Report for the Ecological Assessment of the Significance of Impacts of proposed scheduled Arterial Drainage Scheme channel and embankment maintenance works on SACs & SPAs.

Version 4.3

December 2008

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Report for the Ecological Assessment of the Significance of Impacts of proposed scheduled Arterial Drainage Scheme channel and embankment maintenance works on SACs & SPAs.

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Cover photo: Weed cutting boat operating on the lower reaches of the Cregg River, Lough Corrib SAC.

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SUMMARY

This report is the output of a project entitled ‘Ecological Impact Assessment of the Significance of Impacts of Proposed Scheduled Arterial Drainage Scheme Channel and Embankment Maintenance Works on Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)’. The assessment concerns the 2008 Arterial Drainage Maintenance Programme within Natura 2000 Sites. The key aim of the report was to assess whether the proposed works would be likely to have a significant adverse effect on the respective conservation sites, or individual protected flora and fauna species. The assessment was based on an initial desk based screening assessment prepared for each affected site by the Environment Section of OPW, and a subsequent desk and partial field-based appraisal carried out by ECOFACT.

The current study has concluded that the current strategic approach being developed by OPW to assess the ecological impact of drainage maintenance works is insufficient due to the complexity of channel types, habitats and species potentially affected by these works. However, the significant improvements that have been made in the environmental performance of the OPW in recent years are acknowledged. Likewise, the significant enhancement works being undertaken by OPW on Irish Rivers in association with the Central Fisheries Board is also noted. However, the current assessment must return the conclusion of the likelihood of significant adverse effects on the respective designated sites due to lack of information at present to reach an alternative conclusion. Recommendations on future assessments are made; in particular the requirement for advance ecological surveys on all affected river corridors is highlighted. This would allow the implementation of site specific mitigation measures to protect the integrity of these internationally important conservation sites.

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INTRODUCTION

1.1 Project overview

This report is the output of a project entitled ‘Ecological Impact Assessment of the Significance of Impacts of Proposed Scheduled Arterial Drainage Scheme Channel and Embankment Maintenance Works on Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)’. The report was commissioned by the Office of Public Works (OPW) and was undertaken by Ecofact Environmental Consultants Ltd. (ECOFACT). The assessment concerns the 2008 Arterial Drainage Maintenance Programme within Natura 2000 Sites. Drainage maintenance work involves maintenance of rivers and other channels which were modified by OPW in past as part of an Arterial Drainage Scheme. The purpose of such maintenance works is to maintain channel conveyance at the ‘design level’ of the original scheme by removing the inevitable accumulations of silt, vegetation and other debris. Maintenance of such schemes, as is compliance with the nature conservation legislation, is a statutory obligation of the OPW.

The key aim of the report was to assess whether the proposed works would be likely to have a significant adverse effect on the respective conservation sites, or individual protected flora and fauna species. The assessment was based on an initial desk based screening assessment prepared for each affected site by the Environment Section of OPW, and a subsequent desk and partial field-based appraisal carried out by ECOFACT. Unusually, the actual works being assessed were undertaken concurrently with the current appraisal. This report will examine the accuracy and detail of the screening assessments undertaken by OPW, providing a critique of the ecological conservation interests at the site and a qualified assessment of the functionality of the OPW’s ‘Assessment of Significance’ methodology. Recommendations on the approach that should be taken with future similar assessments are also provided.

European Directives and National Regulations have been developed to preserve, protect and conserve species diversity within European Union (EU) member states. The Wildlife Act (1976) was passed to conserve both flora and fauna by developing wildlife refuges associated with land, inland waterways and marine environments. The Birds and Habitats Directive (Council Directives 79/409/EEC and 92/43/EEC), provide protection for wild birds in the European Union, and provide for the development of a network of protected ecological habitats (Natura 2000). In 1997, both directives were transposed into Irish law in the European Communities (Natural Habitats) Regulations, 1997, which provides a legal framework for the conservation of habitats and species. To ensure compliance with the EC Habitats Directive transposed into Irish law through the European (Natural Habitats) Regulations (1997), the OPW is required to carry out environmental assessments for European sites (Natura 2000 network) which overlap with drainage operations. European sites under the Habitats Directive include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). In accordance with Section 31 of the EC (Natural Habitats) Regulations (1997), where an operation or activity is carried out by the state that is likely to have a significant effect on a European site, an appropriate assessment should be carried out on the implications for that site in view of its conservation objectives. The operation or activity shall only be undertaken when it is ascertained that it will not adversely affect the integrity of the site and then, having regard to conclusions from the assessment (OPW, 2007). Since 1997 The European Communities (Natural Habitats) Regulations, 1997 has been amended to provide a more comprehensive level of protection in 1998 and 2005. Additional protection was afforded to listed floral species under the Flora Protection Order, 1999 with
the Wildlife Amendment Act, 2000 provided enhanced legal protection for species and habitats.

Scientific literature reviewing the environmental and ecological impacts of arterial drainage and drainage maintenance in Ireland to date has been generally limited to studies on the impacts to fisheries, specifically in relation to salmonids (McCarthy 1977; McCarthy 1983; Lynch & Murray 1992; O’Grady 1989; O’Grady et al, 1991; Kennedy et al, 2008; Toner et al, 1965). In an effort to address this shortfall in guidance the Environmental Section of OPW has recently prepared a report entitled ‘Screening of Natura 2000 Sites for Impacts of Arterial Drainage Maintenance Operation’ (OPW, 2007). A subsequent series of ecological assessments for individual conservation interests is now being prepared. This series aims to set out ‘a strategic approach’ to managing the requirements of the EU Habitats Directive in relation to OPW drainage maintenance activities. However, considering the vast diversity of channel types and depending habitats and species affected by drainage maintenance such an overview approach is likely to be difficult to achieve.

A significantly broader amount of literature is available in the United Kingdom. In particular, the Association of Drainage Authorities (ADA) has recently published their updated ‘The Drainage Channel Biodiversity Manual’ in association with Natural England (Buisson et al, 2008). The key approach in this manual is assigning hierarchy to each individual channel based on its flood risk management and biodiversity priority. In each case however advance ecological surveys are undertaken for all channels allowing site specific mitigation and biodiversity enhancement measures to be employed. It must be understood however that this guidance is for maintenance works on artificial channels and modified natural watercourses containing slow flowing waters. It is also primarily intended for watercourses outside the Natura 2000 network. Guidance on managing watercourses with a more natural structure in a UK context is covered in ‘the New Rivers and Wildlife Handbook’ (Ward et al, 1995) and the ‘Manual of River Restoration Techniques’ (River Restoration Centre, 2002). However, the focus of these publications is habitat enhancement rather that drainage maintenance.

The process of designating SACs and SPAs in Ireland commenced after the arterial drainage schemes had finished in 1995 (OPW, 2007). This has presented significant challenges to the OPW in a similar way that local authorities have had to meet similar environmental obligations for their activities many of which (i.e. operation of Waste Water Treatment Plants, hedge cutting along roads) were operational prior to the enactment of the EU Habitats Directive and other environmental legislation (i.e. Phosphorous Regulations; Wildlife Act, 2000).

The drainage schemes are considered by OPW (2007) to hold some of the sites in ecological balance, however there is little scientific information to support this conclusion. It is appreciated however that such works do in many cases need to balance flood risk management, agriculture and biodiversity. It is clear however that many sites protected for nature conservation in Ireland are currently threatened by ongoing drainage maintenance operations and the NPWS site synopses of almost all aquatic and wetland designated sites in Ireland mention drainage as a key threat (Source: NPWS). It is noted that in most cases the word ‘drainage’ and phrase ‘drainage maintenance’ are interchangeable among non-engineering persons and the mis-understanding of these terms among ecologists and NPWS staff has led to confusion and under-reporting of impacts of the activity assessed in this report.
The current report aims to establish the extent of potential impacts in relation to the works being undertaken during 2008 and to set out mitigations and additional ecological considerations to be taken into account at all sites during drainage maintenance works. However, as the works being assessed were undertaken concurrently with the current appraisal the main value of this exercise will be as a discussion / review of the current assessment approach undertaken by OPW.

1.2 Introduction to Arterial Drainage Schemes & Arterial Drainage Maintenance

1.2.1 History of the OPW

The Office of Public Works or the Board of Works, as it was known at the time, was established in 1831 by the ‘Act for the Extension and Promotion of Public Works in Ireland’. As part of its role it took over the Directors General of Inland Navigation, the Fisheries Commissioners, the Postmaster General and the Civil Buildings Commissioners. The Board of Works (OPW) was the leading agency to fund the establishment, extension and/or improvement works. Early inland navigation projects undertaken by the Board of Works included the Upper Shannon, Lough Ree and Lough Derg along with the Tyrone, Maigue (Adare) and Boyne navigations.

1.2.2 History of Arterial Drainage Schemes

The OPW commenced arterial drainage schemes in 1842, under the Drainage (Ireland) Act, 1842, providing drainage loans to facilitate the drainage of land. A number of other acts dealing with drainage works and drainage maintenance were passed between 1863 and the early 1930’s. The government established the Browne Commission, which deliberated in the period 1938-40 and produced a comprehensive plan to deal with drainage and flooding for Ireland. The Arterial Drainage Act, 1945 included many of these recommendations. The 1995 Arterial Drainage Amendment Act requires that;

- Scheme channels are maintained in “proper repair and effective condition” i.e. in a condition that protects benefitting land from an appropriate risk of flooding and provides adequate outfall for land drainage (e.g. from agricultural lands, urban areas, bog developments, forestry and amenities);
- The maintenance of channels and coastal embankments in a condition that protects benefitting land from an appropriate risk of flooding;
- The maintenance, repair and/or replacement of all structures, including accommodation bridges, weirs, sluice barrages, sluices, pumping stations and tidal flap gates.

In summary under the 1945 Arterial Drainage Act, the Commissioners of Public Works were enabled to carry out schemes on a whole catchment to prevent or substantially reduce periodic flooding and to improve the drainage of the land, with the main motivation to improve agricultural productivity. In the late 1980s and early 1990s, following the Boyle and Bonnet drainage schemes, it became apparent that, while it was not cost beneficial to carry out drainage works on entire catchments, there were still significant localised flooding problems. The Arterial Drainage Amendment Act, 1995 addressed this issue by empowering the Commissioners to execute drainage schemes to alleviate localised flooding problems.
Office of Public Works schemes completed between 1945 and 1995 include:

- 34 arterial drainage schemes on river catchments;
- 5 estuarine embankment schemes;
- 11,505km of rivers and schemes, collectively known as channels and their maintenance;
- 733km of tidal and river embankment;
- 18,500 bridges. A significant portion of these bridges are road bridges where Local Authorities are responsible for the structural integrity and the OPW is responsible for flood conveyance;
- 742 sluices;
- 9 pumping stations.

Construction of the original Arterial Drainage Schemes required hard engineering. It usually involved widening, deepening and channelization of the existing channel, and in a few cases, diversions. Using draglines, work involved the excavation of all soil types e.g. clay, peat, gravel and rock. The rock was normally blasted. The channel cross section was excavated to a trapezoidal form, the channel width was standardised, longitudinal gradients were made more uniform and cross sectional beds were made even. All in-stream and riparian vegetation and soils were removed. Access for the construction plant was made along the channel banks. In schemes prior to 1973, excavated material was stockpiled out on riparian lands with “damaged” lands top-soiled and reseeded (OPW 2007). These spoil heaps continue to line major western rivers such as the Clare and Moy almost 50 years after the original schemes. Scheme designs altered the channels to provide flood capacity for a minimum of the 3 year flood and to provide an outfall for drainage of adjoining lands. In many cases, the creation of an outfall dictated the design bed levels (OPW 2007). In the case of modern urban flood relief schemes, flood protection for a 100-200 year flood event would be the design objective (OPW 2007).

1.2.3 Functions of Arterial Drainage Schemes

Arterial drainage schemes normally included the widening and deepening of an existing channel, with some localised re-alignment, and in a few cases, the opening of a new channel. According to the OPW, typically, the water table would have dropped by ca. 1m, although this would vary depending on local conditions e.g. soil, geology etc. However, there is seems to be no scientific data to support this. The OPW considers that regular maintenance works on these drainage channels are considered necessary, in fulfilment of the statutory requirement under the 1945 Drainage Act, to maintain the drainage works in “proper repair and effective condition” (OPW, 2007).

Arterially drained channels differ from more natural channels insofar as they have significantly more uniform slow velocities, more constant depth/width ratios, a reduction in connectivity to floodplains and more in-stream storage capacity (OPW 2007). In ecological terms this translates as a reduction in the availability of habitat and the removal of natural habitat features within a watercourse or channel, with the removal of riffle and boulder features, instream vegetation and bankside shading.
1.2.4 **Ecological Impact of the Arterial Drainage Schemes**

The arterial drainage schemes undertaken under the 1945 Act were not preceded by ecological assessments and even in the more recent schemes very few concessions were given to, or indeed apparently asked for, by ecological or even fisheries interests. The ecological impact of the original arterial drainage schemes has never been fully assessed. However, they have generally been regarded as having a devastating impact on the ecology and fisheries of the catchments that were affected (Toner *et al.*, 1965; McCarthy, 1977; Lynch & Murray, 1992; O’Grady & Curtin, 1993; Healy & Hickey, 2002; O’Reilly, 2004; O’Connor, 2004; NPWS, 2008). Although O’Grady (1998) argues that the Boyne is probably a better salmon producing river than it was pre-drainage. This is largely an accidental effect which resulted from the removal of a series of weirs in the middle reaches of the river for the purposes of increasing conveyance. It is generally appreciated that brown trout, other aquatic species and aquatic/wetland habitats were all severely affected by the scheme. McGarrigle (1998) also contends that the Moy arterial drainage scheme did not significantly affect the status of this river as a salmon fishery. However, his descriptions of the loss of lakes in the catchment and reduction in size of others along with the degraded physical appearance of the Moy and some of its tributaries, even some 50 years later, points to severe ecological impacts in this catchment. The high rainfall levels in the north-west which ensures that many 1st order streams can be used by salmon has contributed significantly to the recovery of salmon stocks in this catchment. This scheme as with later schemes such as the Bonnet and Boyle which brought an end to the catchment level arterial drainage schemes also brought significantly less benefits to agricultural production that originally predicted (McGarrigle, 1998; Purcell, 1996).

![Plate 1 Dragline machine working on the River Suck in the early 1990's. These machines are no longer used by the OPW.](image)

1.2.4 **Arterial Drainage Maintenance Works**

1.2.4.1 **General overview**

After a channel has been subject to arterial drainage scheme works, periodic maintenance is required to remove silt, encroaching vegetation and other obstructions which may affect the channel capacity. This is a statutory role of the OPW (OPW, 2007). According to Purcell (1996) after a scheme is completed, a certificate of completion is issued by the Minister of Finance to the OPW. The OPW is then, under the requirements of the Arterial Drainage Act, 1945, obliged to lodge in the High Court maps and documents detailing the works completed.
The purpose this submission is to serve as a benchmark for the scheme which will detail the repair and condition to which the scheme ought to be maintained. However, according to Purcell (1996) the OPW has not lodged such maps or documents relating to any of the arterial drainage schemes carried out under the 1945 Act. Therefore it can be argued that there is no defined benchmark to which these schemes are being maintained and no means of quantifying any changes in the condition of a channel which has resulted from drainage maintenance. Considering the time that has passed since the original schemes were completed (i.e. up to 60 years ago) it seems unlikely that the original designs could be reconciled with the features currently on-site allowing a decision to be made on which features are to be retained or removed. According to OPW (2007) drainage maintenance require the removal of obstructions to the channel to retain the scheme channels design capacity to convey water in an effective manner. However, in the absence of scheme benchmark drawings this would appear to be a difficult task to achieve and increases the risk that features which were not removed during the original scheme will be removed during subsequent maintenance works.

According to OPW (2007) drainage maintenance will require the removal of features of ecological interest that have recolonised the site. However, it must be appreciated that habitats and species protected under the Habitats Directive and Wildlife Act legislation have the same status whether they occur on an undisturbed site or have colonised an area following disturbance (i.e. drainage scheme). Such features occurring under both scenarios must be protected during drainage maintenance if OPW is to be complaint with its statutory environmental obligations. This therefore poses a significant challenge to the OPW if the issue is to be addressed in an objective scientific manner. OPW (2007) notes that the design capacity of the channels in question was put in place prior to the designation of the conservation sites within which these works are now taking place. However, it is noted that all organisations, agencies and private individuals / companies are required to comply with new legislation as it emerges (i.e. local authority hedge cutting activities) and the OPW should be expected to comply with the requirements of the EU Habitats Directive now it has been transposed into Irish law. According to the OPW (2007), arterial drainage channels are maintained on a regular basis (ca. every 3-5 years); however some sites require ongoing maintenance, section by section on an annual basis, while a small proportion of the sites have not been maintained in over ten years. During the current study it was concluded that works were being undertaken at two sites (i.e. upper River Boyne) that had apparently not been maintained in over 20 years or since the original scheme. According to the OPW, some channels may only require maintenance every 20 years due to the self cleaning characteristic of the channel (OPW 2007). However the example viewed on the River Boyne was a depositing stretch with well developed alluvial woodland at each side.

Some OPW channels are steep and fast flowing, being channelized sections of eroding watercourses requiring little maintenance. However 60-70% of OPW scheme channels are of very gentle, longitudinal gradient, where deposition of silt and high growth rates of in-stream vegetation are experienced (OPW, 2007). The majority of maintenance works are on smaller lower lying channels, with 90% of works in channels with a base of less than 3m (OPW, 2007). According to OPW (2007) regularly maintained channels experience prolific weed growth requiring annual maintenance annually. This in part may be a result of the ‘vicious circle’ that such drainage maintenance can be expected to encourage, with channels becoming successively wider and shallower with increasing maintenance and loss of bankside trees and reduced water depths allowing greater light penetration which subsequently promotes excessive plant growth. Maintenance to address weed growth within the channel and on the channel banks aims to facilitate the conveyance capacity of the channel (OPW, 2007).
1.2.4.2  Particulars of maintenance works

In most cases channel maintenance involving the removal of silt and associated vegetation from the bed of the channel is carried out by hydraulic excavators, while long reach excavators are employed in some channels. Restrictions in channels due to bank slipping or damage would be re-graded to the drainage design profile from the original scheme (OPW, 2007). However, it is not clear if the drawings of the existing scheme are available for all channels and how they can be interpreted on the bank by machine drivers. It is clear that with regular maintenance works that there exists a real likelihood of the channel structure deviating from the original scheme design. According to OPW (2007), channel breeches caused by bank erosion would be resolved by re-profiling the bank in-situ. In other cases protection material is imported such as rock armour or log poles. In addition, trees may be removed as a whole or by selective removal of lower branches, if they are considered to impinge on channel capacity. This may also occur if these trees and/or vegetation block access of the machines carrying out maintenance works (OPW 2007). The material removed in the maintenance operations is normally spread along the bank or on top of existing spoil heaps.

Weed-cutting boats are engaged in a number of channels where the channels are too wide or the bank conditions too unstable to allow maintenance by excavators. They are used when a channel requires removal of aquatic vegetation but not silt or other heavy material. In all ca. 90km of channel are cleaned annually by four weed-cutting boats (OPW, 2007). These operate seasonally and the majority of works are in the West of Ireland (OPW 2007). A new form of weed cutting excavator bucket has recently been introduced in maintenance operations. This equipment allows the excavator to remove in-stream vegetation, while retaining the channel substrate. This technology is currently employed on a limited scale in the Western Region.

1.2.4.3  Particulars of works other than channel maintenance

Embankments are also maintained by the OPW. Most embankment systems are tidal in nature, with some exceptions (i.e. Mulkear scheme). The frequency of maintenance for embankments tends to be less uniform than that for channels. Embankments are scheduled for works when it is deemed that the structure is in need of repair to maintain an effective condition. Repair works normally take a form of structural strengthening by improving soil and/or rock or utilising in-situ material. The in-situ material is the excavation of estuarine silt or soil generally taken from the front berm. This is placed and shaped on the existing embankment therefore restoring the embankment to its original design level. Strips of land
parallel to the existing embankment, usually within 20-30m riverside of the embankment are excavated for maintenance work. In other cases structuring strengthening is achieved by importing rock and/or soil material (OPW 2007).

![Plate 3](image)

Plate 3 Weed cutting buckets are also employed in channels in the western region, allowing for vegetation removal without removing sediment.

Maintenance works also include repairs to approximately 70 structures per annum including 18,500 bridges, concrete pipe culverts, timber bog access ramparts and concrete or masonry abutments (OPW 2007). Repair works are normally carried out with a similar material as that of the structure in question. Some wooden structures are an exception to this whereby if substantially deteriorated they are replaced by concrete structures. Ancillary structures such as sluice gates, tidal barrages and pumping stations are repaired or replaced as necessary to maintain their respective operating function (OPW 2007).

![Plate 4](image)

Plate 4 OPW machines undertaking bankside vegetation management.

1.3 Introduction to the Current Ecological Assessment Project

1.3.1 General overview

This ecological assessment entitled ‘Ecological Assessments of the Significance of Impacts of proposed scheduled scheme channel and embankment works, contained in the 2008 Programme on Special Areas of Conservation and Special Protection Areas’ has been commissioned by the OPW to provide an assessment of the potential impacts of maintenance works in these conservation sites, as an assessment of the significance is required by
European legislation; namely the Habitats Directive (1992), transposed into Irish legislation as the European (Natural Habitats) Regulations, 1997. This requirement was listed in the OPW report titled ‘Screening of Natura 2000 Sites for Impacts of Arterial Drainage Maintenance Operations’ (OPW 2007). The OPW approach to the ‘Assessment of Significance’ entails a desk top assessment of readily available environmental information for each conservation site and a follow up ecological field survey of a selected 15% of the sites, to provide the baseline data for an assessment of the impacts on designated conservation sites from drainage maintenance works.

Protected Annex I habitats and Annex II flora and fauna species require protection through the designation of conservation sites, known as Special Areas of Conservation (SAC) and Special Areas of Protection (SPA). Where an activity or development is not related to the management of these sites for the enhancement of the key conservation interests, an appropriate assessment is required, for works or operations, which are likely to have a significant effect on the conservation aspect of the site (Section 31 of the European (Natural Habitat) Regulations, 1997). All work undertaken by the OPW in SACs and SPAs must lead to the maintenance of the favourable conservation status of the habitats and species for which the site is designated and the restoration of natural habitats, flora and fauna communities. This report aims to highlight the holistic concept of the ecosystem and the conservation objectives set out for designated conservation sites protected under the Natura 2000 network.

The actual works being assessed in this report were being undertaken concurrently with the current appraisal. This report will examine the accuracy and detail of the screening assessments undertaken by OPW, providing a critique of the ecological conservation interests at the site and a qualified assessment of the functionality of the OPW’s ‘Assessment of Significance’ methodology.

The objective of this ecological impact assessment was to determine the effects of statutory arterial drainage maintenance activities on protected Annex I habitats and protected Annex II species in accordance with Section 31 of the European (Natural Habitat) Regulations, 1997. Fifty SAC sites were selected by the OPW. Each of the fifty sites selected was to be assessed in terms of:

- Protected species and habitat;
- Species present, both flora and fauna;
- Surrounding land-use;
- Evidence of recent channel maintenance;
- Impact of Arterial Drainage Maintenance activity on protected Annex I habitats;
- The population and distribution of the protected Annex I & II species which contributed to the designation status of the SAC;
- The extent and distribution of habitat supporting the Annex I & II species.

The OPW have devised an ‘Assessment of Significance Evaluation Form’ for each SAC/SPA to assess the level of potential damage to SACs/SPAs caused by arterial drainage maintenance schemes based on a desktop study carried out by the Environment Section of the OPW. An example of a blank site assessment form is included in Appendix 2 of this report.

The OPW filled out an assessment form for each of the Natura 2000 Sites affected by the 2008 works. ECOFACT then reviewed of the value of these assessment forms in relation to the impacts of arterial drainage maintenance schemes on the relevant SAC/SPAs, and to give an independent opinion as to how successful this method of evaluation is, based on field survey
of selected sites pre- and post- maintenance works. A number of difficulties were however encountered during the procedure which will be outlined in the results section.

1.3.2 **Special Areas of Conservation (SACs) & Special Protection Areas (SPAs)**

Special Areas of Conservation were legally established as nature refuges under Article 3 of the Habitats Directive (Council Directive 92/43/EEC). The purpose of this legislation was to develop an ecological network of Special Areas of Conservation across all European Union states that collectively would be known as Natura 2000. In ecological terms there was a legal obligation for each member state to identify, conserve and protect site(s) supporting rare or endangered plants, animals and their habitats (section 1.2). Designation of Irish sites was performed in accordance with the criteria set out in Annex III of the Habitats Directive. Some of the selection parameters for SACs, used by the National Parks and Wildlife Services are:

- Importance of the site in terms of the habitats and species it supports;
- Degree of representation of a habitat or habitats within a site to enhance, conserve and preserve habitat diversity;
- Extent of isolation of the population;
- Degree of destruction, if any, that has occurred on site;
- Geographic distribution, frequency and distribution of habitats and/or protected and rare species, presence of a priority habitat and the presence of a habitat or species important or unique to Ireland.

The Birds Directive (79/409/EEC) requires the creation of Special Protection Areas (SPAs). The principle criteria for designation of a site as internationally important are that it:

- Regularly supports 20,000 waterfowl;
- Regularly sustains 1% of the all-Ireland bird population for an Annex I species;
- Regularly sustains 1% of the biogeographical (European) bird population for a non Annex I migratory species;
- Regularly holds 1% of the estimated population for non Annex I migratory species.

Together the Birds and Habitats Directives require the 25 EU Member States to take a number of measures in order to protect all bird species, their sites and their habitats:

They require Member States to:

Take measures to conserve all naturally occurring bird species across the EU;

- Classify as Special Protection Areas (SPAs) the most suitable territories for species listed on Annex I of the Directive and migratory species*;
- Maintain SPAs in Favorable Conservation Status;
- Prepare and implement management plans, setting clear conservation objectives for all SPAs in the EU 25;
- Provide co-financing for the management of these protected sites (SPAs);
- Regulate the hunting of certain species of birds listed in Annex II of the Birds Directive;
- Follow the procedure outlined in Article 6 of the Habitats Directive for carrying out appropriate assessments of environmental impacts on SPAs.
Detailed in the European Council Directive (92/43/EEC) under a series of Annexes, are habitats, flora and fauna and the designation criteria for SACs. The Annex listed I to VI are described below:

- **Annex I**: ‘Natural habitat types of community interest whose conservation requires the designation of Special Area of Conservation’. This includes priority habitats for example Calcareous fens with Cladium mariscus and species of the Caricion davallianae (7210). It also includes important habitats e.g. ‘Alkaline fens (7230)’ and ‘Transition mires and quaking bogs (7140)’ which are not priority habitats.

- **Annex II**: ‘Animal and plant species of community interest whose conservation requires the designation of a Special Area of Conservation’. All species listed in Annex II are deemed to be of ecological significance to Europe therefore they and their habitats are designated Special Areas of Conservation.

- **Annex III**: ‘Criteria for selecting sites eligible for identification as sites of community importance and designation as Special Areas of Conservation’. This is a two stage process with stage 1 considers the relative importance of Annex I habitats and Annex II considers species on a national scale. Stage 2 assesses the findings of Stage 1 in a European context.

- **Annex IV**: ‘Animals and plant species of community interest in need of strict protection’. This provides protection for the flora and fauna listed in Annex IV but does not require that all habitat supporting these species be designated as Special Areas of Conservation.

- **Annex V**: ‘Animal and plant species of community interest that taking in the wild may be subject to management measures’. Under Irish law, namely the Habitat Regulations 1997, a licence is required for activities that result in species management.

- **Annex VI**: ‘Prohibited methods of capture and killing modes of transport’. This applies to the transportation, movement and proper treatment of animals and birds.

### 1.3.3 OPW Categories for Conservation Aspects

At present 61 SACs overlap with OPW drainage operations encapsulating 66 conservation aspects (OPW, 2007). SPAs (22) overlap drainage schemes with 22 Annex I and 35 migratory bird species occurring in these sites (OPW, 2007). The OPW have devised a method of categorising the level of impacts associated with arterial drainage maintenance schemes on SACs/SPAs depending on conservation aspect sensitivity and proximity to the works. Conservation aspects are sub-divided into three categories (OPW 2007). This report will also comment on how suitable these category levels are, in relation to conservation aspects of the SACs/SPAs surveyed. It will also provide an independent opinion as to how suitable this categorisation is as a method for assessing the conservation status of protected habitats and species within the SAC/SPA, particularly in the absence of scientific study or field data to establish the significance of impact. These categories are slightly different depending on if the site is a SAC or SPA but a basic summary is as follows and in more detail thereafter;

- **Category I**, Realistic possibility that a significant effect could occur;
- **Category II**, Requires more detailed analysis to decide if impact is either possibly significant or highly unlikely;
- **Category III**, Significant impact is highly unlikely;

The affected number of conservation aspects (i.e. species or habitats for which conservation sites are designated) within SACs/SPAs, are presented in Table 1.
Table 1 The affected number of conservation aspects (i.e. species or habitats), given Categories I, II and III in SACs/SPAs affected by arterial drainage maintenance schemes (OPW 2007).

