullin. It is absent from the main River Moy. The named tributaries that it is recorded from are the following: Upstream of Lough Conn: River Deel and its tributaries of the Toreen River, Rathnamagh River and Rappa Stream; Fiddaunglass; Addergoole River. Upstream of Lough Cullin: Tobergal River; Clydagh; tributaries of the Toormore and Manulla Rivers. Moy tributaries: Gweestion River; tributaries of the Pollagh, Glore, Yellow and Geestaun Rivers; Killeen River; Spaddagh River; Sonnagh River; Owenaher River; Owengarve River
Population structure: recruitment	Occurrence of juveniles and females with eggs	Juveniles and/or females with eggs in all occupied tributaries	See Reynolds et al. (2010) for further details
Negative indicator species	Occurrence	No alien crayfish species	Alien crayfish species are identified as a major direct threat to this species and as a disease vector. See Reynolds (1998) for further details. Ireland is currently free of non-native invasive crayfish species
Disease	Occurrence	No instances of disease	Crayfish plague is identified as major threat and has occurred in Ireland even in the absence of alien vectors. See Reynolds (1998) for further details. Disease can in some circumstances be introduced through contaminated equipment and water in the absence of vector species
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 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 maintain the favourable conservation condition of Sea Lamprey in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	This SAC only covers the freshwater portion of the River Moy. The adjacent Killala Bay/Moy Estuary SAC (site code: 000485) encompasses the estuarine elements of sea lamprey habitat. Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas (Rooney et al. 2015), however, there are no artificial barriers in the Moy catchment limiting lamprey access
Population structure of juveniles	Number of age/size groups	At least three age/size groups present	Attribute and target based on Harvey and Cowx (2003) and O'Connor (2007)
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density at least 1/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on Harvey and Cowx (2003)
Extent and distribution of spawning habitat	m² 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
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	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained. Occupancy in excess of 50% of sites would be 'reasonable' for the Irish catchments examined to date. (King and Linnane, 2004; King et al., unpublished data)

1096 Brook Lamprey *Lampetra planeri*

To maintain the favourable conservation condition of Brook Lamprey in River Moy SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage of river accessible	Access to all watercourses down to first order streams	Artificial barriers can block lampreys' migration both up- and downstream, thereby possibly limiting species to specific stretches, restricting access to spawning areas and creating genetically isolated populations (Espanhol et al., 2007). However, there are no artificial barriers in the Moy catchment limiting lamprey access
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). It is impossible to distinguish between brook and river lamprey juveniles in the field (Gardiner, 2003), hence they are considered together in this target
Juvenile density in fine sediment	Juveniles/m²	Mean catchment juvenile density of brook/river lamprey at least 2/m²	Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003) who state 10/m² in optimal conditions and more than 2/m² on a catchment basis
Extent and distribution of spawning habitat	m² 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
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	Silting habitat is essential for larval lamprey and they can be severely impacted by sediment removal. Recovery can be rapid and newly-created habitat can be rapidly colonised (King et al., 2015). However, it is vital that such sedimenting habitats are retained. Occupancy in excess of 50% of sites would be 'reasonable' for the Irish catchments examined to date. (King and Linnane, 2004; King et al., unpublished data)

1106 Salmon *Salmo salar*

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

Attribute	Measure	Target	Notes
Distribution: extent of anadromy	Percentage of river accessible	100% of river channels down to second order accessible from estuary	Artificial barriers block salmons' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. There are no artificial barriers on the Moy catchment limiting salmon access
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 (2016). Stock estimates are either derived from direct counts of adults (rod catch, fish counter) or indirectly by fry abundance counts. For the 2016 SSC advice, the Moy is currently exceeding its CL by 19,012 salmon
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 minutes 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 (*Lepeophtheirus salmonis*)
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. There are no artificial barriers preventing salmon from accessing suitable spawning habitat in this SAC
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)

1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter in River Moy 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 at 93.6% (Reid et al., 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 1068.8ha	No field survey. Areas mapped to include 10m terrestrial buffer along lake shorelines and along river banks identified as critical for otters (NPWS, 2007)
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 479.4km	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 1248.2ha	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)
Barriers to connectivity	Number	No significant increase. For guidance, see map 8	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

MAP 1:
RIVER MOY SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

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

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 2 4 6 8 10 km

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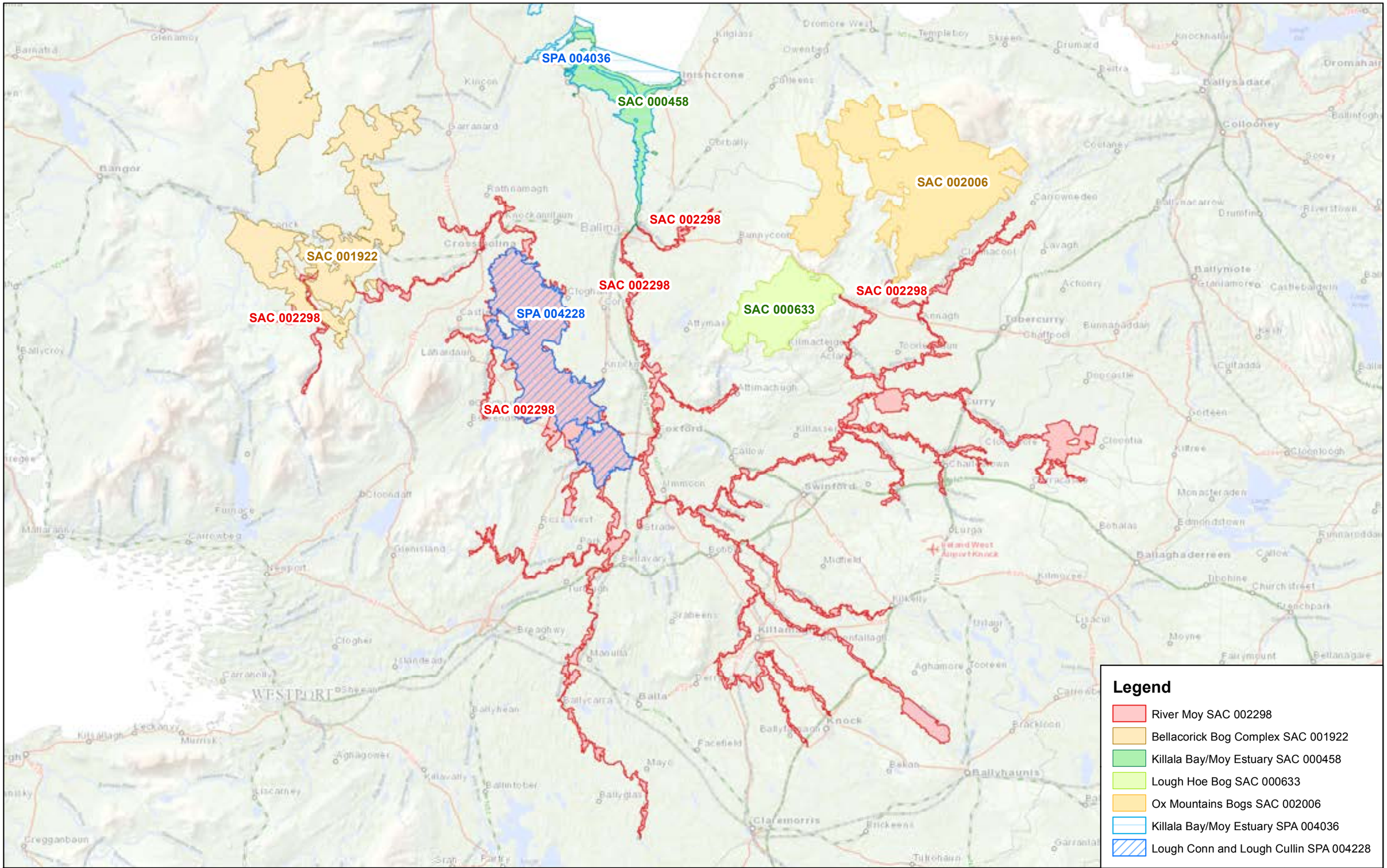
Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas

Legend
River Moy SAC 002298

N

Map Version 1
Date: July 2016



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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 2:
RIVER MOY SAC
CONSERVATION OBJECTIVES
ADJACENT / ADJOINING & OVERLAPPING DESIGNATIONS

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

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0 2.5 5 7.5 10 12.5 km

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N

Map Version 1
Date: July 2016

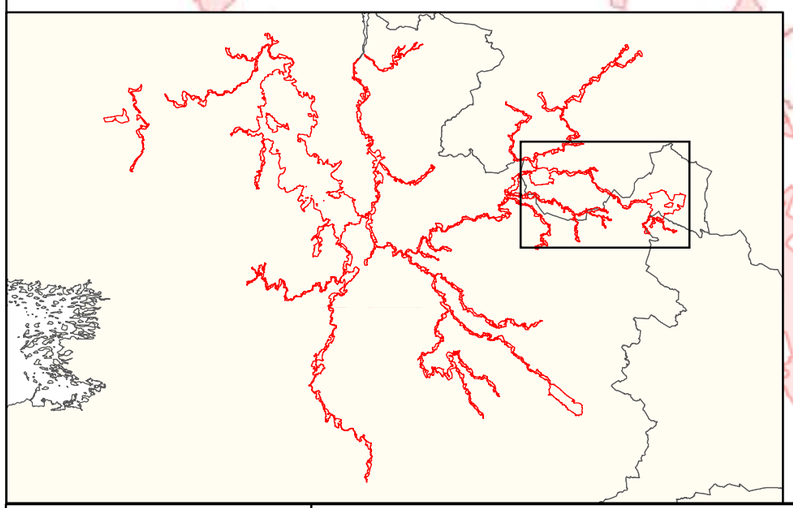
Cloongoonagh Bog

Gowlaun Bog

Tawnaghbeg Bog

Derrynabrock Bog

Kilgarriff Bog



Legend

- River Moy SAC 002298
- High Bog Boundary
- Potential 7110 Active Raised Bogs

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MAP 3:
RIVER MOY SAC
CONSERVATION OBJECTIVES
EXTENT OF POTENTIAL
ACTIVE RAISED BOGS

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

SITE CODE:
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0 0.45 0.9 1.35 1.8 2.25 km

