



National Arterial Drainage Maintenance

Draft List of Activities 2016 – 2021

**Environment Section
Engineering Services
Office of Public Works**

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1. Introduction

There is no statutory requirement under the Arterial Drainage Acts 1945 & 1995, for the production of a 'Plan' or 'Programme', for Arterial Drainage Maintenance. Following Strategic Environmental Assessment (SEA) screening consultations with the Environmental Protection Agency (EPA), it was deemed appropriate for an SEA to be carried out, as Arterial Drainage Maintenance is an ongoing activity in the State. This document has been produced to facilitate the SEA process.

Where the Commissioners of Public Works have completed a drainage scheme under the Arterial Drainage Acts, 1945 and 1995, there is a statutory requirement to maintain the drainage works forming part of the Scheme. These drainage works include watercourses, embankments and other structures. Watercourses are subject to siltation and erosion, among other processes, while embankments are subject to settlement and erosion. Ongoing maintenance activities are of a cyclic nature which are to maintain the channel at a certain outfall datum and conveyance capacity by means of repetitive works. An annual programme of maintenance is compiled to maintain the drainage works which are prioritised based on the rate of deterioration and the risk arising. In any one year, approximately one-fifth of watercourses are maintained.

1.1 Timescale

The 2016 – 2021 timescale has been adopted to facilitate the coordination with the River Basin Management Plans (RBMP) and Catchment Flood Risk Assessment and Management Studies (CFRAMS). The main EU Directives in the water management sector such as the Water Framework Directive (WFD) and the Floods Directive set a six year cycle approach from 2016-2021 and then 2022-2027.

1.2 Arterial Drainage Maintenance

1.2.1 Arterial Drainage Schemes

The Office of Public Works is the body through which Central Government exercises its statutory responsibilities in respect of river drainage and flood relief works. It derives its statutory authority from the Arterial Drainage Acts, 1945 and 1995 and the European Communities (Assessments and Management of Flood Risk) Regulations 2010.

Table 1 OPW Schemes carried out under Arterial Drainage Acts 1945 & 1995

Scheme	Duration of Works	Areas Benefiting (hectares)
<i>Major Schemes (River Catchments over 100,000 acres in extent)</i>		
Brosna	1948-1955	34883
Glyde & Dee	1950-1957	10643
Feale	1951-1959	10724
Corrib-Clare	1951-1959	10724
Maine	1954-1964	30310
Inny	1959-1963	4694
Deel	1962-1968	20234
Moy	1960-1971	4816
Corrib-Headford	1967-1973	24685
Boyne	1969-1986	48157
Maigue	1973-1986	12343
Corrib-Mask	1979-1986	9712
Boyle	1982-1992	10845
Blackwater (Monaghan)	1984-1992	2367
<i>Minor Schemes (River Catchments 25,000 – 1000,000 acres)</i>		
Nenagh	1955-1960	2630
Ballyteige/Kilmore	1959-1961	931
Broadmeadow& Ward	1961-1964	2995
Killimor/Cappagh	1962-1968	5099
Bonet	1982-1992	1295
<i>Other Small Schemes (River Catchments less than 25,000 acres)</i>		
Clareen	1959-1961	445
Ouvane	1962-1963	162
Matt	1964-1965	202
Duff	1963-1965	1457
Brickey	1965-1967	405
Abbey	1964-1967	364
Knockcroghery	1967-1968	202
Creegh	1968-1969	405
Burnfoot/Skeoge	1968-1970	162
Kilcoo	1969-1971	162
Owenavorrhagh	1968-1970	1052
Carrigahorig	1968-1971	1538
Groody	1970-1973	1214
Deel and Swillyburn	1957-1961	1416
Cloonburn	1967-1968	162
<i>Estuarine Embankment Schemes</i>		
Shannon (Limerick)	1962-1971	4897
Shannon (Clare)	1958-1960	728
Fergus	1959-1960	728
Owenogarney	1955-1959	850
Swilly	1961-1968	1295

<i>Flood Relief Schemes</i>	<i>Completion Date</i>
Belclare, Clare River maintained as part of the Corrib-Headford Drainage Scheme	1995
Gort Town, Co. Galway maintained as part of the Gort Flood Relief Scheme	1997
Sixmilebridge, Co.Clare maintained as part of the Owengarney Catchment Drainage Scheme	1997
Lacken (Ardraham), Co. Galway maintained as part of the Lacken Drainage Scheme.	1997
Nanny River, Duleek, Co. Meath maintained as part of the Nanny Scheme.	1998
Mulkear River, Newport, Co. Tipperary maintained as part of the Mulkear River Scheme	1998
Ballymakeogh, Co. Tipperary maintained as part of the Scheme	1998
Mulkear River, Cappaghmore, Co. Limerick maintained as part of the Scheme	2000
Bridge End, Co. Donegal , improvement to the Skeoge Scheme and is maintained as part of the Scheme.	2000
Bandon River, Dunmanway, Co. Cork , this is maintained as part of the Scheme.	2001
Shinkeen Stream, Hazelhatch, Co. Kildare , this is maintained as part of the Scheme.	2001
Maam Valley, Co. Galway ; this was an improvement to the Scheme, and is maintained as part of the Scheme.	2001
Suir River, Carrick-on-Suir, Co. Tipperary ; this is maintained as part of the Scheme.	2003
Nore River, Kilkenny ; This is maintained as part of the Scheme	2006
Ennis, Co. Clare , maintained by the OPW but the maintenance of the pumps is through SLA with the County Council.	2013
Mornington, Co. Meath , maintained as part of the Mornington Scheme	2012
Tullamore, Co. Offaly , this is maintained as part of the Scheme.	2013
Clonmel, Co. Tipperary maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2014
Fermoy, Co. Cork maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2015
Mallow, Co. Cork maintained by the OPW, however maintenance pumps is through SLA and the County Councils.	2016
Belclare, Clare River maintained as part of the Corrib-Headford Drainage Scheme	1995
Gort Town, Co. Galway maintained as part of the Gort Flood Relief Scheme	1997
Sixmilebridge, Co.Clare maintained as part of the Owengarney Catchment Drainage Scheme	1997
Lacken (Ardraham), Co. Galway maintained as part of the Lacken Drainage Scheme.	1997
Nanny River, Duleek, Co. Meath maintained as part of the Nanny Scheme.	1998
Mulkear River, Newport, Co. Tipperary maintained as part of the Mulkear River Scheme	1998