<table>
<thead>
<tr>
<th>Category</th>
<th>SAC (No. of Annex II species)</th>
<th>SAC (No. of Annex I habitats)</th>
<th>SPA (No. of Annex I species)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>11</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Category II</td>
<td>2</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>Category III</td>
<td>6</td>
<td>18</td>
<td>24</td>
</tr>
</tbody>
</table>

The following definitions for categorisation for SACs are taken from the OPW publication ‘Screening of Natura 2000 Sites for Impacts of Arterial Drainage Maintenance Operations’ (2007).

- **Category I** “Conservation aspects that are located in the waterway corridor or on lands adjoining the waterway. They are in close proximity to maintenance operations and have some form of sensitivity to these works. It is deemed that there is a realistic possibility that a significant effect could occur and that some form of an ecological assessment is warranted”.

- **Category II** “Conservation aspects that have some sensitivities to maintenance operations but this is largely dependent on their proximity to waterways where maintenance is carried out. Further analysis is required to delineate their proximity to maintenance works. Insufficient information at present to decide if they are to be deemed Category I or Category III”.

- **Category III** “Conservation aspects that have less sensitivity to maintenance operations and are not in close proximity to these works. It is expected that a significant impact is highly unlikely and further study would not be warranted unless contrary knowledge arises in the future.”

The categorisation for SPA sites is outlined as follows:

- **Category I** “Birds that inhabit, for the whole of the year, either a waterway corridor or an adjoining wetland, hence they are consistently in close proximity to maintenance works and could have sensitivities to habitat impacts or disturbance. It is deemed that there is a realistic possibility that a significant effect could occur and some form of ecological assessment is warranted”.

- **Category II** “Birds that inhabit, for part of the year, either a waterway corridor or an adjoining wetland. They may be in close proximity to maintenance operations for a portion of their life and their sensitivity is partly determined by what activity they carry in the area e.g. breeding, feeding or resting. Further analysis is required to delineate their proximity to maintenance works and judge their susceptibility to habitat impacts or disturbance. There is insufficient information at present to decide if they are deemed as Category I or Category III”.

- **Category III** “Birds that rarely inhabit a maintained waterway corridor or an area adjoining a waterway. They would normally not be in close proximity to maintenance operations; hence they would not be as sensitive to habitat impacts or disturbance by these works. It is expected that a significant impact is highly unlikely and further study would not be warranted”. 

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2 METHODOLOGY

2.1 Desk study of affected sites

Fifty SACs and/or SPAs were selected by the OPW for study and have a variety of conservation aspects present, i.e. Annex I habitats and Annex II species listed in the Habitats Directive and also Annex I bird species, listed in the Birds Directive. Out the 50 SAC sites affected by the proposed maintenance works, eight sites (ca.15%) were chosen for ecological site walkover studies; these sites were surveyed over the summer of 2008. The remaining 42 Natura sites were subjected to further desk study and were evaluated by the OPW using the ‘Assessment of Significance’ evaluation cards developed by the OPW. The ecological assessment seeks to address both the efficacy of the desk based assessment of impacts and the observed impacts of arterial drainage maintenance recorded from the field survey studies of the selected sites.

2.2 Review of OPW desk based assessments

This report sets out to assess and evaluate the efficacy of the OPW’s current assessment methodology and to provide guidance for future improvements to the drainage maintenance operations of this organisation. The assessment methodology employed by the OPW for this study involved the creation of ‘Assessment of Significance’ forms which set out the primary conservation interests of each site and allowed for a brief assessment of the potential impacts, the recommended mitigations and the overall significance of impact.

These forms were submitted to Ecofact for review and comment. Ecofact then returned comment and suggested improvements in both format and content to be carried out by the OPW. The final draft of these forms and the current level of ecological assessment employed by the OPW for works in Natura sites is reviewed.

2.3 Field survey

The ecological assessment of the channels affected by arterial drainage within 8 SACs and/or SPAs was undertaken between July and September 2008. Each channel section surveyed was assessed for the presence of Annex I habitats, evidence of or potential to support Annex II fauna or Annex I avifauna. Pre-maintenance surveys were carried out on the majority of the site, while in some instances works were taking place at the time of the site visit. Post drainage site visits were carried out a number of locations. The summer of 2008 was particularly wet and the high water levels on many rivers held up both the current field studies and OPW maintenance operations. The location of drainage maintenance works for the 2008 period was not clearly identified in the mapping provided by the OPW; due to apparent technical problems.

The field survey served to provide on the ground evidence regarding the success of the current mitigations employed by the OPW at these sites. Other information gathered during the course of the ecological survey will include a description of adjacent lands, land-use in the vicinity of these habitats and knowledge from landowners where available. Habitat classification follows the Heritage Council’s ‘A guide to habitats in Ireland’ (Fossitt 2000). The ‘River habitat survey in Britain and Ireland’ manual (2003) was also utilised.
2.4 Evaluation of OPW assessments

The desk based review of the OPW ‘Significance of Impacts’ assessments for each Natura site, combined with the observations and records taken from the ecological site visits allowed for an evaluation of the efficacy of the current desk based assessment methodology employed by the OPW. The overall evaluation of the OPW assessment methodology utilised the format of the existing screening methodology provided for in the Appropriate Assessment guidelines as detailed in the following documents:-


This follows the requirements of Article 6, paragraphs 3 and 4 of the EU Habitats Directive (1992) which state that:

- 6(3) Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives. In the 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.

- 6(4) If, in spite of a negative assessment of the implications for the 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, the Member State 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.

Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.

Based on the above guidelines, the assessment is a four staged approach described below and illustrated in Figure 1.

- Stage One: Screening / Test of Significance - the process which identifies the likely impacts upon a Natura 2000 site of a project or plan, either alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant;
• **Stage Two: Appropriate Assessment** - the consideration of the impact of the project or plan on the integrity of the Natura 2000 site, either alone or in combination with other projects or plans, with respect to the site’s structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;

• **Stage Three: Assessment of Alternative Solutions** - the process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site; and

• **Stage Four: Assessment Where Adverse Impacts Remain** - an assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the project or plan should proceed.

The current report is a screening report, assessing the methodology utilised to date by the OPW for works in Natura 2000 sites and therefore carries the assessment to stage one only.

### 2.5 Consultation

Within the framework of this assessment report no external discussion of current OPW maintenance works and assessments was undertaken prior to issuing the current version of the report. The current assessment was considered to be a review of the current assessment methodology undertaken by the OPW and seeks to provide a framework for the improvement of environmental performance of the OPW drainage maintenance works within Natura 2000 conservation sites.

Following the preparation of this report it is considered that this report be utilised as a discussion document for consultation with the NPWS, the Regional Fisheries Boards, and other relevant organisations. Consultation was however undertaken with following bodies in order to obtain information relevant to the assessment:-

• National Parks and Wildlife Service (NPWS);
• Central Fisheries Board (CFB);
• UK Association of Drainage Authorities (ADA);
• Natural England (NE);
• English Nature (EN);
• Environment and Heritage Service, Northern Ireland (EHS);
• Rivers Agency, Northern Ireland (RA);
• UK Environment Agency (EA);
• Institute of Ecology and Environmental Management (IEEM);
• Birdwatch Ireland (BWI);
• Irish Peatland Conservation Council (IPCC);
• UK Centre for Ecology and Hydrology (CEH);
• UK Department for Environment, Food and Rural Affairs (DEFRA).
Figure 1 Flowchart outlining the appropriate assessment process (Adapted from EC, 2001).
3 DESK STUDY ASSESSMENT

3.1 Descriptions of Natura Sites selected by OPW

This study assesses the potential impacts of the 2008 arterial drainage maintenance programme on the selected SACs and SPAs. The OPW supplied a list of fifty SACs/SPAs which overlap Arterial Drainage Maintenance channels on which works were carried out under the 1945 Arterial Drainage Act and the 1995 Amendment to the Act. Table 2 presents the fifty SACs selected by the OPW for 2008; the eight SACs/SPAs chosen for further walkover studies are also identified. The conservation aspects of each site are identified for sites that were surveyed, as well as sites that were the subject to desk study only.

Table 2 Designated conservation sites affected by the Arterial Drainage Maintenance Scheme and their conservation interests

<table>
<thead>
<tr>
<th>SPA Site No.</th>
<th>SAC Site No.</th>
<th>Site Name</th>
<th>Region</th>
<th>SAC</th>
<th>SPA</th>
<th>No. of Annex I habitats</th>
<th>No. of Annex II species</th>
<th>No. of Annex I Bird species</th>
<th>Selected for site walkover</th>
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<td>East</td>
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<td>SAC Site No.</td>
<td>Site Name</td>
<td>Region</td>
<td>SAC</td>
<td>SPA</td>
<td>No. of Annex I habitats</td>
<td>No. of Annex II species</td>
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<td>Selected for site walkover</td>
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### 3.1.2 Charleville Wood SAC

Charleville Wood is large Oak woodland surrounded by estate parkland and agricultural grassland located about 3 km south-west of Tullamore. The site, which is underlain by deep glacial deposits, includes a small lake with a wooded island, and a stream runs along the western perimeter. The woodland is considered to be one of very few ancient woodlands remaining in Ireland, with some parts undisturbed for at least 200 years.

The site is notable for the presence of a large population of the rare snail species, *Vertigo moulinisiana*. Extensive swamps of Bulrush (*Typha latifolia*) and Bottle Sedge (*Carex rostrata*) have developed in the lake shallows. Old Oak woodland is a habitat listed on Annex I of the EU Habitats Directive, while the rare snail species, *Vertigo moulinisiana*, is listed on Annex II of this directive (NPWS site synopsis). A previous study of this SAC was found to have a favourable extent of optimal habitat for *Vertigo moulinisiana* (Moorkens 2007a).
3.1.1 **Lough Ennell SAC/SPA**

Lough Ennell is a large, open, steep-sided lake, located 3km south of Mullingar, Co. Westmeath. The lake bottom is of limestone with a marl deposit. The water is markedly alkaline and mesotrophic, possibly owing to effluents received from Mullingar town and to fertilizer inputs from farmland surrounding the lake. The River Brosna flows into the lake from the north, at Butler’s Bridge, and out from the south. Seven Stonewort species including two Red Data Book species, *Chara denudata* and *C. Tomentosa* have been recorded here.

Much of the lake shore is rather dry, stony ground, which was formerly part of the lake bed but is now exposed by drainage, and colonised by calcareous grassland. Reedbeds and species-poor swamp vegetation occasionally fringe the lake, particularly around the points of inflow and outflow and on the eastern shore, around Tudenham Park. Mixed woodland of Beech (*Fagus sylvatica*), Ash (*Fraxinus excelsior*) and Downy Birch (*Betula pubescens*) fringes the lakeshore to the northwest. Yellow Archangel (*Lamiastrum galeobdolon*), a rare plant listed in the Red Data Book, has been recorded in the woods along the eastern shores of Lough Ennell. The rare Myxomycete fungus, *Licea castanea*, has been recorded from woodland in the site.

Lough Ennell is of significance as a highly productive lake which supports a rich variety of lower plant and invertebrate species. Its lakeshore habitats, which include alkaline fen, a habitat listed on Annex I of the EU Habitats Directive, support a diverse flora. These habitats also provide important refuges for wildfowl. The occurrence of a further two species in the vicinity of the lake, Greenland White-fronted Goose and Golden Plover, is of particular note as these are listed on Annex I of the E.U. Birds Directive.

3.1.3 **Lough Owel SAC/SPA**

Lough Owel is a large hard water lake, a habitat listed on Annex I of the EU Habitats Directive. It is a medium- to large-sized lake, with a length of c. 6 km along its long axis and a maximum width of 3 km. The lake is located approximately 4km north-west of Mullingar. It is a relatively shallow lake, with a maximum depth of 22 m with a rocky, marl-covered bottom. The lake is classified as a mesotrophic system and its status has been stable in recent years.

Areas of marsh and fen occur above the shoreline in the northern and south-western corners of the lake though these are largely outside of the site. Several small islands occur in the
southern sector. Lough Owel is the best example of a large, spring-fed calcareous lake in the country. The site is of major conservation significance, containing, as it does, three habitats that are listed on Annex I of the EU Habitats Directive, i.e. alkaline fens, transition mires and hard water lakes. Lough Owel is one of the most important Midland lakes for wintering waterfowl, with nationally important populations of Shoveler, Coot, Pochard, Tufted Duck, Goldeneye and the Greenland White-fronted Goose.

3.1.4 Ballyteigue Burrow SAC/SPA

This site is located on the south coast of Co. Wexford between the towns of Kilmore Quay and Cullenstown. It comprises a sand and shingle barrier beach, approximately 8 km in length, and the estuary of the Duncormick River. The extensive overlying sand spit is known as the Burrow, while the estuary that it encloses is known as the Cull. The site contains several coastal habitats listed on Annex I of the E.U. Habitats Directive, including three priority habitats: fixed dune, dune heath and lagoon. Most of the site is designated a Nature Reserve. A dominating feature of this site is its large dune system, many of the dunes reaching over 20m high. Embryonic shifting dunes and Marram dunes occur along the seaward side with more stable fixed dunes and dune heath inland, though blow-outs occur throughout.

Saltmarsh vegetation fringes The Cull. Part of the saltmarsh complex contains halophilous scrub vegetation. This is a very rare habitat in Ireland. This habitat is characterised by the rare Perennial Glasswort (*Arthrocnemum perenne*). A series of drainage channels and a small pond, which are largely artificial in origin, now have a flora and fauna characteristic of lagoons. The channels have a maximum depth of 3 m. Seawater enters mainly be percolation through the dunes along the southern shore and apparently by leakage of the sluice on the Cull at high tide. The Red Data Book charophyte *Chara canescens*, was recorded here.

This site is host to a range of rare plant species such as Wild Asparagus (*Asparagus officinalis*), Lesser Centaury (*Centaurium pulchellum*), Borrer’s Saltmarsh-grass (*Puccinellia fasciculata*) and Perennial Glasswort (*Arthrocnemum perenne*). There is record for Sea Pea (*Lathyrus japonicus*). All five species are protected under the Flora (Protection) Order 1999. The invertebrate fauna of the site includes a number of scarce species, examples being the bumble bees *Bombus distinguendus* and *B. sylvarum*, the jewel wasp *Hedychrium ardens* and the ant *Tetramorium caespitum*.
The Cull and adjacent reclaimed land provide important habitat for wintering waterfowl and Brent Goose occur here in internationally important numbers. Other over-wintering birds include Shelduck, Ringed Plover, Golden Plover, Lapwing, Black-tailed Godwit and Bar-tailed Godwit. A range of other species occur in numbers of regional importance, including Wigeon, Grey Plover, Dunlin, little tern and Redshank. Golden Plover, Little Ternand Bar-tailed Godwit, are listed on Annex I of the E.U. Birds Directive.

3.1.5 Ryewater Valley SAC

This site is located between Leixlip and Maynooth. It extends along the Rye Water, a tributary of the River Liffey. The Rye Water in Carton Estate is dammed at intervals, creating a series of lakes. The marsh, mineral spring and seepage area found at Louisa Bridge supports a good diversity of plant species, including Stoneworts, Arrowgrass (Triglochin palustris), Purple Moor-grass (Molina caerulea), Sedges (Carex spp.), Common Butterwort (Pinguicula vulgaris), Marsh Housewort (Pedicularis palustris), Grass-of-parnassus (Parnassia palustris) and Cuckooflower (Cardamine pratensis). The mineral spring found at the site is of a type considered to be rare in Europe and is a habitat listed on Annex I of the EU Habitats Directive. The semi-aquatic snails Vertigo angustior and V. moulinsiana occur in marsh vegetation near Louisa Bridge; both are rare in Ireland and Europe and are listed on Annex II of the EU Habitats Directive. The main importance of the site lies in the presence of several rare and threatened plant and animal species, and of a rare habitat, thermal, mineral, petrifying spring.

The woods on Carton Estate are mostly old demesne woods with both deciduous and coniferous species. Conifers, including some Yew (Taxus baccata) are dominant, with Beech (Fagus sylvatica), Oak (Quercus sp.), Sycamore (Acer pseudoplatanus), Ash and Hazel (Corylus avellana) also occurring. Hairy St. John’s-wort (Hypericum hirsutum), a species legally protected under the Flora Protection Order (1987), occurs in Carton Estate. Green Figwort (Scrophularia umbrosa), occurs on the site in several locations by the Rye Water. The woods at Carton Demesne are the site of a rare Myxomycete fungus, Diderma deplanatum. Within the woods, Blackcap, Woodcock and Long-eared Owl have been recorded. Little Grebe, Coot, Moorhen, Tufted Duck, Teal and Kingfisher, the latter a species listed on Annex I of the EU Birds Directive, occur on and about the lake.

3.1.6 Split Hills and Long Hill SAC

Split Hills and Long Hill Esker is a 5km long site which crosses the main Galway-Dublin road mid-way between Kilbeggan and Tyrrellspass in Co. Westmeath. The main habitat is of semi-natural woodland dominated by Hazel (Corylus avellana), Ash (Fraxinus excelsior), and Hawthorn (Crataegus monogyna). Oak (Quercus robur), Wych Elm (Ulmus glabra) and Irish Whitebeam (Sorbus hibernica) are important constituents. The scarce woodland grass, Wood Fescue (Festuca altissima), is present, and the scarce Bird’s-nest Orchid (Neottia nidus-avis) has also been recorded here.

Several areas of species-rich calcareous grassland occur, with typical calcicole species such as Yellow-wort (Blackstonia perfoliata), Carline Thistle (Carlina vulgaris), Mountain Everlasting (Antennaria dioica) and Early-purple Orchid (Orchis mascula). These occur on unstable old and active quarry faces, and on cleared woodland areas. Areas of scrub with Blackthorn (Prunus spinosa) and Gorse (Ulex europaeus) occur, and regenerating Hazel (Corylus avellana) scrub exists in some areas where woodland has been cleared. Other habitats in the site include a small lake and freshwater marsh with Slender Sedge (Carex lasiocarpa). Narrow-
leaved Bittercress (*Cardamine impatiens*) occurs, this species is protected under The Flora Protection Order (1999), and this is its only known location in Ireland. Another protected species, Hemp Nettle (*Galeopsis angustifolia*), occurs on more open ground on the esker. The main threats to this SAC are quarrying, over-grazing and under-grazing. The site also supports some excellent examples of calcareous grassland which is rich in orchids. The increasing rarity of this habitat (due to agricultural intensification) is recognised in that it is awarded priority status on Annex I of the European Habitats Directive.

### 3.1.7 River Boyne & Blackwater SAC

This site comprises the freshwater element of the River Boyne as far as the Boyne Aqueduct, the Blackwater as far as Lough Ramor and the Boyne tributaries including the Deel, Stoneyford and Tremblestown Rivers. These riverine stretches drain a considerable area of Meath and Westmeath and smaller areas of Cavan and Louth. The underlying geology is Carboniferous Limestone for the most part with areas of Upper, Lower and Middle well represented. In the vicinity of Kells Silurian Quartzite is present while close to Trim are Carboniferous Shales and Sandstones.

The main areas of alkaline fen are concentrated in the vicinity of Lough Shesk, Freehan Lough and Newtown Lough. A series of base-rich marshes have developed in the poorly-drained hollows, generally linked with these three lakes. There is an abundance of aquatic Stoneworts (*Chara* spp.) which are characteristic of calcareous wetlands. The rare plant, Round-leaved Wintergreen (*Pyrola rotundifolia*) occurs around Newtown Lough. This species is listed in the Red Data Book and is protected under the Flora Protection Order, 1999. Wet woodland fringes many stretches of the Boyne. The Boyne River Islands are a small chain of three islands situated 2.5 km west of Drogheda. Other habitats present along the Boyne and Blackwater include wet woodland, freshwater marsh, lowland dry grassland, improved grassland, reedswamp, weedy waste ground areas, scrub, hedge, drainage ditches and canals.

![Plate 7 The middle reaches of the Kells Blackwater was excluded from the Boyne Arterial Drainage Scheme.](image)

The site is also important for the populations of two other species listed on Annex II of the E.U. Habitats Directive, namely River Lamprey (*Lampetra fluviatilis*) which is present in the lower reaches of the Boyne River while the Otter (*Lutra lutra*) can be found throughout the site. In addition, the site also supports many more of the mammal species occurring in Ireland. Those which are listed in the Irish Red Data Book include Pine Marten, Badger and Irish Hare. Common Frog, another Red Data Book species, also occurs within the site. All of these animals with the addition of the Stoat and Red Squirrel, which also occur within the
site, are protected under the Wildlife Act. Whooper Swans winter regularly at several locations along the Boyne and Blackwater Rivers.

3.1.8 **Ballymore Fen SAC**

Ballymore Fen lies approximately 17 km west of Mullingar adjacent to the Mullingar to Ballymore road (R390) in Co. Westmeath. The geology of the area is Carboniferous Limestone. The site occupies a relatively wide and deep depression in the surrounding drift which is fed on both the east and west by springs. The area may at one stage have been a lake of some size but at present is occupied by a transition mire complex with the characteristic lagg fen at the edges. The site is a candidate SAC selected for transition mires, a habitat listed on Annex I of the E.U. Habitats Directive. Throughout the areas of fen dominated by black bog rush (*Schoenus nigricans*) are Willow saplings with some Purple Moor-grass (*Molinia caerulea*) and bog moss hummocks (*Sphagnum* spp.). Between the hummocks, abundant Round-leaved Wintergreen (*Pyrola rotundifolia*) - a Red Data Book Species, occurs with species typically found in such conditions.

On the slopes surrounding the fen area is a mosaic of improved, semi-improved and species-rich calcareous grasslands lightly grazed by cattle. Associated with drains and flowing streams throughout the site are the 10-spined stickleback along with the common frog and smooth newt.

3.1.9 **Moneybeg & Clare Island SAC**

This site is located on the border of Counties Meath and Westmeath 9 km east of the town of Granard. It is situated mainly in the townlands of Clare Island or Derrymacegan, Williamstown and Moneybeg in County Westmeath and Ross in County Meath.

The site is a candidate Special Area of Conservation selected for active raised bog, degraded raised bog and Rhynchosporion, habitats that are listed on Annex I of the E.U. Habitats Directive. Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (*Sphagnum* spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, *Sphagnum* lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration. The Rhynchosporion habitat occurs in wet depressions, pool edges and erosion channels. The Moneybeg and Clareisland Bogs site is of considerable conservation significance, comprising as it does two raised bogs with semi-natural lake margins at the north-eastern extreme of the range of raised bogs in Ireland. This is a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland.

3.1.10 **Mount Hevey Bog SAC**

Mount Hevey Bog is situated approximately 4 km north-east of Kinnegad, in the townlands of Cloncrave, White Island, Aghamore, Kilwarden and Kilnagalliagh. The Meath-Westmeath county boundary runs through the centre of the bog. The site comprises a raised bog that includes both areas of high bog and cutover bog. The Dublin-Sligo railway runs through the northern part of the bog isolating two northern lobes. The northern lobes are adjacent to the Royal Canal.
The site is a candidate Special Area of Conservation selected for active raised bog, degraded raised bog and Rhynchosporion, habitats that are listed on Annex I of the E.U. Habitats Directive. Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (*Sphagnum* spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, *Sphagnum* lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration.

The site consists of a long narrow bog separated into four sub-sections; the larger eastern section supports a wet quaking area with hummock/hollows and pool complex. Hummock/hollow complex also occurs in the south-west lobe and the north-west lobe of the site. An infilled lake is now a soak system. Forestry occurs on the most easterly section of the site. There is abandoned cutover all around this bog and particularly on the western section. There is some wet and actively regenerating areas of the cutover along the southern margins of the western lobe and along the railway. Mount Hevey Bog is a site of considerable conservation significance comprising as it does a raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. The site supports a good diversity of raised bog microhabitats, including hummock/hollow complexes, pools, flushes and regenerating cutover, as well as a number of scarce plant species. Active raised bog is listed as a priority habitat on Annex I of the E.U. Habitats Directive. Priority status is given to habitats and species that are threatened throughout the E.U. Ireland has a high proportion of the total E.U. resource of this habitat type (over 60%) and so has a special responsibility for its conservation at an international level.

![Plate 8 Channel C60 flows adjacent to Moneybeg Bog SAC and discharges to Lough Sheelin SPA. The bog habitat was found to be well buffered from the drain; however, there was extensive woodland habitat either side of the channel that would be affected by drainage maintenance works.](image)

### 3.1.11 Lough Derravaragh SPA

Lough Derravaragh is located approximately 12 km north of Mullingar town. It is a medium-to large-sized lake of relatively shallow water (maximum depth 23 m). The lake extends along a south-east/north-west axis for approximately 8 km. The Inny River, a tributary of the River Shannon, is the main inflowing and outflowing river. It is a typical limestone lake with water of high hardness and alkaline pH, and is classified as a mesotrophic system. Eight species of charophytes have been recorded here, including the rare, Red Data Book species *Chara denuidata* and *C. tomentosa*. The western end of the lake contains extensive areas of swamp dominated by Common Reed (*Phragmites australis*). There is also freshwater marsh vegetation.
dominated by sedges (Carex spp.) and tussock-forming grasses. Poor fen habitats occur in abundance and deciduous woodland fringes the lake in some areas.

Lough Derravaragh is one of the most important midland lakes for wintering waterfowl. The lake is a traditional area for the internationally important Midland lakes Greenland Whitefronted Geese, Annex I of the E.U. Birds Directive. It supports nationally important populations of Little Grebe, Mute Swan, Pochard, Tufted Duck and Coot. It supports regionally important populations of regionally important populations of Great Crested Grebe, Cormorant, Wigeon, Teal, Mallard, Pintail, Shoveler, Goldeneye, Lapwing, Whooper Swan and Golden Plover. The latter two species are listed on Annex I of the E.U. Birds Directive.

![Plate 9 The upper Inny River (C61) at Lough Sheelin.](image)

### 3.1.12 Lough Kinale & Derragh SPA

Lough Kinale is a relatively small lake that is situated immediately downstream of Lough Sheelin, both lakes being near the top of the catchment of the Inny River, a main tributary of the River Shannon. Derragh Lough, a much smaller system, is connected to Lough Kinale and the Inny River. This is a typical limestone system and is very shallow (maximum depth of Lough Kinale is c. 4 m). As with Lough Sheelin, the trophic status of the lake has varied greatly since the 1970s due to pollution. It was recently (1998-2000) classified as a highly eutrophic system. The lake was formerly an important Trout fishery.

Lough Kinale has two main basins, almost separated by swamp formations. Reed swamp is frequent around the lakes, with Common Reed (Phragmites australis) and Tufted-sedge (Carex elata) occurring commonly. A calcium-rich small sedge marsh occurs along parts of the shoreline. Areas of bog occur around the margins of the lakes in places but some of these have been planted with conifers. Despite the very variable water quality in recent decades, Lough Kinale and Derragh Lough remains an important site for wintering waterfowl, especially diving duck. The site supports nationally important populations of two species, i.e. Pochard and Tufted Duck. A number of other species are found, including Great Crested Grebe, Mallard, Goldeneye, Mute Swan, Coot, Lapwing and Golden Plover.

### 3.1.13 Stabannan-Braganstown SPA

Stabannan-Braganstown SPA, situated approximately 4 km inland from Dundalk Bay in Co. Louth, is a small, very flat alluvial plain adjacent to the River Glyde. It is bounded to the
north and south by low, rolling hills. Much of the site was formerly marshland or wet grassland, but is now drained and agriculturally improved. It is farmed intensively for grass, cereals and root crops.

While the site is privately owned and actively farmed, it is not under threat as there is a management agreement in place to benefit the waterfowl. The site is of most importance as the largest Greylag Goose site in the country, but it also regularly supports three species which are listed on Annex I of the E.U. Birds Directive – Greenland White-fronted Goose, Whooper Swan and Golden Plover.

3.1.14 Curraghchase Woods SAC

This site is situated approximately 7 km east of Askeaton in County Limerick. The area is characterised by glacial drift deposits over Carboniferous limestone. The site consists largely of mixed woodland and a series of wetlands. The main interest, however, is the presence of a hibernation site of the Lesser Horseshoe Bat (Rhinolophus hipposideros), a species listed on Annex II of the EU Habitats Directive. This is the largest known site for this species in County Limerick.