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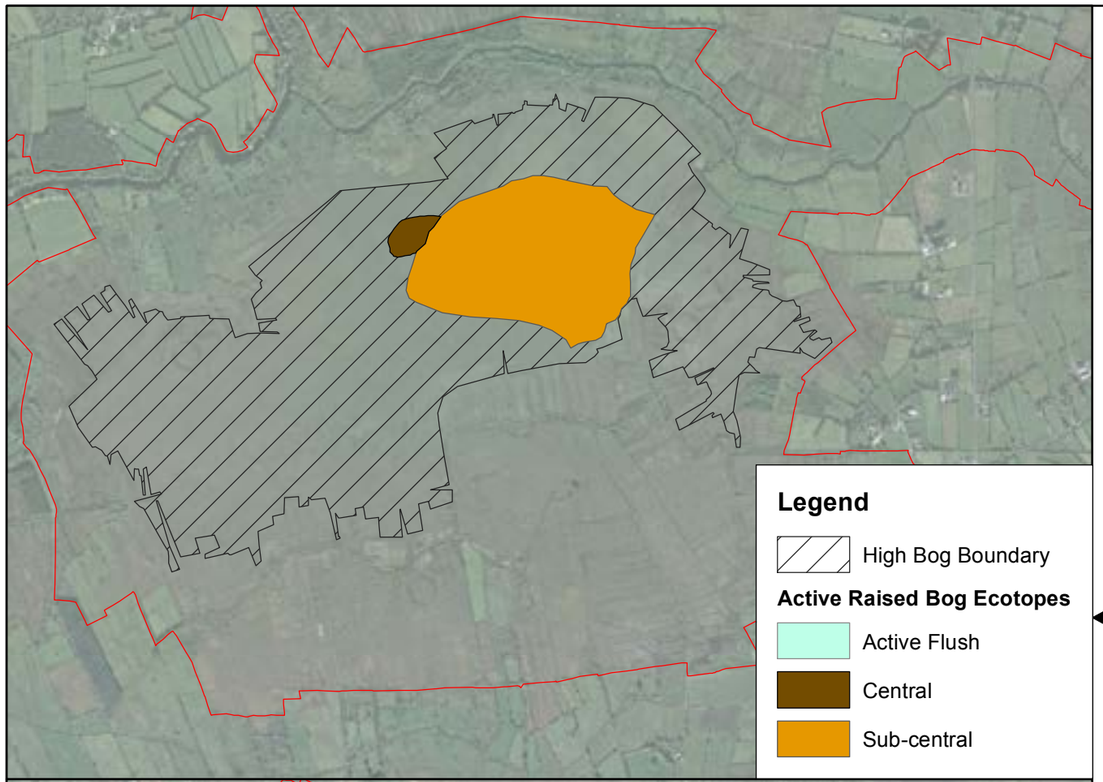
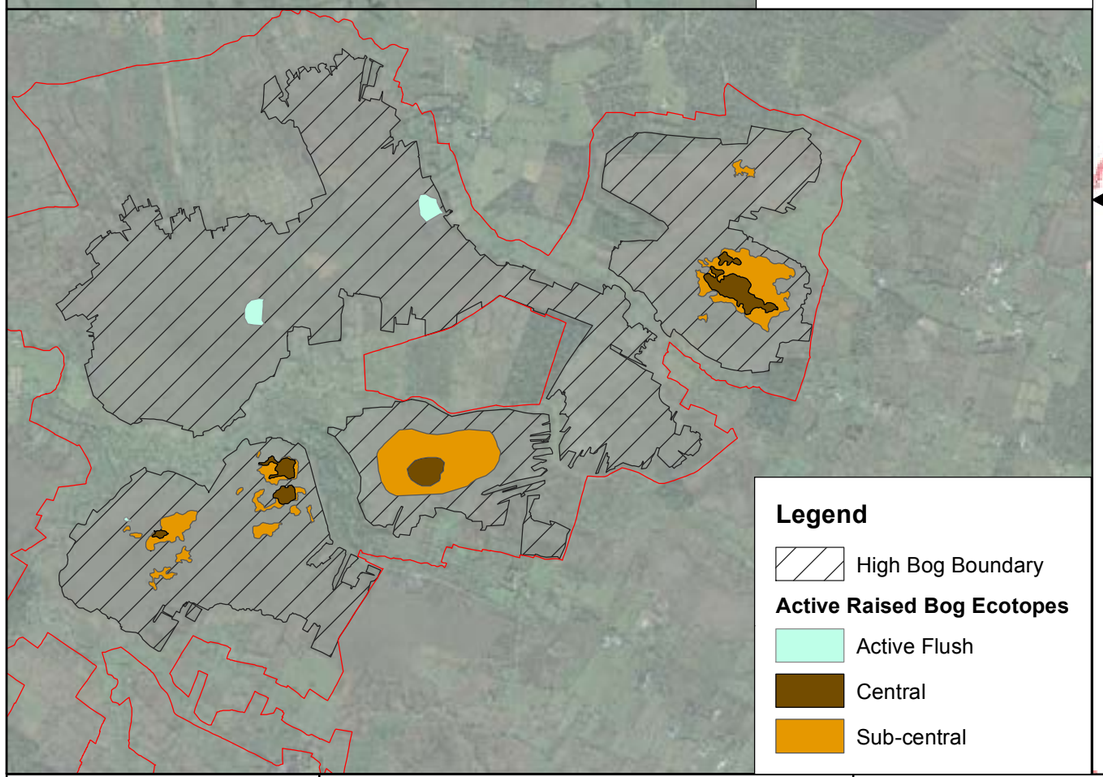
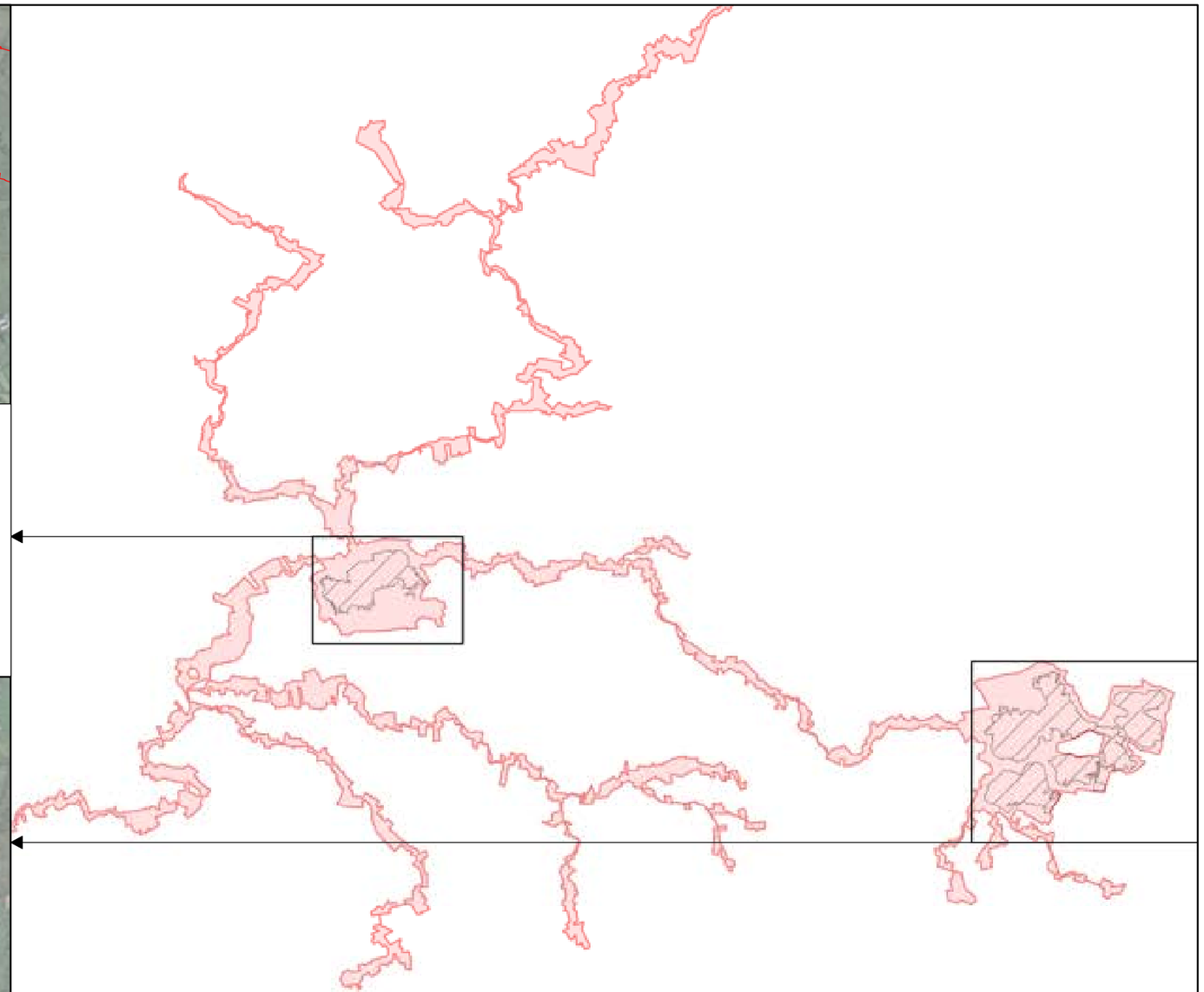
N

Map Version 1
Date: July 2016







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MAP 4:
RIVER MOY SAC
CONSERVATION OBJECTIVES
ACTIVE RAISED BOG
ECOTOPES

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

SITE CODE:
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0 1 2 3 4 5 km

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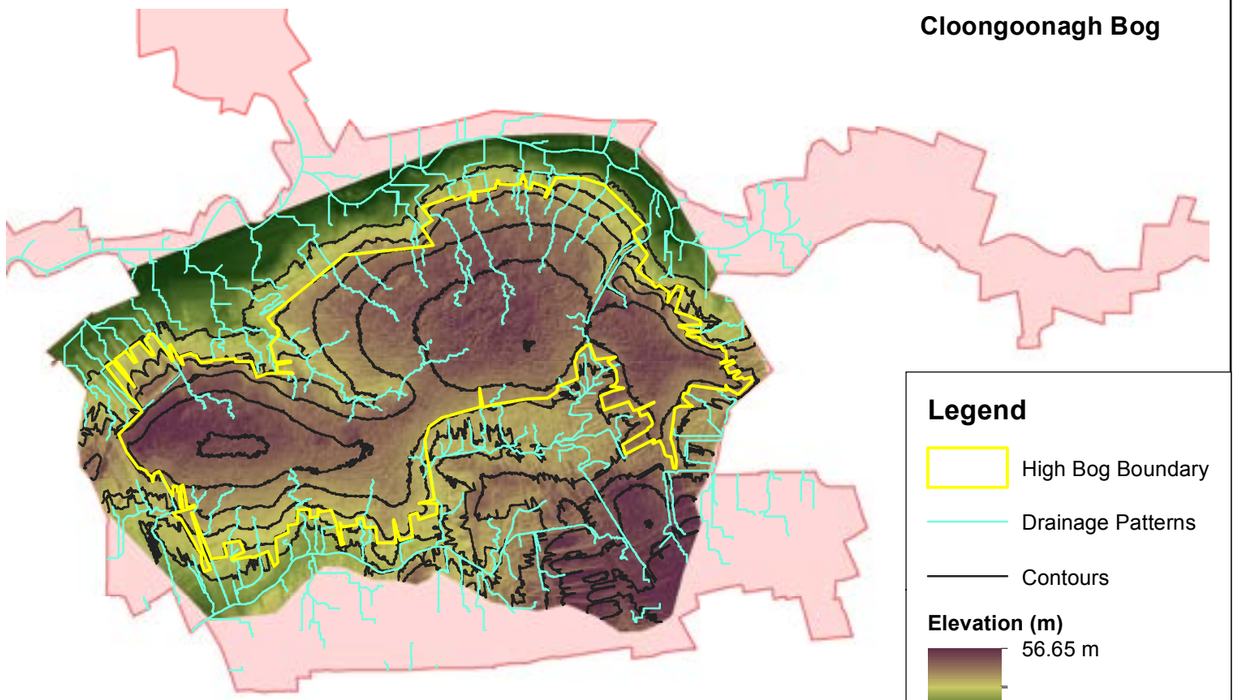
N

Map Version 1
Date: July 2016

Cloongoonagh Bog



Legend

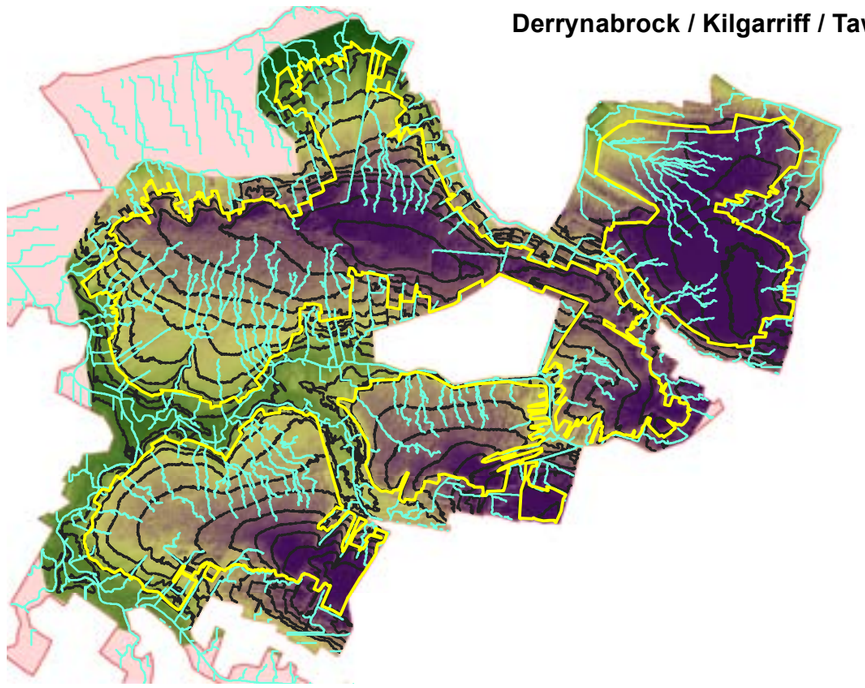
- High Bog Boundary
- Drainage Patterns
- Contours