1.2.2 OPW's Roles and Responsibilities in Arterial Drainage Maintenance

Under Section 37 of the Arterial Drainage Act 1945, the OPW is statutorily obliged to maintain all rivers, embankments and urban flood defences on which it has executed works since the 1945 Act (**Table 1**) in “proper repair and effective condition”.

Maintenance referred to under the Arterial Drainage Act 1945 includes:

- The maintenance of river channels in a condition that ensures they are free-flowing, thus reducing flood risk and providing adequate outfall for land drainage.
- The maintenance of river and coastal embankments, in a condition that protects benefiting lands to the extent defined in the Scheme, from risk of flooding.
- The maintenance, repair and/or replacement of all structures forming part of a Scheme, including accommodation bridges, weirs, sluice barrages, sluices, pumping stations and tidal flap gates.

The Act uses the terms “*proper repair and effective condition*”. The performance criteria relate to the design standard of the original Scheme works, its condition and performance of the various watercourses, embankments etc.

Failure to comply with these obligations would be contrary to the Drainage Acts and could lead to a “writ of mandamus” or an award of compensation arising from claims for damage to the benefiting lands. All of the completed Arterial Drainage and Estuarine Embankment Schemes are now maintained under the statutory obligation.

1.2.3 Extent of Operations

OPW Head Office is based in Trim, Co Meath. The maintenance function is divided into three regions for the purpose of programming and executing the work, **Table 2**. Each region has a main regional office with at least one sub office. The annual maintenance budget is circa €15 Million. The OPW maintain their own transport and excavator fleet and other specialised equipment such as weed cutting boats. The operations are carried out by a trained direct labour work force numbering circa 300. OPW direct labour staff uses a fleet of approximately seventy hydraulic excavators nationwide to execute the maintenance programme.

Table 2 OPW Drainage Maintenance Office Locations

Region	Main Regional Office	Sub-Office(s)
East	Newtown, Trim, Co. Meath	Ardee, Monaghan, Mullingar & Wexford
South West	Templemungret, Co. Limerick	Listowel & Portumna
West	Headford, Co. Galway	Ballina & Lifford