The woodland consists of both deciduous species and stands of commercial conifers. A series of small lakes and fens runs the length of the site. Some of these lakes are overgrown with vegetation. These wetlands, along with some wet grassland, add habitat diversity to the site.

3.1.15 Barroughter Bog SAC

Barroughter Bog is a relatively small raised bog, situated on the shores of Lough Derg, a few kilometres east of Woodford, and bounded in the north by the Cappagh River. A large area (about 34 hectares) in the centre shows an outstanding raised bog habitat with small and large pools containing Bog Mosses (Sphagnum spp.), including Sphagnum pulchrum - a very scarce plant in Ireland. Extensive flat lawns of a range of Bog Mosses (Sphagnum spp.) and low hummocks occur between the pools, and the whole area is quaking. Barroughter Bog is a raised bog of considerable conservation value. Given its relatively small size, the area of outstanding quaking habitat is remarkably large. Its proximity to the shores of Lough Derg, with its succession from open water through extensive reed beds and marginal scrub, to raised bog, adds to its importance. It is also the only raised bog on the shores of Lough Derg. Threats include burning and drainage which cause the drying out of the bog surface.

3.1.16 Derrycrag Wood Nature Reserve SAC

Derrycrag Wood is an old Oak (Quercus sp.) woodland, a habitat listed on Annex I of the EU Habitats Directive. It is situated 1.5 km south-east of Woodford, Co. Galway, and is traversed by the Woodford River. The underlying rock is Old Red Sandstone, which is overlain in places by drift. The soils vary from thin, acidic podzols to deeper, gleyed brown earths. The site is dominated by planted conifers, but fragments of old oak woodland still occur. Elements of the original ground flora persist beneath the conifers, especially where mature Scot’s Pine (Pinus sylvestris) is present. At one small location on the Woodford River bank there is a remarkably rich flora, including the Red Data Book species Alder Buckthorn (Frangula alnus) and three plant species which are otherwise scarce in Ireland: Blue-eyed-grass (Sisyrinchium bermudiana), Lesser Meadow-rue (Thalictrum minus) and Wild Columbine (Aquilegia vulgaris). Pine Marten and Badger, both Red Data Book species, Red Squirrel, Fox
and Fallow Deer are all found in the wood. Bat species also forage in the area. Kestrel, Sparrowhawk and Jay are a few of the more notable bird species present in the site.

3.1.17 Tory Hill SAC

Tory Hill is an isolated wooded limestone hill situated about 2 km North East of Croom, Co. Limerick. It represents an important feature of the surrounding countryside and is a prime example of a limestone hill set amongst a region of volcanic intrusions of differing shape and geology. The hill is of geomorphological interest for the endmoraine, left by retreating ice, on its northern flanks and for ice-marks that are clearly visible on the solid rock. The site includes Lough Nagirra and its associated wetland vegetation, located to the north and north-east of Tory Hill. This site is designated for three Annex I habitats. This site contains scrub and hazel woodland. There is also stands of Yew woodland which is rare in Ireland. Many calcium loving species are found growing in the ground layer of this woodland type. This site is also designated for its areas of orchid-rich calcareous grassland found on the eastern side. No fewer than 4 species of orchid occur, e.g. Bee Orchid (Ophrys apifera), Pyramidal Orchid (Anacamptis pyramidalis), Early-purple Orchid (Orchis mascula) and Common Spotted-orchid (Dactylorhiza fuchsii).

Lough Nagirra has a thick fringe of Common Reed (Phragmites australis) and, in association with it, areas of alkaline fen and calcareous fen vegetation referable to the Caricion davallianae alliance with Great Fen-sedge (Cladium mariscus). Both of these fen types are listed on Annex I of the E.U. Habitats Directive, the latter with priority status.

3.1.18 Castlemaine Harbour SAC/SPA

This is a large site located on the south-east corner of the Dingle Peninsula, County Kerry. It consists of the whole inner section of Dingle Bay, i.e. Castlemaine Harbour, the spits of Inch and White Strand/Rosbehy and a little of the coastline to the west. The River Maine, almost to Castlemaine and much of the River Laune catchment, including the Gaddagh, Gweestion, Glanooragh, Cottoner’s River and the River Loe, are also included within the site.

The site is a candidate SAC selected for fixed grey dunes and alluvial wet woodlands, both priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for estuaries, tidal mudflats, Atlantic salt meadows, Salicornia mudflats, Mediterranean salt meadows, drift line vegetation, perennial vegetation of stony banks, dunes with creeping willow, dune slacks, embryonic shifting dunes and Marram dunes, all
habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Sea Lamprey, River Lamprey, Atlantic Salmon, Otter and the liverwort, Petalwort. The rivers and their associated habitats also make up a considerable portion of the site. These associated habitats include wet grassland, woodland, scrub and bog/heath. The Natterjack Toad is found at this site. This amphibian is listed in the Irish Red Data Book and on Annex IV of the E.U. Habitats Directive. The site also supports a small colony of Common Seal.

Five plants listed in the Irish Red Data Book have been recorded at this site: Sea-kale, Sea Pea _Lathyrus japonicus_, Corn Cockle (_Agrostemma githago_), Pennyroyal (_Mentha pulegium_) and Irish Lady's-tresses (_Spiranthes romanzoffiana_). The two last-named are legally protected under the Flora (Protection) Order, 1999. Other scarce species which occur here are Yellow Bartsia (_Parentucellia viscosa_), Lax-flowered Sea-lavender (_Limonium humile_) and Blue-eyed-grass (_Sisyrinchium bermudiana_). Castlemaine Harbour is a very important site for passage and wintering waterfowl. Examples include Brent Goose, Cormorant, Shelduck, Pintail, Scap, Wigeon, Red-breasted Merganser, Oystercatcher Ringed Plover, Golden Plover, Grey Plover, Knot, Sanderling, Dunlin, Redshank, Greenshank and Turnstone.

Castlemaine Harbour SPA holds a Light-bellied Brent Goose population of international importance as well as populations of national importance of an additional sixteen species. Of particular note is that five species that occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Red-throated Diver, Great Northern Diver, Golden Plover, Bar-tailed Godwit and Chough. The site includes a Nature Reserve and two Wildfowl Sanctuaries.

### 3.1.19 Lower Shannon River SAC

This very large site stretches along the Shannon valley from Killaloe to Loop Head/Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkar and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkar catchments and the marine area between Loop Head and Kerry Head.

The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, _Molinia_ meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, _Salicornia_ mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic salmon and Otter. A number of plant species that are Irish Red Data Book species occur within the site; several are protected under the Flora (Protection) Order, 1999:

- Triangular Club-rush (_Schloenaplectus triquetrus_) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
- Opposite-leaved Pondweed (_Groenlandia densa_) - this protected pondweed is found in the Shannon where it passes through Limerick City.
- Meadow Barley (_Hordeum secalinum_) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
- Hairy Violet (_Viola hirta_) - this protected violet occurs in the Askeaton/Foynes area.
- Golden Dock (_Rumex maritimus_) - noted as occurring in the River Fergus Estuary.
- Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
- Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. Species listed on Annex I of the E.U. Birds Directive which are found here were the Great Northern Diver, Whooper Swan, Pale-bellied Brent Goose, Golden Plover and the Bar-tailed Godwit. This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank. A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregrine Falcon, Sandwich Tern, Common Tern, Chough and Kingfisher.

![Plate 11](image)

Plate 11 Machine sourcing material for embankment maintenance in the Lower Shannon SAC/SPA.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twait Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. There are few other river systems in Ireland which contain all three species of Lamprey. Two additional fish of note, listed in the Irish Red Data Book also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River.

### 3.1.20 Bandon River SAC

The site consists of relatively short adjoining stretches of the Bandon and Caha Rivers. These rivers flow in a southerly direction to the east of Dunmanway, Co. Cork. The site is important for a number of reasons. It contains a small though very important example of the Annex I priority habitat Alluvial Forest as well as good examples of another Annex I habitat - Floating River Vegetation. The Annex II animal species Otter, Salmon (*Salmo salar*), Brook Lamprey (*Lampetra planeri*) and Freshwater Pearl Mussel (*Margaritifera margaritifera*) occur. The populations of the Mussel are thought to be nationally important. The Kingfisher, listed under Annex I of the E.U. Birds Directive, breeds along the river. Wet broadleaved semi-natural woodland is found in an undisturbed area of braided river channels and islands below Dunmanway. Some small areas of woodland occur within the site north of Long
Two Red Data Book plant species have been recorded in the past from within or close to the site - Greater Broomrape (Orobanche rapum-genistae) and Small White Orchid (Pseudorchis albida), a species that is protected under the Flora Protection Order 1999. Floating river vegetation is found along the length of the river and is dominated by Water-crowfoot (Ranunculus spp). Heath in mosaic with wet grassland, exposed rock, scrub and improved grassland covers up to 30% of the site north of Long Bridge. The river below Long Bridge is an important inland site in Cork for Mute Swan, Snipe, Grey Heron, Cormorant and Mallard. The site supports many of the mammal species occurring in Ireland. Those which are listed in the Irish Red Data Book include Badger, Irish Hare, Daubenton’s Bat and Pipistrelle. The two bat species can be seen feeding along the river and roosting under the old bridges.

Plate 12 Bandon River at Long Bridge.

3.1.21 Askeaton Fen Complex SAC

Askeaton Fen Complex consists of a number of small fen areas to the east and south east of Askeaton in Co. Limerick. This area of undulating hills, some of which are quite steep, is underlain by Lower Carboniferous Limestone. At the base of the hills a series of fens/reedbeds/loughs can be found, more often than not, in association with marl or peat deposits. At the south east of Askeaton, both Cappagh and Ballymorisheen fens are surrounded by large cliff-like rocky limestone outcrops. The site is a candidate SAC selected for Cladium fen and also for alkaline fen, both habitats listed on Annex I of the E.U. Habitats Directive. At this site a diversity of fen types are represented in a graduation from open water to drier seepage areas. Most importantly the fen type represented by Saw Sedge (Cladium mariscus) occurs in various forms. It is the dominant fen type present. It is associated with wet conditions generally not > 25 cm deep and can be found in mono-dominant stands growing on a marl base such as at Feereagh and Mornane Loughs and in the fen in the townland of Mornane.

One such area of fen within the site is the only known location in Ireland for the water beetle Hygrotus decoratus and is also known to contain Hydroporus scalesianus, a rare water beetle indicative of undisturbed fens. At the edge of some of the Saw Sedge fens, particularly where improved grassland is not present, there is typically found a gradation to wet marsh in turn grading to wet grassland. This transition habitat adds to the ecological diversity of the site. Other habitats types found within this site are scrub and woodland and limestone species rich grassland. Birds which have been recorded on the site include Snipe and Sparrowhawk.
2.1.22 Slieve Aughty SPA

The Slieve Aughty Mountains SPA is a very large site that extends southwards from just south of Lough Rea, County Galway to Scariff in County Clare. The peaks are not notably high or indeed pronounced; the site rises to a maximum of 378 m near Cappaghabaun Mountain. It site includes many small- and medium-sized lakes, notably Lough Graney and Lough Atoick; several important rivers rise in the site, including the Owendalulleegh and Graney. Lough Derg occurs immediately to the south-east. The Slieve Aughty hills are predominantly comprised of Old Red Sandstone, but outliers of Lower Palaeozoic rocks provide occasional outcrops capping the hills. The site consists of a variety of upland habitats, though approximately half is afforested. The coniferous forests include first and second rotation plantations, with both pre-thicket and post-thicket stands present. Substantial areas of clear-fell are also present at any one time. The remainder of the site is mostly rough grassland that is used for hill farming. The remainder of the site is mostly rough grassland that is used for hill farming.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Hen Harrier and Merlin. This SPA holds 17% of the Hen Harrier national total of the country. The site also supports a breeding population of Merlin, a species that is also listed on Annex I of the E.U. Birds Directive. The population size is not well known but is likely to exceed five pairs. Red Grouse is found on many of the unplanted areas of bog and heath – this is a species that has declined in Ireland and is now Red-listed.

3.1.23 River Cashen Estuary SPA

Situated in north Co. Kerry between Ballybunnion and Ballyduff, the site comprises the estuary of the Cashen River and some adjoining farmland and bog. The outlet to the sea is narrow (c.100 m wide) and is to the south of the large sand dune system holding the Ballybunnion Golf Course.

The estuary is relatively small though some intertidal mudflats and marginal salt marshes occur. The tidal river channel above Ferry Bridge is included for a distance of c. 3 km. The Red Data Book vascular plant species Triangular Club-rush (S. triquetra) and Dwarf Spike-rush (Eleocharis parvula) have been recorded from the Cashen River, but not in recent times. Part of the site is used by wintering Hen Harrier, a species listed on Annex I of the E.U. Birds Directive. The principal ornithological interest is the internationally important population of Whooper Swan, the largest in the region. This bird is listed on Annex I of the E.U. Birds Directive. The site also supports nationally important populations of Golden Plover, a species listed on Annex I of the E.U. Birds Directive and Lapwing with smaller numbers of Oystercatcher, Dunlin and Curlew.

3.1.24 Lough Derg SAC/SPA

Lough Derg, the lowest order lake on the River Shannon, is one of the largest bodies of freshwater in Ireland. The site, however, only includes the northern shore of the lake from the mouth of the Cappagh River in the north-west to just below Black Lough at the north-eastern shore. The greater part of this site lies on Carboniferous limestone, although there is Old Red Sandstone on the southern shores of the eastern section.

The site is of significant ecological interest, with six habitats listed on Annex I of the E.U. Habitats Directive. Four of these are priority habitats - Cladium fen, alluvial woodland,
limestone pavement and Yew woodland. Other annexed habitats present include alkaline fen and Juniper scrub formations on heath and calcareous grasslands. In addition, the lake itself is an SPA (Special Protection Area) that supports important numbers of wintering wildfowl, Greenland White-fronted Goose, Common Tern and Cormorant. Both the Greenland White-fronted Geese and Common Tern are listed under Annex I of the EU Birds Directive. A Wildlife Sanctuary is located in the lake close to Portumna Forest Park. The lake is rated as nationally important for waterfowl. The entire lake, including all islands, is a designated SPA and contains Mute Swan, Cormorant, Mallard, Teal, Tufted Duck and Goldeneye. The lake also supports a number of Greenland White-fronted Geese, a bird species listed on Annex I of the EU Birds Directive.

Lough Derg is of conservation interest for its fish and freshwater invertebrates. Lampreys, listed under Annex II of the EU Habitats Directive, are known to occur and the lake contains an apparently self sustaining landlocked population of Sea Lamprey (*Petromyzon marinus*). A landlocked population, where the fish are feeding and not completing a seaward migration, is unique in an Irish context, though there are several such populations in the U.S. and one is known from Loch Lomond in Scotland. Brook Lamprey (*L. planeri*) is known to be common in the lower Shannon catchment where all three Lamprey species breed. The endangered fish species Pollan (*Coregonus autumnalis pollan*) is recorded from Lough Derg, one of only three sites in Ireland and in western Europe. Atlantic Salmon (*Salmo salar*) also use the lake as a spawning ground. The Otter and Badger have been recorded within the site. Both of these species are listed in the Irish Red Data Book and are legally protected by the Wildlife Act 1976.

### 3.1.25 Rivers Shannon and Fergus SPA

The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The site comprises the entire estuarine habitat west from Limerick City and south from Ennis, extending west as far as Killalysert and Foynes on the north and south shores respectively of the River Shannon (a distance of some 25 km from east to west). Also included are several areas in the outer Shannon estuary, notably Clonderalaw Bay and Poulnasherry Bay, as well as the intertidal areas on the south shore of the Shannon between Tarbert and Beal Point.

The site has vast expanses of intertidal flats. Salt marsh vegetation frequently fringes the mudflats and this provides important high tide roost areas for the wintering birds. Elsewhere
in the site the shoreline comprises stony or shingle beaches. The site is the most important coastal wetland site in the country and regularly supports excessive numbers of wintering waterfowl at a concentration easily of international importance. The site has internationally important populations of Dunlin, Black-tailed Godwit and Redshank. A further 16 species have populations of national importance, i.e. Cormorant, Whooper Swan, Greylag Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Golden Plover, Grey Plover, Lapwing, Knot, Bar-tailed Godwit, Curlew and Greenshank. The site is also used by Oystercatcher, Ringed Plover, Brent Goose, Great Crested Grebe, Red-breasted Merganser, Mallard, Turnstone, Mute Swan, Grey Heron, Black-headed Gull and Common Gull. Some species, particularly Whooper Swan and Greylag Goose, utilise areas outside of the site for feeding. Apart from the wintering birds, large numbers of some species also pass through the site whilst on migration in spring and/or autumn. Regular species include Blacktailed Godwit, Whimbrel and Greenshank.

3.1.26 **Levally Lough SAC**

Levally Lough is a fluctuating lake, or turlough, situated 9 km east of Tuam and to the north of the Grange River. It is overlooked by a low rise on the north side with some esker or drift mound to the south. The land is flat at the eastern and western ends. A stream enters the turlough from the north-east corner. The vegetation at this site is varied and unusual, and the areas of marl and reedbed here are the largest found in any turlough in a recent national survey.

At each end of the turlough, there is less moisture and the ground is mainly covered by species-poor grassland with some Willows (*Salix* sp.), Amphibious Bistort (*Polygonum amphibium*) and Tufted Vetch (*Vicia cracca*). The main body of the lake appears to overlie a sheet of marl, and here, Oligotrophic plants occur, such as Shoreweed (*Littorella uniflora*) and Stoneworts (*Chara* spp. including *Chara curta*). Wintering wildfowl include Wigeon, Teal, Mallard, Pochard, Tufted Duck, Golden Plover, Lapwing and Curlew.-The summer birds include Mallard, Coot, Moorhen, Lapwing and Black-headed Gull.

3.1.27 **Lisnageeragh Bog & Ballinastack Turlough SAC**

This site comprises a large raised bog and a small turlough, situated about 3 km northeast of Glenamaddy in County Galway. The bog has a largely intact dome, approximately 50% of which is high quality raised bog habitat. This includes a small but active hummock/pool system in an isolated portion of the bog, in the south-west. Three separate areas of long, winding pools occur, the best being in the centre of the bog. Brown Beaksedge (*Rhynchospora fusca*), a plant which is scarce in Ireland, is abundant in the pool complexes.

The turlough attracts wintering waterfowl, which move between this site and other turloughs in the Glenamaddy area according to water levels and disturbance. Three species which are listed on Annex I of the EU Birds Directive occur – Greenland White-fronted Goose, Whooper Swan and Golden Plover. Wigeon is also regular in winter, along with smaller numbers of other waterfowl species. Lisnageeragh Bog provides habitat for Red Grouse.

3.1.28 **Lough Corrib SAC/SPA**

Lough Corrib is situated to the north of Galway City and is the largest lake in the country. The lake can be divided into two parts: a relatively shallow basin, underlain by Carboniferous limestone, in the south and a larger, deeper basin, underlain by more acidic granite, schists,
shales and sandstones, to the north. The main inflowing rivers are the Black, Clare, Dooghta, Cregg, Owenriff and the channel from Lough Mask.

This site is of major conservation importance and includes 14 habitats listed on Annex I of the E.U. Habitats Directive. Six of these are priority habitats - *Cladium* fen, petrifying springs, active raised bog, limestone pavement, bog woodland and orchid-rich calcareous grassland. The other annexed habitats present include alkaline fens, hard water lakes, lowland oligotrophic lakes, floating river vegetation, degraded raised bogs, Rhynchosporion vegetation, *Molinia* meadows and old Oak woodlands. Species present on the site that are listed on Annex II of this directive are Sea Lamprey, Brook Lamprey, Atlantic Salmon, White-clawed Crayfish, Freshwater Pearl Mussel, Otter, Lesser Horseshoe Bat, Slender Naiad and the moss *Drepanocladius vernicosus*. The shallow, lime-rich waters of the southern basin of the lake support one of the most extensive beds of Stoneworts (Charophytes) in Ireland. These *Chara* beds are an important source of food for waterfowl. In contrast, the northern basin contains more oligotrophic and acidic waters, without *Chara* species, but with Shoreweed, Water Lobelia, Pipewort (*Eriocaulon septangulare*), Quillwort (*Isoetes lacustris*), Alternate Water-milfoil (*Myriophyllum alternifolium*) and Slender Naiad (*Najas flexilis*). The last-named is listed under the Flora (Protection) Order, 1999 and is an Annex II species under the EU Habitats Directive.

![Plate 14 Brook lampreys from the River Nanny (channel C3/17).](image)

Three Red Data Book species are found in association with limestone scrub - Alder Buckthorn (*Frangula alnus*), Shrubby Cinquefoil (*Potentilla fruticosa*) and Wood Bitter-vetch (*Vicia orobus*), the latter is also protected under the Flora (Protection) Order, 1999. Open areas of orchid-rich calcareous grassland are also found in association with the limestone exposures. Many orchids are found here such as Pyramidal Orchid (*Anacamptis pyramidalis*), Common Spotted-orchid (*Dactylorhiza fuchsii*), Early-purple Orchid (*Orchis mascula*), Frog Orchid (*Coeloglossum viride*), Fragrant Orchid (*Gymnadenia conopsea*), Marsh Helleborine (*Epipactis palustris*), Greater Butterfly-orchid (*Platanthera chlorantha*) and Irish Lady’s-tresses (*Spiranthes romanzoffiana*). The latter is protected under the Flora (Protection) Order, 1999. The alkaline fens contain the Slender Cottongrass (*Eriophorum gracile*), a species protected under the Flora (Protection) Order, 1999. This large site contains four discrete raised bog areas and is selected for active raised bog, degraded raised bog, Rhynchosporion and bog woodland. The Hill of Doon, located in the north-western corner of the lake, is a fine example of a Sessile Oak (*Quercus petraea*) woodland. The understorey is dominated by Sessile Oak, Holly (*Ilex aquifolium*) and occasional Juniper.
The lake is rated as an internationally important site for waterfowl. The lake supports internationally important numbers of Pochard and nationally important numbers of the following species: Coot, Mute Swan, Tufted Duck, Cormorant and Greenland White-fronted Goose. The latter species is listed on Annex I of Birds Directive. Other bird species of note recorded from or close to the lake recently include Hen Harrier, Whooper Swan, Golden Plover and Kingfisher. All of these species are listed on Annex I of the E.U. Birds Directive.

![Plate 15 The Clare River near Corofin, Co Galway. The channelised banks and spoil heaps from the original arterial drainage scheme / ongoing maintenance are clearly evident in this image.](image)

### 3.1.29 Killala Bay – Moy estuary SAC

The River Moy flows to the sea via a long, narrow estuarine channel north of Ballina town. After approximately 8 km, the estuary widens to form a north-facing triangular bay, with the towns of Inishcrone (Co. Sligo) and Killala (Co. Mayo) situated on the eastern and western shores, respectively. The estuary itself forms the county boundary along its northern part. A long sandy island (Bartragh Island) separates the south-western side of the bay from the open water. Much of the inner part of the bay is intertidal. The northern part shelves to approximately -10 m. Extensive sandflats and mudflats are exposed in the estuary and bay at low tide. The site still contains a relatively large area of intact fixed dunes, a priority habitat listed on Annex I of the EU Habitats Directive. Salt marshes are present in sheltered parts of the site, some of which occur in association with the dune systems. Elsewhere along the coastline are sandy beaches, shingle beaches and some bedrock shores which are occasionally backed by clay sea-cliffs. It is significant for the presence of the Thin-lipped Mullet, a fish which is only occasionally found in the region. A number of rare plants have been found in the site. The Opposite-leaved Pondweed (*Groenlandia densa*), a species protected under the Flora (Protection) Order, 1999, has been recorded in the Moy Estuary and Hoary Whitlowgrass (*Draba incana*), a Red Data Book species has been recorded from sand dunes along the coast east of Killala town.

The rare snail *Vertigo angustior* has been known at this site for over 100 years. It occurs in an area of wet marsh and this site represents one of the few remaining examples of *Vertigo angustior* in its marsh “phase”. This species is listed on Annex II of the EU Habitats Directive as it is considered vulnerable in Europe and has being declining throughout much of its range due to loss of habitat, in particular, drainage of wetlands. The site is very important for wintering waterfowl, with eight species having populations of national importance. These are as follows, Red-breasted Merganser, Ringed Plover, Grey Plover, Knot, Sanderling, Dunlin, Bar-tailed Godwit and Greenshank. Other notable populations include Golden Plover and
Brent Goose. At times Brent Geese occur in numbers of International Importance (>200). The presence of Golden Plover and Bartailed Godwit is of particular note as these species are listed on Annex I of the EU Birds Directive.

3.1.30 Callow Bog SAC

Callow Bog is located approximately 7 km north-west of Frenchpark, Co. Roscommon in the townlands of Callow or Runnavillin, Cloonmagunnaun, Keelbanada, Creggan and Ratra. It is situated on the south-western shore of Lough Gara and is underlain by Carboniferous limestone. The Rhynchosporion habitat occurs in wet depressions, pool edges and erosion channels where the vegetation includes White Beak-sedge (Rhynchospora alba) and/or Brown Beak-sedge (R. fusca), and at least some of the following associated species, Bog Asphodel (Narthecium ossifragum), Sundews (Drosera spp.), Deergrass (Scirpus cespitosus), Carnation Sedge (Carex paniculata).

The raised bog habitat includes both areas of high bog and cutover. The high bog consists of five lobes dissected by roads and a stream. Overall the high bog is relatively flat with slight slopes north to Lough Gara. Two wet areas with pools occur, and there are a number of tear pools to the north. The high bog also supports a very large central flush. The River Lung flows near the north-western boundary of the site and there is a low relief drumlin to the north west of the bog. To the south the raised bog is surrounded by agricultural land.

Callow Bog is of considerable conservation significance comprising as it does a raised bog, a rare habitat in the E.U. and one that is becoming increasingly scarce and under threat in Ireland. Its semi-natural lake margins and its northerly location add to its overall conservation value. Active raised bog is listed as a priority habitat on Annex I of the E.U. Habitats Directive. Priority status is given to habitats and species that are threatened throughout the E.U. Ireland has a high proportion of the total E.U. resource of this habitat type (over 60%) and so has a special responsibility for its conservation at an international level.

3.1.31 Bunduff Lough and Machair/Trawalua/ Mullaghmore SAC

This site is situated on the south side of Donegal Bay, 5 km south-west of Bundoran. The part of the site west of Mullaghmore Head is very exposed to the prevailing wind and swells from the Atlantic, whereas the Head itself affords moderate shelter to the eastern part of the site. The underlying geology is of sedimentary rocks including limestone, shale and sandstone. Windblown sand is common in places, covering much of the underlying rocks and shingle.

The site is a candidate SAC selected for fixed dune, machair and orchid-rich grassland, all priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for other habitats listed on Annex I of the directive alkaline fen, reefs, Marram dunes, large shallow inlets and bays and tidal mudflats. In addition, the site is also selected as a candidate SAC for the liverwort, Petalwort Petalophyllum ralfsii, a plant listed on Annex II of the E.U. Habitats Directive. Machair, is common throughout the site. It occurs mostly in the flat areas between the dune ridges and the areas of alkaline fen/marsh vegetation. Although areas with typical dry machair grassland can be found close to dunes ridges, much of the habitat is wetter than is usually seen and there are large areas that are considered to be transitional to alkaline fen, another Annex I habitat.
Bunduff Lough is locally important for waterfowl. In winter, Whooper Swan, Teal and Mallard are regular, along with Golden Plover at certain times. Resident species include Coot, Water Rail, Mute Swan and Little Grebe. Both Whooper Swan and Golden Plover are listed on Annex I of the EU Birds Directive. The site also provides habitat for breeding waders, notably Lapwing and Snipe. This extensive coastal site contains a good range of habitats including several listed on Annex I of the E.U. Habitats Directive. The machair found on the site is of particular importance because it is intact and has not been sub divided by fences.

3.1.32 Ross lake and Woods SAC

Ross Lake and Woods is located approximately 4 km north-west of Moycullen on the west side of Lough Corrib in Co. Galway. The area is underlain by limestone. The main habitat on the site is a medium-sized lake, Ross Lake, which has a limestone bed covered by deposits of precipitated marl and a shoreline of marl-encrusted limestone boulders. It is a good example of a hard water lake, a habitat listed on Annex I of the EU Habitats Directive, and supports beds of stoneworts, including Chara globularis var. virgata, C. pedunculata and C. curta.

The rocky limestone shore mostly supports fen-type vegetation characterised by Black Bog-rush (Schoenus nigricans). This grades into areas of wet grassland dominated by Purple Moor-grass (Molinia caerulea) and species-rich marsh. The site contains a large block of coniferous plantation, consisting largely of Spruce (Picea) and Larch (Larix) species, on the site of a former mixed-deciduous woodland, Annagh Wood. A breeding colony (not less than 155 individuals counted in 1994) of Lesser Horseshoe Bat (Rhinolophus hipposideros) occurs in an outbuilding beside Ross House. This species is threatened within the EU and consequently listed on Annex II of the EU Habitats Directive; the population at the site is rated as of international importance. The presence on the site of Otter, a species also listed on Annex II of the EU Habitats Directive, and of a small colony of Common Gull is notable.