Elevation (m)

56.65 m

39.86 m

Derrynabrock / Kilgarriff / Tawnabeg / Gowlaun Bogs



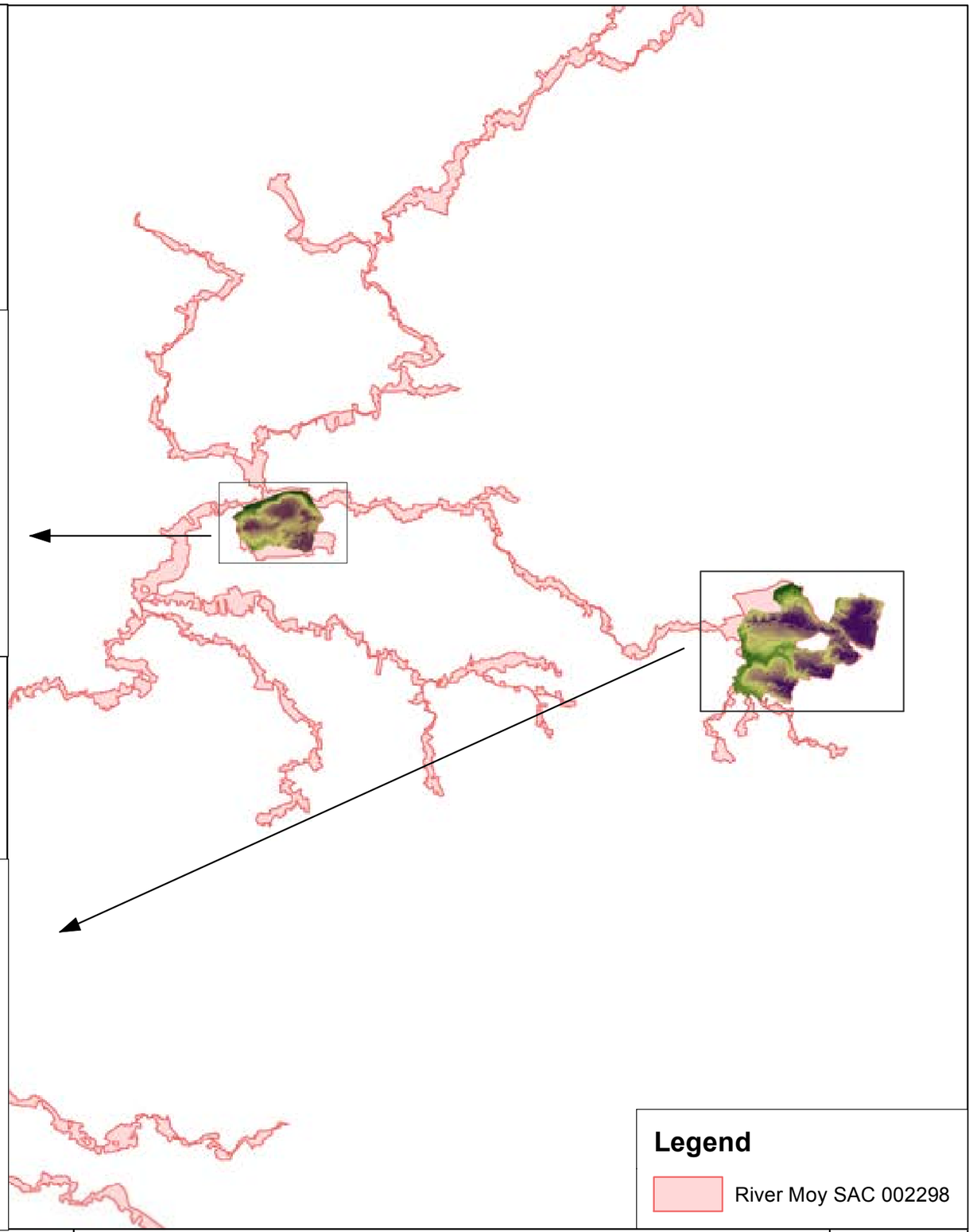
Legend

- High Bog Boundary
- Drainage Patterns
- Contours

Elevation (m)

91.94 m

71.07 m



Legend

- River Moy SAC 002298

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MAP 5:
RIVER MOY SAC
CONSERVATION OBJECTIVES
ACTIVE RAISED BOG
DIGITAL ELEVATION MODEL
& DRAINAGE PATTERN

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

SITE CODE:
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0 1.5 3 4.5 6 7.5 km

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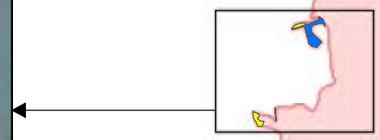
N

Map Version 1
Date: July 2016

NSNW Site Code: 1800



Legend

River Moy SAC 002298

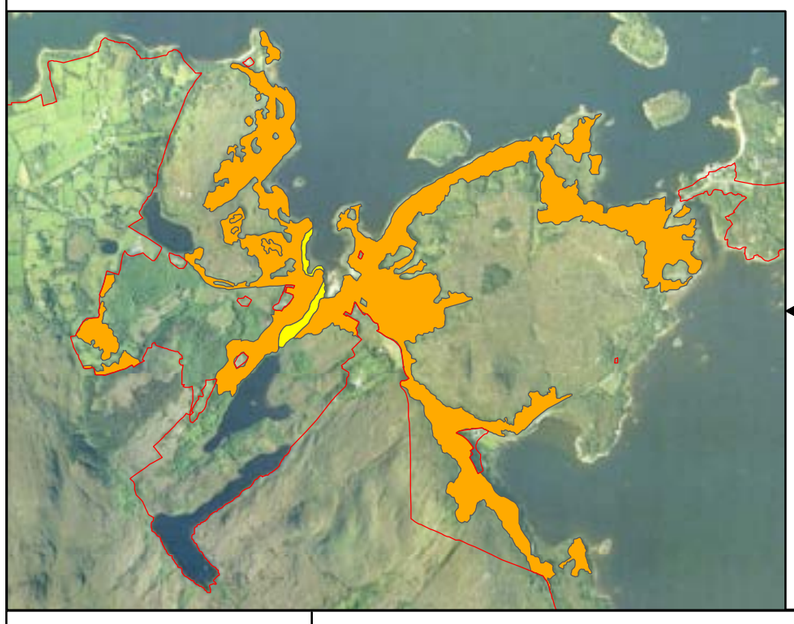
Qualifying Interests

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

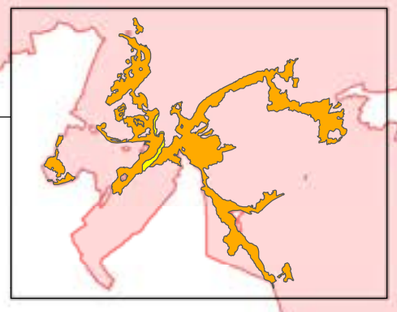
91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Pandion, Alnion incanae, Salicion albae)

Non Qualifying Interests

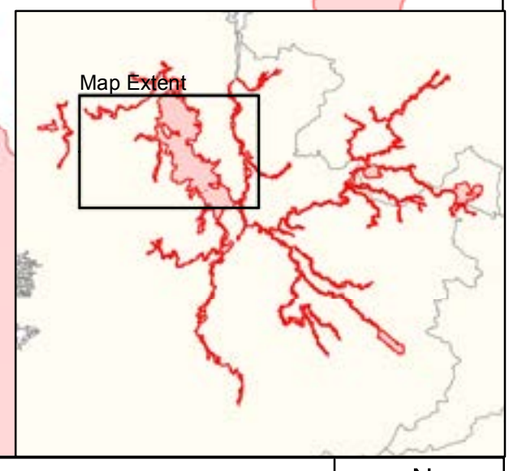
WN6, Wet willow-alder-ash woodland



NSNW Site Code: 1763



Map Extent



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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 6:
RIVER MOY SAC
CONSERVATION OBJECTIVES
WOODLAND HABITATS

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

SITE CODE:
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0 1 2 3 4 km

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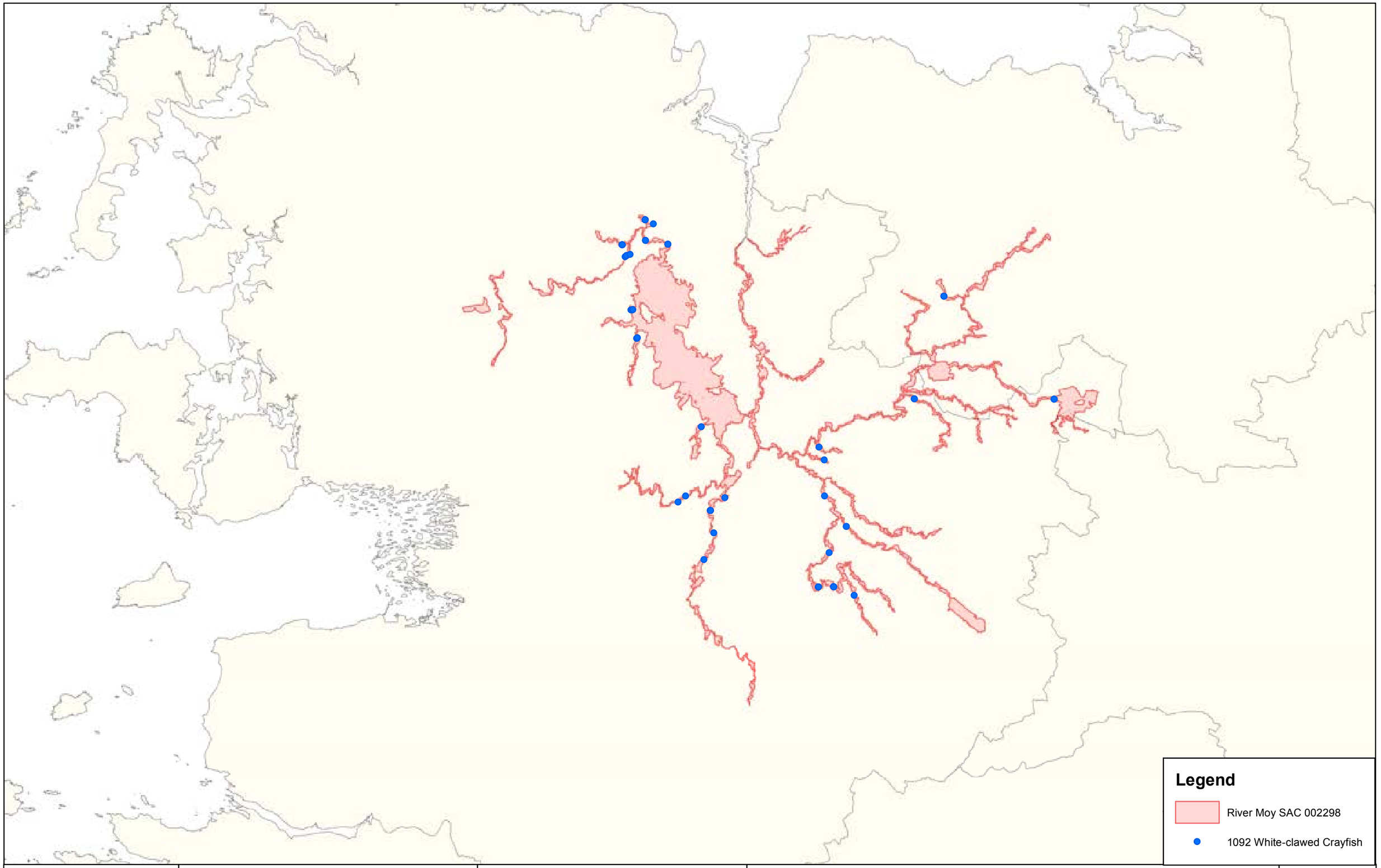
N

Map Version 1
Date:July 2016



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Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs