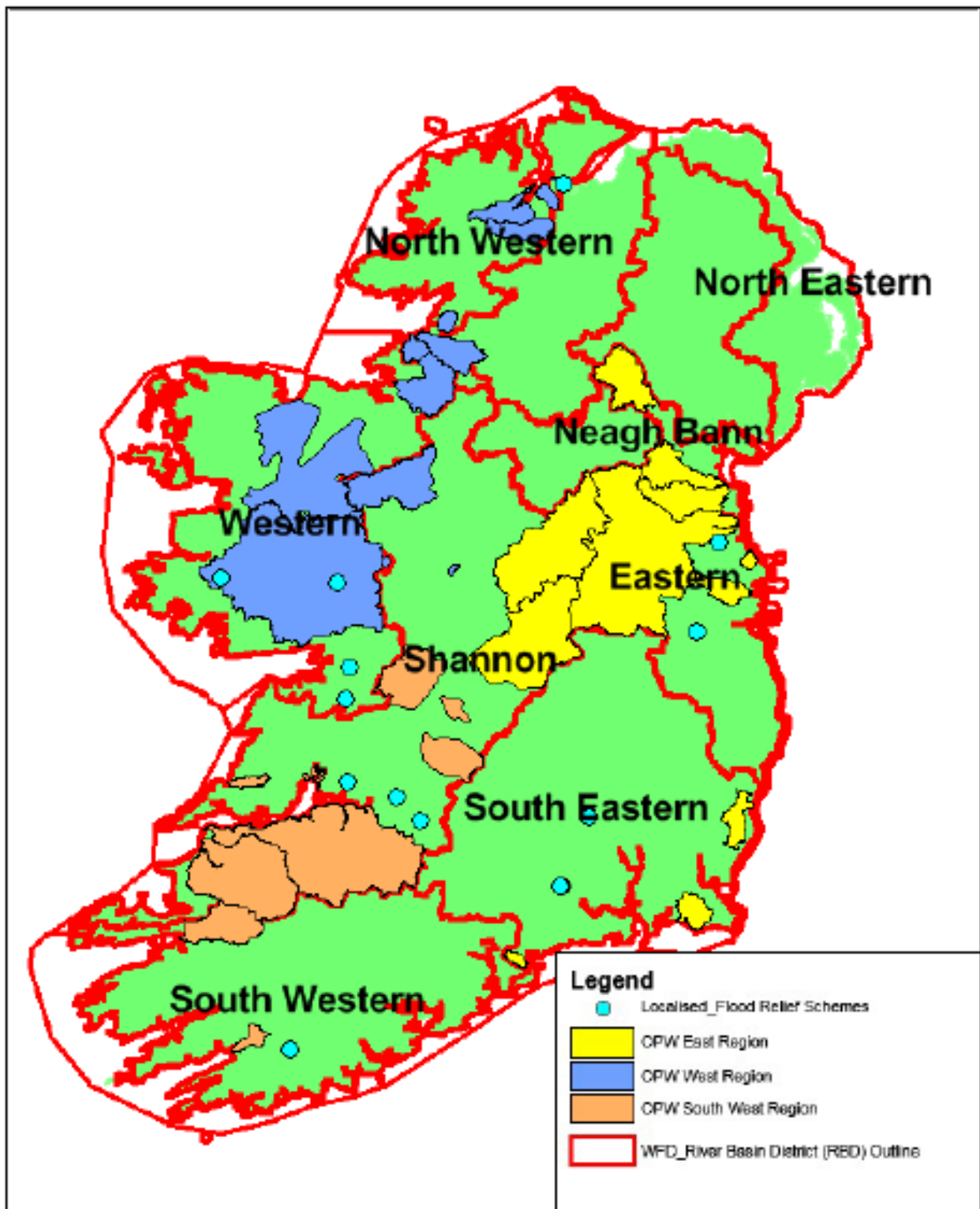


Figure 3.1 Arterial Drainage Catchments and RBDs

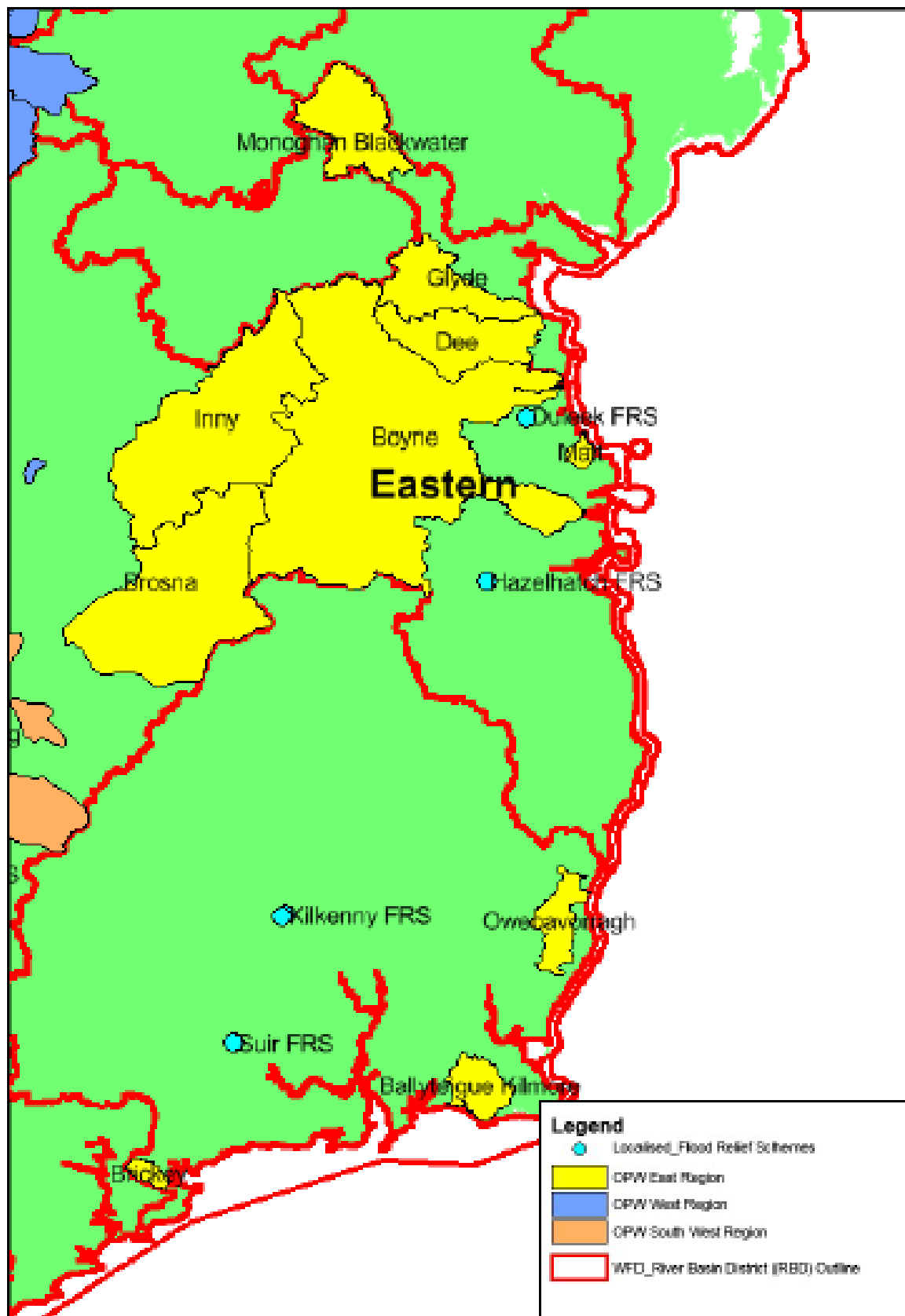


Figure 3.2 OPW East Region Schemes

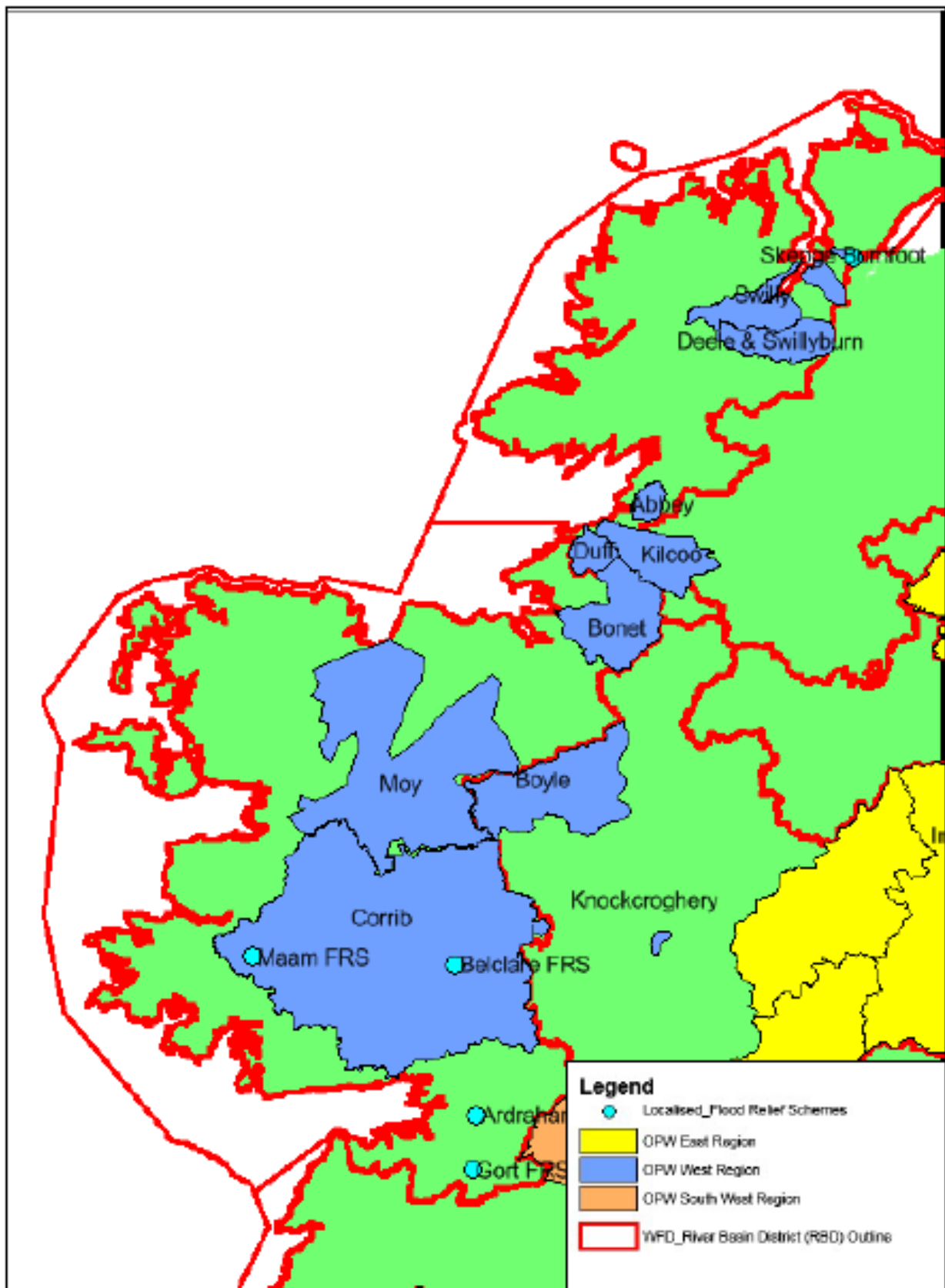


Figure 3.3 OPW West Region Schemes

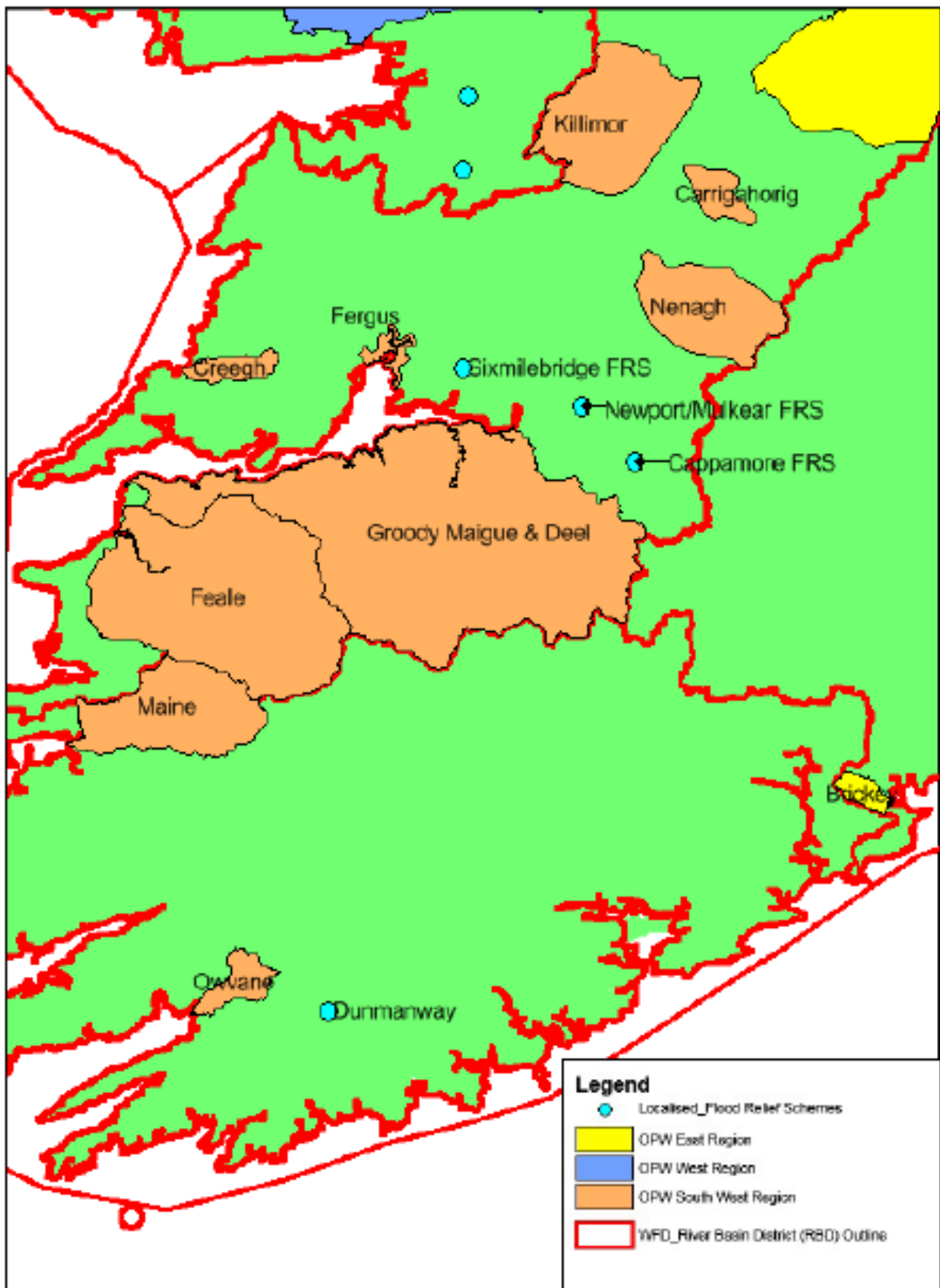


Figure 3.4 OPW South West Region Schemes

2.0 List of Activities

The National Arterial Drainage Maintenance 2016-2021 activities includes:

1. Channel Maintenance activities
2. Embankment Maintenance activities
3. Structural Maintenance activities
4. Flood Relief Scheme Maintenance activities

Statutory Arterial Drainage Maintenance entails the maintenance of completed Arterial Drainage Schemes and completed Flood Relief Schemes. The OPW are responsible for the maintenance of 11,500km of channel, 730km of embankments, some 18,500 bridges and 750 ancillary structures such as sluice gates, pumping stations and tidal barrages.

The majority of Arterial Drainage Maintenance works is on channel maintenance with the average channel requiring maintenance every four to six years. While this varies, with some channels requiring maintenance annually and others only requiring maintenance every twenty years, circa 2000km of channels are maintained annually and nearly all of the 11,500km of channels will have been maintained at least once over the Programme cycle of five years. Of the 750km of