3.1.33 Lough Carra – Mask Complex SAC

This site is dominated by two large lakes, Lough Mask and Lough Carra, and includes the smaller Cloon Lough. On the western side, the site is overlooked by the Partry Mountains, while to the east the landscape is largely low-lying agricultural land. The nearest large town is Ballinrobe which is about 4 km east of Lough Mask. The general geological character of the area is Carboniferous limestones, with some shales and sandstones on the western side of Lough Mask. The underlying geology results in a great diversity of habitats, which support many scarce and rare plants and animals. Six habitats which are on Annex I of the EU Habitats Directive are listed for this site, including two which are priority habitats - limestone pavement and Cladium fen.

Lough Mask, at over 8,000 ha, is the sixth largest lake in the country and with a maximum depth of 58 m it is one of the deepest. It is an excellent example of a lowland oligotrophic lake. An intricate mixture of plant communities has developed on the limestone adjacent to the lake. Habitats include bare pavement, scrub-dominated pavement, dry grassland and heath. There are significant amounts of deciduous woodland along the eastern and southern shores. The western shoreline is less diverse and lacks the limestone communities.

A wide range of wetland habitats occur around Lough Carra and along parts of the eastern and southern shores of Lough Mask, including Cladium fen and alkaline fen, both listed as Annex I habitats on the EU Habitats Directive. The Cladium occurs as pure stands in places but also intermixed with Black Bog-rush (Schoenus nigricans), Common Club-rush (Scirpus
lacustris), Common Reed (Phragmites australis) and a number of sedge species (Carex spp.). The alkaline fens are more extensive than the Cladium fens and here Black Bog-rush is a dominant species. In addition to the fen habitats, there are scarce but widespread reed swamps, wet grassland and some freshwater marsh communities around the lake shores. Broad-leaved deciduous woodland occurs fairly frequently around much of the shores of the lakes and on some of the islands. Five species protected under the Flora Protection Order (1987) occur: Irish St. John's-wort (Hypericum canadense), Chives (Allium schoenoprasum), Pillwort (Pilularia globulifera), Irish Lady's-tresses (Spiranthes romanzoffiana), and Small Cudweed (Logfia minima). Two other Red Data Book plants, Alder Buckthorn (Frangula alnus) and Bird's-nest Orchid (Neottia nidus-avis), also occur, along with two Red Data Book Stonewort species - Chara curta and Chara rudis. A large loft in the stable block of Curramore House provides a summer breeding site of the Lesser Horseshoe Bat (Rhinolophus hipposideros), a species listed on Annex II of the EU Habitats Directive. The site provides excellent habitat for Otter (Lutra lutra), also an Annex II species on the Habitats Directive, and the area has Pine Marten (Martes martes), a species listed in the Irish Red Data Book.

The site has important bird interests, both in winter and summer. It provides feeding areas for part of the Erriff/Derrycraff population of Greenland White-fronted Geese. Other birds recorded on this site include Wigeon; Mallard; Shoveler; Pochard; Tufted Duck; Goldeneye; Lapwing; Curlew, Whooper Swan and Gadwall. The Shoveler, Tufted Duck and Goldeneye populations are of national importance. Both lakes are traditional sites for breeding gulls and terns e.g. Common Tern, Black-headed Gull, Common Gull and Lesser Black-backed Gull. The deep waters of Lough Mask are home to a population of the glacial relict Arctic Char (Salvelinus alpinus), and a rare shrimp (Niphargus spp.) is also found in these waters. Lough Mask is a very important Brown Trout fishery. White-clawed Crayfish (Austropotamobius pallipes), a species listed on Annex II of the Habitats Directive, has been recorded from Lough Carra.

3.1.34 Lough Gill SAC

This site comprises Lough Gill with Doon Lough to the north-east, the Bonet River as far as but not including Glenade Lough, and a stretch of the Owenmore River near Manorhamilton in Co. Leitrim. Lough Gill itself, 2 km east of Sligo town, lies at a geological junction of ancient metamorphic rocks which produce acid groundwater, and limestone which dissolves in the groundwater. The large 8 km long lake has steep limestone shores and underwater

Plate 16 Shoreline of Lough Mask. Water levels were significantly lowered in this lake with the deepening of the Cong Canal in 1983.
cliffs and is over 20m deep in places. The lake appears to be naturally eutrophic, and thus represents a habitat listed on Annex I of the EU Habitats Directive.

The site is a candidate SAC selected for alluvial wet woodlands a priority habitat on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for old Oak woodlands and natural eutrophic lakes, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, White-clawed Crayfish, Atlantic Salmon and Otter. The site supports several rare plant species, including Yellow Bird’s-nest (Monotropa hypopitys), Lady’s Mantle (Alchemilla glaucescens), Ivy Broomrape (Orobanche hederae), Black Bryony (Tamus communis), Intermediate Wintergreen (Pyrola media) and Bird’s-nest Orchid (Neottia nidus-avis). There is also an unconfirmed record for Melancholy Thistle (Cirsium helenioides) from the eastern side of the site.

Lough Gill supports only low numbers of wintering waterfowl, mostly Mallard, Tufted Duck and Goldeneye. A small colony of Common Terns breed on the islands, while Kingfishers are found on the lake and rivers. Both of these species are listed on Annex I of the E.U. Birds Directive. A colony of Black-headed Gulls occurs with the terns. The woods support a good diversity of bird species including Jay, Woodcock and Blackcap.

3.1.35 Towerhill House SAC

Towerhill House is situated 10 km north of Ballinrobe in Co. Mayo. This site comprises the ruins of Towerhill House, the surrounding woodlands, and Lough Beg and its associated swamp vegetation. The primary importance of the site is that it is used as a wintering site by the Lesser Horseshoe Bat (Rhinolophus hipposideros), a species listed on Annex II of the EU Habitats Directive.

In the south of the site, a series of drains and a stream flow into Lough Beg, a small lake which is surrounded by swamp vegetation and wet woodland. The lake system is of some interest, with extensive reed beds (Phragmites australis) and fine stands of Greater Tussock-sedge (Carex paniculata). The wet woodland is mainly Downy Birch (Betula pubescens), Rusty Willow (Salix cinerea subsp. oleifolia) and Alder (Alnus glutinosa). The uncommon Greater Spearwort (Ranunculus lingua) occurs within the swamp vegetation. The macro-invertebrate community of the wetland area is also interesting, containing elements characteristic of littoral lacustrine and slow-flowing riverine habitats and has an extremely high diversity of aquatic beetles.

3.1.36 Lough Swilly SAC

This large site, situated in the northern part of Co. Donegal, comprises the inner part of Lough Swilly. It extends from below Letterkenny to just north of Buncrana. Lough Swilly is a long sea-lough, cutting through a variety of metamorphic rocks on the west side of Inishowen. The site is estuarine in character, with shallow water and intertidal sand and mud flats being the dominant habitats. Salt marshes are well represented in the inner sheltered areas of the site, with good examples in the Ramelton area. The marshes are the Atlantic salt meadow type. Lakes which are lagoonal in character occur at Inch and Blanket Nook. Inch Lough is a good example of a large, shallow lagoon with very low salinity in most of the lagoon. Less information is available for Blanket Nook but it is of a higher salinity and adds to the richness of the habitat within the site as a whole. The vegetation in Inch is diverse and
typically lagoonal, with well developed charophyte communities, including a large population of *Chara canescens* (a Red Data Book species).

Two woodlands occur adjacent to the north-western shore of Lough Swilly. These are Rathmullen and Carradoan Woods, the former being a Nature Reserve. They are dominated by Sessile Oak (*Quercus petraea*) and Birch (*Betula pubescens*). A further area of woodland (Oak/hazel), scrub and heath occurs above the north-east shore at Crockacashel and at Porthaw.

The site supports a population of Otter, a species listed on Annex II of the EU Habitats Directive. Lough Swilly is an important site for waterfowl in autumn and winter. The shallow waters provide suitable habitat for grebes and diving duck, while the intertidal flats are used by an excellent diversity of wildfowl and waders. At high tide, the duck and wader species roost on the salt marshes and shorelines, with some species moving to the adjacent pasture and arable fields. Species recorded include the Great Crested Grebe, Shelduck, Wigeon, Teal, Mallard, Shoveler, Scap, Goldeneye, Red-breasted Merganser, Coot, Oystercatcher, Knot, Dunlin, Curlew, Redshank and Greenshank. Other species which occur in regionally or locally important numbers, and at times may exceed the threshold for national importance, include Brent Goose, Pochard, Tufted Duck, Lapwing, Ringed Plover, Grey Plover, Bar-tailed Godwit and Turnstone. The site is also an important area for the Great Northern Diver and the rare Slavonian Grebe.

The adjacent pasture and arable polders at Inch, Big Isle and Blanket Nook support internationally important populations of Whooper Swans, Greenland White-fronted Geese and Greylag Geese. Inch Lough is an important roosting area for these birds and at times they utilise other parts of Lough Swilly for roosting.

### 3.1.37 River Moy SAC

This site comprises almost the entire freshwater element of the Moy and its tributaries including both Loughs Conn and Cullin. The system drains a catchment area of 805 sq. km. Most of the site is in Co. Mayo though parts are in west Sligo and north Roscommon. Apart from the Moy itself, other rivers included within the site are the Deel, Bar Deela, Castlehill, Addergoole, Clydagh and Manulla on the west side and the Glenree, Yellow, Strade, Gweestion, Trimogue, Sonnagh, Mullaghanoe, Owengarve, Eighnagh and Owenaheer on the east side. The underlying geology is Carboniferous Limestone for the most part though Carboniferous Sandstone is present at the extreme west of the site with Dalradian Quartzites and schists at the south west. Some of the tributaries at the east, the south of Lough Conn and all Lough Cullin are underlain by granite. There are many towns adjacent to but not within the site. These include Ballina, Crossmolina, Foxford, Swinford, Kiltimagh and Charlestown.

The site is a candidate SAC selected for alluvial wet woodlands and raised bog, both priority habitats on Annex I of the E.U. Habitats Directive. The site is also a candidate SAC selected for old oak woodlands, degraded raised bog and Rhynchosporion, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Atlantic Salmon, Otter, Sea and Brook Lamprey and White-clawed Crayfish. In addition, the site also supports many more of the mammal species occurring in Ireland. Those which are listed in the Irish Red Data Book include Pine Marten, Badger, Irish Hare and Daubenton’s Bat. Common Frog, another Red Data Book species, also occurs within the site. The rare Narrow-leaved Helleborine (*Cephalanthera longifolia*), protected under the Flora Protection Order, 1999, occurs in association with the woodlands.
Also found in these woodlands is the snail (*Acanthinula lamellata*), associated with old natural woodlands.

![Plate 17 Channelised section of the Lower River Moy SAC, downstream of Foxford, Co Mayo.](image)

Drainage of the Moy in the 60s lowered the level of the lakes, exposing wide areas of stony shoreline and wet grassland, which are liable to flooding in winter. This increased the habitat diversity of the shoreline and created a number of marginal wetlands, including fens and marshes. Plant species of note in the lake-margin include Heath Cudweed (*Omalotheca sylvatica*), Great Burnet (*Sanguisorba officinalis*) and Irish Lady’s-tresses (*Spiranthes romanzoffiana*). These three species are listed on the Irish Red Data list and are protected under the Flora Protection Order 1999. Other habitats present within the site include wet grassland dominated by Rushes (*Juncus* spp.) grading into species-rich marsh in which sedges are common. Small pockets of conifer plantation, close to the lakes and along the strip both sides of the rivers, are included in the site.

Loughs Conn and Cullin support important concentrations of wintering waterfowl and both are designated Special Protection Areas. A nationally important population of the Annex I species Greenland White-fronted Geese is centred on Lough Conn. Whooper Swans also occur, along with nationally important populations of Tufted Duck, Goldeneye and Coot. A range of other species occur on the lakes in regionally important concentrations, notably Wigeon, teal, Mallard, Pochard, Lapwing and Curlew. Golden Plover also frequent the lakes. Loughs Conn and Cullin are one of the few breeding sites for Common Scoter in Ireland. The Common Scoter is a Red listed species.

### 3.1.38 River Finn SAC

This site comprises almost the entire freshwater element of the Finn and its tributaries – the Corlacky, the Reelan sub-catchment, the Sruhamboy, Elatagh, Cummirk and Glasagh, and also includes Lough Finn, where the river rises. The spawning grounds at the headwaters of the Mourne and Derg Rivers, Loughs Derg and Belshade and the tidal stretch of the Foyle north of Lifford to the border are also part of the site. The Finn and Reelan, rising in the Bluestack Mountains, drain a catchment area of 195 square miles. All of this site is in Co. Donegal.

The site is a candidate SAC selected for active blanket bog, a priority habitat listed under Annex I of the E.U. Habitats Directive. The River Finn is a designated Salmonid Water under the EU Freshwater Fish Directive. The site is also listed for lowland oligotrophic lakes, wet
heath and transition mires, also on Annex I of the E.U. Habitats Directive. The site is also listed for lowland oligotrophic lakes, wet heath and transition mires, also on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Atlantic Salmon and Otter. Those which are listed in the Irish Red Data Book include the Badger and the Irish Hare. Common Frog, another Red Data Book species, also occurs within the site. Golden Plover, Peregrine and Merlin, threatened species listed on Annex I of the EU Birds Directive, breed in the upland areas of the site. A Red Listed species Red Grouse occurs on the site, while the scarce Ring Ouzel, another Red List species is also known to occur. Other habitats present within the site include a fringe of wet grassland/marsh along some river stretches dominated by Rushes (*Juncus* spp.) grading into species-rich marsh in which sedges are common. There are areas of scrub surrounding parts of the lake margins, along the channels and on the ungrazed islands. These are composed of Alder (*Alnus glutinosa*), Willow (*Salix* spp.), Rowan (*Sorbus aucuparia*) and Silver Birch (*Betula pendula*). The Rare Narrow-leaved Helleborine (*Cephalanthera longifolia*) occurs on the shores of Lough Derg. This species is listed in The Irish Red Data Book and is protected under the Flora Protection Order, 1999.

Lough Finn holds a population of Arctic Charr (*Salvelinus alpinus*). This fish is a relative of salmon and trout and represents an arctic-alpine element in the Irish fauna. In Ireland this fish occurs only in a few cold, stoney, oligotrophic lakes. It is listed in The Irish Red Data Book as threatened in Ireland. The Charr in Lough Finn are unusual in that they are dwarfed. Dwarfed Charr only occur in one other Lough in Ireland, Lough Coornasahom, Co. Kerry and they are therefore of national importance.

![Plate 18 The Lower River Finn upstream of Lifford, County Donegal.](image)

### 3.1.39 Lough Gara SPA

Lough Gara is a shallow (maximum depth 16 m), medium-sized lake which overlies Carboniferous limestones and shales, and Devonian sandstone. The main inflowing river is the River Lung while the main outflow is the Boyle River. There are two main sections to the lake, a larger northern basin and a smaller southern basin, joined by a narrow channel. The lake is classified as a mesotrophic system, with reduced planktonic algal growth noted in a recent sampling period (1998-2000). The shoreline is convoluted and has receded substantially from its original level due to various drainage schemes since the mid-19th century. The site includes several low-lying islands.
The shallow lake margins have extensive swamps dominated by Common Reed (Phragmites australis) and Bottle Sedge (Carex rostrata), with occasional Bulrush (Typha latifolia). In the southernmost part of the lake, clumps of Common Club-rush (Scirpus lacustris) are particularly abundant. The upper part of the shore is frequently colonised by scrub, which includes willows, Alder (Alnus glutinosa) and Hawthorn (Crataegus monogyna). Raised bog occurs outside of the site to its south and south-west.

Lough Gara is a regularly used site by an internationally important Greenland Whitefronted Goose population. The geese feed mainly on intensively-managed grasslands bordering the lake. When disturbed the geese use an island in the site or the lough itself. An important Whooper Swan population also uses the site. A range of other species occurs, though all in relatively low numbers; species present include Great Crested Grebe, Mute Swan, Wigeon, Teal, Mallard, Shoveler, Pochard, Tufted Duck, Goldeneye and Golden Plover.

3.1.40 Lough Carra SPA

Lough Carra, which extends for over 9 km along its long axis, lies to the north-east of Lough Mask, in the Corrib catchment. It is one of the best examples in Ireland of a hard water marl lake. It is a shallow (mean depth 1.5 m, max depth 18 m), predominantly spring-fed lake with only a few streams flowing into it. It is connected to Lough Mask via the Keel River. Lough Carra has well developed stonewort communities in the submerged zones, and includes such species as Chara curta, C. desmacantha, C. rudis and C. contraria. The lake has a highly indented shoreline (over 69 km in length) and is fringed by a diverse complex of limestone and wetland habitats. The wetland habitats include both Great Fen-sedge (Cladium mariscus) fen and alkaline fen. In addition to the fen habitats, there are widespread reed swamps, wet grassland and some freshwater marsh communities around the lakeshores. There is a good scattering of small islands within the lake.

The site is a significant ornithological site, both in winter and summer. It supports nationally important wintering populations of Shoveler and Gadwall, along with a range of other species in relatively low numbers, including Wigeon, Teal, Mallard, Tufted Duck, Goldeneye, Pochard, Lapwing, Little Grebe and Great Crested Grebe. In the past, Lough Carra supported a population of Mallard of national importance. Common Gull and Black-headed Gull have also been recorded. The site provide excellent habitat for Otter, a species that is listed on Annex II of the E.U. Habitats Directive. The White-clawed Crayfish (Austropotamobius pallipes), a species that is also listed on Annex II of this directive, has been recorded from Lough Carra.

3.1.41 Lough Conn SPA

Lough Conn is a large, calcareous lake which overlies Carboniferous limestone and, in the southern part, outcrops of acid metamorphic rocks and granite. It has a maximum length of 13 km and is several kilometres wide. Its maximum depth is 28m. The main inflowing rivers are the Deel, the Addergoole and the Castlehill, and the main outflow is to Lough Cullin. The lake is of a moderately hard type with relatively low colour, good transparency and alkaline pH. It is classified as a Mesotrophic system and has been fairly stable in recent years. The lake mostly has a stony shoreline and includes several reefs and islands. The islands are mostly scrub covered but the largest, Annagh, is improved grassland. Fringing swamp vegetation, comprised mainly of Common Reed (Phragmites australis), occurs in some sheltered areas. Lough Conn is a very important salmonid fishery.
Lough Conn supports a regionally important population of Greenland White-fronted Goose. The geese feed mainly on Annagh Island and at a shoreline site near Cloonaghmore Point. Whooper Swan occur regularly at Lough Conn, with the flock also utilising nearby Lough Cullin. Both Greenland White-fronted Goose and Whooper Swan are listed on Annex I of the E.U. Birds Directive. A further species listed on Annex I of the Directive is Golden Plover. The species is regular in the area. The site supports a good range of other wildfowl species, particularly diving duck. Tufted Duck, Goldeneye, Wigeon, Teal and Mallard have all been recorded. The Goldeneye population is close to the qualifying threshold for national importance. Lapwing and Curlew are also regular at the lake.

Lough Conn and nearby Lough Cullin represent one of only four breeding sites in the country for Common Scoter, which in Ireland is at the south-west end of its European range. The population, however, has seriously declined in recent years. Common Scoter is listed as a Red Data Book species. Lough Conn is a traditional breeding site for gulls and terns. Common Gull, Lesser Black-backed, Common Tern and Arctic Tern have been recorded here in the past. Lough Conn supports a good diversity of wintering waterfowl species, most notably Greenland White-fronted Goose and Whooper Swan, as well as diving duck such as Goldeneye. Arctic Char \((Salvelinus alpinus)\), a glacial relic fish species which is listed as threatened in the Irish Red Data Book, had been recorded from Lough Conn but the latest reports suggest that it may now have disappeared from the site. Lough Conn is a mesotrophic system but with eutrophic tendencies in its North Basin.

### 3.1.42 Lough Cullin SPA

Lough Cullin is a medium-sized lake that is connected, by a narrow inlet near Pontoon on its northern shore, to the larger Lough Conn. The main outflowing river is the River Moy. The underlying geology is mainly granite, though there is some limestone in the southern part of the catchment. Lough Cullin is classified as an Oligotrophic system and has been fairly stable in recent years. The lake has a number of very small islands. Fringing swamp vegetation occurs in some sheltered areas. Lough Cullin is a very important salmonid fishery.

Lough Cullin formerly supported a colony of nesting gulls, Common Gull and Black-headed Gull. Common Tern also bred in small numbers. Lough Cullin supports a good diversity of wintering waterfowl species, most notably Tufted Duck and Coot. The occurrence of Whooper Swan and Golden Plover, albeit in small numbers, is of note as these species are listed on Annex I of the E.U. Birds Directive. The site is perhaps of most importance as, together with Lough Conn, it is one of only four areas in the country where Common Scoter breed. Common Scoter is listed as a Red Data Book species. The worrying decline in the breeding population of this species requires investigation.

### 3.2 Description of Conservation Interests affected by Arterial Drainage Maintenance

The conservation interests of designated conservation sites include both the habitats and individual species listed on Annex I and Annex II of the EU Habitats Directive (1992), respectively. The national distribution and conservation status of these habitats and species has been formally documented and submitted to Brussels by the Department of the Environment in December 2007. The findings of the NPWS are published in ‘The status of EU protected habitats and species in Ireland’ (NPWS 2008) and are summarised in this section to provide in indication of the protected habitats and species most significantly affected by
drainage maintenance works. All data for these habitats and species is referenced from the above report (NPWS 2008).

3.2.1 Annex I habitats

3.2.1.1 Active raised bogs (7110)

Raised bogs are abundant in the lowlands of central and mid-west Ireland. In Ireland raised bogs are confined to areas with an annual rainfall below 1250 mm. In areas of high rainfall raised bogs are replaced by blanket bog. Raised bog occur principally in land below 130m and are most extensive and abundant where the limestone plain is covered by a variable thickness of undulating glacial drift which originally provided suitable basins for the development of lakes and/or fens, which in turn acted as precursors to the bogs. The current range of Active Raised Bog habitat is much smaller than the range of raised bogs in Ireland. Bog Woodland habitat (91D0), on raised bog, is also deemed part of Active Raised Bog habitat as it also actively peat forming. The current habitat range is 45.53% below the Favourable Reference Range (i.e. unfavourable – bad). The latter is considered to be the current range of Degraded Raised Bog still capable of regeneration (7120). The original extent of raised bog in the Republic of Ireland was 308,742ha; 50,011ha of intact raised bog remain in the country, much of this is fragmented and includes Degraded Raised Bog habitat. 21,519ha of this are within designated sites (NHAs and SACs). Further losses have occurred in the last two decades but despite this, the Republic of Ireland still has the most extensive area of conservation worthy sites remaining in Western Europe.

Peat cutting, drainage and burning were the most impacting activities affecting the conservation status of these bogs. These activities were found to seriously disrupt the high bog hydrology, leading to desiccation of the bog and loss of the characteristic micro topographical features and eventually flora and fauna. Arterial drainage directed at improving agriculture land and providing for improve bog drainage was also considered a serious threat to the hydrological status of the high bog and therefore the Active Raised Bog habitat. The blocking of drains is considered essential for the recovery of the habitat; however, previous drains continue to have a serious impact on the raised bog habitats within designated sites.

Thus, considering the Unfavourable Bad assessment for the four main habitat attributes (Favourable Reference Range, Habitat Extent, Habitat Structure and Future Prospects) the overall conservation status for Active Raised Bog habitat is Unfavourable – Bad.

3.2.1.2 Degraded raised bogs still capable of regeneration (7120)

Degraded Raised Bog habitat occurs on those raised bogs where there has been disruption of the natural hydrology of the peat body, leading to desiccation and/or species change or loss. The current range of Degraded Raised Bog is similar to the range of the whole raised bog ecosystem, which occasionally may contain Active Raised Bog habitat. However, it does not include those areas of Secondary degraded raised bog. Ireland is obliged to ensure that Favourable Conservation Status is achieved for both Active and Degraded Raised Bog, which may not necessarily require the restoration of the total national area of

Degraded Raised Bog. Ireland was obliged to designate areas of Degraded Raised Bog that were capable of regeneration to Active Raised Bog. 19,574ha of raised bog, which correspond to the extent of Degraded Raised Bog within protected areas, should be the target value for
the restoration of Active Raised Bog areas. However this restoration area will be targeted in areas deemed suitable for the restoration throughout the range of raised bogs. Particularly in adjacent areas to raised bogs within designated sites with Active Raised Bog habitat present in order to optimise the conservation of their biodiversity values. Threats from peat cutting, drainage and burning affect degraded raised bog habitat, the same as for raised bog, as these impacts reduce the capacity for regeneration.

Plate 19 Cutover raised bog habitat adjacent to the upper reaches of the River Abbert (channel C3/8/8)

3.2.1.3 Blanket bog (7130)

Irish Lowland Atlantic Blanket Bogs are of very particular importance in a European context, as the only other area of Western Europe which possesses large areas of Lowland Blanket Bog is Scotland. However, Irish Lowland Blanket Bogs are characterised by the abundance of Black Bog-rush (Schoenus nigricans) and are considered to be a rare hyper-oceanic variant of the habitat. This habitat is confined to altitudes less than 150m rain-days in excess of 250 days per annum and rainfall > 1,250mm/year. Peat depths vary according to underlying topography from less than 1.0m to greater than 6.0m within this sub-category. The best-developed and most extensive area of the Lowland Atlantic habitat subtype occurs in north-west Co. Mayo, the second largest area occurs in the Connemara region of Co. Galway. Co. Donegal also contains a large area of Lowland Atlantic Blanket Bog. Lesser areas of this habitat sub-type occur in counties Kerry, Cork, Sligo and west Leitrim. However, decreases in habitat extent greater than 1% per year are expected considering the impacting nature of the activities damaging the habitat particularly since 1980 (agriculture (overstocking), afforestation,mechanised cutting) and since 1994 agriculture (overstocking), afforestation, mechanised cutting, windfarm and infrastructural developments, quarrying, erosion and peat slides. Drainage and fertilisation. associated with agriculture reclamation, have often resulted in the complete elimination of the peatland flora and fauna.

Peat extraction seriously interrupts the bog hydrology and depending on the extraction technique finally causes the complete removal of the peat substrate and/or the top vegetation. Agriculture reclamation completely dramatically modifies the vegetation through removal of peat and fertilisation that encourage a completely new arrange of species. The conservation status of the habitat extent is deemed Unfavourable – Bad.

3.2.1.4 Transition mires

The term ‘transition mire’ relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and Alkaline fens, in which the
surface conditions range from markedly acidic to slightly base-rich. The vegetation normally has intimate mixtures of species considered to be acidophile and others thought of as calciphile or basophile. Transition mires and quaking bogs can occur in a variety of situations, related to different geomorphological processes: in flood plain mires, valley bogs, basin mires and the lagg zone of raised bogs, and as regeneration surfaces within mires that have been cut-over for peat or areas of mineral soil influence within Blanket bogs.

The two activities which are most important for the decline of this habitat are drainage activities associated with the related activities of land reclamation and the development of turf extraction schemes on bogs, in particular midland raised bogs. Mechanical extraction has accounted for a loss of 22% of the raised bog resource in less than 50 years, and the drainage works needed to make peat harvesting possible has also resulted in significant loss of Transition mire areas associated with the margins of raised bogs. As habitat quality and typical species are so interdependent, it can be suggested that an unknown but likely to be Unfavourable Bad conservation status can also be inferred for Typical Species. Peat or turf cutting, arterial drainage, local drainage and agricultural reclamation are reported as being the most significant activities affecting the conservation status of Transition mire. Drainage is undertaken to dry out the actual fen habitat surface, or the agricultural land or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural purposes and the cutting of turf.

These activities were found to seriously disrupt the hydrological conditions needed to maintain these habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna, resulting in at least a 79% decline in the extent of fens, with only 21% remaining in a conservation worthy condition.

From the mid 1800’s to the present day the total area of and drained under the various Acts and Schemes amounted to more than 2 million hectares, or some 30% of the total land area in Ireland. Much of this work was carried out under the following: the 1945 Arterial Drainage Act, the Land Project of 1949, the Farm Modernisation Scheme 1974-1985, and the Western Drainage Package 1979-1988. These schemes are likely to have had a serious impact on many fen systems, a fact that is supported by evidence from the Arterial drainage Act which resulted in drainage works being carried out on 38 catchments in Ireland, affecting some 262,800 ha of land. These drainage activities seriously disrupt the hydrological conditions needed to maintain these water dependent habitats, where water levels are at or close to surface all year round, with fluctuations being limited to just a little below the surface. Where a floating matt or scraw is present, a certain resilience to reduced water levels can occur due to the ability of the matt to move upwards or downwards with changing water levels; however, long term reduction in water level is likely to affect species composition of the scraw. The blocking of drains is considered as an essential tool for the recovery and improvement of the habitat which has been affected by this activity, together with suitably nutrient poor water supply.