MAP 7:
RIVER MOY SAC
CONSERVATION OBJECTIVES
WHITE-CLAWED CRAYFISH

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

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 5.5 11 16.5 22 km

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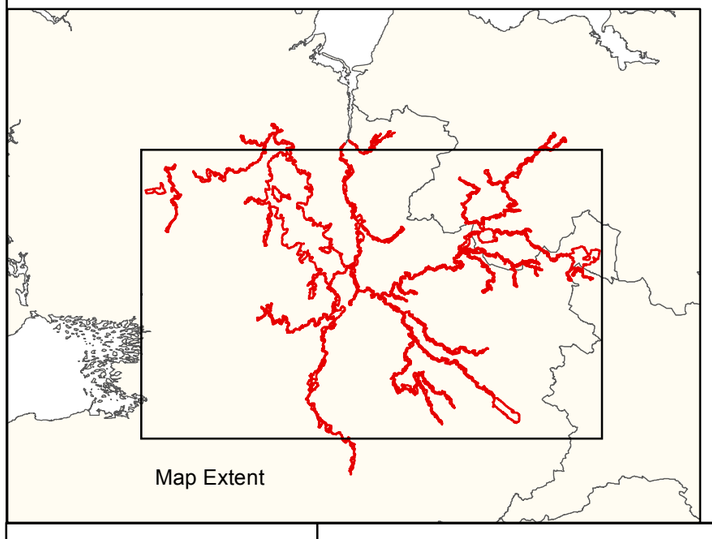
N

Map Version 1
Date: July 2016

Legend

- River Moy SAC 002298
- 1355 Otter - *Lutra lutra* commuting 250m buffer



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MAP 8:
RIVER MOY SAC
CONSERVATION OBJECTIVES
OTTER COMMUTING

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

SITE CODE:
SAC 002298; version 3.01. CO. MAYO, CO. SLIGO & CO. ROSCOMMON

0 1.5 3 4.5 6 7.5 km

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Níl sna teorainneacha ar na léarscáileanna ach nod garshuiomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaithe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas

N

Map Version 1
Date: July 2016

ISSN 2009-4086

National Parks and Wildlife Service

Conservation Objectives Series

Urlaur Lakes SAC 001571

An Roinn
Cultúir, Oidhreachta agus Gaeltachta
Department of
Culture, Heritage and the Gaeltacht

National Parks and Wildlife Service,
Department of Culture, Heritage and the Gaeltacht,

7 Ely Place, Dublin 2, Ireland.

Web: www.npws.ie
E-mail: nature.conservation@ahg.gov.ie

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Series Editor: Rebecca Jeffrey
ISSN 2009-4086

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***

001571 Urlaur Lakes SAC

3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Supporting documents, relevant reports & publications

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

NPWS Documents

Year :	2013
Title :	A survey of the benthic macrophytes of three hard-water lakes: Lough Bunny, Lough Carra and Lough Owel
Author :	Roden, C.; Murphy, P.
Series :	Irish Wildlife Manual No. 70
Year :	2013
Title :	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
Author :	NPWS
Series :	Conservation assessments
Year :	2015
Title :	Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting
Author :	O Connor, Á.
Series :	Unpublished document by NPWS

Other References

Year :	1982
Title :	Eutrophication of waters. Monitoring assessment and control
Author :	OECD
Series :	OECD, Paris
Year :	2000
Title :	Colour in Irish lakes
Author :	Free, G.; Allott, N.; Mills, P.; Kennelly, C.; Day, S.
Series :	Verhandlungen Internationale Vereinigung für theoretische und angewandte Limnologie, 27: 2620-2623
Year :	2006
Title :	A reference-based typology and ecological assessment system for Irish lakes. Preliminary investigations. Final report. Project 2000-FS-1-M1 Ecological assessment of lakes pilot study to establish monitoring methodologies EU (WFD)
Author :	Free, G.; Little, R.; Tierney, D.; Donnelly, K.; Coroni, R.
Series :	EPA, Wexford
Year :	2015
Title :	Water quality in Ireland 2010-2012
Author :	Bradley, C.; Byrne, C.; Craig, M.; Free, G.; Gallagher, T.; Kennedy, B.; Little, R.; Lucey, J.; Mannix, A.; McCreesh, P.; McDermott, G.; McGarrigle, M.; Ní Longphuirt, S.; O'Boyle, S.; Plant, C.; Tierney, D.; Trodd, W.; Webster, P.; Wilkes, R.; Wynne, C.
Series :	EPA, Wexford
Year :	in prep.
Title :	Monitoring of hard-water lakes in Ireland using charophytes and other macrophytes
Author :	Roden, C.; Murphy, P.
Series :	Unpublished report to NPWS

Spatial data sources

Year :	2008
Title :	OSi 1:5000 IG vector dataset
GIS Operations :	WaterPolygons feature class clipped to the SAC boundary. Expert opinion used to identify Annex I habitat and to resolve any issues arising
Used For :	3140 (map 2)

3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

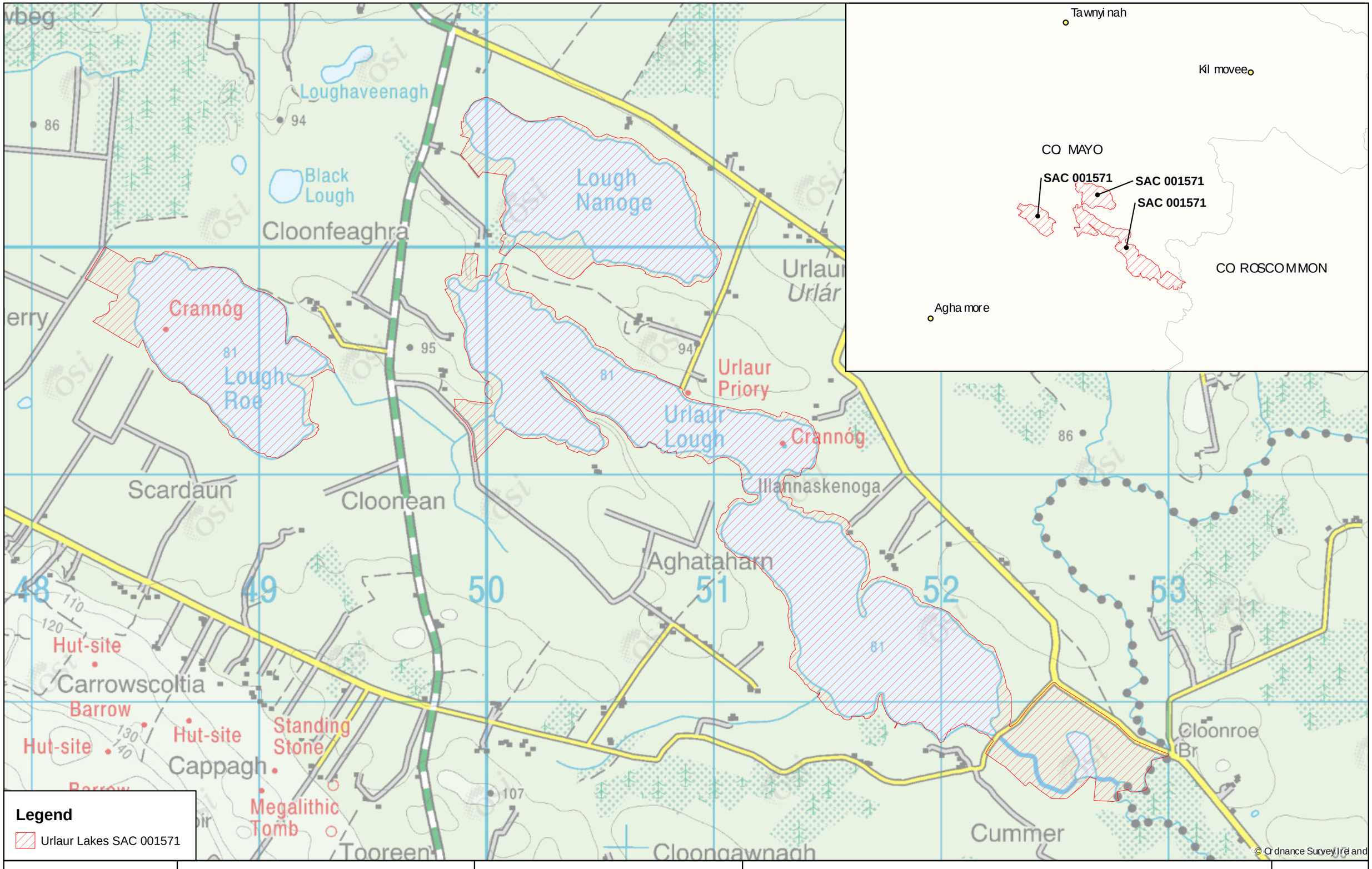
To restore the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. in Urlaur Lakes SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Urlaur Lakes SAC contains three marl lakes with habitat 3140 (Urlaur Lough, Lough Nanoge and Lough Roe). The vegetation of Urlaur Lough was surveyed in 2012 and assessed as being in poor conservation condition (Roden and Murphy, in prep.). Urlaur Lough is on the Water Framework Directive (WFD) monitoring programme and regular macrophyte surveys are conducted by the Environmental Protection Agency (EPA). Two measures of extent should be used: 1. the area of the lake itself and; 2. the extent of the vegetation communities/zones that typify the habitat. Further information relating to all attributes is provided in the lake habitats supporting document for the purposes of site-specific conservation objectives and Article 17 reporting (O Connor, 2015)
Habitat distribution	Occurrence	No decline, subject to natural processes	As noted above, lake habitat 3140 occurs in Urlaur Lough, Lough Nanoge and Lough Roe in the SAC. See map 2
Vegetation composition: typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	For lists of 3140 typical species (cyanobacteria, algae, higher plants and water beetles), see the Article 17 habitat assessment for lake habitat 3140 (NPWS, 2013) and the lake habitats supporting document (O Connor, 2015). Roden and Murphy (in prep.) recorded krustenstein, *Chara aspera, C. contraria, C. curta, C. virgata, Ophrydium versatile, Baldellia ranunculoides, Callitriche hermaphroditica, Eleocharis palustris, Elodea canadensis, Fontinalis antipyretica, Hippuris vulgaris, Lemna trisulca, Littorella uniflora, Potamogeton berchtoldii, P. perfoliatus, Ranunculus flammula, Utricularia minor* and *U. vulgaris* in Urlaur Lough. NPWS site files also note *Cladium mariscus, Equisetum fluviatile, Nuphar lutea, Nymphaea alba, Phragmites australis* and *Schoenplectus lacustris* in the SAC (NPWS internal files)
Vegetation composition: characteristic zonation	Occurrence	All characteristic zones should be present, correctly distributed and in good condition	The characteristic zonation of lake habitat 3140 is described in Roden and Murphy (2013). Urlaur Lough had few charophyte bands in 2012: *Chara contraria* or *C. curta* and *C. virgata* extending to c.2m; common *Elodea canadensis* at the base of the euphotic zone and well-developed krustenstein on occasional boulders (Roden and Murphy, in prep.)
Vegetation distribution: maximum depth	Metres	Restore maximum depth of vegetation, subject to natural processes	Maximum vegetation depth is expected to be deep in clear, hard water lakes, and extremely clear marl lakes can have charophyte vegetation to more than 9m (e.g. Lough Rea has charophytes to 10-11m, Coolorta >9m) (Roden and Murphy, in prep.). The indicative target of >6m for lake habitat 3140 may need to be modified based on the habitat sub-type/form and/or the specific lake in question (Roden and Murphy, 2013, in prep.). In this SAC, the maximum depth of vegetation at Urlaur Lough was very shallow at 2-2.1m in 2012 (Roden and Murphy, in prep.). The water is highly coloured in Urlaur Lough and this may contribute to the limited vegetation development. Areas of drained peatland (for turf-cutting, conifer forest, agricultural use) in the catchments of Urlaur Lough, Lough Nanoge and Lough Roe are likely to artificially increase the lakes' water colour