embankments, the frequency of maintenance tends to be more variable than that for channels with embankments scheduled for maintenance works as the need arises. There is an ongoing programme of Flood Relief Schemes carried by the OPW and statutory Arterial Drainage Maintenance includes the maintenance of these schemes. In respect of the various bridges and structures, a relatively small number are maintained annually i.e. circa 170 bridges and 30 other structures which are restricted to the most critical structures. Note that a portion of the 18,500 bridges are road bridges where the Local Authorities are responsible for the structural integrity, hence OPW maintenance operations typically exclude bridge deck or arch repair works on road bridges.

2.1 Channel Maintenance Activities 2016 – 2021

Channel maintenance operations normally involves removing the build up of foreign or natural material that impedes the free flow of water. Predominately this consists of the removal of water-entrained silt and associated vegetation from the bed of the channel by suitably rigged hydraulic excavators. Restrictions in channels due to bank slippage or damage would be re-graded to the original profile. Channel breaches due to bank erosion would be resolved by re-profiling the bank in-situ or in some cases by importing protection material such as rock armour or log poles. In addition, other larger vegetation such as trees, which impinge on channel capacity are either removed in whole or impingement is reduced by selective removal of lower branches. The material removed in the maintenance operations is normally spread along the bank, or on top of existing spoil heaps where present. In most cases, no alterations to the bank are required and in some cases the channel is not disturbed at all if no build up of material is present.

Some channels are steep and fast flowing, which are subject to flash floods, bank erosion and rapid movement of bed gravel. However, 60 – 70% of Scheme channels are of gentle longitudinal gradient and subject to relatively rapid deposition of silt, especially those that are subject to prolific growth of in-stream vegetation. The steeper sections of channel normally require relatively little maintenance works. The

majority of maintenance works are on smaller lower-lying channels, with 90% of works in channels with a base width of less than three metres. The average channel requires maintenance every four to six years. Channels with prolific weed growth may require maintenance annually, particularly where downstream bridges are at risk of being blocked due to a flow of decaying vegetation in autumn. Conversely, some channels may only require maintenance every twenty years due to the self-cleaning characteristics of the channel.