No specific studies have been undertaken on drainage trends of the habitat in Ireland. Although, according to the findings of numerous surveys conducted on sites with this habitat, drainage operations are a recurring feature that continues to threaten the integrity of sites or to lead to their degradation. Ongoing deterioration of the hydrological conditions of Transition Mire at current rates caused by drainage, reclamation and infilling severely threatens the viability of the habitat. Major positive management actions: land purchase and restoration works are required. Considering the assessment of the four main habitat’s attributes, the overall conservation status for Transition Mire habitat is Unfavourable – Bad.
3.2.1.5 Calcareous fens (7210)

Fens are usually peat-forming wetlands that receive mineral nutrients (magnesium, iron and in particular calcium) from sources other than precipitation: usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement, and are not generally so acidic as bogs. In general they are poor in nitrogen and phosphorus, the latter of which tends to be the limiting nutrient in fen systems. Fens often occur in mosaics with other wetland communities such as reed beds, bogs or open water in which case they may be of relatively limited extent. Although fens can be found as discrete habitats in their own right, they may also occur in association with (or within) a range of other habitats including blanket bog, raised bog, turlough, dune slack, machair, wet heathland, wet grassland, woodland, karst areas, lacustrine and riverine habitats and systems. In Ireland *Cladium* fens occur in a variety of situations including topogenous fens found in valleys or depressions, floodplains, over-grown-ditches, in flat and depressions, extensive wet meadows, within tall reed beds, on the landward side of lakeshore communities, calcium rich flush areas in blanket bogs, dune slack areas, fens adjacent to raised and blanket bogs, in turlough sites and wet hollows in machair often in association with Alkaline fen.

The two activities which are most important for the decline of this habitat are drainage activities associated with the related activities of land reclamation and the development of turf extraction schemes on bogs, in particular midland raised bogs. Specifically for Calcareous fens with *Cladium mariscus*, the results of the NPWS Fen Study showed that, 57 sites with a habitat area of 803 ha (55%) have been damaged by human activities, while 50 sites with a habitat area of 536 ha (37%) are threatened by human activities. It is likely that the number of sites for the habitat which have experienced damage in the past from a variety of negative factors (i.e. burning, peat extraction, dumping, infilling, over grazing) or suffered alteration in hydrological conditions (i.e. local drainage, arterial drainage, water abstraction etc.) or are threatened by these and other activities, is in fact much higher than indicated by these two studies.

These activities were found to seriously disrupt the hydrological conditions needed to maintain these habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna. These activities have resulted in a 79% decline in the extent of fens with only 21% remaining in a conservation worthy condition. Ongoing deterioration of the hydrological conditions of Alkaline fen at current rates caused by drainage, reclamation, and infilling severely threatens the viability of
the habitat. Major positive management actions: land purchase and restoration works are required. Thus, considering the assessment of the four main habitat’s attributes, the overall conservation status for Calcareous fen habitat is Unfavourable – Bad.

3.2.1.6 Alkaline fens (7230)

In Ireland Alkaline fens occur in a variety of situations including topogenous fens found in valleys or depressions, valley head fens, within transition mire and tall reed beds, on the landward side of hard water oligotrophic lakeshore communities, calcium rich flush areas in blanket bogs, dune slack areas, fens adjacent to raised and blanket bogs, in turlough sites, depressions in limestone pavement and wet hollows in machair and spring fed habitats including cliffs, upper ecotones with salt marsh. Fens may also occur as secondary habitats on mined out bog sites which have been excavated to the fen peat layer. The threats and impacts of arterial drainage and drainage maintenance works are as above.

Ongoing deterioration of the hydrological conditions of Alkaline fen at current rates caused by drainage, reclamation, and infilling severely threatens the viability of the habitat. Major positive management actions: land purchase and restoration works are required. Considering the assessment of the four main habitat’s attributes, the overall conservation status for Alkaline fen habitat is Unfavourable – Bad.

3.2.1.7 Alluvial forest with Alnus glutinosa (91E0)

Within Ireland, Alluvial Alder-Ash Forests have been heavily altered by thousands of years of human activity. What remains is a modified and highly fragmented sample of the primeval forests that once covered significant areas of the island. As a result of its long history of fragmentation and greatly reduced area many species now found in this habitat can also occur in other woodland types or non-woodland habitats (e.g. freshwater marsh). The Favourable Reference Range (FRR) is very large because alluvial woodlands occur throughout the country. However, the area of potential alluvial woodland is restricted to those areas subject to flooding and will be very much less than the FRR. Due to the fact that the current habitat extent of Alluvial Alder-Ash Forest is only 37% of the favourable reference area the conservation assessment for habitat extent is considered Unfavourable – Bad.

The drainage of Alluvial Alder-Ash Forests lowers the water table leading to a drying out of the soil and a possible reduction in the incidence of flooding. Over time the drying out of Alluvial Alder-Ash Forests will lead to a change in the flora and fauna with the typical species associated with the habitat replaced by those adapted to a drier environment. Drainage was recorded at 46% of sites, either in the form of internal drains or drains dug around the borders of a site. Arterial drainage work has been widespread in Ireland and results in a reduced incidence and / or longevity of flooding. Thus, considering the Unfavourable – Bad assessment for three of the four main habitat attributes, the overall conservation status for Alluvial Alder-Ash Forest within Ireland is Unfavourable – Bad.

3.2.1.8 Coastal lagoons (1150)

According to recent NPWS data 87 lagoon sites are recognised in the Republic, including clusters of very small lagoons. There is no evidence of any significant loss of coastal lagoon habitat range in the last 100 years and status of habitat range is regarded as Favourable. The most damaging impact affecting habitat extent is the deliberate drainage of the previously largest lagoon in the country (Tacamshin Lake) for largely agricultural reasons and a smaller
lagoon (Shannon airport) for safety reasons. Approximately 90% of lagoon habitat is now designated as, or lies within a Special Area of Conservation (SAC) under the Habitats Directive and all designated sites are listed as "Transitional Water Bodies" and are included in the Register of Protected Areas under the Water Framework Directive. Deliberate drainage of lagoons is a Notifiable Action in SACs. The most common type of lagoon within this state is the artificially created lagoon where the ecological communities present determine the classification of the habitat.

Lagoon biota is basically subtidal and cannot survive desiccation and the impacts/threats of inadvertent temporary drainage should decrease. More than 80% of habitat area is unfavourable and therefore conservation status of Habitat Structure and Functions is assessed as Unfavourable – Bad.

Plate 21 Upper River Boyne at Russellswood (outside the SAC). The above view is of section pre-works. It is clear that this channel has not been maintained since the original scheme and is of high potential importance for bats, birds, lampreys, and crayfish.

3.2.1.9 Turloughs

Turloughs are classified as priority Annex I habitats. Irish turloughs can be defined as topographic depressions in karst which are intermittently inundated on an annual basis, mainly from ground water, and have a substrate and/or ecological communities characteristic of wetlands. All turloughs are characterised by the fact that they chiefly flood and drain via connections with groundwater, such as springs, swallow-holes and estavelles.

Although turloughs have been lost historically, the overall range for the habitat is not thought to have declined. These site losses were caused by arterial drainage and, therefore, sites cannot now be reinstated. Large scale drainage has ceased and the range of turloughs is thought to have been stable throughout the trend period of 1986-2007. The assertion that the current habitat range is equal to the favourable reference range indicates that the conservation status of the habitat is favourable. From a survey of turlough habitat in Ireland it was found that ca. 50% of turlough habitat in Ireland has been drained. Most of the turloughs lost through drainage were within the catchment of the Clare River and Lough Carra. Turloughmore at 790 ha was the largest known turlough and formed a sink for Clare river system, before an overland channel was opened to Lough Corrib. Originally an area of 2,025 ha flooded within the Clare catchment, including the semi-permanent Clonkeen Lough and the large neighbouring turloughs (Turloughcor, Killower, Turloughmore etc.). Drainage at a large-scale (arterial) and local scale (internal within an individual turlough) can affect the hydrological functioning of this habitat.
Drainage in the nineteenth century eliminated many of the large turloughs of East Galway in the creation of the Clare River as it is today. A second burst of activity followed the Arterial Drainage Act of 1945. More recent schemes affecting turloughs have been the Corrib-Clare drainage (1954-64), draining over 21,000ha of farmland, and the smaller Corrib-Headford and Corrib-Mask-Robe schemes. Seven sites of importance for Greenland white-fronted geese and Bewick and whooper swans were drastically affected, and drainage may also have curtailed the numbers of breeding black-necked grebe. Additionally the Dunkellin River that leaves Rahasane turlough (SAC) was partly drained in 1992. At Rahasane turlough the clearance of the lower part of the river channel has increased run-off in summer by allowing the water to avoid the main swallow hole. This has reduced the area of wetland vegetation in a former river channel in the northern part of the basin though it has probably not affected the wintering birdlife. Drainage has been seen as of benefit to the land owners, though completely altering the ecology and species composition of the turlough basin. Ongoing drainage at a local scale could potentially serve to lower the groundwater levels, resulting in faster drainage of turlough habitats during the spring/summer season.

Plate 22 Artificial cut on the River Clare near Tuam, Co Galway. The original course of the river was changed during the original drainage scheme.

3.2.1.10 Annex I lake habitats

The five Annex I lake habitats, which are believed to occur in Ireland are:

- Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)
- Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetae
- Hard oligo-mesotrophic waters with benthic vegetation of Chara sp
- Natural eutrophic lakes with Magnopotamion or Hydrocharition – type vegetation
- Natural dystrophic lakes and ponds

The principal threats to all standing waterbodies in Ireland include eutrophication, agricultural practices including overgrazing and excessive fertilization, afforestation and the introduction of invasive alien species. Waterbodies may be negatively affected by increased housing developments in rural areas and the associated wastewater treatments but it is difficult to quantify the risks associated with this. The utilization of lakes for an increasing number of sport and leisure activities may also impact on lake habitats. Lakes are also affected by drainage of peatlands and the anthropogenic alteration of hydrological conditions.
within the catchment. Based on the best available information the overall assessment of lakes is Unfavourable –Bad.

3.2.2 Annex II species

3.2.2.1 Vertigo species

Vertigo moulinsiana is one of 8 species of whorl snail (genus Vertigo) living in Ireland. The whorl snails are amongst the smallest of the country’s land molluscs with a size ranging from 1.7 to 2.7mm in height and 1 to 1.5mm in width. Vertigo moulinsiana is the largest, with a height of 2.2 – 2.7mm. All whorl snails favour damp or wet habitats, especially marshes where they live mostly in moss, leaves and decaying vegetation. Some of the species of whorl snails (including V. moulinsiana) are particularly sensitive to changes in hydrology. Such changes have become more evident in recent times, with the result that 4 of the 8 species are now listed on Annex II of the European Habitats & Species Directive. Vertigo moulinsiana is considered to be an Atlantic-Mediterranean species with a range extending from Ireland to Russia and south to North Africa, but the main populations are in western and Central Europe. The species mainly inhabits calcareous, lowland wetlands. It occurs in swamps, fens and marshes usually bordering rivers, canals, lakes and ponds where very humid conditions prevail, often enhanced by open water evaporation during the spring to autumn.

Vertigo moulinsiana lives on both living and dead stems and leaves of tall plants: grasses (eg Glyceria maxima), sedges (e.g. Carex riparia and Cladium marismus, and reeds (e.g. Phragmites australis). As well as the tall vegetation structure of the habitats above, V. moulinsiana requires a stable hydrology, where the watertable is at, or slightly above, the ground surface for much of the year and any seasonal flooding is of very low amplitude. By the nature of its wetland habitat, the snails are likely to be able to float on the water surface or attached to floating vegetation, and can therefore disperse during periods of flooding.

The range of Vertigo moulinsiana has become smaller in recent years than it was in former times, when habitat for the species was widespread along the major river basin flood plains. It is likely that this habitat began to experience losses when large-scale modification became widespread. The present range of Vertigo moulinsiana is the Midlands, and the Shannon Basin from Lough Derg to Longford, with some outlying squares in areas of old calcareous wetland. The Favourable Reference Range (FRR) for Vertigo moulinsiana in Ireland is taken to be 5200 km². Many of the sites lost are from riparian margins which have been cleaned and marginal vegetation has been lost. Other sites have been lost through large-scale drainage. The current range is therefore 79% of its favourable range.

In Ireland, the greatest loss of Vertigo moulinsiana sites has been through drainage of wetlands, and riparian management. Further pressure on habitats through spread of urban development is likely. The range of Vertigo moulinsiana has decreased considerably from its historical range, but has good protection in some of its SAC. Considering the impacts, pressures and threats to Vertigo moulinsiana in the Republic of Ireland today, the overall Conservation Status for this snail is Unfavourable – Bad.

In Ireland, the main decline of Vertigo angustior sites appears to be a result of loss of riverside and canal-side habitat, particularly from drainage of marshy areas in the midlands and south east. Drainage results in changes in hydrology particularly from ditch deepening or abstraction, alteration of fertilisation or drainage of land that alters the plant community. The range of Vertigo angustior has decreased from its historical range, but has good protection in
some of its SACs, and has reasonably wide distribution, particularly in more remote areas. Considering the impacts, pressures and threats to *Vertigo angustior* in the Republic of Ireland today, the overall Conservation Status for this snail is Unfavourable – Bad.

![Plate 23 Desmoulin’s whorl snail Vertigo mouinsiana.](image)

### 3.2.2.2 White-clawed crayfish

The species is more common in base rich watercourses and has been frequently recorded from smaller arterial drainage systems. In Ireland there is only one species of crayfish and despite the ongoing threat of the introduction of non-native species or associated crayfish disease, the white-clawed crayfish populations in Ireland are considered to be of European importance.

![Plate 24 White-clawed crayfish Austropotamobius pallipes.](image)

Crayfish require moderate to good water quality (less than 10% of records were from moderately polluted stretches, Q3 or lower), slow to moderate current and a heterogeneous habitat with different types of shelter. As crayfish do not migrate to breed, the habitat used by adult and juvenile crayfish for foraging, shelter and breeding is considered to be identical. While losses may occur rapidly, recovery is much slower for this long-lived, late-breeding species than for most macroinvertebrates which have seasonal or circum-annual life cycles. Principal impacts include deterioration in water quality, discharges of silt, restructuring of water courses, streambeds or bank habitat, alteration of watercourses by dredging and the introduction of non-native species. The overall Conservation Status for future prospects of the white-clawed crayfish in Ireland is considered Unfavourable – Inadequate, due to the reduction of range and locality and the continuing pressures.
3.2.2.3 Freshwater pearl mussel

The freshwater pearl mussel lives in oligotrophic, acid to neutral waters of rivers flowing over granite or sandstone rock, mainly in the western part of Ireland, but also in areas of the south and south east where geological conditions allow. There are eleven populations that were considered, by expert judgement, to be viable in 1994 (Bandon, Barrow-Mountain, Bundorragha, Caragh, Corrib/Owenriff, Eske, Kerry Blackwater, Leannan, Newport, Owenagappul and Slaney/Dereen). These 11 populations cover the main parts of the species’ range. The OPW maintains drainage channels in the above catchments.

Freshwater pearl mussels require clean gravel beds with no silt for recruitment. Siltation in the watercourse directly kills adult pearl mussels. In addition, siltation causes colonisation by higher plants, eutrophication principally by phosphorous, causing filamentous algae growth.

Both arterial drainage of the river and catchment and field drainage associated with agriculture and forestry impact on pearl mussels. Arterial drainage, canalisation, boulder removal, etc. has destroyed river habitat by replacing natural channel reach patterns of pools and riffles with more uniform runs that suit neither the pearl mussel nor its host fish. Bank reinforcement actions often accompany or are deemed necessary following canalisation. They are a response to external damage to river banks at the site of reinforcement or that has taken place elsewhere but has had ramifications at the site of reinforcement. The reinforcement structures in themselves can affect river dynamics both upstream and downstream of the works. Hard reinforcement measures are considered to be damaging activities in pearl mussel rivers. The increased drainage network has led to an increase in the release of silt into river channels hosting pearl mussels, with the subsequent destruction of juvenile habitat. Drainage of peaty catchments has been shown to increase run-off rates and flood peaks. Such hydrological changes lead to instability in mussel habitat and increased disturbance.

The freshwater pearl mussel *Margaritifera margaritifera* is listed as Critically Endangered in the Republic of Ireland in the most recent review of local IUCN threat status of Irish molluscs.

![Pearl mussel *Margaritifera margaritifera* in the River Lee at Inchigeelagh, Co Cork.](Plate 25)
3.2.2.4 Lamprey species

There are three Irish lamprey species (brook lamprey Lampetra planeri, river lamprey Lampetra fluviatilis, and sea lamprey Petromyzon marinus). The anadromous sea and river lampreys are considered to be generally absent from smaller drainage channels, although they do occur in the larger watercourses in which OPW works take place. The brook lamprey is the smallest of the three lamprey species native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater. All lamprey species are listed in Annex II of the EU Habitats Directive, 1992 and in Appendix III of the Berne Convention. Although lamprey are frequently found in Irish watercourses, particularly brook lamprey, these populations are considered to be of European importance, as this species is under significant pressure due to the deterioration of natural watercourses, bank maintenance, weir and river channel developments and a deterioration in water quality.

Lamprey species require soft silt beds in their juvenile life stages, suitable habitat frequently encountered within arterial drainage channels. Suitable spawning grounds for brook lamprey are known from a large number of the rivers and also from small streams and drains nationally which are included in the Natura 2000 network. The catchment of these rivers and arterial drains associated with these provide optimal silt-bed habitat for the lamprey ammocoetes to spend their juvenile life stages.

The principal threat to sea lamprey populations is the presence of weirs and other barriers to migration which prevent colonisation of catchments. Channel maintenance, is seen to have considerable potential to impact adversely on lamprey populations (Code No. 810, 811, 820). Inappropriate timing of channel maintenance could lead to disruption of redd structures in gravelled area with egg washout and dispersal. Removal of silt is a typical procedure in channel cleaning or maintenance, as practised by the Office of Public Works Drainage Division, River Drainage Boards and Local Authorities. Such silt not infrequently contains populations of juvenile lamprey that may be left stranded on the bank slope or spoil lines where they are predated on or die of desiccation. It is clear that such a process can lead to substantial losses of juveniles.

Arterial drainage has been identified as a major factor in altering the hydraulic regime in impacted channels and, in turn, eliminating juvenile lamprey habitat. The processes of straightening, of removal of bed high points and subsequent formation of extensive uniform
glide areas are considered to have reduced the areas available for natural sediment deposition utilised by juvenile lamprey. Channel maintenance, is also seen to have considerable potential to impact adversely on lamprey habitat through removal of silt deposits and possibly also through the removal of gravel shoals or their re-distribution within the channel cross-section.

The installation of low-level structures as channel enhancement devices for salmonid fish can lead to local increases in ammocoete numbers, presumably through the structures permitting sediment focussing and deposition. However, where drained channels have been left undisturbed for a number of years it is clear from surveys that sediment can accumulate to the level where it can support large densities of juvenile lamprey.

The overall Conservation Status for future prospects of the sea lamprey in Ireland is considered Unfavourable – Inadequate; while the future prospects for the river/brook lamprey (Lampetra spp.) is considered Favourable. This positive conservation status for Lampetra species is considered to be important, as these species are currently of conservation concern at a European level.

Plate 27 Boyne tributary (C1/32) scheduled for maintenance works during 2008. This tributary of the Stoneyford River was considered to be ideal for lamprey and salmonid production and was clearly not subjected to maintenance in some time. This channel is outside the SAC.

3.2.2.5 Salmon

Atlantic salmon Salmo salar is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. Irish populations of Atlantic salmon stock is of European importance. While salmon have a nominal presence in some other catchments, 148 designated rivers are regarded as encompassing the natural range of salmon in Ireland. Hydro-electric barriers on the rivers Liffey, Lee, Shannon and Erne restrict the distribution of salmon in these four catchments.

It is evident that current salmon stock abundance in Ireland is lower than previously recorded. This decline has been contributed to by poor marine survival which has become apparent throughout the range of North Atlantic Salmon. There are real concerns relating to factors causing mortality at sea such as predation by seals, diseases and parasites, marine pollution etc. However, there is insufficient empirical information to allow anything other than general advice to be given on these factors at this stage.

Deterioration in water quality is considered the most significant impact to salmon in Irish freshwaters. Drainage and channel modifications are also listed as a significant conservation
concern. From the Water Framework River Basin District assessment of Irish watercourses 50% of salmonid watercourses are identified as being probably at risk, while 16% have been identified as at risk.

Land drainage results in a change in the hydraulic characteristics of the surface water drainage network. This leads to increased and rapid run-off of water and thus to shorter, but more intense, flood events. Consequently, bank erosion and substrate loading can increase. The geomorphological response of the river is to widen, become shallower and increase substrate fines resulting in reduced habitat quality. Arterial drainage is the re-engineering of natural river channels to increase the rate and volume of water transfer from land to sea resulting in loss of natural stream and bankside structure. Some of Ireland’s major salmonid catchments have been subjected to arterial drainage schemes at some time between 1840 and 1980. The more major mechanised schemes took place from 1950s onwards. While the short-term impact of these schemes was very detrimental to salmon stocks, recent studies have shown that the long term impact has been varied and complex ranging from positive, to neutral, to negative in relation to salmon stocks (Kennedy et al. 1983; CFB 2001). The long term negative impacts of drainage on the fish carrying capacity of Irish salmonid rivers are, in most cases, very significant. Surveys have shown little physical recovery of the natural form of channels even 60 years after drainage. Any land management practice or, combination of practices, which lead to a significant alteration in the natural morphology of a channel and/or its riparian zone, will have negative consequences for fish stocks. It is difficult to quantify the negative impact of drainage alone as a factor. In general terms drainage of smaller channels (<6m) will usually result in a significant loss in the standing crop of 1+ year-old salmonids. In larger (>6m) channels there will be a reduction in the number of resting pools for adult salmon. Salmon catchments which have been subjected to arterial drainage are shown in Table 3.

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Period of works</th>
<th>Catchment area drained (km²)</th>
<th>Rehabilitation work carried out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyde &amp; Dee</td>
<td>1950-1957</td>
<td>106</td>
<td>No</td>
</tr>
<tr>
<td>Feale</td>
<td>1951-1959</td>
<td>107</td>
<td>Yes</td>
</tr>
<tr>
<td>Corrib-Clare</td>
<td>1954-1964</td>
<td>303</td>
<td>Yes*</td>
</tr>
<tr>
<td>Maine</td>
<td>1959-1963</td>
<td>47</td>
<td>No</td>
</tr>
<tr>
<td>Deel</td>
<td>1962-1968</td>
<td>48</td>
<td>Yes**</td>
</tr>
<tr>
<td>Moy</td>
<td>1960-1971</td>
<td>247</td>
<td>Yes**</td>
</tr>
<tr>
<td>Corrib-Headford</td>
<td>1967-1973</td>
<td>79</td>
<td>Yes**</td>
</tr>
<tr>
<td>Boyne</td>
<td>1969-1986</td>
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<td>Yes**</td>
</tr>
<tr>
<td>Maigue</td>
<td>1973-1986</td>
<td>123</td>
<td>Yes*</td>
</tr>
</tbody>
</table>

*No rehabilitation undertaken on main stem of River Clare.  
**Selected areas of the catchment only.  
+Rehabilitation of main channel involved the installation of concrete weirs which have restricted the hydraulic and ecological recovery of the river.
3.2.2.6 Otter

Otters are known to occur throughout the freshwater and coastal environments of Ireland, recorded at 70% of studied sites; however, they have been noticeably affected by human disturbance and dramatic declines occurred in many European otter populations during the latter half of the 20th Century. Otters remain threatened, declining, rare, or extinct in many European states. Otter are listed on Annex II and Annex IV of the EU Habitats Directive and also on the Wildlife Act (1976, amendment 2000) and in the Irish Red Data book. The Wildlife Amendment Act (2000) provided legislation making it illegal to hunt, disturb, or intentionally kill otters. Otter are considered to be a semi-aquatic species as they breed and rest on land but rely on the water for forage and often for commuting.

Plate 28 Manulla River (Moy tributary). This channel is excessively wide resulting in extensive macrophyte growth and subsequent requirement for ongoing drainage maintenance. This stretch does however contain brook lamprey, salmon and crayfish.

In addition to the width of the watercourse a 10m buffer of both banks is also included as comprising otter habitat. In terms of the favourable conservation status of otter, there has been a recognised decline in numbers and distribution since the initial otter survey carried out in 1982. It is therefore the aim of the NPWS to provide for the increase in otter densities within all SACs where they have been previously recorded, while ensuring no further loss occurs outside of these conservation sites.

Otters are subject to pressures in both the terrestrial and the aquatic (freshwater and marine) environments. Impacts that reduce the availability or quality of, or cause disturbance to, these habitats are likely to affect otters. These factors may act directly (e.g. through road kills or the removal of holt sites) or indirectly (e.g. by reducing prey availability). Habitat destruction is considered to be the most significant major threat to otter populations in Ireland and Europe as a whole, while river/wetland drainage is considered to be the single most significant threat/area of conflict. From the NPWS conservation status report (2008) the conservation status of otters is considered Unfavourable – Inadequate.

3.2.3 Annex 1 Bird species

Kingfisher is listed on Annex I of the EU Birds Directive (1979). This species is vulnerable to habitat degradation through pollution or unsympathetic management of watercourses and also to hard winters when cold and poor prey availability results in low survival rates. This species is amber listed because of their unfavourable conservation status in Europe. Kingfishers are found by still or slow flowing water such as lakes, canals and rivers in
lowland areas. The nest burrow is located in stone-free sandy soil of a low stream bank, usually about 0.5m from the top. The birds choose a vertical bank clear of vegetation, since this provides a reasonable degree of protection from predators. Kingfishers inhabit slow-moving, shallow rivers or streams which are clean enough to support abundant small fish. Fast-moving streams and polluted waters do not contain enough available fish, and hence do not contain kingfishers. Branches overhanging shallows make essential fishing perches. Human disturbance of nesting birds is a serious problem, since the broods fail if the feeding routine is upset. If human presence close to a nest prevents these shy birds from entering the nest for too long, the chicks may weaken enough (either from cold or hunger) to stop calling. Heavy machinery undertaking landscaping and maintenance of channel banks destroys many nests each year on lowland rivers (RSPB website).

Other Annex 1 birds species which occur in Ireland and could be expected to potentially occur near OPW drainage channels are as follows:

- Red-throated Diver (Gavia stellata)
- Black-throated Diver (Gavia arctica)
- Great Northern Diver (Gavia immer)
- Little Egret (Egretta garzetta)
- Bewick's Swan (Cygnus bewickii)
- Whooper Swan (Cygnus cygnus)
- Greenland White-fronted Goose (Anser albirostris flavirostris)
- Barnacle Goose (Branta ruficollis)
- Corncrake (Crex crex)
- Golden Plover (Pluvialis apricaria)
- Dunlin (Calidris alpina schinzii)
- Bar-tailed Godwit (Limosa lapponica)
- Wood Sandpiper (Tringa glareola)
4 RESULTS

4.1 Review of OPW desk based assessments

Desk based assessments carried out by the OPW were reviewed both in the format of the ‘Assessment of Significance’ forms prepared by the OPW staff and also through an extended commentary on OPW drainage maintenance works between the OPW and the ecological consultants. The final ‘Assessment of Significance’ forms are not included as an output of this report. The Ecological Assessments series produced by the OPW to date were also reviewed to include an assessment of the mitigations and procedures adopted or proposed for adoption in the future by the OPW.

The Ecologists comments on of the ‘Assessment of Significance’ forms prepared by the OPW were not intended to be negative against the OPW. However, as a starting point for change the problems with the assessment need to be clearly defined. A way forward is also presented later in this report. The main issue is that the forms were filled out by engineering staff rather than ecologists. There was an also problem with the mapping produced so it was impossible for the ecological consultants, in many cases, to identify the exact areas along a river channel that would affected by works. An example for OPW staff Ecofact filled out an example number of the Assessment Forms. However, in most cases these examples were replicated into the other forms by OPW without any consideration of the different requirements and interests that would be present as each site. In the end a very simplified generic response was replicated on each of the forms. It is likely that the current project was too ambitious in preparing assessments for 50 sites in this way. It also quickly became apparent that in absence of site specific local information that advance ecological surveys would be required in each case. It is also clear that such assessments would need to be carried out by ecologists rather than engineers.