Hydrological regime: water level fluctuations	Metres	Maintain appropriate hydrological regime necessary to support the habitat	The hydrological regime of lakes with habitat 3140 is driven by groundwater flows. Groundwater can discharge directly to the lake, via springs or seepages, or to in-flowing rivers. Fluctuations in lake water level are typical in Ireland, but can be amplified by activities such as abstraction and drainage. Increased water level fluctuations can increase wave action and turbidity, up-root vegetation, alter the substratum and lead to nutrient release from sediment. The hydrological regime, particularly the groundwater contribution, must be maintained so that the area, distribution and depth of the lake habitat and its constituent/characteristic vegetation zones and communities are not reduced
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation	The hard water lake habitat (3140) is associated with a range of base-rich substratum types, from marl and limestone bedrock, through rocks, cobbles, gravel, muds and even peat. Further research into substratum quality (notably calcium, iron and nutrient concentrations) in the hard water lake habitat would be beneficial. Roden and Murphy (in prep.) recorded sand, mud and occasional shoreline boulders at Urlaur Lough. The EPA have recorded cobble and gravel on the shoreline and silt at depth in Urlaur Lough. NPWS site files note stony, gravelly and sandy shorelines at Lough Nanoge (NPWS internal files)
Water quality: transparency	Metres	Restore appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	Transparency relates to light penetration and, hence, to the depth of colonisation of vegetation. It can be affected by phytoplankton blooms, water colour and turbidity. A target of >6m has been set for hard water lakes (3140) (Roden and Murphy, in prep.). The OECD fixed boundary system set transparency targets for oligotrophic lakes of ≥6m annual mean Secchi disk depth and ≥3m annual minimum Secchi disk depth. Hard water lakes typically have high transparency, particularly in the very clear and typical marl forms (Roden and Murphy, in prep.). Secchi depth at Urlaur Lough was 1.5m in 2001 (Free et al., 2006) and 1.54m in 2012 (Roden and Murphy, in prep.)
Water quality: nutrients	µg/l P; mg/l N	Restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	Lake habitat 3140 is typically associated with high water quality, as demonstrated by naturally low dissolved nutrients. The target for Loughs Urlaur, Nanoge and Roe is WFD High Status or oligotrophic (OECD, 1982). Annual average total phosphorus (TP) concentration should be ≤10µg/l TP, average annual total ammonia concentration should be ≤0.04mg/l N and annual 95th percentile for total ammonia should be ≤0.09mg/l N. Where nutrient concentrations are lower than the targets, there should be no upward trend in concentrations. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. Free et al. (2006) measured <10µg/l TP in Urlaur Lough in April 2001. Urlaur Lough failed to reach the target in 2010-12, however, having good nutrient status (Bradley et al., 2015)

Water quality: phytoplankton biomass	µg/l Chlorophyll *a*	Maintain/restore appropriate water quality to support the habitat, including high chlorophyll *a* status	Lake habitat 3140 is associated with high water quality, as demonstrated by naturally low algal growth. As for nutrients, the default target is WFD High Status or oligotrophic (OECD, 1982). Average growing season (March-October) chlorophyll *a* concentration must be <5.8µg/l. Annual average chlorophyll *a* concentration should be <2.5µg/l and the annual peak should be <8.0µg/l. Where chlorophyll *a* concentrations are lower than the targets, there should be no upward trend in phytoplankton biomass. See also The European Communities Environmental Objectives (Surface Waters) Regulations 2009. In Urlaur Lough, Free et al. (2006) measured 7.7µg/l chlorophyll *a* in April 2001 and chlorophyll *a* status was high in 2010-12 (Bradley et al., 2015)
Water quality: phytoplankton composition	EPA phytoplankton composition metric	Restore appropriate water quality to support the habitat, including high phytoplankton composition status	The EPA has developed a phytoplankton composition metric for nutrient enrichment of Irish lakes. As for other water quality indicators, the default target for lake habitat 3140 is WFD high status. Urlaur Lough failed to reach the target in 2010-12, having good phytoplankton composition status (Bradley et al., 2015)
Water quality: attached algal biomass	Algal cover and EPA phytobenthos metric	Maintain/restore trace/absent attached algal biomass (<5% cover) and high phytobenthos status	Nutrient enrichment can favour epiphytic and epipelic algae that can out-compete the submerged vegetation. The cover abundance of attached algae in hard water lakes (3140) should, therefore, be trace/absent (<5% cover). EPA phytobenthos status can be used as an indicator of changes in attached algal biomass. As for other water quality indicators, the default target for lake habitat 3140 is high phytobenthos status. Phytobenthos status was high in Urlaur Lough in 2010-12 (Bradley et al., 2015); however, filamentous algae were recorded by the EPA in the lake in 2001 and 2011
Water quality: macrophyte status	EPA macrophyte metric (The Free Index)	Restore high macrophyte status	Nutrient enrichment can favour more competitive submerged macrophyte species that out-compete the typical and characteristic species for hard water lakes (3140). The EPA monitors macrophyte status for WFD purposes using the 'Free Index'. The target for lake habitat 3140 is high status or an Ecological Quality Ratio (EQR) for lake macrophytes of ≥0.90, as defined in Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009. Urlaur Lough failed to reach the target in 2010-12, having good macrophyte status (Bradley et al., 2015)
Acidification status	pH units; mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	The specific requirements of lake habitat 3140, in terms of water and sediment pH, alkalinity and cation concentration, have not been fully determined. Acidification is not considered a threat to lake habitat 3140; however, eutrophication can lead to at least temporary increases in pH to toxic levels (>9/9.5 pH units). Maximum pH should be <9.0 pH units, in line with the surface water standards. See Schedule Five of the European Communities Environmental Objectives (Surface Waters) Regulations 2009
Water colour	mg/l PtCo	Maintain/restore appropriate water colour to support the habitat	Increased colour decreases light penetration and reduces the area of macrophyte habitat, particularly at the lower euphotic depths. Higher colour also appears to favour angiosperms over charophytes in hard water lakes (Roden and Murphy, in prep.). The primary source of increased colour in Ireland is peatland disturbance. No habitat-specific or national standards for water colour exist. Studies have shown median colour concentrations in Irish lakes of 38mg/l PtCo (Free et al., 2000) and 33mg/l PtCo (Free et al., 2006). Lake habitat 3140 is typically associated with very clear waters and expected colour would be <10mg/l PtCo or, more likely, <5mg/l PtCo. Free et al. (2006) recorded colour of 33mg/l PtCo in Urlaur Lough

Dissolved organic carbon (DOC)	mg/l	Maintain/restore appropriate organic carbon levels to support the habitat	Dissolved (and particulate) organic carbon (OC) in the water column is linked to water colour and acidification (organic acids). Increasing DOC in water has been documented across the Northern Hemisphere, including afforested peatland catchments in Ireland. Damage and degradation of peatland, leading to decomposition of peat is likely to be the predominant source of OC in Ireland. OC in water promotes decomposition by fungi and bacteria that, in turn, releases dissolved nutrients. The increased biomass of decomposers can also impact directly on the characteristic lake communities through shading, competition, etc. As noted above, increased water colour, low transparency and shallow vegetation zones at Urlaur Lough may be linked to peatland disturbance
Turbidity	Nephelometric turbidity units/ mg/l SS/ other appropriate unit	Maintain appropriate turbidity to support the habitat	Turbidity can significantly affect the quantity and quality of light reaching rooted and attached vegetation and can, therefore, impact on lake habitats. The settlement of higher loads of inorganic or organic material on lake vegetation communities may also have impacts on sensitive, delicate species. Turbidity can increase as a result of re-suspension of material within the lake, higher loads entering the lake, or eutrophication. Turbidity measurement and interpretation is challenging. As a result, it is likely to be difficult to set habitat-specific targets for turbidity in lakes
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3140	Most lake shorelines have fringing habitats of reedswamp, other swamp, fen, marsh or wet woodland that intergrade with and support the structure and functions of the lake habitat. Equally, fringing habitats are dependent on the lake, particularly its water levels, and support wetland communities and species of conservation concern. Many of the fringing wetland habitats support higher invertebrate and plant species richness than the lake habitats themselves. Fringing fen habitats can be particularly important around hard water lakes, notably the Annex I habitats alkaline fen, *Cladium* fen and petrifying springs (habitat codes 7230, 7210 and 7220). Reedbeds (*Schoenoplectus lacustris, Phragmites australis*), swamp (*Carex rostrata, Cladium mariscus, Typha latifolia, Equisetum fluviatile*), fen/flush, heath, revegetated cutaway bog, scrub and calcareous grassland have been recorded on the shores of Urlaur, Nanoge and Roe. Transition mire/quaking bog may also occur



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Legend

Urlaur Lakes SAC 001571

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MAP 1:
URLAUR LAKES SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION

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

SITE CODE:
SAC 001571; version 3. CO. MAYO

0 200 400 600 800 Meters

The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.
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Map Version 1
Date: Nov 2017

Legend

- Urlaur Lakes SAC 001571
- 3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.
- OSi Discovery Series County Boundary

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Department of
Culture, Heritage and the Gaeltacht

MAP 2:
URLAUR LAKES SAC
CONSERVATION OBJECTIVES
INDICATIVE LAKE HABTIATS

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

SITE CODE:
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Map Version 1
Date: Nov 2017

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National Parks and Wildlife Service

Conservation Objectives Series

Killala Bay/Moy Estuary SPA 004036

An Roinn
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Department of
Arts, Heritage and the Gaeltacht

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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***

004036	Killala Bay/Moy Estuary SPA
A137	Ringed Plover *Charadrius hiaticula*
A140	Golden Plover *Pluvialis apricaria*
A141	Grey Plover *Pluvialis squatarola*
A144	Sanderling *Calidris alba*
A149	Dunlin *Calidris alpina alpina*
A157	Bar-tailed Godwit *Limosa lapponica*
A160	Curlew *Numenius arquata*
A162	Redshank *Tringa totanus*
A999	Wetlands

Please note that this SPA overlaps with Killala Bay/Moy Estuary SAC (000458) and Lackan Saltmarsh and Kilcummin Head SAC (000516). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping 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 :	2013
Title :	Killala Bay/Moy Estuary SPA (site code 4036) Conservation objectives supporting document V1
Author :	NPWS
Series :	Conservation objectives supporting document

A137 Ringed Plover *Charadrius hiaticula*

To maintain the favourable conservation condition of Ringed Plover in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number and range of areas used by waterbirds	No significant decrease in the range, timing or intensity of use of areas by ringed plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of conservation objectives supporting document

A140 Golden Plover *Pluvialis apricaria*

To maintain the favourable conservation condition of Golden Plover in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A141 Grey Plover *Pluvialis squatarola*

To maintain the favourable conservation condition of Grey Plover in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by grey plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A144 Sanderling *Calidris alba*

To maintain the favourable conservation condition of Sanderling in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by sanderling, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A149 Dunlin *Calidris alpina alpina*

To maintain the favourable conservation condition of Dunlin in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by dunlin, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A157 Bar-tailed Godwit *Limosa lapponica*

To maintain the favourable conservation condition of Bar-tailed Godwit in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by bar-tailed godwit, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A160 Curlew *Numenius arquata*

To maintain the favourable conservation condition of Curlew in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by curlew, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A162 Redshank *Tringa totanus*

To maintain the favourable conservation condition of Redshank in Killala Bay/Moy Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Number, range, timing and intensity of use of area	No significant decrease in the range, timing or intensity of use of areas by redshank, other than that occurring from natural patterns of variation	Waterbird distribution from the 2010/2011 waterbird survey programme is discussed in part five of the conservation objectives supporting document

Conservation Objectives for : Killala Bay/Moy Estuary SPA [004036]

A999 Wetlands

To maintain the favourable conservation condition of wetland habitat in Killala Bay/Moy Estuary SPA as a resource for the regularly occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 3204 hectares, other than that occurring from natural patterns of variation	The wetland habitat area was estimated as 3204ha using OSi data and relevant orthophotographs. For further information see part three of the conservation objectives supporting document

Lackan Bay

KILLALA
Cill Ala

INISHCRONE
Inis Crabhann

Legend

SPA 004036

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

MAP 1:
KILLALA BAY / MOY ESTUARY SPA
CONSERVATION OBJECTIVES
SPA DESIGNATION

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

SITE CODE: SPA 004036
CO. MAYO; version 1.02
CO. SLIGO; version 1.02

0 0.5 1 1.5 2 km

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N

Map Version 1
Date: Feb 2013

SAC 000516

SPA 004036

SPA 004036

SAC 000458

Legend

- SPA 004036
- SAC 000458 Killala Bay/Moy Estuary
- SAC 000516 Lackan Saltmarsh And Kilcummin Head
- OSi Discovery Series County Boundaries

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Department of Arts, Heritage and the Gaeltacht

MAP 2:
KILLALA BAY / MOY ESTUARY SPA CONSERVATION OBJECTIVES ADJOINING / OVERLAPPING DESIGNATIONS

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

SITE CODE:
SPA 004036 CO. MAYO; version 1.02, CO. SLIGO; version 1.02
SAC 000458 CO. MAYO; version 1.01, CO. SLIGO; version 1.01
SAC 000516 CO. MAYO; version 1.01