A number of channels have an annual prolific growth of aquatic plants, but are too wide or the bank conditions are too unstable to allow maintenance by way of excavators. Weed cutting boats are engaged in these cases, or where a particular channel requires to be cleared of vegetation but it is not deemed necessary to remove silt or other heavy material. In all, approximately 90km of channel are cleaned annually by four weed cutting boats, operating on a seasonal basis, with the majority of the works concentrated in the West of Ireland.

Historical databases have been built up in all regions. From these are extracted a base line list of channels which are due for cleaning. Critical sections of these channels are inspected and a work programme developed. This takes account of requests from the general public and potential flooding risk to roads, properties, urban areas and sewage works.

In developing the works programme, special consideration is given to potential impacts on fisheries, Natura 2000 Sites and the environment. This includes assessment of all works for their potential to impact on Natura 2000 sites by an external ecological consultants, specific timing of certain works, and consultation with both Inland Fisheries Ireland and National Parks and Wildlife Service

In general, scheme channel maintenance work is carried out by trained OPW drivers, using a hydraulic excavator. The material removed is normally spread along the bank or on top of existing spoil heaps where present.

2.2 Embankment Maintenance Activities 2016 – 2021

Most Embankment Schemes are tidal in nature hence they tend to be located at estuaries. The foremost inland embankments are the Annagh Embankments, on the Inny Arterial Drainage Scheme. During the period between 1987-1993 the financial resources for drainage maintenance were reduced resulting in a reduction in staff numbers and in the capability of OPW to carry out necessary work. By 1994 the deteriorating condition of the embankments, which at some critical locations had been eroded to less than half their original volume, gave cause for great concern, especially in Kerry, Wexford and Donegal. A programme of embankment strengthening was put in place to redress this.

Currently, programming of maintenance work consists of regular inspections of sections of embankments, which are known from experience to be at risk, together with additional inspections after a storm at sea, or a high tidal/flood event in the case of tidal embankments. 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 the form of topping up clay embankments to design height and structural strengthening by importing rock/soil material or utilising in-situ material.

In addition, the programme extends to the refurbishment of the deteriorated embankments in Kerry, Wexford and Donegal. The Shannon Embankments are also undergoing refurbishment works, due to their importance to flood defence for Limerick and Shannon Town. The refurbishment of the embankments is carried out by contract or by direct labour.

2.3 Structural Maintenance Activities 2016 – 2021

During the course of the original Arterial Drainage Scheme excavations following the 1945 Act, circa 18,500 accommodation bridges were modified or replaced as required. These bridges provide riparian farmers with farm vehicular/foot access. The type of bridge provided depended on the width, depth and required flow capacity, and ranged from concrete piped culverts to larger concrete or masonry spanned bridges.

In general, as channel maintenance work proceeds, the bridges are inspected by supervisory industrial staff, and if required repairs/replacements are programmed. On many occasions, it is not necessary to totally replace the structure, and repairs such as under-pinning foundations or replacement of wing walls, parapets or deck are carried out to extend the bridge life.

Currently all Scheme structure maintenance work is carried out by the direct labour gangs. Approximately 170 bridges are repaired/replaced each year. Ancillary structures such as sluice gates, tidal barrages and pumping stations are repaired or replaced as necessary to maintain their respective operating function.

2.1.4 Part 1.4 - Flood Relief Scheme Maintenance Activities 2016 – 2021

Flood Relief Schemes completed since the Arterial Drainage (Amendment) Act, 1995 also have a statutory maintenance requirement. The requirement for maintenance is identified at regional level on an annual basis, and included in the Annual Arterial Drainage Maintenance Programme. Maintenance cycles vary depending on the characteristics of the Flood Relief Scheme. Original scheme works that included durable structural works such as new embankments, retaining walls or hard bank reinforcement typically require little or no maintenance while some flood relief scheme channels require periodic silt removal or riparian vegetation management, to maintain the designed channel capacity.

2.4 Programme Exclusions

The National Arterial Drainage Maintenance Activities 2016-2021 list of activities does not include the following:

- Newly constructed Arterial Drainage Schemes.
- Catchment Flood Risk Assessment & Management Studies (CFRAMS).
- New Flood Relief Schemes – carried out under the Arterial Drainage Acts 1945-1995, which entail aspects such as public exhibition and Ministerial approval. Modern Flood Relief Schemes typically involve relatively large-scale engineering construction, generally within the confines of an urban area and designed to specific criteria such as 1 in 100 year flood protection.

- Drainage Districts – channel maintenance works on the various Drainage Districts by Local Authorities or Drainage Boards.

3.0 Environmental Management

All maintenance operations are carried out in accordance with OPW's Environmental Management Protocols and Standard Operating Procedures.

3.1 OPW Environmental Management Protocols

Communications - Statutory Stakeholders

- By the end of each year, each Arterial Drainage Maintenance Region to forward a draft version of its Annual Drainage Maintenance Programme for the upcoming year to OPW's Environment Section, and to the Inland Fisheries Ireland (IFI) EREP Project Manager who will review it for appropriate sites and study locations for the Environmental River Enhancement Programme (EREP) project.
- By end of each year, each Arterial Drainage Maintenance Region to forward the relevant sections of the final version of its Annual Drainage Maintenance Programme for the upcoming year with a copy of appropriate scheme maps, to the National Parks & Wildlife Services (NPWS) Regional Managers and the IFI Directors.
- When compiling the programme the type of works proposed should be indicated for each channel under the headings A-F:
 - A – Silt & Vegetation Management
 - B – Aquatic Vegetation Cutting
 - C – Bank Protection
 - D – Bush Cutting/Branch Trimming
 - E – Tree Cutting
 - F – Bridge/ Structure Repairs
- Ideally, approximate timing (season/month) and approximate duration of works should be included for each channel.
- Works that fall within Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Natural Heritage Areas (NHA) are to be highlighted on the programme.
- As a follow up, the Arterial Drainage Maintenance Regions offer the opportunity for a meeting with the stakeholders to discuss the Annual Drainage Maintenance Programme and where a meeting is requested, preferable for this to take place as early as possible in the year.