The principal issue regarding the desk based assessments carried out by the OPW was a deficiency of ecological data relating to both the baseline conditions within the watercourses and their adjacent habitats. Where works were being carried out within designated conservation sites, the habitats and species for which these sites were listed, for the most part; however, the location and extent of these conservation features was not identified, making an accurate assessment of the significance of impact impossible. The size and scale of the works proposed were not adequately described and the location of the key conservation interests of the sites in relation to the works was not defined. The extent of the works, duration and other features of the proposed works were also omitted. Potential changes to the designated site as a result of reduction of habitat area; disturbance to key species; habitat or species fragmentation; reduction in species densities; and potential changes in key indicators of conservation value were not described. Moreover, likely impacts on the Natura 2000 site as a whole in terms of (a) potential interference with the key relationships that define the structure of the site, and (b) possible interference with key relationships that define the function of the site, were not addressed. Based on this it was concluded that there is clearly potential for significant negative impacts on the relevant SAC/SPA areas as a result of the OPW channel maintenance works on their own, or in combination with other projects, and it is considered that an appropriate assessment would required, following the determination of the EU Habitats Directive (Council Directive 92/43/EEC for the conservation of natural habitats and of wild flora and fauna).
The following comments regarding the OPW assessments were communicated to the OPW, responses to these ecological concerns are included where applicable and the current approach taken by the OPW is outlined.

- Mapping of the exact areas where work was proposed was not supplied.
- No information was provided regarding the requirement for such works in the specific areas. The flood risk and flood relief requirements were not outlined. Details of the relevant design levels and baseline channel status was not supplied.
- The presence of protected species within these sites have not been identified and no mitigations for their protection are listed.
- The upstream impacts of drainage maintenance on designated conservation sites downstream has not been adequately assessed or quantified.
- Coastal conservation concerns including saltmarsh habitat, dune habitats etc. occurring within or adjacent to drains has not been adequately assessed or mitigated against.

It was concluded at early stage in this assessment that there was a clear need for advanced ecological survey work on all the affected channels. The OPW was advised of this which would be consistent with the approach taken in Britain.

It was also concluded that the potential impacts of OPW drainage maintenance works within SPA sites were not adequately addressed. It was concluded that the desk based assessment carried out by the OPW contained no effective mitigation measures for the protection of bird species within SPAs, neither was there any reference to the location of protected bird species within these sites which require protection. Mitigations such as timing of works and the protection of feeding, breeding or nesting sites would be considered straightforward to implement.

In SAC sites where *Vertigo* snails are present there was no data referenced in the OPW assessments to identify the locations of these species or the potential impacts that the drainage maintenance works may have.

Flora included on the Red Data List or within the Flora Protection Order 1999 are cited as conservation concerns within many Natura sites and although only a small number of these are listed on Annex II of the EU Habitats Directive, their presence within a designated site is considered a significant element of the biodiversity and conservation importance of that particular ecosystem. It was noted during the review of the Assessment Forms prepared by the OPW that there was no reference to the locations or susceptibility of these individual flora species to the activities of the OPW drainage maintenance works within Natura sites where they are known to occur. It was therefore considered highly likely that aquatic, riparian and wetland flora could be significantly affected by machinery access and drainage maintenance activity; particularly in channels where works have not taken place for a long period of time i.e. over 10 years.

It was also noted that mitigation mitigation measures for specific conservation interests such as freshwater pearl mussels were not included in the Assessment of Significance reports, particularly where new records of these species have been recorded (e.g. the River Deel at Crossmolina).

It was also concluded that potential impacts on internationally important salmon fisheries were not adequately considered in the OPW assessment, despite works taking place in the
catchments of some of the most important salmon fisheries in the country. However, although the mapping supplied to Ecofact indicated that major fisheries such as the lower Moy were affected, it later emerged that these areas had been included in the mapping due to a technical error. Notwithstanding this however, measures to reduce suspended solids impacts on spawning grounds were not defined in the assessment forms and the location these spawning grounds were also not identified. Likewise, potential suspended solids impacts to lamprey and lamprey spawning grounds were not considered. It was suggested that the suspended solids mitigations outlined by the OPW were insufficient to protect the integrity of river channels within designated Special Areas of Conservation, particularly where sensitive aquatic fauna are listed as the key qualifying interests for these sites.

It was concluded during the review that adherence to steps 1 – 6 of the Environmental Drainage Maintenance Guidance Notes as proposed in the OPW Assessment Forms would offer no protection to lampreys, crayfish, otter, and protected habitats of the SAC. It was considered that such an approach was overall far too simplistic to protect the variety of habitats and species that would be encountered on the many channel types affected by the works.

In the absence of site walkovers by qualified ecologists it was not clear how OPW machinery operators and field staff would identify the locations and susceptibility of Annex II species on-site in advance of works. It also is considered unsatisfactory that recording of such species would be limited to accidental recordings during works, as proposed in the Assessment Forms.

A timescale for work limitation in salmonid spawning channels was provided in the assessment forms supplied. However, a differentiation between salmonid spawning channels and poor quality drainage channels was not been provided. Drainage maintenance works in such channels would result in the destruction of spawning habitats for an Annex II listed species; however, no assessment of the projected loss of such habitats was provided. Lampreys will use the same areas to spawn but the timing of works specified in the assessment forms did not consider lamprey species, despite these being included as the key conservation interests for a number of the designated Natura sites.

It was recommended to OPW that the identification of areas which are important for crayfish and lampreys should be undertaken prior to works commencing. The requirements highlighted by any ecological baseline surveys should also be acknowledged prior to works commencing. It was noted that lampreys are present throughout the entirety of the larger river catchments (i.e. Moy, Boyne and Corrib) and no clear methodology to deal with their removal during works has been proposed. Existing OPW operating procedures require the identification of these species on the bankside during maintenance works; however the feasibility of this has not been substantiated. Both crayfish and lamprey species are afforded the same level of international protection as salmon or otter, however, effective mitigation for these species has not been provided. It was concluded that a derogation licence from the NPWS would be required to remove these species and their habitat.

Likewise, it would seem sensible for otter surveys to be completed prior to machines starting work on site. Such surveys should be undertaken at a suitable time of the year by a qualified ecologist. The desk based ‘Assessment of Significance’ reports did not identify the location of otter activity or otter dwellings other than where this species was mentioned within the site synopsis for a designated site. The avoidance of a holt while carrying out maintenance works upstream and downstream does not constitute best practice for the conservation of this
species, as there are impacts relating to disturbance, severance and habitat loss that affect otters beyond the extent of the holt site. The effectiveness of using OPW operational staff to survey for otters has not been demonstrated and post maintenance surveys would also be required to establish the level of impacts in more detail (OPW, 2007). Impacts on terrestrial mammals (i.e. badgers) and bats were not given any consideration in the Assessment Forms.

Potential hydrological or hydrogeological impacts on raised bogs, fens, or other sensitive wetland habitats were not assessed during the OPW desk study. Also, there was no evaluation of the potential drying out impact of drainage maintenance on these habitats. It was concluded that the OPW do not have any operating procedures in place to mitigate against negative impacts when working in hydrologically sensitive sites, or in sites containing protected terrestrial habitats or flora.

It was also concluded that the impact of placing spoil on existing spoil heaps was not adequately assessed in the OPW Assessment Forms. These spoil heaps are considered to constitute ecologically diverse habitats along many river corridors, supporting both mammal dwellings, as well as diverse calcareous grassland and scrub habitats. The presence of spoil heaps on river banks throughout the country is considered to comprise an aesthetic problem and their removal, where possible, is recommended, either by spreading the material out over riparian land, as referenced in to the OPW document ‘Screening of Natura 2000 sites for impacts of arterial drainage maintenance operations’ (OPW, 2006), or by removing the material off-site.
Recent river enhancement works by the OPW have utilised the rock and stone material in the spoil heaps to recreate habitat and flow diversity within the river channel. This enhancement programme should be rolled out across the country. Continuous adding to these spoil heaps is not considered a sustainable solution where this practice impacts the ecological features of a designated conservation site.

Invasive species present within channel catchments upstream or downstream of designated sites were not identified in the Assessment Forms and therefore it was concluded that the potential for the transfer of invasive species into designated sites was not adequately addressed. Affected channels can act as a vector for the downstream infection of an entire watercourse with ramifications for receptor sites downstream. Maintenance works dislodging substrates, soil or rooting material can greatly increase the rate of downstream colonisation. Movement of machines within sub-catchments can also result in dispersion of an exotic species. In the absence of a baseline assessment by a qualified ecologist it is not clarified how OPW field staff would recognise and mitigate against invasive species encountered onsite. Mitigation measures provided in the Assessment Forms did not reference findings of scientific study to show the ecological benefits of these measures.

4.2 Field survey results

The results of all field survey site visits are presented below for the eight sites selected from the list of SACs and SPAs provided by the OPW. In summary these sites were:

- River Moy SAC
- Lough Corrib SAC/SPA
- Lough Mask/Lough Carra SAC/SPA
- Ballyteigue Burrow SAC/SPA
- Bandon River SAC
- River Finn SAC
- Moneybeg and Clareisland bog SAC
- River Boyne/River Blackwater SAC

A summary of the desk based assessments and the potential impacts identified during the field survey are presented in Table 4.

4.1.1 River Moy SAC/SPA

The site ecologists were escorted throughout the site surveys of the Moy catchment and although no works were ongoing during the site visit the standard practices in the Moy catchment were outlined. Crayfish, lamprey, salmon and otter are all present within this catchment and OPW noted that regular contact is made with the NPWS and the NWRFB prior to works taking place on the watercourses. However, a quality type system here would be useful as there was no way to verify what consultations had taken place and what mitigations had been agreed. The OPW told us that the majority of maintenance works do not extend into the SAC boundary at the request of the NPWS and the NWRFB prior to works taking place on the watercourses. However, a quality type system here would be useful as there was no way to verify what consultations had taken place and what mitigations had been agreed. The OPW told us that the majority of maintenance works do not extend into the SAC boundary at the request of the NPWS, however as this designation is related to an aquatic ecosystem it is considered that the conservation interests of the River Moy i.e. salmon, lamprey, otter and crayfish, are not limited to the borders of the SAC as designated and require adequate protection throughout. It became apparent on the site visit that there were errors in the mapping originally provided. However, this made it impossible for Ecofact to provide independent verification of the areas where machines were working.
According to the OPW, drainage maintenance works within SAC river corridors on the Moy catchment are in the main carried out using weed cutting buckets where vegetation removal is the primary requirement. Drainage maintenance works also require targeted bankside removal of trees on a long term rotation. Ten channel sections were visited during this field survey and are discussed below.

Plate 31 Pollagh River (channel C49) in the Moy catchment. According to the OPW typical channel maintenance in these larger watercourses is limited to tree cutting along the banks. However, removal of silt also occurs affecting lampreys and crayfish.

Blanket bog and fen habitat were noted adjacent to and in the direct vicinity of a number of drains within the Moy catchment (C1/21; C1/30; C1/48/6) while additional channels have been subject to salmonid enhancement works (C1/27; C1/31; C1/30/7; C1/48/f and C1/48/E). Impacts to river banks are considered avoidable within this region but the original drainage scheme resulted in deep river banks and straightened channels. Current works did appear to be limited to tree pruning in most places, this brash is stored back from the bank to allow for the creation of wildlife habitat. It is strongly recommended that the practices encountered in the section of the Moy catchment be written up and adopted as standard throughout the OPW operations nationally. The drainage maintenance works in this catchment show that the OPW is capable of working in close contact with the statutory bodies responsible for the conservation of natural diversity and that the incorporation of ecological mitigations does not impede significantly on the works carried out by the OPW. Enhancement works for salmonids developed in conjunction with the NWRFB is also seen as a positive development and again should be incorporated into the national operations. Drainage maintenance works observed during the site walkover surveys were limited to weed cutting and branch pruning. Low levels of impacts, historical impacts but current level of works in close association with NPWS and NWRFB ensure sensitivity of ongoing works. Impacts to lamprey, crayfish, otter and hydrologically dependant habitats remain in the absence of ongoing pre-works identification and removal/mitigation.

The desk based impact assessment did not allow for the identification of crayfish, lamprey, otter and salmonid spawning habitats within specific channels described above. Works continue in these channels without differentiation between designated conservation sites and non-designated sites. Conservation of salmonid fish is given attention in the Moy catchment due to a close working relationship with the North-western Regional Fisheries Board. However, the measures to protect salmonid fish do not adequately protect additional Annex II species within the SAC site.
Plate 32 River Moy main channel. Tree cutting been carried and removal of silt deposits will be scheduled for bends. This would significantly affect lampreys in this part of the Moy.

Plate 33 Moy Catchment. Channel F/15 36 with emergent vegetation upstream of Mannin Bridge. This high diversity river corridor is a potential site for whorl snails, lampreys, crayfish and otter.

Plate 34 Channel C1/47 tributary stream of River Moy near Swinford, outside SAC but has salmon spawning potential.
4.1.2 Lough Corrib SAC/SPA

In all 21 channels within this SAC were visited during the field study. Baseline ecological conditions observed varied from site to site. The Corrib SAC extends from Lough Corrib to include a number of rivers within the catchment which have an importance for salmon, an Annex II species and one of the primary conservation interests of the designated site.

Sections surveyed included drains at Moycullen (C/32 and C/27). The downstream ends of these drains were assessed where they entered into the Lough Corrib SAC. No works were recorded in the drains at the time of the survey. Channel C/32 was found to be densely overgrown with trees upstream and downstream of Lough Ballyquirke and presented suitable habitat for both salmonid fish, lamprey and otter. Bats and badger were also thought to be likely in the woodland habitat at this location. Wet woodland recorded along the channel may be affected by the drainage maintenance works if the drainage capacity of the channel is increased. The channel C/27 joins Lough Corrib via alkaline fen habitat and this would be potentially impacted by both machinery access and the potential for further drainage of the surrounding lands.

Plate 35 Channel C32, upstream of the Ballyquirke lakes at Moycullen.

Plate 36 Channel C3/8/8, this drainage channel drained agricultural land on two sides but was also directly adjacent to a large section of cutover bog.

The Abbert River (Channel C3/8) was surveyed by the site ecologists. The river was found to have good salmonid spawning habitat with some diverse calcareous grassland occurring along both the banks and the spoil heaps flanking the channel. Evidence of otter activity was
recorded throughout the drainage channels within this catchment. The Cregg River was being maintained by a weed cutting boat at the downstream end near the confluence with Lough Corrib. This boat was operating from upstream of the confluence with the lake to the N84 bridge and was cutting vegetation (primarily bulrush *Scirpus lacustris*) to approximately 1m below the water surface.

Plate 37 Grange catchment (Channel C3/9/8/2) scheduled for maintenance in 2008. It is noted that this channel was developed by the W.R.F.B. in the 1990’s and is a salmon spawning and nursery stream. Crayfish and lampreys are also present.

Plate 38 C3/8/Sect.7 The Abbert River main channel. Drainage maintenance works were scheduled for this channel during 2008. This is an important area for salmon, lampreys, crayfish, otter and floating river vegetation.

The Grange River was examined downstream of Grange Bridge (Channel C3/9/7) after maintenance works during September 2008. This stretch of river contains salmon, brook lamprey, otter, crayfish and floating river vegetation. It is also an angling area for brown trout and previously was known as a minor salmon fishery (see below). Work on this stretch apparently involved vegetation removal using an excavation bucket (rather than a weed cutter). Examination of the river bed and spoil heaps confirmed that river substrate (rocks, cobbles, gravel and silt) had been removed along with instream vegetation (which included stands of floating river vegetation). It can be expected than crayfish and lampreys were also physically removed and deposited on the spoil heaps. It was concluded that this stretch of river is a key example of the damage that ongoing arterial drainage maintenance can have on SAC river corridors. As this is mainly an eroding stretch it is also not clear why regular maintenance is being undertaken here. This stretch of river is well known by the author and originally contained three known grilse / large trout holding pools (one approximately 200m upstream of the bridge, and two located approximately 1km downstream of the bridge).
previous existence of these pools is acknowledged in Peter O’Reilly’ Rivers of Ireland, A Flyfisher’s Guide (O’Reilly, 1991). Although these pools (unlike the nearby Agloragh Ford) survived the original arterial drainage scheme and existed up until the early 1980’s, they were successively degraded by maintenance works since this time (O’Connor, W., pers. observations). The two pools are located downstream of the bridge are located upstream and downstream of a small footbridge. This stretch of the river was apparently skipped during the original scheme. During the late 1980’s the downstream pool was lowered during maintenance operations and a rock cascade area between the two pools was removed to provide bank armouring for the right bank of the pool. This pool was again lowered during maintenance works during the mid 1990’s. Since this time both pools have again been lowered and the upper pool in particular appears to have been affected by the 2008 works. The salmon holding pool upstream of the bridge was lost when the river was lowered during drainage maintenance works in the mid-1980s. This stretch of river is now shallow and has excessive weed growth in summer. Previously water depths prevented such growths. The stretch downstream of the bridge was developed with fisheries features during the late 1980’s and incredibly these features were removed during maintenance works approximately 10 years later. During the development works two small cascades were also removed at the first bend of the river located approximately 300m downstream of the bridge. The changes along this stretch of river over the past 25 years illustrate the ongoing significant effects of arterial drainage maintenance. In the case of this channel it has involved the ongoing physical degradation of stretch of river channel from a locally important salmon fishery to a relatively featureless weed choked channel today (upstream of the bridge in particular).

It is noted however, that development of the Grange River upstream of Castlemoyle during 1990’s, under the TAM (Tourist Angling Measure) which was undertaken by the OPW, significantly improved salmonid habitats in this area of the river. It is contended that such works could be extended to all work areas and opportunities for channel enhancement be taken wherever possible. It is acknowledged that this change is underway with a pilot enhancement programme being undertaken in 2008. It is however recommended that rehabilitation works be undertaken on this particular neglected channel in the future.

![Crayfish remains on the banks of Channel C3/9/12 (River Grange) indicating presence of both this species and otters on the channel.](Plate 39)

At the Cross River weed cutting was being carried out in improved agricultural grassland/drainage channel habitat. This channel was determined to have lamprey and crayfish potential but there was no OPW staff on site monitoring the removal of these species. With the use of the weed cutting bucket limited sediments were removed from the substrate.
The River Nanny (outside the SAC) was also visited during the walkover study. It was noted that maintenance works had been undertaken through Tuam town which included the removal of a berm which had slowly formed over the past 40+ years since the drainage. This was an important nursery area for brook lampreys (Ecofact, unpublished data). This stretch of river had not been maintained since the original scheme. It is noted that within the town fisheries enhancement features were installed in association with the WRFB. However, it is not clear if the large numbers of brook lampreys which occurred in the mill pond in the town (Ecofact, unpublished) were removed prior to infilling.

![Plate 40](image)

**Plate 40** Channel C27 drains an area of improved agricultural grassland and bog, extending through the fen habitat at the margin of Lough Corrib. NW of Moycullen

![Plate 41](image)

**Plate 41** The OPW weed cutting boat is used in the lower sections of the Clare and Cregg Rivers near the confluence with Lough Corrib where there is sufficient draft for the vessel and where weed growth is considered excessive.

The site ecologists were escorted to a number of drainage maintenance channels within the Corrib catchment where the operation of both weed cutting boats and weed cutting buckets were being employed to remove vegetation from the watercourses. It was noted that weed cutting operations posed significantly less risk to both the fauna and vegetation in the river as well as ensuring no further deepening of the channel occurs. The use of a weed bucket also limits the potential for impacts to the channel banks. Weed material is stored at the top of the bank and is left to decompose. This also has the added advantage of reducing the requirement for permanent spoil heaps along river corridors. Drainage maintenance works observed on the site included both weed cutting in the SAC and also evidence of dredging outside of the SAC where recent works had resulted in the disposal of spoil on the river banks. Given the number of channels to be maintained, the diversity of
conservation concerns and the variety of drainage maintenance technologies employed within this SAC it is considered that the conservation interests of the SAC need to be examined on a channel by channel basis. This would then require an assessment of the conservation interests of each channel prior to spoil removal works. Vegetation removal is considered to be a low impact technology and its use is encouraged nationally.

Plate 42 The River Nanny (C3/18) immediately upstream of the Clare River confluence. This is an important area for Brook lampreys.

4.1.3 Lough Mask/Carra SAC/SPA

Channels CM/8/2 and CM/9/1 were found to be heavily encroached. A Molinia meadow habitat was recorded from CM8/2 upstream of Lough Mask which may be impacted by drainage maintenance; however it is proposed to maintain this channel using a weed cutting bucket which would minimise impacts. Channel CM/9/1 was dominated by willow Salix spp and gorse Ulex europeaus on the banks, while common reed Phragmites australis was found to be encroaching within the main channel.

Channel CM5/12 was found to transect Cladium fen habitat at the intersection with Lough Carra. Lough Carra is bordered by common reedmace Typha latifolia and bulrush Schoenoplectus lacustris. Drainage maintenance works affecting the hydrology of this location could potentially have significant negative impacts on this habitat. Habitats in the vicinity of this drain include improved grassland, treelines and scrub.

Channel CM/5/10 had been recently maintained by weed cutting boat or weed cutting bucket. This drain is bordered by diverse wet grassland both sides with tall herb and reed swamp vegetation along the margins. There is alder Alnus glutinosa and willow salix spp. along the bankside.

These channels were found to contain otter potential and also could potentially contain white-clawed crayfish.

4.1.4 Ballyteigue Burrow SAC/SPA

Six channels were surveyed within this SAC. The drainage channels were found to contain some saltmarsh habitat, however in the main these channels were stagnant and highly eutrophic at most locations with dense algal filamentous green algal growth covering the water surface at the majority of locations surveyed in the smaller channels. Duckweed Lemna
sp. was also recorded from the water surface in high densities. The lower end of the drain near Kilmore was potentially receiving inputs from a fish processing plant and water quality appeared severely impacted; however this location was found to receive higher salinity inputs than the other channels. Banks throughout the drainage channels were lined with reed canary grass *Phalaris arundinacea* and common reed *Phragmites australis* while the riparian band of the banks were dominated by bracken, bramble, honeysuckle and gorse. Stands of tall reed swamp were recorded adjacent to the main drainage channel which discharges into the Cull. This section is recognised as comprising a lagoonal ecosystem and is included in the SAC in recognition of this priority Annex I habitat. Kingfisher was also observed within one of the drains.

![Plate 43](Plate 43.jpg)

**Plate 43** Channel CM9/1 in the Lough Mask/Lough Carra SAC. North of L Mask.

![Plate 44](Plate 44.jpg)

**Plate 44** CM5/10 north of Lough Carra had been recently maintained using weed cutting machinery. The vegetation was trapped upstream of a low bridge.

Drainage maintenance works could potentially affect the botanical species composition within the drains and along the drain banks where protected species are expected to occur in conjunction with lagoonal conditions recorded from these channels. Works in the drains may also impact on the lagoonal environment of the main channel within the Ballyteigue Burrow SAC, resulting in either increased drainage of the lagoonal habitat within the drain or impacts on the botanical or faunal communities arising from localised high suspended solids releases or releases of anoxic or contaminated sediments. In addition the activities of heavy machinery may result in the disturbance of bird species for which the SPA is designated, including the removal of, or disturbance to kingfisher nesting and foraging habitat.
No works were underway at any of the channels within this site. Ballyteigue Burrow is designated for a variety of coastal Annex I and priority Annex I habitats, containing a number of rare and protected species of flora. The likelihood of the drainage maintenance works affecting the dune habitats and associated flora within the SAC is considered very low; however there is the potential for lagoonal habitats within the drainage system to be affected by the proposed works, either directly by removal of habitat, or through the release of high levels of suspended solids or anoxic sediments.

The desk based impact assessment did not identify the potential for or locations of rare flora and Annex I saltmarsh habitat within the drainage channels. The kingfisher (Annex I bird species) is also present within the drainage channels and no mitigations are prescribed for the protection of this species.

![The main drain within the Ballyteigue Burrow SAC](image)

### 4.1.5 Bandon River SAC

Four channel sections are proposed for works, three of which are within the SAC. Three of these sections surveyed. The River Bandon was found to contain suitable habitat for salmonid fish, lamprey and otter. Salmonid and lamprey spawning habitat was observed within the study area which comprised drains on the western side of the Bandon River floodplain directly east of Dunmanway Village. The drains were found to be significantly overgrown and flows were considerably reduced. All drains were dominated by silt substrate and the downstream end of the drains in the vicinity of the confluence with the Bandon River is considered to provide suitable lamprey ammocoete habitat, where recruitment may occur from spawning grounds in the Bandon River. No works are proposed in the Bandon River itself and the drains are separated from the river by a flood bund which contains the river on the western bank. Drains C2 and C3 empty into the river downstream of Dunmanway town and a pumphouse which may be part of a sewerage scheme was noted upstream of the confluence of Channel C3 and the river. The drains are likely to be used by otter for commuting and mammal activity was noted throughout these drains in the form of trails through the vegetation. The Long Bridge over the Bandon River is also considered to have bat potential, while Dunmanway Lake was found to be of poor water quality and of limited ecological value.

Potential impacts observed include the release of suspended solids and organic pollutants into the river, impacts to riparian habitats along the river banks should drainage maintenance works extend down to the confluence. Impacts to otter habitat and dwelling along the
riparian margins of the drainage channels are also considered to be possible. The desk based assessment did not identify the ecological status or water quality conditions of the drainage channels adjacent to the Bandon River. The limits of the proposed works were not fully described so it is unclear of the extent of impacts arising within the SAC, whether works within the channels may extend to the banks of the river or whether impacts may arise from suspended solids loading during the maintenance works in the channels upstream of the SAC.

Plate 46 Example of one of the drains within the Bandon River SAC

4.1.6 River Finn SAC

The River Finn (Cannels D16/15/14) was visited when maintenance works were being undertaken on the Swilly Burn; a small tributary of the Foyle estuary. The Swilly is a spate river which rises in the Donegal mountains and joins Lough Swilly below Letterkenny. The area affected by drainage maintenance works is much degraded and appears to be tidal. In assessing impacts on the SAC itself these works are likely to have little effect on the site itself as there would not be a significant interaction. However it is noted that the assessment form completed for the site does not seem to assess any of the potential impacts of works on this site and provides an extended list of generic, non-specific and in many cases irrelevant mitigation measures.

Plate 47 Channelised section of the Swilly Burn River (Foyle tributary). This area is not within the SAC.

The River Foyle in this area is a tidal river which naturally has a very high level of background suspended solids levels. Neither the Foyle itself nor the affected area of the Swilly Burn would be an area used by salmon or lampreys for spawning purposes. It is
possible however that the affected area is being used by smelt (*Osmerus eperlanus*) and/or river lampreys. No mitigation measures for these species were considered in the assessment form.

### 4.1.7 Moneybeg and Clare Island SAC

Channels surveyed included C/60 and C/60/1. C/60 flows through mixed broadleaved woodland and is over 100m from the bog, separated by a road and wet grassland habitat. Japanese knotweed was noted in the vicinity of the drain and it is considered important that this does not enter the watercourse. Wet alder/birch/ash woodland along the drain in the townland of Ross is currently flooded and could potentially be drained by channel maintenance works. Impacts to the bog itself were considered unlikely. Section C60/1 was found to have already worked with vegetation and some substrate removed from the channel. The channel has a silt substrate and lamprey were considered likely to occur, however, none were noted in the spoil. This section is adjacent to the wet woodland and borders the SAC boundary to the west. No evidence of increased drainage of the SAC was noted. Both drains could potentially be used by otter for commuting, although no signs or dwellings were recorded from the locations visited. The conservation interests of the site were found to be unaffected by the works at this location, however future works should be limited to weed cutting to avoid deepening the channel and draining the SAC directly adjacent to C60/1. Should spoil removal be required it is recommended that the channel is surveyed for lamprey. The desk based assessment did not establish the potential for lamprey, crayfish or otter in the channel and neither did it provide information on the significance of drainage works on the peatland and wet woodland habitat in the vicinity of the drains.

**Plate 48** The Yellow River (Boyne tributary). It is clear that increased nutrient loading also plays a role in the excessive macrophyte growth on some rivers. However, maintenance works which can reduce water depths, increase stream widths and prevent the establishment of canopy can exasperate the problem. Nonetheless, this site holds salmon, brook lamprey, crayfish and otter.