0 1 2 3 km

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N

Map Version 1
Date: Feb 2013

Appendix B

Nutrient Sensitive Qualifying Interests

Code	Qualifying Interest	Code	Qualifying Interest	Code	Qualifying Interest
A001	Red-throated Diver (Gavia stellata)	A160	Curlew (Numenius arquata)	1130	Estuaries
A003	Great Northern Diver (Gavia immer)	A162	Redshank (Tringa totanus)	1140	Tidal mudflats
A004	Little Grebe (Tachybaptus ruficollis)	A164	Greenshank (Tringa nebularia)	1150	Lagoons*
A005	Great Crested Grebe (Podiceps cristatus)	A169	Turnstone (Arenaria interpres)	1160	Large shallow inlets and bays
A013	Manx Shearwater (Puffinus puffinus)	A179	Black-headed Gull (Larus ridibundus)	1170	Reefs
A014	Storm Petrel (Hydrobates pelagicus)	A182	Common Gull (Larus canus)	1210	Annual vegetation of drift lines
A016	Gannet (Morus bassanus)	A183	Lesser Black-backed Gull (Larus fuscus)	1230	Sea cliffs
A017	Cormorant (Phalacrocorax carbo)	A184	Herring Gull (Larus argentatus)	1310	Salicornia mud
A018	Shag (Phalacrocorax aristotelis)	A188	Kittiwake (Rissa tridactyla)	1330	Atlantic salt meadows
A028	Grey Heron (Ardea cinerea)	A199	Guillemot (Uria aalge)	1410	Mediterranean salt meadows
A037	Bewick's Swan (Cygnus columbianus bewickii)	A200	Razorbill (Alca torda)	1420	Halophilous scrub
A038	Whooper Swan (Cygnus cygnus)	A204	Puffin (Fratercula arctica)	2110	Embryonic shifting dunes
A043	Greylag Goose (Anser anser)	A229	Kingfisher (Alcedo atthis)	2120	Marram dunes (white dunes)
A045	Barnacle Goose (Branta leucopsis)	A395	Greenland White-fronted Goose (Anser albifrons flavirostris)	2130	Fixed dunes (grey dunes)*
A046	Light-bellied Brent Goose (Branta bernicla hrota)	A466	A/A149 Dunlin (Calidris alpina)	2140	Decalcified Empetrum dunes*
A048	Shelduck (Tadorna tadorna)	1013	Geyer's whorl snail (Vertigo geyeri)	2150	Decalcified dune heath*
A050	Wigeon (Anas penelope)	1014	Narrow-mouthed whorl snail (Vertigo angustior)	2170	Dunes with creeping willow
A051	Gadwall (Anas strepera)	1016	Desmoulin's whorl snail (Vertigo moulinsiana)	2190	Dune slack
A052	Teal (Anas crecca)	1024	Kerry Slug (Geomalacus maculosus)	21A0	Machair*
A053	Mallard (Anas platyrhynchos)	1029	Freshwater Pearl Mussel (Margaritifera margaritifera)	3110	Lowland oligotrophic lakes
A054	Pintail (Anas acuta)	1092	White-Clawed Crayfish (Austropotamobius pallipes)	3130	Upland oligotrophic lakes
A056	Shoveler (Anas clypeata)	1095	Sea Lamprey (Petromyzon marinus)	3150	Natural eutrophic lakes
A061	Tufted Duck (Aythya fuligula)	1096	Brook Lamprey (Lampetra planeri)	3160	Dystrophic lakes
A062	Scaup (Aythya marila)	1099	River Lamprey (Lampetra fluviatilis)	3180	Turloughs*

Code	Qualifying Interest	Code	Qualifying Interest	Code	Qualifying Interest
A065	Common Scoter (Melanitta nigra)	1103	Twaite Shad (Alosa fallax fallax)	3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
A067	Goldeneye (Bucephala clangula)	1106	Atlantic Salmon (Salmo salar)	3270	Chenopodium rubri
A069	Red-breasted Merganser (Mergus serrator)	1303	Lesser Horseshoe Bat (Rhinolophus hipposideros)	6130	Calaminarian grassland
A130	Oystercatcher (Haematopus ostralegus)	1349	Bottle-Nosed Dolphin (Tursiops truncatus)	6210	Orchid-rich calcareous grassland*
A137	Ringed Plover (Charadrius hiaticula)	1351	Harbour Porpoise (Phocoena phocoena)	6410	Molinia meadows
A140	Golden Plover (Pluvialis apricaria)	1355	Otter (Lutra lutra)	6430	Hydrophilous tall herb
A141	Grey Plover (Pluvialis squatarola)	1364	Grey Seal (Halichoerus grypus)	7110	Raised bog (active)*
A142	Lapwing (Vanellus vanellus)	1365	Common Seal (Phoca vitulina vitulina)	7120	Degraded raised bogs
A143	Knot (Calidris canutus)	1421	Killarney Fern (Trichomanes speciosum)	7210	Cladium fen*
A144	Sanderling (Calidris alba)	1528	Marsh Saxifrage (Saxifraga hirculus)	7220	Petrifying springs*
A148	Purple Sandpiper (Calidris maritima)	1833	Slender Naiad (Najas flexilis)	7230	Alkaline fens
A156	Black-tailed Godwit (Limosa limosa)	1990	Nore Freshwater Pearl Mussel (Margaritifera durrovensis)	8240	Limestone pavement*
A157	Bar-tailed Godwit (Limosa lapponica)	1110	Sandbanks	8330	Sea caves
				91A0	Old oak woodlands
				91E0	Residual alluvial forests*

Appendix C

EAM Summary Report for 217 Swinford WSZ

Irish Water

Lead in Drinking Water Mitigation Plan - EAM

Swinford EAM

18 January 2022 Issue 6 | 18 January 2022

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 257367

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Document verification

ARUP

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Document ref		

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		Signature			
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		Signature			

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		Signature			
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			Prepared by	Checked by	Approved by
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Contents

1 Introduction

This document presents the results of the implementation of the Lead Mitigation Environmental Assessment Methodology (EAM) to assess the impact of dosing Swinford Water Supply Zone with orthophosphate.

The assessment tracks the orthophosphate dosed drinking water from source (i.e. water treatment plant), through drinking water distribution (i.e. watermains), waste water collection and treatment systems (i.e. wastewater treatment plants and septic tanks) to environmental receptors (i.e. river water, groundwater, lake, and transitional waterbodies). The orthophosphate load that by-passes the wastewater treatment plants (i.e. through leakages and storm overflows) are also included in the assessment.

The assessment methodology is described in full in RPS (2016) *Irish Water – Lead in Drinking Water Mitigation Plan. Environmental Assessment Methodology*.

The assessment includes processing steps in Graphic Information System (GIS) and excel. The assessment also draws upon the following source data:

- Results of the Plumbosolvency reports by Ryan Hanley.
- Results of pre-processing GIS work to generate regional input files.
- Data relating to Waste Water Treatment Plants (WWTP) from Annual Environmental Reports (AER) and the Environmental Protection agency (EPA) web-based WFD App which is accessed through their Eden Portal.
- Data relating to water body monitoring and characterisation from the EPA WFD App downloaded on the 1st of December 2021.
- Data relating to rainfall and catchment areas from the OPW Flood Studies Update (FSU) Portal.
- GIS data river segment data providing river flows from the EPA “hydrotool data”.
- Gauge data providing river flows from the EPA web-based HydroNet.

2 Abbreviations & Glossary

- AER – Annual Environmental Report
- Agglomeration- the catchment of the WWTP
- DWWTS -Domestic Waste Water Treatment System
- EAM – Environmental Assessment Method
- ELV – Emission Limit Values
- EPA- Environmental Protection Agency
- FSU – Flood studies Update Portal – website hosted
- GIS - Graphic Information Systems
- GWB- Ground Water Body
- IW – Irish Water
- LWB – Lake Water Body
- OP- Orthophosphate
- PE- Population Equivalent or unit per capita loading in waste-water treatment. PE can be considered the estimated number of people required to produce a measured load (eg. of organic matter, water or P) at the WWTP
- RWB – River Water Body
- SAAR - Standard-period Average Annual Rainfall method. The 30%ile flow for the river catchment is calculated using the catchment area and the SAAR value at the catchment outlet point. The area of the total river catchment is calculated using the Water Framework Directive App defined river subbasin GIS layer. The SAAR value is from the OPW FSU portal.
- SWO- Storm Water Overflow
- TP- Total Phosphorus
- TraC – Transitional and Coastal
- WFD- Water Framework Directive
- WSZ - Water Supply Zone
- WWTP – Waste Water Treatment Plant

3 Swinford Water Supply Zone

Swinford Water Supply Zone (WSZ) (2200PUB1024) is located in County Mayo. Treated water is distributed through a single reservoir, located at Swinford Water Treatment Plant (WTP). The Draft Plumbosolvency Control Plan proposes universal orthophosphate dosing at Swinford WTP.

The average flow from the WTP is currently 750 m^3/day. Approximately 56% of the flow is accounted for, and this fixed rate for water mains leakage is assumed in the WSZ.

Swinford WSZ is serviced by Swinford WWTP. There are an estimated 242 properties across the WSZ that are serviced by Domestic Waste Water Treatment Systems (DWWTS i.e. septic tanks). Figure 1, at the end of this report, shows the location of the areas proposed to receive Orthophosphate dosed water

Water Supply Zone	Swinford (2200PUB1024)
Step 1 – Appropriate Assessment Screening	*To be completed by Ryan Hanley*
Model Assumptions	All concentration and loading units for orthophosphate (PO_4-P) are expressed as mg/l P and kg P/yr. Adopted Orthophosphate Optimum Dosing Concentration is 1.0 mg/l P. Unaccounted for water from the mains is 44%. Seepage from the mains is distributed evenly across the entire length of the WSZ network. The water consumption per person has been assigned as 125 litres per day in order to calculate the direct discharges to surface water with 2.7 people per household. The water discharge per person is assigned as 105 litres per day for the discharge to DWWTS with 2.7 persons per household. Conversion factor for Total Phosphorus to Orthophosphate for WWTP effluent is 0.5 It is assumed there will be no treatment of additional OP load for WWTPs with secondary, primary or no treatment. For plants with tertiary treatment it is assumed all the additional load will be treated. Where a tertiary plant is in exceedance of its ELV for TP or OP then the ability of the plant to treat the additional load is confirmed with Irish Water. Where IW indicates a tertiary plant has not remaining treatment capacity it will be assumed the entire additional load is not treated. Where existing monitoring data is not available a surrogate status is derived from the Orthophosphate indicative quality of the waterbody in the following hierarchy: • Upstream waterbodies • Downstream waterbodies

Water Supply Zone	Swinford (2200PUB1024)
	• Adjacent waterbodies of similar hydrological settings • Ecological status of the waterbody. The mid-point of that surrogate indicative quality range is used as baseline concentration.
Step 2 & 3 – Impact on Waste Water Treatment Plant (WWTP) Effluent Concentrations and receiving WBs	This section assesses the influent and effluent P loads and resultant OP dosages at WWTP within the WSZ before and after dosing. Inputs to and results of the Step 2 assessment for individual WWTP are given in Table 1. Where an agglomeration includes SWOs, discharges from this source are included. Emission Limit Value (ELVs) are assigned for WWTPs to protect the receiving River Waterbodies (RWB) from direct discharges during low flows. Where ELVs are in force these are shown in Table 1. WWTPs that are failing to comply with their ELVs are also indicated. The treatment level and PE of the WWTPs within the agglomerations are as follows; - Swinford – Tertiary treatment PE 2,174 A sensitivity analysis was carried out on the conversion between Orthophosphate and Total Phosphorus at three factors; 0.4, 0.5 and 0.68. The results of the assessment are presented in Table 1.
Step 4 - Subsurface pathways	The loading from mains leakage is 329 m^3/d (120 kg/yr P). Approximately 114 kg/yr P of the load is attenuated along the flowpaths. The hydraulic loading from the DWWTS is 69 m^3/d (25.0 kg/yr P). Approximately 24.7 kg/yr P of the load is attenuated along the flowpaths. One flow monitoring gauge, Swinford (station number 34021), is available for one waterbody within the assessment area – Swinford_010. The river flows for the remaining receiving water bodies are established from Hydrotool data or, if that is not available, using the Area-SAAR method. Baseline Orthophosphate monitoring data and associated thresholds are available for all RWBs. Orthophosphate drinking water dosing does not lead to a deterioration in any RWB status from subsurface and near surface pathways.
Step 5 and 6 - Combined Impact from direct and diffuse sources on River Waterbodies (RWB)	This section assesses the combined impact as a result of increased Orthophosphate load from WWTP discharges (Steps 2 & 3), DWWTS, seepage from mains and cumulative impacts from other drinking water dosing areas. Figure 2 illustrates the scale of Orthophosphate loading to the receiving water bodies from mains leakage, DWWTS and direct discharges from WWTP and SWOs and upstream dosing areas. This illustrates that a significant proportion of the load come from mains seepage through the subsurface and preferential flow