Interim Stakeholders Meetings

- In addition to the start of the year stakeholder meeting to overview the Annual Works Programme, Regional Offices will offer and facilitate a schedule of more frequent and catchment focused meetings.
- The need and the frequency of these meetings will be determined on a regional basis in partnership with the relevant stakeholders.
- Typically a frequency of every 2-3 months to discuss the following 2-3 months work on the catchment, identifying any further environmental sensitivities, appropriate mitigating measures, follow up joint site visits where deemed beneficial and flagging any opportunities for added benefit in proposed River Enhancement works.
- Typical attendance includes a range of OPW Management Staff, i.e. Engineer, Technician and/or Foreman, NPWS Rangers and/or DCO and IFI Officers.

- OPW Engineer will compile minutes of the meeting to record attendance and a brief account of main decisions and follow up actions.
- Any channel specific information resulting from these meetings, such as timing requests should be entered into the Records Database in accordance with the National Recording Process.
- Consultations with statutory stakeholders such as NPWS and IFI are of critical importance to continuously improving environmental performance. However, in the interest of maximising the efficiency of stakeholders input, Management Staff are as far as practical, to plan their consultative requirements and address a range of aspects in any one discussion forum. Interim Stakeholder Meetings or similar forums offer good opportunities to maximise consultation efficiencies.

Correspondence

- All Environment related correspondence/complaints are recorded on the Engineering Services Correspondence Database as per normal protocol. Complaints received are forwarded to the Environment Section should assistance be required. All queries/complaints are responded to within 21 days.

Walkover Surveys

- As a component to the EREP Project, on a number of channels, EREP project team members will request for Walkover Surveys as an opportunity to discuss in detail on site the environmental enhancement options for a particular channel with a range of relevant stakeholders.
- Typical attendance will be an IFI EREP representative, a range of OPW Management Staff and relevant Operational Crew if deemed beneficial, local IFI Officer and/or NPWS Ranger or DCO.
- OPW Management Staff to liaise with EREP team and coordinate the site visit with local IFI and NPWS to facilitate their participation if these stakeholders wish to attend.
- Environmental river enhancement plans are then prepared by the IFI EREP team and issued to the relevant OPW Engineer for inclusion in the annual works programme

Appropriate Assessments

- A national framework has been set up where Arterial Drainage Maintenance activities will undergo Appropriate Assessment (AA) to include all required activities for a 5 year period
- Environment Section procures for the annual `Environmental Consultancy Services` contract, prepares the 5 year programme for each scheme and issues completed AA Screening Statements/Conclusion Statements to the respective OPW engineers as completed.
- The Ecological Consultant will consult with OPW management to define the precise extents of proposed works in each Natura 2000 Site during the 5 year period.

- In addition, the Ecological Consultant will be carrying out walkover surveys for pre and post maintenance works for a representative number of the sites and OPW Management will be required to facilitate the same.
- OPW Management Staff will issue the relevant completed Assessments directly to the NPWS District Conservation Officer. In addition, Environment Section will issue all of the Assessments to the Development Applications Unit, Department of Arts, Heritage and the Gaeltacht, Newtown Road, Wexford.
- Preferably the Appropriate Assessments are forwarded to the DCO as soon as it is completed, but in any case with a minimum of three weeks notice before commencement of the works.
- Management Staff to implement all prescribed mitigating measures and ensure that Operational Staff are made aware of all relevant site specific mitigating measures.

Environmental River Enhancement Programme (EREP)

- After reviewing the draft Annual Works Programme, IFI EREP team contact the relevant OPW Regional Office and request follow up meetings as required to discuss aspects of the programme in relation to the EREP.
- River enhancement sites require hydromorphological surveys to ensure they are technically feasible as envisaged. This is to be coordinated by the IFI EREP team with local IFI and OPW personnel as required.
- Sites shortlisted by the IFI EREP project team for capital enhancement works are emanating from a screening process of technical feasibility in terms of gradient and water quality. Also, sites are selected on other requirements such as the Water Framework Directive Programme of Measures under the requirements for morphology.
- IFI EREP team in consultation with the local IFI and OPW staff, will prioritise sites on a basis of best return for investment. IFI EREP team will liaise with the Regional Offices to assist in identifying channels deemed suitable for capital enhancement which should be integrated with the following years work programme. In some cases, a situation may arise where the site selected is not overlapping with the annual Drainage Maintenance Programme but where feasible and subject to any third party agreement, OPW will accommodate these works.
- Similarly for enhanced maintenance works, IFI EREP team in consultation with the local IFI and OPW, will select sites again that are technically feasible and offer best return for investment. These sites will normally be from channels on the annual Drainage Maintenance Programme.
- IFI EREP project team will coordinate all the scientific monitoring works, provide the enhancement design details and guidance to OPW Management Staff and maintain a level of site supervision proportional to the complexity of the works and the experience of the OPW Staff involved.
- Consultations with local IFI through the interim stakeholder meetings are encouraged to identify sites suitable for enhancement works and in some cases the local IFI may also be in a position to produce an enhancement design. All enhancement designs and works are to be coordinated through the IFI EREP team to facilitate formal recording into the national EREP project and allow for biodiversity and/or hydromorphology monitoring if required. Local

IFI may coordinate with IFI EREP team or alternatively OPW Regional Staff coordinate directly with the EREP team.