### 4.1.8 River Boyne and River Blackwater SAC

Works in the Boyne and Blackwater SAC were visited with OPW staff during September 2008. It was noted that no works were being undertaken within the SAC at the time of the site visit. However, the maps supplied for OPW indicated that extensive works were proposed for within the SAC. In this respect the likely impact of works within the SAC is impossible to assess. One of the sites visited included the upper reaches of the River Boyne immediately upstream of the SAC boundary at Ballyboggan Bridge / Russellwood. Works were ongoing at this site when visited and it was apparent that the affected stretch of river had not been
maintained in some time, possibly since the actual arterial drainage scheme had been completed. The channel was quite overgrown with riparian trees and vegetation and this cover was being completely cleared on alternate banks by the machine. The berm on the river was also being fully removed to restore a trapezoidal shape with an increase in base width of approximately 1/3 of the river. There was no evidence that any mitigation measures for protecting lampreys, crayfish or otters were being undertaken on the site and all three species were considered to be present. A water rail was observed to be disturbed during the works. Excavation works were resulting in a steep unstable bank with potential for further erosion into downstream areas. It was considered that the extent of works being undertaken was unnecessary and had the potential to have significant adverse impacts on the river corridor.

The works were considered to be particularly detrimental to the wildlife of the river corridor as it was clear that there had been a significant interval since the last time any such works were undertaken in the area. The scale of the works should have required a pre-works EcIA to have been prepared. However, the conclusions of the ecologists were disputed by the OPW on-site and it is noted that this area is outside of the SAC and within a statutory drainage channel.

Plate 49 Upper River Boyne at Russellswood (outside the SAC). Banks in this area have been destabilised as a result of the 2008 maintenance works. The OPW’s ‘EDM’ approach was clearly not being adhered to at this site.

Plate 26 Upper River Boyne at Ballyboggan Bridge post-works (outside the SAC).
Table 4 Summary of 2008 assessment of arterial drainage maintenance works programme affecting natura sites.

<table>
<thead>
<tr>
<th>Site Name</th>
<th>SAC</th>
<th>SPA</th>
<th>Conservation interests of site</th>
<th>OPW Desk based impact assessment results</th>
<th>OPW Assessment based on field survey</th>
<th>Adequacy of proposed mitigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Moy</td>
<td>✓</td>
<td></td>
<td>Annex I habitats raised bog and wet woodland, Annex II species salmon, lamprey, otter, white clawed crayfish and flora listed on the FPO</td>
<td>No significant impact</td>
<td>Likelihood of impacts to otter, crayfish and lamprey during instream works. Flora listed on the FPO would not be identified by the machinery operators</td>
<td>Proposed mitigations utilising weed buckets will lessen impacts, however the location of protected species is not identified and therefore mitigations are not enacted on site.</td>
</tr>
<tr>
<td>Lough Corrib</td>
<td>✓</td>
<td>✓</td>
<td>14 Annex I habitats, salmon, otter, lamprey, white clawed crayfish, freshwater pearl mussel, wintering wildfowl and flora listed on the FPO</td>
<td>No significant impact</td>
<td>Likelihood of impacts to otter, crayfish and lamprey during instream works. Flora listed on the FPO would not be identified by the machinery operators</td>
<td>Mitigation measures proposed do not allow for the proper protection of Annex II fauna in the channels, particularly crayfish. Locations of protected species are unknown therefore mitigations are not enacted on site. However use of weed buckets is considered to lessen impact.</td>
</tr>
<tr>
<td>River Finn</td>
<td>✓</td>
<td></td>
<td>Blanket bog, heath, mire, salmon, otter smelt, lamprey and arctic char</td>
<td>No significant impact</td>
<td>Likelihood of impacts to otter, smelt, and lampreys during instream works.</td>
<td>No specific measures proposed to protect local potential conservation inliers. However, works are in general outside the SAC.</td>
</tr>
<tr>
<td>Ballyteigue Burrow</td>
<td>✓</td>
<td>✓</td>
<td>Priority Annex I dune habitats, saltmarsh, lagoon flora, flora listed on the FPO and wintering wildfowl</td>
<td>No significant impact</td>
<td>Potential impacts to grey dunes and wet land habitat due to drainage. Significant potential for removal of flora within drains or occurring on banks not identified by machinery operators.</td>
<td>The presence of protected flora or the potential for drainage of priority Annex I dune habitats was not identified. There are no current mitigations to protect FPO flora within the drains.</td>
</tr>
<tr>
<td>River Boyne and Blackwater</td>
<td>✓</td>
<td></td>
<td>Annex I fen habitats, salmon, lamprey, crayfish, and otter</td>
<td>No significant impact</td>
<td>Likelihood of impacts to otter, crayfish, salmon and lamprey during instream works within the main channel.</td>
<td>No works observed within the SAC, however mitigations do not adequately allow for the protection of Annex II fauna recorded from the proposed works area.</td>
</tr>
<tr>
<td>Lough Mask and Lough</td>
<td>✓</td>
<td>✓</td>
<td>Annex I wetland and aquatic</td>
<td>No significant impact</td>
<td>Likelihood of impacts to otter</td>
<td>Impacts to Annex II fauna will require</td>
</tr>
<tr>
<td>Site Name</td>
<td>SAC</td>
<td>SPA</td>
<td>Conservation interests of site</td>
<td>OPW Desk based impact assessment results</td>
<td>OPW based on field survey</td>
<td>Adequacy of proposed mitigations</td>
</tr>
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<td>----------------------------------</td>
</tr>
<tr>
<td>Carra</td>
<td>0</td>
<td>0</td>
<td>habitats, crayfish and lamprey during instream works. Potential drainage of wetland/fen habitats. Flora listed on the FPO would not be identified by the machinery operators.</td>
<td>Adequacy of proposed mitigations as these occur throughout the site and the locations of works will require pre-works survey for removal. Mitigations do not allow for the prevention of drainage of fen habitat.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandon River</td>
<td>✓</td>
<td>0</td>
<td>Alluvial woodland, floating river vegetation, salmon, otter, lamprey and freshwater pearl mussel</td>
<td>No significant impact</td>
<td>Release of suspended solids from drainage works could affect the fauna in the river. Any works within the river itself would impact on floating river vegetation and possibly alluvial woodland.</td>
<td></td>
</tr>
<tr>
<td>Moneybeg and Clare Island</td>
<td>✓</td>
<td>0</td>
<td>Active raised bog with semi-natural habitats</td>
<td>No significant impact</td>
<td>Potential for drainage impact to active raised bog, additional potential for impacts to wet woodland and semi</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No works noted on site, however mitigations did not identify the proximity of the drains to the bog or the presence of wet woodland near the works area.</td>
</tr>
</tbody>
</table>
4.3 Evaluation of OPW ‘Assessment of Significance’ methodology

4.3.2 Existing OPW assessment methodology

The OPW methodology was based on prescribing generic mitigations across the spectrum of designated sites.

It was found that a site specific desk study for each site was lacking and in the absence of a site walkover within the conservation site, there was no data gathered or published data utilised to enable a robust assessment of the potential impacts on the conservation interests of the sites, thereby rendering any assessment of significance impossible.

4.3.2 Article 6 Screening Assessment/Test of Significance

As the significance of impact arising from drainage maintenance works within Natura sites could not be quantified from a desk study, and given the potential for significant impacts to Annex I habitats and Annex II species within these conservation sites it was considered that an Article 6 Assessment be carried out on a site by site basis for works in designated Natura 2000 sites. This assessment stage examines whether or not likely effects of drainage maintenance works upon a Natura 2000 site will be significant.

The screening process for drainage maintenance works in each designated site should follow the matrix outlined in the EC Environment DG (2001) report. The headings to be covered by this matrix are outlined below and are discussed further in the following text.

- Brief description of the project or plan
- Brief description of the Natura 2000 site

4.3.2.1 Assessment criteria

Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.

Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of:

- size and scale;
- land-take;
- distance from the Natura 2000 site or key features of the site;
- resource requirements (water abstraction etc.);
- emissions (disposal to land, water or air);
- excavation requirements;
- transportation requirements;
- duration of construction, operation, decommissioning, etc.;
- other.

Describe any likely changes to the site arising as a result of:

- reduction of habitat area;
- disturbance to key species;
- habitat or species fragmentation;
- reduction in species density;
- changes in key indicators of conservation value (water quality etc.);
- climate change.

Describe any likely impacts on the Natura 2000 site as a whole in terms of:
- interference with the key relationships that define the structure of the site; 
- interference with key relationships that define the function of the site.

Provide indicators of significance as a result of the identification of effects set out above in terms of:
- loss;
- fragmentation;
- disruption;
- disturbance;
- change to key elements of the site (e.g. water quality etc.).

Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.

4.3.2.2 Screening process

The opinion of the consulting ecologists was that there was not enough data provided in the OPW 'Assessment of Significance' forms to allow a true assessment of significance appraisal. Significant impacts were assessed as being likely for all eight sites surveyed and based on this data, impacts were assessed as being likely for all 50 SAC sites assessed in this report.

It is therefore recommended that the formula outlined in Article 6 be followed to the next stage where an Appropriate Assessment of drainage maintenance works for every Natura Site be undertaken to evaluate the significance of impacts of drainage maintenance works on the key conservation interests of each individual site. It is not considered sufficient that the OPW prepare conservation reports for individual species or habitats at a national level, where severity of impacts can vary widely between conservation sites.

Following further study should impacts be assessed as being not significant or should reasons of overriding public interest be invoked to progress works within designated sites there is the obligation for compensation works for any deterioration in the status of the conservation interests of the site. It is recommended that this be built into the current operating procedures of the OPW.

4.4 Review of potential impacts affecting Natura sites

Impacts resulting from the proposed works have been assessed based on the baseline surveys carried out by Ecofact staff. Identified impacts have been compared to the details provided in the OPW ‘Assessment of Significance’ forms provided by the OPW as a desk study exercise for each site. This serves to identify accuracy or shortfalls in utilising a desk based assessment to identify the significance of impacts of drainage maintenance operations within designated sites.
4.4.1 Annex I Habitats

The following potential impacts have been highlighted in relation to works in drainage channels:

- Loss of or damage to protected Annex I habitat and to general habitats utilised by bird species and mammals, within SACs and SPAs.
- Direct impacts on Annex I bird species and Annex II species.
- Direct impacts on communities within the watercourse while the removal of bankside vegetation will affect the riparian habitat.
- The dumping of spoil adjacent to the channel can alter the bankside habitat.
- Machine access to channels can directly impact on habitats along the route chosen.
- Machinery working in or adjacent to the drainage channels could potentially result in the accidental spillage or leakage of fuels, oils or lubricants into the watercourses which drain into the SAC. This would have significant negative impacts on the water quality of the SAC.
- Alteration in water levels in the SAC resulting from drainage works around the site could potentially affect the distribution of fen and wet grassland habitats dependent on a flooding regime.
- Machinery within the works site could potentially import non-native invasive species into the SAC/SPA, or exacerbate the spread of existing invasive species that may be within the SAC/SPA. Non-native invasive species can potentially colonise large areas either in the terrestrial or aquatic environment and in many instances can outcompete native flora and/or fauna resulting in a reduction in biodiversity and in the case of designated conservation sites, a loss of some of the key qualifying interests such as individual species, or entire habitats. Some of the most common non-native invasive species include Japanese knotweed, Himalayan balsam, giant hogweed, rhododendron, zebra mussels, water fern, curly-leaved waterweed and Nuttall’s pondweed.

4.4.2 Fauna

Some of the SACs in this report contain important populations of Annex II fauna including lamprey species, white clawed crayfish, Atlantic salmon and otter. Increased human activity within the site, the presence of machinery working on the arterial drains and the removal of existing substrate features that provide cover/refuges for aquatic species may have a direct negative potential impact. There is potential for the loss of otter dwellings (holts) that may be present in or directly adjacent to the drains, similar impacts could potentially affect kingfisher populations within these riparian habitats. Other potential impacts identified include the following:

- Removal of silt material would have significant impacts on the juvenile (ammocete) lamprey populations in these watercourses/drains if present.
- Dredging works in the channel could potentially result in the release of high levels of suspended solids into the watercourses of the subject SACs/SPAs. This would in turn affect both the botanical and faunal diversity of the site, smothering plants with silt and affecting light entering the water. Increased suspended solids can also affect the gills of both macroinvertebrates and fish, resulting in significant negative impacts, particularly to salmon.
- Tree clearance along the banks of arterial drains could have significant impacts on foraging and commuting routes for bats if present on the site. Disturbance from large
machinery traffic, any ground works or forest clearance could potentially affect the viability of bat roost present on the SAC/SPA sites, especially at dusk.

- Storage of dredged material and cleared vegetation could potentially result in the release of high suspended solids loads back into the drainage channels, should the material not be appropriately stored.

Such impacts of arterial drainage maintenance may be short term, but regular maintenance means there would be a continual occurrence. Certain plants, invertebrates and other animals will not survive or thrive with continual maintenance disturbance.

### 4.5 Existing mitigation measures in place by the OPW

The screening report prepared by the OPW in 2005 (Gilligan, 2005) identified four areas of policy to be adopted by the OPW. These aimed to mitigate many of the direct ecological impacts of maintenance works;

- Environmental Drainage Maintenance Programme
- Annual Works Programme to accommodate spawning
- Fishery habitat enhancement
- Upgraded excavator fleet

These mitigation measures go some way to mitigating the potential impacts to designated conservation sites, however, there are no site specific mitigations detailed in this policies. In addition, further mitigations are required for Annex II listed species not protected under these policies.

#### 4.5.1 Environmental Drainage Maintenance Programme

The OPW Drainage Division, in partnership with the Regional and Central Fisheries Boards (CFB) has established an Environmental Drainage Maintenance (EDM) programme (CFB 2001). Following on from the results of this study, ten environmentally sensitive alterations to work practices were recommended for adoption. They range from leaving banks untouched, managing trees and vegetation and the timely tossing of spawning gravels to enhance salmonid spawning habitat. This study specifically highlighted that in leaving one bank untouched during maintenance the ecological impact to both flora and fauna within the drain can be lessened. These measures go some way to improving the environmental impact of the OPW works within designated conservation sites. However, it is considered by Ecofact that this approach is too simplistic to protect all the conservation interests present in such a wide variety of channel types. However, it would have application in a number of areas although it is too focused on protecting salmonids.

The primary results of this study found that dredging operations resulted in changes in population structure at three of the monitored sites; while two sites were considerably deepened by dredging maintenance and finally contained larger numbers of older fish than prior to the drainage scheme. The opposite effect was found to have taken place at a site, which became shallower as a result of drainage works, and contained larger numbers of fry at the end of the survey. Some channels have been excavated beyond the design level in the original arterial drainage works while others have become enlarged, relative to design, due to successive maintenance operations (CFB, 2001).
River channels were found to be impacted with regard to population dynamics with higher numbers of smaller, younger fish and a decrease in older larger fish, these impacts lasted for over 4 years to the next maintenance cycle. The most stable fish populations were found to reflect locations where the least habitat clearance had taken place.

With regard to impacts to the aquatic environment, i.e. the habitat requirements for salmonid fish, impacts on aquatic vegetation were severe. Replacement of stone and rock from spoil heaps back into the river for fisheries enhancement works was found to be a positive benefit, also the digging of pools to create habitat diversity was found to encourage larger trout populations, while not affecting river flow levels.

The CFB made recommendations for loosening of bed gravels. However, these measures are not recommended where crayfish, lamprey or freshwater pearl mussel are located in the channel. CFB recommendations made in the 2001 ‘Environmental Drainage Maintenance Programme’ regarding OPW operations that could be ‘evolved’ to reduce impacts have been introduced at some locations but in the main have not been adopted.

4.5.2 Annual works programme to accommodate spawning

The OPW Drainage Regions and relevant Fisheries Boards discuss and revise the annual works programme to accommodate the timing of works in spawning drainage channels in relation to salmonid species. Further discussions with the CFB and the NPWS is required to take account of additional protected species including freshwater pearl mussel, white-clawed crayfish and lamprey species.

4.5.3 Fishery habitat enhancement

The Fisheries Boards liaise with the OPW operational staff to co-ordinate operations on the ground, to benefit fish stocks. This could involve the timely construction of in-channel fishery improvements or the removal of existing stock by electro-fishing, where works could impact on the same. The liaison with the Fisheries Board in relation to salmon (an annex II species) should be considered as a blueprint for the requirement to provide protected for additional Annex II species such as lamprey, crayfish and whorl snails.

Since 2003, OPW has rolled out a new training protocol for its field staff, including excavator drivers. This protocol incorporates a series of strategies designed to incorporate environmentally-sensitive work practises. Of relevance to juvenile lamprey is the procedure whereby maintenance is done from one bank and the non-working bank slope habitat and water’s edge area are to be left untouched. This should serve to leave intact areas of sediment, even though areas on the working side may be removed. However, Ecofact considers that this approach is unacceptable as it would result in the loss of up to 50% of the lampreys and lamprey habitat along a stretch of river. Subsequent work on the alternative bank during the next maintenance schedule a few years later could result in a loss of lampreys from the affected stretch. Such impacts would be particularly severe on sea lampreys which are not at favourable conservation status on most of the rivers where they occur so loss of even individual ammocoetes may be of significance to the populations.

4.5.4 Upgraded excavator fleet

Traditional maintenance utilised dragline excavators which had a number of environmentally related disadvantages. The introduction of a hydraulic excavator fleet began in the mid 1990’s
and was completed in 1999. These excavators replaced the draglines and eliminated many of the disadvantages associated with the older technology.

The OPW maintain that the excavators used on site are appropriate for the ground conditions and offer a high level of control to the drivers. Therefore a more selective approach to material removal can be implemented including the ability to alter the channel profile if desirable (Ryan 2006).

4.6 Recommended mitigation measures

It is recommended that the OPW assign a hierarchy to each individual channel in the country based on its flood risk management and biodiversity priority. Channels which fall under the category ‘drainage channels’ could be managed in the future in a similar way as described in ‘The Drainage Channel Biodiversity Manual’ (Buisson et al., 2008). There seems little reason why all the elements in this manual could not be adopted in an Irish context. This manual requires a pre-works ecological assessment.

OPW (2007) states that “statutory drainage maintenance operations are an ongoing activity across the state and overlap with many European Sites to varying degrees, resulting in a possible requirement for multiple environmental assessments”. The authors of the current report believe that there will indeed be a need for such multiple assessments in the future if OPW is to meet its statutory environmental responsibilities in a similar way as, for example, local authorities have to meet similar environmental obligations for their activities many of which (i.e. operation of Waste Water Treatment Plants, hedge cutting along roads) were operational prior to the enactment of the EU Habitats Directive and other environmental legislation (i.e. Phosphorous Regulations; Wildlife Act, 2000) but nonetheless have to comply with such legislation. Ecological walkover surveys will be essential to establish presence of protected species or habitats within the affected areas in advance of works. This will establish the presence of otter holts, lamprey ammoecetes in silt beds, salmonid spawning beds, kingfisher holes, crayfish, freshwater pearl mussel, or wetland dependant habitats. Additional ecological data relating to protected species such as bats and badgers can also be gathered during these surveys. This data will provide a baseline for mitigation works required when working in channels either in or adjacent to designated conservation sites, which contain or directly affect protected species.

Determination for the requirement of drainage maintenance would significantly reduce disturbance and impacts instream where there is no immediate requirement for maintenance. The installation of an assessment procedure for this is recommended. Ongoing maintenance has been found to result in the widening of the channels, and deepening in some instances. However, wider channels become shallower and are more susceptible to prolific weed growth, increasing the cycle of maintenance (CFB, 2001).

Fisheries enhancement works as demonstrated on the Moy catchment has been successfully carried out as a result of close collaboration with both the fisheries boards and NPWS. It is considered that the enhancement works have had a significant benefit to salmonid stocks in this catchment and should be utilised as a model of good practice for deployment at a national level. There are issues with the existing enhancement scheme with regard to the focus on salmonids, whereas Annex II species lamprey and crayfish also require mitigations and habitat rehabilitation. Enhancement works for salmon should not be to the detriment of these equally protected species.
It is clear that a good deal of consultation takes place on the ground and informally between the OPW and NPWS/fisheries boards. It is recommended that a formal and quality controlled system be set up to manage record and implement the outcome of such consultation. The current system where 3 weeks’ notice is given to local NPWS staff is inadequate.

A detailed hydrological and hydrogeological assessment is recommended for raised bog and wetland habitats such as alkaline fen, peat depressions or riparian woodland to establish the impact of the proposed drainage works on the Annex I habitats occurring within the footprint of, or connected to the proposed works by the existing hydrology at this site. These Annex I habitats require conservation and the most significant impacts would result from the alteration of the water levels upon which they are dependant.

Drainage maintenance works are expected to directly affect the Annex I habitats such as fen and bog. Suitable mitigation is required to allow for the retention of groundwater flows and wetland conditions within these SACs/SPAs, while also providing for the effective drainage of surrounding lands within the remit of the OPW. This may require further assessment of the character of the SAC and the drainage requirements at this location, potentially requiring a full hydrological assessment of the site should it be considered that the proposed works could affect the favourable conservation status of the conservation interests of the sites in question.

Appropriate fencing is required on-site to avoid unnecessary trampling or damage to sensitive habitats adjacent to the works area. Machinery will be limited to the works area and the footprint of the required works.

During maintenance works, the SAC river corridors should be protected by the provision of runoff control and attenuation measures (i.e. temporary silt fences).

All necessary measures need to be taken to minimise the generation and release of silt and other pollutants from the proposed works area. Excavation works should be carried out during drier months and halted during heavy rainfall to reduce suspended solids entering the SAC and/or SPA.

All machinery including boats, engines, dredgers and personal equipment must be disinfected and appropriately cleaned (i.e. pressure or steam washing) prior to entering any watercourse, drainage ditch or accessing land from one drainage ditch to another; in order to limit the spread or introduction of invasive non native species. The OPW has standard operating procedures in place for the cleaning protocols. However, again a recorded quality controlled procedure is required here.

Specific mitigation measures are required to be in place for the removal, treatment and management of invasive species should they be encountered within drainage channels or upon the banks. The presence of non-native species within a work area should be identified prior to machines entering a site.

Under the provisions of the Wildlife Act (1976, amendment 2000), no removal of trees, scrub, fen or reed-bed habitat should be carried out during the bird breeding season; unless written permission is obtained from the NPWS.

A survey of all channel banks is required to establish the level of otter activity within the proposed works area and to identify holts that may be impacted by the proposed works. This
survey should be undertaken by a qualified ecologist prior to works commencing. No works should be allowed within 50m of an active breeding holt. It is an offence to damage or destroy an otter holt without a derogation licence issued by the Department of the Environment.

The felling of any mature trees requires prior assessment by a qualified ecologist to ensure that no bats are roosting in cracks or crevices. All mature trees felled or cleared should be left on the ground for over 24 hours in order to allow bats contained within to escape. The NRA publication ‘Guidelines for the treatment of bats during the construction of national road schemes’ provides useful guidance on the treatment of bats when felling mature trees. Particular care needs to be taken when working near mature trees in order to protect roots extending into the works site. Where possible mature trees, scrub and hedgerow should be retained, with only the minimum required width for machinery to operate safely removed. This shall take cognisance of flood risk and flood relief requirements in specific channels.

All e sites should be examined prior to maintenance works by a qualified ecologist to determine the presence of Annex II species within the watercourse including freshwater pearl mussel, white-clawed crayfish or lamprey species. These protected species will require removal from the impact area prior to dredging and any populations retained downstream of the works require additional mitigations to ensure the viability of these populations. The NPWS should be consulted prior to works taking place in order to agree upon a methodology for the removal and protection of Annex II species within these designated sites.

Dredge spoil and removed vegetation material should be stored no less than 5m back from the dredged channel and vegetation within this 5m buffer zone is to be retained, in order to reduce the run-off of suspended solids back into the water course. This may require on-site supervision where the habitats bordering the drainage channel comprise protected Annex I habitat.

Where drainage works are being carried out in a previously unmodified channel, dredge spoil should not be deposited in a linear form along the bank of the channel. This is particularly relevant to works within designated conservation sites. A qualified ecologist is required to carry out an on-site assessment to aid in the selection of disposal sites of low ecological importance. Dredged material should not be dumped directly onto existing spoil heaps, as these have become features of the surrounding environment and in many cases support good examples of semi-natural habitat, providing cover and shelter for mammals and avifauna. A restoration plan for these spoil heaps should now be drawn up in the interests of conservation and aesthetics.

The original arterial drainage schemes within the catchment of habitats containing Annex I habitats and Annex II species are likely have had some detrimental impact on these habitats and species either directly or indirectly. However all SAC and/or SPA sites containing conservation aspects were designated post completion of arterial drainage schemes. Therefore their ecological quality was adequate to designate as an SAC/SPA with the arterial drains in place. Special Areas of Conservation and Special Protection Areas are not designated on their potential value. The purpose of SAC/SPA designation is to maintain (and possibly enhance) the sites ecological quality.
5 CONCLUSIONS

The current approach to providing an EcIA for OPW works on Natura sites involved the selection of a subset of sites (ca. 15%) for ecological assessment involving both a desk study and field site walkover with an overall desk based appraisal for the rest of the sites. It is considered that although detailed information can be gained for this subset of sites, some of which will be useful in the further assessment of sites not surveyed, this approach does not constitute an EcIA for all sites, neither does it allow for a scientific assessment of the potential impacts to the favourable conservation status of Natura sites or the habitats or species for which they are designated.

As previously stated in this report, the following criteria are used by the NPWS in selecting Natura sites (NPWS websites):

- Importance of the site in terms of the habitats and species it supports
- Degree of representation of a habitat or habitats within a site to enhance, conserve and preserve habitat diversity
- Extent of isolation of the population
- Degree of destruction, if any, that has occurred on site
- Geographic distribution, frequency and distribution of habitats and/or protected and rare species, presence of a priority habitat and the presence of a habitat or species

It is therefore clear that impacts affecting these selection criteria will negatively impact on the conservation status of these Natura sites. Based on these criteria it can be seen that drainage maintenance works have potential to significantly impact on SAC and SPA sites, affecting the habitat and species the site supports; the conservation and preservation of the diversity of the site; the isolation of the population on the site (increasing connectivity or in some instances fragmenting habitat); impacting on the integrity of the site and potentially affecting the geographic distribution of species and habitats by altering the environment upon which they rely.

Plate 50 The Tonmoyle Stream (C3/26) (Clare catchment) scheduled for maintenance in 2008 contained salmon, brown trout, white-clawed crayfish, and brook lamprey. It also drained a raised bog, and fen with whorl snail potential. This is not widely appreciated to be a stream that would be important to salmon, for example, and highlights the need for pre-work ecological assessment by a professionally qualified ecologist within all areas scheduled for maintenance.
Given the extent of drainage maintenance work proposed within Natura sites for the 2008 programme, the current ‘Assessment of Significance’ for these sites and the desk study behind these assessments would be considered to be insufficient, in terms of the obligation to provide an appropriate assessment for works that may result in significant impacts to the conservation aspects of a Natura site. The ‘Assessment of Significance’ evaluations are not considered to contain sufficient data or scientific evidence by which an accurate assessment could be made.

From the Article 6 assessment of significance, as outlined in Appendix 4, it can be seen that the screening phase does not include sufficient data at a baseline level and will require further assessment to quantify the significance of impact of drainage maintenance works within these designated Natura sites.

The size and scale of the works proposed have not been adequately described for any site and the location of the key conservation interests of the site in relation to the works have not been defined. This is particularly relevant for SPA sites where no reference is made to birds of conservation importance in the impact assessment (bar references to kingfisher), or in the mitigation measures (where no measures relating to birds are proposed). No mention is made in relation to waterfowl, migratory or wintering birds in these assessments.

Plate 51 Brook lamprey Lampeutra planeri, hatchling white-clawed crayfish Austropotamobius pallipes, and the Angler’s mayfly Ephemer a danica mayfly. These three species are particularly vulnerable to drainage maintenance as they live in lateral silt deposits on rivers.

In these SPA assessment forms it is stated that the location and extent of the conservation interests of the site are not known and the proximity of these bird populations to the works is not known. It is considered impossible to make an assessment on the level of impact with the absence of this data. It is also worth noting that many of these SPA sites are also designated as SAC sites and the Annex I bird species and birds of conservation importance

The extent of the works, duration and other features of the proposed works has also been omitted. Potential changes to the site as a result of reduction of habitat area, disturbance to key species, habitat or species fragmentation, reduction in species densities, and potential changes in key indicators of conservation value have not been described.

Moreover, likely impacts on the Natura 2000 site as a whole in terms of (a) potential interference with the key relationships that define the structure of the site, and (b) possible interference with key relationships that define the function of the site, have not been addressed.
There is clearly potential for significant negative impacts on the Natura sites as a result of the proposed works on their own, or in combination with other projects, and it is considered that an appropriate assessment should be required for many of the sites (as required by the EU Habitats Directive (Council Directive 92/43/EEC)). This will be confirmed following the field exercise where ecological baseline conditions will be assessed.