Water Supply Zone	Swinford (2200PUB1024)
	pathways and storm water overflows. In Moy_080 a significant proportion of the load is from upstream EAMs. Figure 3 presents the total loading to the drinking water dosing area from the main sources and illustrates how much of the loading is attenuated in the subsurface, treated in WWTPs and ultimately how much is transported to the receiving RWBs. This illustrates that mains leakage and primary discharge from the WWTP account for the largest proportion of the load. A large proportion of the load from the mains leakage, primary discharge and DWWTS is attenuated. The Orthophosphate concentrations in the RWBs following drinking water dosing are presented in Table 2. The increase in concentration as a result of drinking water dosing does not cause a deterioration in the status of any RWB.
Step 5 and 6 - Combined Impact through subsurface and surface pathways on Groundwater Waterbodies (GWB)	The increase in Orthophosphate concentrations in the GWBs as a result of the P drinking water dosing is shown in Table 3. Monitoring data is available for all the groundwater bodies except for the Swinford Gravels GWB. The surrogate status is derived from an adjacent GWB. The mid-range of that surrogate status is used as baseline concentration. Where multiple monitoring points are available within a GWB the results are averaged spatially to derive a GWB average. There is no deterioration in GWB status as a result of dosing.
Step 5 and 6 - Combined Impact from direct and diffuse sources on <u>Lakes</u> within the WSZ	There are no lake water bodies affected by the drinking water dosing in the assessment area.
Step 5 and 6 - Combined Impact from direct and diffuse sources on Transitional and Coastal Waterbodies	The increase in Orthophosphate concentrations in the downstream Transitional Waterbodies and small Coastal (TraC) Waterbodies as a result of drinking water dosing is shown in Table 4. Baseline Orthophosphate monitoring data and associated thresholds are available for both Moy Estuary and Killala Bay. The drinking water dosing with Orthophosphate does not deteriorate the status of either transitional waterbodies for both the summer and winter seasons.
Step 5 and 6 Cumulative Assessment of impact from all EAMs within the catchment on:	<u>Step 5 and 6 Cumulative Assessment of impact from all EAMs within catchment on Transitional and Coastal Waterbodies</u> A cumulative assessment was undertaken to assess the impact on TraC WBs from all the contributing EAMs. The assessment is carried out on a catchment scale.

Water Supply Zone	Swinford (2200PUB1024)
Transitional and Coastal Water Bodies **AND** **Protected Waterbodies**	The following EAM dosing areas are within the Moy and Killala Bay Catchment and discharge to the same TraC WBs as the Swinford EAM see Figure 4: 014 Tourmakeady 217 Swinford 056-160. Ballina Lisglennon 045. Lough Talt 071. Lough Gara 247. Kiltimagh 289. Charlestown The increase in Orthophosphate concentrations in the downstream TraC WBs as a result of the drinking water dosing of all four EAMs with Orthophosphate is shown in Table 5. There is no deterioration in waterbody status as a result of the cumulative assessment. <u>Step 5 and 6 Cumulative Assessment of impact from EAMs on downstream Protected Waterbodies</u> The cumulative load from this dosing area and any upstream dosing area was tracked downstream to determine the potential concentration increase in any RWBs which are Special Areas of Conservation (SAC). The increase in Orthophosphate concentrations in the waterbodies (WBs) as a result of the P drinking water dosing is shown in Table 6. The results show there is no deterioration in WB status downstream of the EAM. The results that there will be no discernible increase (i.e. above 0.00125mg/l P) in any of the downstream SAC RWBs.
Conclusions	**Red, Amber, Green (RAG) STATUS: EAM Result - GREEN** The purpose of the RAG status is to indicate the waterbodies that are failing the EAM assessment on a map. Any waterbodies failing the EAM model will be marked as **Amber** in the interim while further analysis is being completed, where the further analysis confirms the water body is failing the water body will be coloured **Red**. If the EAM indicates there will not be a deterioration in the waterbody status as a result of drinking water dosing it will remain **Green**. A map of the RAG status of waterbodies is presented in Figure 5.
Recommendation	No mitigation measures are required.

Table 1: Increased loading/concentration from WWTP due to dosing of drinking water – Dosing rate = 1.0 mg/l P

Agglomeration and Discharge Type	Effluent Treatment level	WWDL ELV AER (2017) Compliance	Primary Discharge Receiving WB		Annual average TP Load kg/yr	Ortho P Concentration mg/l P TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)		
						0.5	0.4	0.68
Swinford Primary Discharge	Tertiary	Orthophosphate 0.15mg/l P - Compliant	Swinford_010	Pre-Dosing	89	0.09	0.07	0.12
				Post Dosing	89	0.09	0.07	0.12
Swinford SWOs (1 No.)				Pre-Dosing	89	0.44	0.35	0.60
				Post Dosing	93	0.46	0.37	0.62

Table 2: Orthophosphate concentrations in river water bodies following dosing of drinking water

Name	EU_CD	Indicative Quality *Surrogate Status in italic*	Baseline Conc. (mg/l P)	75% of status threshold (mg/l P)	Cumulative load to SW (kg/yr P)	Modelled dosing conc. (mg/l P)	Potential conc. following dosing (mg/l P)
Moy_070	IE_WE_34M020500	High	0.0086	0.0188	196.2	0.0004	0.0090
Moy_080	IE_WE_34M020650	High	0.0101	0.0188	221.1	0.0003	0.0104
Spaddagh_010	IE_WE_34S030200	High	0.0068	0.0188	0.1	0.000004	0.0068
Swinford_010	IE_WE_34S050300	High	0.0108	0.0188	5.2	0.0004	0.0112

Table 3: Orthophosphate concentrations in groundwater bodies following dosing of drinking water

Name	**EU_CD**	**Indicative Quality** *Surrogate Status in italic*	**Baseline Conc. used in calculation (mg/l P)**	**75% of status threshold (mg/l P)**	**Cumulative load (kg/yr P)**	**Modelled dosing conc. (mg/l P)**	**Potential Baseline conc. following dosing (mg/l P)**
Swinford	IE_WE_G_0033	Good	0.0070	0.0263	2.4	0.00001	0.0070
Foxford	IE_WE_G_0034	Good	0.0050	0.0263	0.6	0.00001	0.0050
Swinford Gravels	IE_WE_G_0108	*Good*	0.0175	0.0263	0.1	0.000005	0.0175
Kilkelly Charlestown	IE_WE_G_0032	Good	0.0050	0.0263	0.2	0.00001	0.0050

Table 4: Orthophosphate concentrations in transitional and coastal water bodies following dosing of drinking water

Name	**EU_CD**	**Season**	**Indicative Quality** *Surrogate Status in italic*	**Baseline conc used in calculation (mg/l P)**	**75% of status threshold (mg/l P)**	**Cumulative load (kg/yr P)**	**Modelled dosing conc. (mg/l P)**	**Potential conc. following dosing (mg/l P)**
Moy Estuary	IE_WE_420_0300	Summer	High	0.0110	0.0188	221.1	0.0001	0.0111
		Winter	High	0.0150	0.0188	221.1	0.0001	0.0151
Killala Bay	IE_WE_420_0000	Summer	*High*	0.0125	0.0188	221.1	0.0001	0.0126
		Winter	*High*	0.0125	0.0188	221.1	0.0001	0.0126

Table 5: Cumulative assessment of orthophosphate concentrations in transitional and coastal water bodies following dosing of drinking water

Name	**EU_CD**	**Season**	**Indicative Quality** *Surrogate Status in italic*	**Baseline conc used in calculation (mg/l P)**	**75% of status threshold (mg/l P)**	**Load, (kg/yr P) from current EAM**	**Cumulative load (kg/yr P)**	**Modelled dosing conc. (mg/l P)**	**Potential conc. following dosing (mg/l P)**
Moy Estuary	IE_WE_420_0300	Summer	High	0.0110	0.0188	221.1	480.7	0.0002	0.0112
		Winter	High	0.0110	0.0188	221.1	480.7	0.0002	0.0112
Killala Bay	IE_WE_420_0000	Summer	*High*	0.0125	0.0188	221.1	589.5	0.0002	0.0127
		Winter	*High*	0.0125	0.0188	221.1	589.5	0.0002	0.0127

Table 6: Orthophosphate concentrations in downstream Protected waterbodies following dosing of drinking water

Name	**EU_CD**	**Indicative Quality** *Surrogate Status in italic*	**Baseline Conc. (mg/l P)**	**75% of status threshold (mg/l P)**	**Cumulative load (kg/yr P)**	**Modelled dosing conc. (mg/l P)**	**Potential conc. following dosing (mg/l P)**
Gweestion_020	IE_WE_34G030200	High	0.0093	0.0188	17.6	0.0001	0.0093
Moy_080	IE_WE_34M020650	High	0.0101	0.0188	208.6	0.0003	0.0104
Moy_090	IE_WE_34M020750	High	0.0118	0.0188	208.6	0.0003	0.0121
Moy_100	IE_WE_34M020800	High	0.0074	0.0188	372.1	0.0002	0.0076
Moy_110	IE_WE_34M020850	*High*	0.0125	0.0188	372.6	0.0002	0.0127
Moy_120	IE_WE_34M021100	High	0.0069	0.0188	409.1	0.0002	0.0071