The OPW’s current screening approach (OPW 2007) assigns a weighting to the potential impacts incurred by each conservation aspect recorded from conservation sites based on their sensitivity to impacts from drainage maintenance works. Habitats and species deemed to be significantly affected by drainage maintenance works are attributed a Category I status, while those aspects considered unlikely to be affected by the OPW operations are attributed Category III status. Although this methodology allows for an identification of the individual conservation aspects and the potential for an EcIA for each aspect, it does not provide a format for the assessment of the overall impacts to the SAC/SPA, which is considered to constitute an ecosystem. The concept of ecology is holistic; the relationships between environment, habitat, flora and fauna provide the basis for the continuing favourable status of all conservation interests.

Other comments in relation to the OPW assessments contained in the ‘Assessment of Significance’ evaluation forms are as follows:-

There is a clear need for a comprehensive desk study, wider consultation, along with advance ecological survey work on all the affected channels.

Although the website www.npws.ie is listed as an information source, there is no evidence that data from the website was utilised. Up to date conservation interests for the site are not included in table (i.e. Pearl Mussels in the River Deel near Crossmolina). No specific mitigation measures for protecting Pearl Mussels are included in the relevant Natura site assessment forms.

At no point do the assessment forms for coastal or estuarine sites make reference to this environment or to the potential for differing ecological requirements or conditions to occur at these sites. No mitigation measures reflecting the requirements of these habitats are proposed.

Potential impacts on internationally important salmon fisheries have not been considered for drainage works on new channels such as the River Boyne, the River Moy or the River Bandon.

Adherence to steps 1 – 6 of the Environmental Drainage Maintenance Guidance Notes offers no protection to lampreys, crayfish, otter, and protected habitats of the SAC. It is not clear how OPW operational staff on-site would locate and identify the Annex II species expected to occur within these sites. These species include otter, lamprey, crayfish, pearl mussel, whorl snail, marsh fritillary butterfly and the young of these species. It also is considered unsatisfactory that recording of such species would be limited to accidental recordings during works.

A timescale for work limitation in salmonid spawning channels has been provided in some assessments. However, the location of these channels has not been determined. Work in such channels would also result in the destruction of spawning habitats for an Annex II listed species but no assessment on the protection loss of such habitats has been provided.
Lampreys will use the same areas to spawn but the timing of works has not considered lamprey species.

The identification of areas which are important for crayfish and lampreys should be undertaken prior to works commencing. The requirement of any baseline surveys should also be acknowledged prior to works commencing.

Lampreys are present continuously along the entire catchments of the River Moy, the River Boyne, are extensive in the Corrib catchment and in many other catchments throughout the country. Despite this no clear method to deal with their removal during works has been proposed. Likewise, it would seem sensible for otter surveys to be completed prior to machines starting work on site. Such surveys should be undertaken at a suitable time of the year by a qualified ecologist.

The absence of an EcIA for lampreys and crayfish does not provide an opportunity for not protecting these species. Loosening of gravels in salmonid spawning areas could potentially have negative effects on lampreys.

Potential hydrological impacts on raised bogs or other sensitive habitats should be assessed by suitably qualified personnel.

Measures to reduce suspended solids impacts on spawning grounds have not been defined and the location these spawning grounds have not been identified.

The impact of placing spoil on existing spoil heaps has not been adequately assessed. The impact assessments make no reference to the disposal of contaminated or anoxic sediments on the banks. The presence of anoxic sediments is considered likely in many of the coastal and estuarine Natura sites, as well as in sites where there is high organic pollution inputs.

Invasive species known to be present within waterbodies and watercourses have not been identified in this assessment, while mitigation is left to measures following the discovery of these species on site. It is not clear how OPW operations staff will identify non-native, invasive species within these sites.

The requirement for works at these Natura sites has not been stated for the individual sites concerned. The flood risk and flood relief requirements have not been outlined. It is not clear whether maintenance works at individual sites has been assessed on the ground or whether this judgement is based on a maintenance rotation cycle. It is considered that in some instances the initial drainage maintenance works are no longer required for the prevention of flooding, as is the remit of the OPW, and that the requirement for the works should be considered, or weighted against the potential negative impacts to the designated conservation site. In sites where there is no flooding risk affecting human health or reasons of overriding public interest, then the works should not proceed.

From another viewpoint it is clear that significant positive impacts to Annex I habitats and Annex II species would be gained through the abandonment of drainage maintenance works within specific designated conservation sites. This would allow the recolonisation of the drains, reducing the potential for drying of surrounding habitats and allowing the recovery of protected habitats and species affected by drainage maintenance works which occur within SAC designated for the conservation of these species. The feasibility of this would be reliant on an OPW study to assess the requirement for drainage maintenance works on a channel by
channel basis to establish which channels within SACs require maintenance in order to protect human health and safety or over-riding public interest.

Hydrological impacts affecting wetland habitats such as blanket bog, raised bog and fen habitat are stated to be indirect impacts in the OPW ‘Assessment of Significance’ forms. However, it is considered that the alteration of the hydrology and the drainage of these habitats is a direct result of the drainage channel works. There is no scientific evidence to show that there is no significant impact from drainage on these habitats. In fact many of the NPWS site synopses for raised bog and fen habitat cite drainage operations as posing a significant threat to the favourable conservation status of these Annex I and priority Annex I habitats.

![Plate 52 Visual elevation of suspended solids levels downstream a working machine.](image)

In cases where the OPW propose to clear channels for the first time or where drainage maintenance works have not been carried out in more than ten years, the naturalness of the ecological conditions within the designated site require greater consideration. This has not been assessed as a significant potential impact of the proposed drainage maintenance works.

In all channels weed control should utilise weed cutting buckets to prevent deepening and widening of the channels caused by ongoing substrate removal. Weed cutting buckets have additional benefits in reducing the number of aquatic Annex II species (within the drainage channels and on the banks) impacted by the removal of channel substrate and bankside vegetation.

Discussion with the NPWS is recommended to determine a concerted plan for the conservation of these habitats and species which allows for the fulfilment of OPW duties in flood relief and drainage maintenance, while allowing for the protection and enhancement of the conservation status of these ecological interests.

A principal mitigation measure for the storage of water-entrained silt and vegetation is the placement of this material on the bank. This practice comprises a major negative impact for botanical communities present along the channel bank, but in particular whorl snail species which have been recorded from the banks of OPW drains.

The OPW follow the Environmental Drainage Maintenance Guidance Notes drafted by the Environment Section of the OPW and reference is made to following steps 1-6 of these guidelines; however, steps 1-6 of the OPW EDM does not constitute suitable mitigation for
the majority of Annex II species, neither do they take account for the protection of Annex I wetland habitats such as fens or mires which require a stable groundwater hydrology within a specified range. It is concluded that additional scientific study and monitoring is required to establish the significance of impact of arterial drainage maintenance on protected Annex I and Annex II conservation interests, both within designated conservation sites and at a national level.

It is recommended the OPW assess all sites containing these conservation interests, as it will not possible to mitigate for these protected Annex II species present in the other SACs containing arterial drainage channels without knowing where these ecological interests are located. This will require ecological site surveys prior to drainage maintenance works at all sites where these conservation interests are known or expected to occur. Stringent and enforceable mitigations are also required to ensure that the conservation targets set by the OPW are met across the board by all regional operations.
REFERENCES


Scottish Environmental Protection Agency (2003) River habitat survey in Britain and Ireland. SEPA manual

APPENDIX 1 – SAMPLE ‘ASSESSMENT OF SIGNIFICANCE’ FORM

ASSESSMENT OF SIGNIFICANCE
of Impact of Statutory Arterial Drainage Maintenance on
Natura 2000 Sites
SAC Site:
Conservation Aspects of SAC

<table>
<thead>
<tr>
<th>Annex I Habitats:</th>
<th>Annex II Habitats:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority Habitats:</td>
<td>Non-priority Habitats:</td>
</tr>
<tr>
<td>Fauna</td>
<td>Flora</td>
</tr>
</tbody>
</table>

Maintenance Details
Region: Schemes:

Relevant Channels:

<table>
<thead>
<tr>
<th>Channel</th>
<th>Scheme</th>
<th>Chainage From</th>
<th>Year of Last Maintenance</th>
<th>Maintenance Details</th>
</tr>
</thead>
</table>

Maintenance Details Guide

A = Silt / Vegetation Management
B = Aquatic Vegetation Cutting
C = Bank Protection
D = Bush Cutting / Branch Trimming
E = Tree Cutting
F = Bridge / Structure Repairs

Assessment of Significance

Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.

Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 200 site by virtue of:
size and scale; distance from the Natura 2000 site or key features of the site; emissions (disposal of spoil); excavation requirements; transportation requirements; duration of works; other.

Describe any likely changes to the site arising as a result of:
reduction of habitat area; disturbance to key species; habitat or species fragmentation; reduction in species density; changes in key indicators of conservation value (water quality etc); climate change.
| Describe any likely impacts on the Natura 2000 site as a whole in terms of:
| interference with the key relationships that define the structure of the site |

| Provide indicators of significance as a result of the identification of effects set out above in terms of: loss; fragmentation; disruption; disturbance; changes to key elements of the site (water quality etc) |

| Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known. |

**Mitigation Measures**

**Statement of Significance of Impact**

**Comments from Ecologist**

**Assessment carried out by**

**Sources of Data**

**Level of Assessment completed**

**Where full results can be accessed**

**Ecologist**

**Selected for pre / post assessment** Yes / No

**OPW Signature:** __________________________

**Ecologist Signature:** __________________________
## APPENDIX 2  
### ARTICLE 6 ASSESSMENT OF NATURA SITES SURVEYED

Table A3.1 Likely direct, indirect or secondary impacts on the Natura 2000 site.

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Size and scale</th>
<th>Land take</th>
<th>Distance from the key conservation features of the site</th>
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<th>Resource requirements</th>
<th>Emissions</th>
<th>Excavation requirements</th>
<th>Transportation requirements</th>
<th>Duration of works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lough Mask &amp; Lough Carra SAC/SPA</td>
<td>The size and scale of works in the Lough Mask/Lough Carra catchment for the year 2008 is currently unknown</td>
<td>The required land take of OPW drainage maintenance works is considered to include the riparian zone of any drainage channel. However, the drainage of habitats surrounding the site may be affected over a larger area.</td>
<td>The location of key conservation interests at individual channels within the Lough Mask/Lough Carra catchment is currently unknown. However, Annex I habitats and Annex II species are located directly within the footprint of the proposed works.</td>
<td>Drainage maintenance works require the abstraction of river bed substrates and the removal of vegetation both within the aquatic environment and from the riparian zone. Emissions from the works include the release of suspended solids into the watercourses and volatile emissions from the operation of heavy machinery within the SAC.</td>
<td>The drainage maintenance works require the excavation of silt substrate from a number of channels.</td>
<td>The transportation of heavy machinery throughout the networks of watercourses within the SAC is required.</td>
<td>Ongoing, annual.</td>
<td></td>
</tr>
<tr>
<td>Bandon River SAC</td>
<td>The size and scale of works in the River Bandon catchment for the year 2008 is currently unknown</td>
<td>The required land take of OPW drainage maintenance works is considered to include the riparian zone of any drainage channel. However, the drainage of habitats surrounding the site may be affected over a larger area.</td>
<td>The location of key conservation interests at individual channels within the Bandon catchment is currently unknown. However Annex II species are located directly within the footprint of the proposed works.</td>
<td>Drainage maintenance works require the abstraction of river bed substrates and the removal of vegetation both within the aquatic environment and from the riparian zone. Emissions from the works include the release of suspended solids into the watercourses and volatile emissions from the operation of heavy machinery within the SAC.</td>
<td>The drainage maintenance works require the excavation of silt substrate from a number of channels.</td>
<td>The transportation of heavy machinery throughout the networks of watercourses within the SAC is required.</td>
<td>Ongoing, annual.</td>
<td></td>
</tr>
<tr>
<td>Site Name</td>
<td>Size and scale</td>
<td>Land take</td>
<td>Distance from the key conservation features of the site</td>
<td>Resource requirements</td>
<td>Emissions</td>
<td>Excavation requirements</td>
<td>Transportation requirements</td>
<td>Duration of works</td>
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</tr>
<tr>
<td>Moneybeg &amp; Clareisland SAC</td>
<td>The size and scale of works this SAC for the year 2008 is currently unknown</td>
<td>The required land take of OPW drainage maintenance works is considered to include the riparian zone of any drainage channel. However, the drainage of habitats surrounding the site may be affected over a larger area.</td>
<td>The location of key conservation interests at individual channels within this SAC is currently unknown. However Annex I habitats and Annex II species are located directly within the footprint of the proposed works.</td>
<td>Drainage maintenance works require the abstraction of river bed substrates and the removal of vegetation both within the aquatic environment and from the riparian zone.</td>
<td>Emissions from the works include the release of suspended solids into the watercourses and volatile emissions from the operation of heavy machinery within the SAC</td>
<td>The drainage maintenance works require the excavation of silt substrate from a number of channels.</td>
<td>The transportation of heavy machinery throughout the networks of watercourses within the SAC is required.</td>
<td>Ongoing, annual.</td>
</tr>
<tr>
<td>River Moy SAC</td>
<td>The size and scale of works in the River Moy catchment for the year 2008 is currently unknown</td>
<td>The required land take of OPW drainage maintenance works is considered to include the riparian zone of any drainage channel. However, the drainage of habitats surrounding the site may be affected over a larger area.</td>
<td>The location of key conservation interests at individual channels within the Moy catchment is currently unknown. However lamprey, crayfish, salmon and otter are located directly within the footprint of the proposed works.</td>
<td>Drainage maintenance works require the abstraction of river bed substrates and the removal of vegetation both within the aquatic environment and from the riparian zone.</td>
<td>Emissions from the works include the release of suspended solids into the watercourses and volatile emissions from the operation of heavy machinery within the SAC</td>
<td>The drainage maintenance works require the excavation of silt substrate from a number of channels.</td>
<td>The transportation of heavy machinery throughout the networks of watercourses within the Moy SAC is required.</td>
<td>Ongoing, annual.</td>
</tr>
<tr>
<td>Lough Corrib SAC/SPA</td>
<td>The size and scale of works in the Lough Corrib SAC/SPA</td>
<td>The required land take of OPW drainage maintenance works is considered to include the riparian zone of any drainage channel. However, the drainage of habitats surrounding the site may be affected over a larger area.</td>
<td>The location of key conservation interests at individual channels within the Moy catchment is currently unknown. However lamprey, crayfish, salmon and otter are located directly within the footprint of the proposed works.</td>
<td>Drainage maintenance works require the abstraction of river bed substrates and the removal of vegetation both within the aquatic environment and from the riparian zone.</td>
<td>Emissions from the works include the release of suspended solids into the watercourses and volatile emissions from the operation of heavy machinery within the SAC</td>
<td>The drainage maintenance works require the excavation of silt substrate from a number of channels.</td>
<td>The transportation of heavy machinery throughout the networks of watercourses within the Moy SAC is required.</td>
<td>Ongoing, annual.</td>
</tr>
</tbody>
</table>
Lough Corrib catchment for the year 2008 is currently unknown.

Drainage maintenance works is considered to include the riparian zone of any drainage channel. However, the drainage of habitats surrounding the site may be affected over a larger area.

The removal of any material from watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.

The extent and frequency of drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.

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**Table A3.2 Likely changes to Natura site from drainage maintenance works.**

<table>
<thead>
<tr>
<th>Site name</th>
<th>Reduction in habitat area</th>
<th>Disturbance to key species</th>
<th>Habitat/species fragmentation</th>
<th>Reduction in species density</th>
<th>Changes in key indicators of conservation value</th>
<th>Climate change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>River Moy SAC</strong></td>
<td>Unquantified</td>
<td>Disturbance to salmon, otter, lamprey, salmon, crayfish, crayfish are expected</td>
<td>Drainage maintenance works along the drains and watercourses within the Moy catchment will have unquantified impacts on wetland habitats including fens and bogs, as well as alluvial woodland and riparian/fluvial habitats.</td>
<td>The removal of any material from watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.</td>
<td>Drainage maintenance works has the potential to reduce the populations of key species indicators of conservation value, although this has not been quantified.</td>
<td>The extent and frequency of drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.</td>
</tr>
<tr>
<td><strong>Lough Corrib SAC/SPA</strong></td>
<td>Unquantified</td>
<td>Disturbance to salmon, otter, lamprey, salmon, lamprey, salmon, crayfish and kingfisher are expected</td>
<td>Drainage maintenance works along the drains and watercourses within the Corrib catchment will have unquantified impacts on wetland habitats including fens and bogs, as well as alluvial woodland and riparian/fluvial habitats.</td>
<td>The removal of any material from watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.</td>
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<td>The extent and frequency of drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.</td>
</tr>
<tr>
<td><strong>River Finn</strong></td>
<td>Unquantified</td>
<td>Disturbance to</td>
<td>Drainage maintenance works along</td>
<td>The removal of any material from watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.</td>
<td>Drainage maintenance works has the potential to reduce the populations of key species indicators of conservation value, although this has not been quantified.</td>
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<td>Site name</td>
<td>Reduction in habitat area</td>
<td>Disturbance to key species</td>
<td>Habitat/species fragmentation</td>
<td>Reduction in species density</td>
<td>Changes in key indicators of conservation value</td>
<td>Climate change</td>
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</tr>
<tr>
<td>SAC</td>
<td>d reduction in habitat area salmon, otter and lamprey are expected</td>
<td>the drains and watercourses within the Finn catchment will have unquantified impacts on wetland habitats including fens and bogs, as well as riparian/fluvial habitats.</td>
<td>watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.</td>
<td>works has the potential to reduce the populations of key species indicators of conservation value, although this has not been quantified</td>
<td>drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.</td>
<td></td>
</tr>
<tr>
<td>Ballyteigue Burrow SAC/SPA</td>
<td>Unquantified reduction in habitat area Potential for disturbance to Annex I bird species, and plants listed on the FPO Drainage maintenance works along the drains within the Ballyteigue Burrow will have unquantified impacts on priority Annex I fixed/grey dune habitat, as well as priority Annex I lagoonal habitats.</td>
<td>The removal of any material from watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.</td>
<td>Drainage maintenance works has the potential to reduce the populations of key species indicators of conservation value, although this has not been quantified</td>
<td>The extent and frequency of drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivers Boyne &amp; Barrow SAC</td>
<td>Unquantified reduction in habitat area Disturbance to salmon, otter, lamprey and crayfish are expected Drainage maintenance works along the drains and watercourses within the Moy catchment will have unquantified impacts on wetland habitats including fens and bogs, as well as alluvial woodland and riparian habitats.</td>
<td>The removal of any material from watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.</td>
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<td>The extent and frequency of drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.</td>
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<tr>
<td>Lough Mask &amp; Lough Carra SAC/SPA</td>
<td>Unquantified reduction in habitat area Disturbance to salmon, otter, lamprey and crayfish are expected Drainage maintenance works along the drains and watercourses within the Moy catchment will have unquantified impacts on wetland habitats including fens and bogs, as well as alluvial woodland and riparian habitats.</td>
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<td>The extent and frequency of drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.</td>
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<tr>
<td>Bandon River SAC</td>
<td>Unquantified reduction in habitat area Disturbance to salmon, otter, lamprey and crayfish are expected Drainage maintenance works along the drains and watercourses within the Moy catchment will have unquantified impacts on wetland habitats including fens and bogs, as well as alluvial woodland and riparian habitats.</td>
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</tr>
<tr>
<td>Site name</td>
<td>Reduction in habitat area</td>
<td>Disturbance to key species</td>
<td>Habitat/species fragmentation</td>
<td>Reduction in species density</td>
<td>Changes in key indicators of conservation value</td>
<td>Climate change</td>
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</tr>
<tr>
<td>Moneybeg &amp; Clareisland SAC</td>
<td>Unquantified reduction in habitat area</td>
<td>Potential disturbance to lamprey within drainage ditches</td>
<td>Drainage maintenance works along the drains and watercourses within the Moy catchment will have unquantified impacts on wetland habitats including fens and bogs, as well as alluvial woodland and riparian habitats.</td>
<td>The removal of any material from watercourses containing protected species could potentially result in a reduction in the density of these populations. Disturbance to the river banks will also affect the density of protected fauna within the riparian habitats.</td>
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<td>The extent and frequency of drainage maintenance works will require ongoing review, aligned with climate change predictions for flood events, precipitation and climate patterns.</td>
</tr>
</tbody>
</table>

### Table A3.3 Likely impacts affecting Natura Sites resulting from drainage maintenance works.

<table>
<thead>
<tr>
<th>Site name</th>
<th>Interference with key relationships that define the structure of the site</th>
<th>Interference with key relationships that define the function of the site</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Moy SAC</td>
<td>Works could potentially affect the population density and structure of lamprey, crayfish, salmon and otter within the SAC.</td>
<td>The key conservation interests of the site are reliant on the functioning of the aquatic environment, which is affected by drainage maintenance.</td>
</tr>
<tr>
<td>Lough Corrib SAC/SPA</td>
<td>Works could potentially affect the population density and structure of lamprey, crayfish, salmon and otter within the SAC.</td>
<td>The key conservation interests of the site are reliant on the functioning of the aquatic environment, which is affected by drainage maintenance.</td>
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<tr>
<td>River Finn SAC</td>
<td>Works could potentially affect the population density and structure of lamprey, crayfish, salmon and otter within the SAC.</td>
<td>The key conservation interests of the site are reliant on the functioning of the aquatic environment, which is affected by drainage maintenance.</td>
</tr>
<tr>
<td>Ballyteigue Burrow SAC/SPA</td>
<td>Annex I bird species, Annex I habitats and flora listed on the FPO.</td>
<td>Drainage maintenance works could result in impacts to saltmarsh habitat, Annex I bird species and flora listed on the FPO.</td>
</tr>
<tr>
<td>Rivers Boyne &amp; Barrow SAC</td>
<td>Works could potentially affect the population density and structure of lamprey, crayfish, salmon and otter within the SAC.</td>
<td>The key conservation interests of the site are reliant on the functioning of the aquatic environment, which is affected by drainage maintenance.</td>
</tr>
<tr>
<td>Lough Mask &amp; Lough Carra SAC/SPA</td>
<td>Impacts to Annex I fen habitat and Annex I aquatic fauna.</td>
<td>The key conservation interests of the site are reliant on the functioning of the aquatic environment, which is affected by drainage maintenance.</td>
</tr>
<tr>
<td>Bandon River SAC</td>
<td>Works could potentially affect the population density and structure of lamprey, crayfish, salmon and otter within the SAC.</td>
<td>The key conservation interests of the site are reliant on the functioning of the aquatic environment, which is affected by drainage maintenance.</td>
</tr>
<tr>
<td>Moneybeg &amp; Clareisland SAC</td>
<td>Impacts to Annex I habitats and potential impacts to Annex II fauna.</td>
<td>The key conservation interests of this site are directly connected in ecological terms to the drainage maintenance works.</td>
</tr>
</tbody>
</table>
### Table A3.4 Indicators of significance of impacts.

<table>
<thead>
<tr>
<th>Site name</th>
<th>Habitat/species loss</th>
<th>Habitat/species fragmentation</th>
<th>Disruption to conservation of the site</th>
<th>Conservation interests of the site</th>
<th>Disturbance to conservation interests of the site</th>
<th>Change to key elements of the site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>River Moy SAC</strong></td>
<td>Loss of key indicator habitats and species could occur</td>
<td>Fragmentation of species populations separated by channels which have been maintained. Fragmentation of Annex I habitats through drainage also possible</td>
<td>Disruption through drainage maintenance and bankside disturbance could potentially affect faunal conservation interests, as well as impacting on the wetland habitats within the drainage catchment</td>
<td>Disturbance to conservation interests of the site will result from works in the aquatic environment</td>
<td></td>
<td>The proposed works could potentially result in a reduction in the population of the key conservation interests of the site. The impacts of drainage maintenance on wetland habitats is not fully known.</td>
</tr>
<tr>
<td><strong>Lough Corrib SAC/SPA</strong></td>
<td>Loss of key indicator habitats and species could occur</td>
<td>Fragmentation of species populations separated by channels which have been maintained. Fragmentation of Annex I habitats through drainage also possible</td>
<td>Disruption through drainage maintenance and bankside disturbance could potentially affect faunal conservation interests, as well as impacting on the wetland habitats within the drainage catchment</td>
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<td>The proposed works could potentially result in a reduction in the population of the key conservation interests of the site. The impacts of drainage maintenance on wetland habitats is not fully known.</td>
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<td><strong>River Finn SAC</strong></td>
<td>Loss of key indicator habitats and species could occur</td>
<td>Fragmentation of species populations separated by channels which have been maintained. Fragmentation of Annex I habitats through drainage also possible</td>
<td>Disruption through drainage maintenance and bankside disturbance could potentially affect faunal conservation interests, as well as impacting on the wetland habitats within the drainage catchment</td>
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<td><strong>Ballyteigue SAC/SPA</strong></td>
<td>Loss of key indicator habitats and species could occur</td>
<td>Fragmentation of species populations separated by channels which have been maintained. Fragmentation of Annex I habitats through drainage also possible</td>
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<tr>
<td><strong>Rivers Boyne &amp; Barrow SAC</strong></td>
<td>Loss of key indicator habitats and species could occur</td>
<td>Fragmentation of species populations separated by channels which have been maintained. Fragmentation of Annex I habitats through drainage also possible</td>
<td>Disruption through drainage maintenance and bankside disturbance could potentially affect faunal conservation interests, as well as impacting on the wetland habitats within the drainage catchment</td>
<td>Disturbance to conservation interests of the site will result from works in the aquatic environment</td>
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<tr>
<td>Site name</td>
<td>Habitat/species loss</td>
<td>Habitat/species fragmentation</td>
<td>Disruption to conservation interests of the site</td>
<td>Disturbance to conservation interests of the site</td>
<td>Change to key elements of the site</td>
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</tr>
<tr>
<td>Lough Mask &amp; Lough Carra SAC/SPA</td>
<td>Loss of key indicator habitats and species could occur</td>
<td>Fragmentation of species populations separated by channels which have been maintained. Fragmentation of Annex I habitats through drainage also possible</td>
<td>Disruption through drainage maintenance and bankside disturbance could potentially affect faunal conservation interests, as well as impacting on the wetland habitats within the drainage catchment</td>
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<td>Bandon River SAC</td>
<td>Loss of key indicator species could occur</td>
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<td>The proposed works could potentially result in a reduction in the population of the key conservation interests of the site.</td>
<td></td>
</tr>
<tr>
<td>Moneybeg &amp; Clare Island SAC</td>
<td>Loss of key indicator habitats and species could occur</td>
<td>Fragmentation of species populations separated by channels which have been maintained. Fragmentation of Annex I habitats through drainage also possible</td>
<td>Disruption through drainage maintenance and bankside disturbance could potentially affect faunal conservation interests, as well as impacting on the wetland habitats within the drainage catchment</td>
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<td></td>
</tr>
</tbody>
</table>
## Table A.3.5 Significance of impacts

<table>
<thead>
<tr>
<th>Site name</th>
<th>Likely significance of impacts</th>
<th>Scale of impacts unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Moy SAC</td>
<td>The significance of impacts cannot be determined at this time and requires more detailed baseline data on the extent of works and the conservation interests affected by the drainage maintenance works.</td>
<td>Scale of magnitude of impacts is unknown as the extent of works and the location of species and habitats of conservation concern is currently undetermined. The interference with and level of disturbance to key conservation interests of the site is unquantified.</td>
</tr>
<tr>
<td>Lough Corrib SAC/SPA</td>
<td>The significance of impacts cannot be determined at this time and requires more detailed baseline data on the extent of works and the conservation interests affected by the drainage maintenance works.</td>
<td>Scale of magnitude of impacts is unknown as the extent of works and the location of species and habitats of conservation concern is currently undetermined. The interference with and level of disturbance to key conservation interests of the site is unquantified.</td>
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<td>River Finn SAC</td>
<td>The significance of impacts cannot be determined at this time and requires more detailed baseline data on the extent of works and the conservation interests affected by the drainage maintenance works.</td>
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<tr>
<td>Ballyteigue Burrow SAC/SPA</td>
<td>The significance of impacts cannot be determined at this time and requires more detailed baseline data on the extent of works and the conservation interests affected by the drainage maintenance works.</td>
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</tr>
<tr>
<td>Rivers Boyne &amp; Barrow SAC</td>
<td>The significance of impacts cannot be determined at this time and requires more detailed baseline data on the extent of works and the conservation interests affected by the drainage maintenance works.</td>
<td>Scale of magnitude of impacts is unknown as the extent of works and the location of species and habitats of conservation concern is currently undetermined. The interference with and level of disturbance to key conservation interests of the site is unquantified.</td>
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<td>Lough Mask &amp; Lough Carra SAC/SPA</td>
<td>The significance of impacts cannot be determined at this time and requires more detailed baseline data on the extent of works and the conservation interests affected by the drainage maintenance works.</td>
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<td>The significance of impacts cannot be determined at this time and requires more detailed baseline data on the extent of works and the conservation interests affected by the drainage maintenance works.</td>
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