Figure 1: Swinford WS Dosing Areas

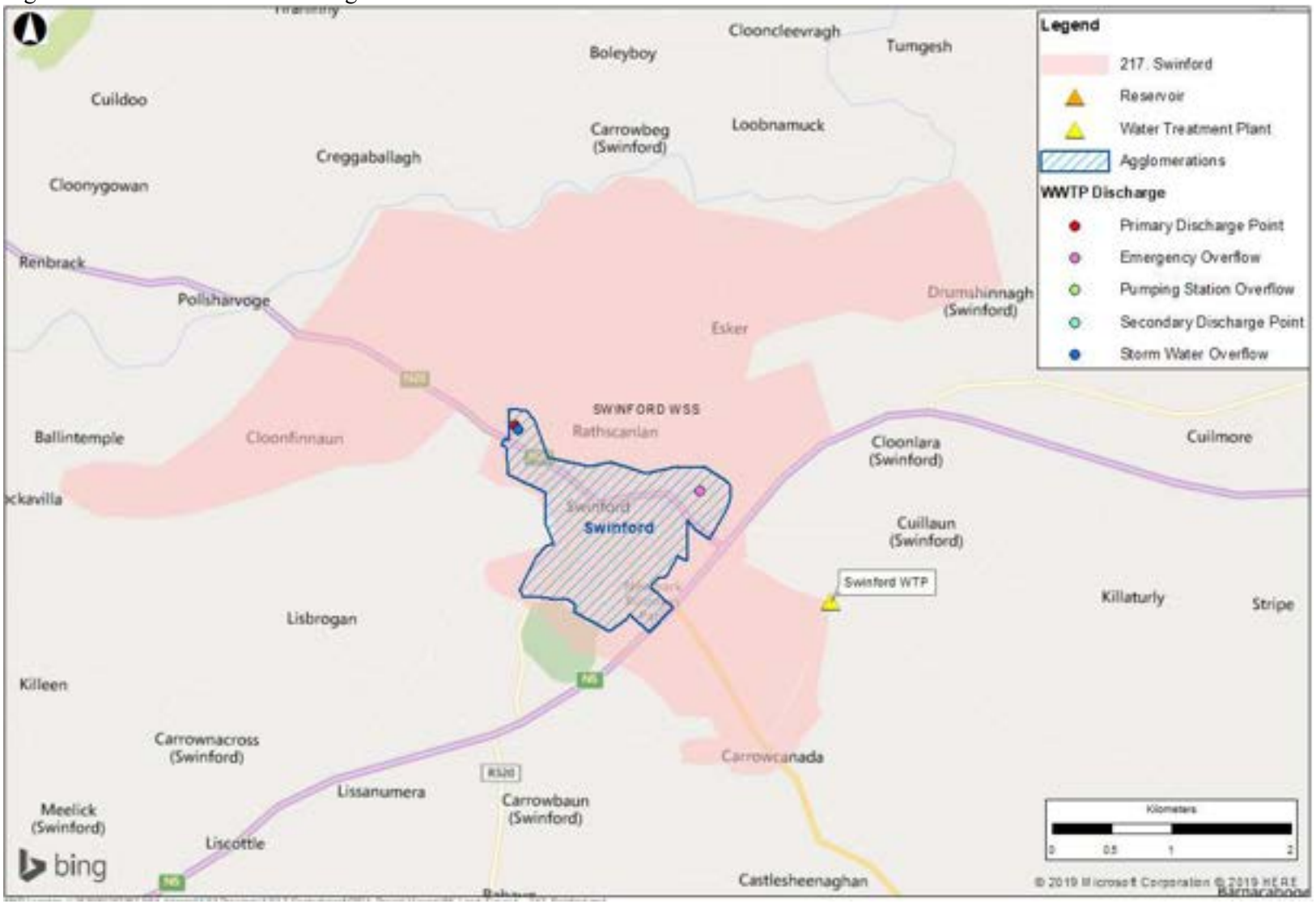

Figure 2: RWB Cumulative Loading Assessment

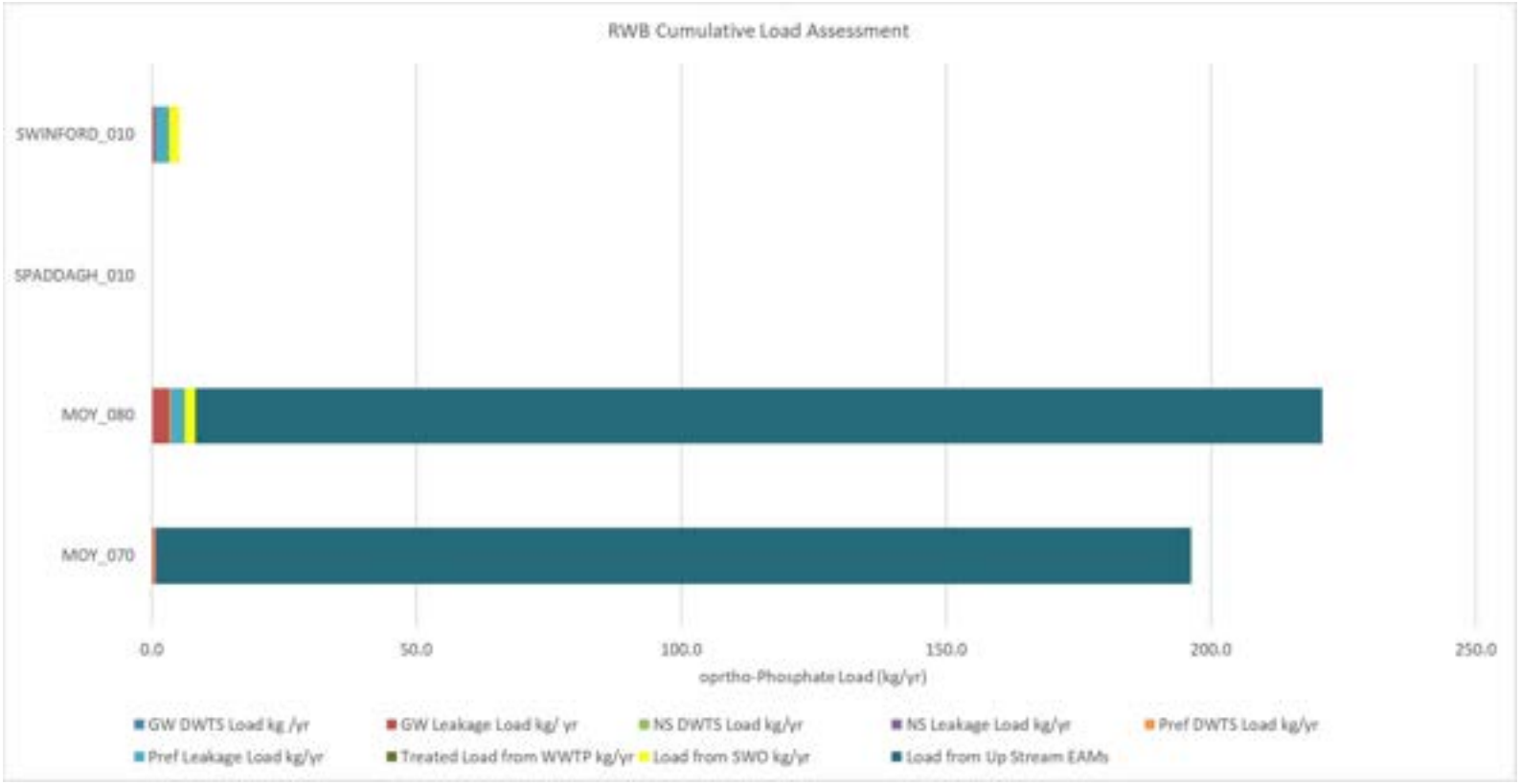

Figure 3: Total dosing area Attenuated, Treated and Transported Loads

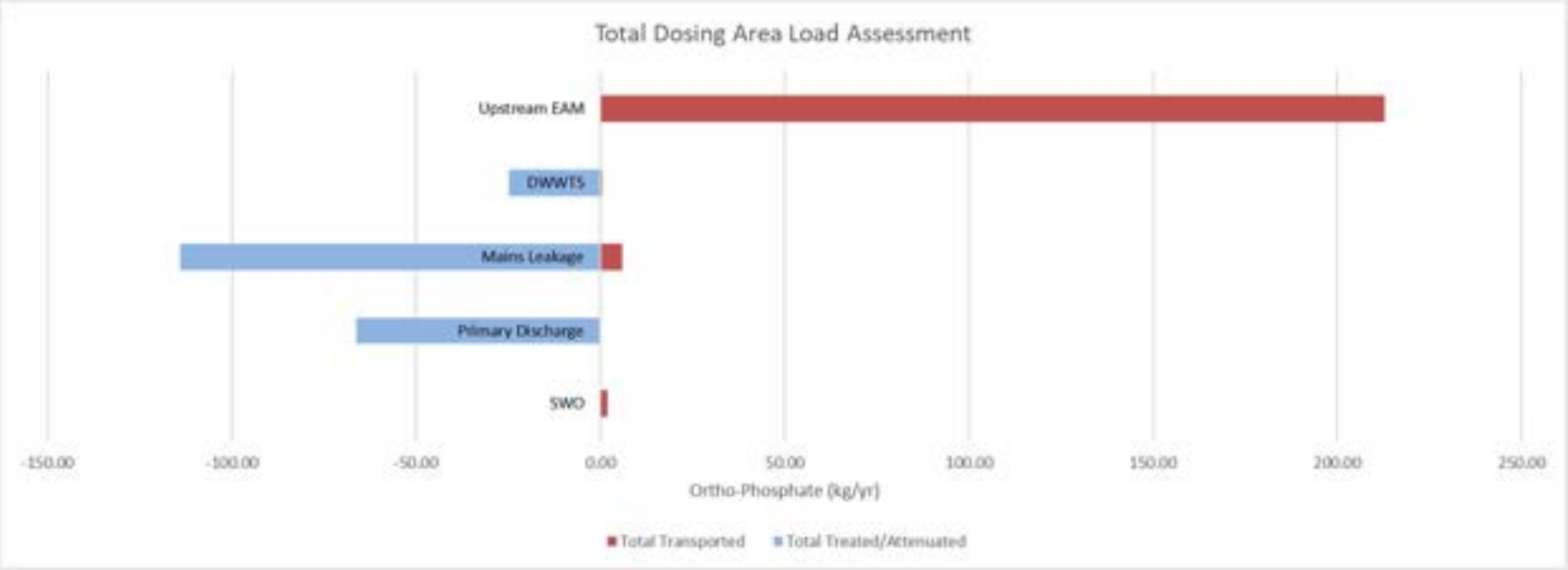

Figure 4: Upstream and downstream EAMs within WFD catchment

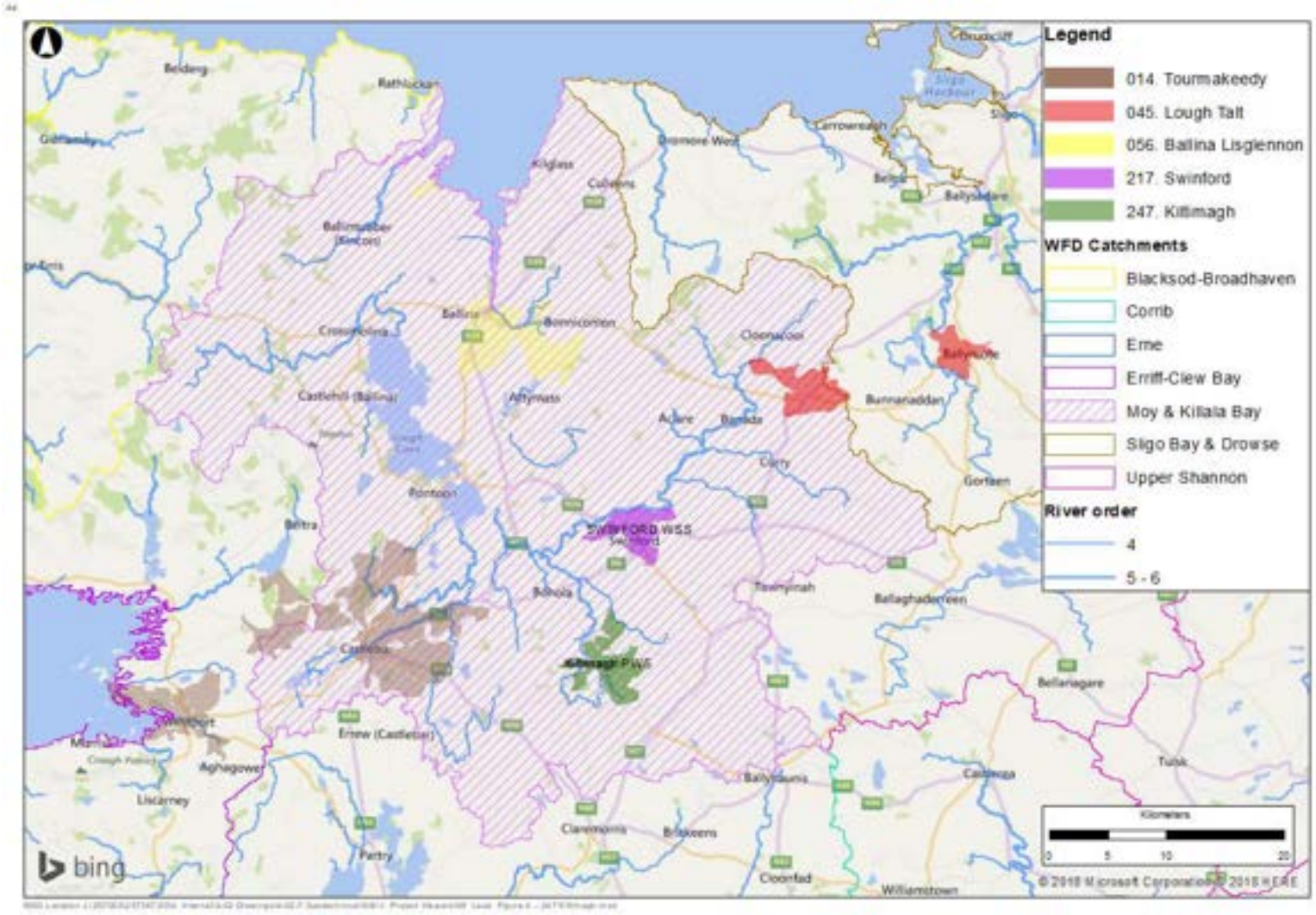

Figure 5: Red, Amber, Green (RAG) Status of waterbodies