- A small portion of channels have more infrequent maintenance cycles and these cases can offer particularly good opportunities for enhanced maintenance type works. Channels programmed where maintenance works have not being carried out for in excess of 10 years, to be flagged to IFI EREP team for possible walkover surveys and guidance on appropriate Environmental Drainage Maintenance (EDM) procedures.
- Management Staff to ensure that as far as practical, all Operational crews have an opportunity to get experience on these projects.
- Each Regional Engineer is to make provision in the Annual Works Programme for Plant & Labour resources in addition to provisions in the Annual Budget for materials subject to expenditure constraints. Typical resources are as follows:

Capital Enhancement

Region	Target (Km)	Capital Costs	Machine Weeks	Man Weeks
East Region	20	€200,000	30	60
South West Region	14	€140,000	21	42
West Region	16	€160,000	24	48
	50	€500,000	75	150

- Progress targets for EREP to be shown on monthly production reports.
- OPW are the primary contact point for liaison with landowners including the organising of access and egress for machinery and materials. Brochures on EREP are available in all Regional Offices. Additional copies can be obtained through OPW Environment Section.
- Management Staff are encouraged to maximise the use of all available on-site materials such as stone from historical spoil heaps as opposed to importing materials at a higher cost.
- In addition, Management Staff are encouraged to maximise synergies with other funding sources such as Fisheries Development grants attained by local Angling Clubs, which could be combined with OPW plant and labour to supply materials.
- In all cases, Inland Fisheries Ireland is the statutory authority to give design guidance to OPW. Angling Clubs or other sectoral funding sources to liaise with the Fisheries authorities in respect of all design and environmental monitoring requirements.
- As-Built plans are to be completed by the IFI EREP team for all enhancement works. This will entail a site visit by IFI and relevant OPW Staff where requested. These will be retained by IFI as well as any relevant design information.
- IFI EREP team will forward a copy of the as-built plans to Environment Section who will upload the same to Alfresco for access to the information by all Staff.
- At the end of the year, IFI EREP team will forward Environment Section a GIS layer of that year's works for uploading to OPW's GIS records.
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National Recording Process

- Weekly Record Cards records information on Lamprey, Crayfish, Kingfisher, Mussels, Otter and other site specific environmental information as arises.
- Environmental information on Cards will be recorded onto the Records Database by each Drainage office. The latest Records Database has been revised to integrate environmental records.
- On an interim basis, a copy of all Cards with environmental information to be copied and forwarded to Environment Section by each Drainage Office. This is to allow Environment Section to review the detail of information being recorded, feedback to the Operational crews through the Management Staff and attain a national consistency in the style of information being recorded.
- All relevant information to be uploaded to GIS by Environment Section.
- All other relevant environmental information sourced by Management Staff whether from direct observations or through stakeholder consultations, should be entered into the Records Database.
- Relevant environmental information sourced through the EREP project and related research will be forwarded by IFI EREP team to Environment Section directly for centralised GIS uploading.
- On a bi-annual basis, Environment Section will compile an update of Weekly Records Cards species records and make available to all Staff via Socialtext to assist in tracking progress.
- On an ongoing basis, Environment Section will make available the various OPW compiled species records to other authorities to assist in contributing to any appropriate national conservation knowledge.
- As described above, each drainage office will upload onto the Records Database all environmental information from the Weekly Record Cards and all other broader environmental information attained by Management Staff. Within a few years, it's envisaged that multiple regional Staff will be able to use the new Records Database, and then environmental information from all sources will be uploaded directly by a whole host of Staff. Typically this will include any mitigating agreements for particular channels agreed with stakeholders or any other individuals observation such as protected species presence noted during a separate site visit.

Salmonids

- As far as practicable, the maintenance works are to be scheduled to accommodate salmonid (Salmon & Trout) spawning areas, as is in place across all regions for many years. This is a widespread measure on many catchments and is most applicable to medium gradient channels with gravel substrate.
- Prior to works commencing, consult with local IFI. Ideally, consultations to be conducted through Interim Stakeholder Meetings or alternatively, direct contact in respect of the specific site.
- Maintenance operations on salmonid spawning beds typically carried out between July and September but timing subject to adjustment due to local knowledge of IFI.
- Raking of spawning gravels to improve spawning capacity also typically carried out between July and September.

- River enhancement works to enhance both the fisheries and the broader ecology of the drainage channel are covered under the EREP project.
- In the future, as the extent of completed enhancement works increases, there is a risk of damage to structures due to future maintenance. All channels scheduled for maintenance to be checked against GIS records for presence of previous enhancement works. Where a presence is indicated, carry out a site visit as appropriate and in consultation with IFI, devise on-site procedures to protect or enhance existing instream structures.

Lamprey (Brook, River & Sea) & Crayfish

- All channels scheduled for maintenance to be checked against GIS records for presence of Lamprey or Crayfish.
- In accordance with the OPW Protocols and SOPs, Operational Staff will closely observe the spoil three times daily and report to the Foreman any Lamprey or Crayfish located.
- Mitigating procedures to apply when GIS records indicate species presence, or Operational Staff locate Lamprey or Crayfish during operations, or where particularly suitable habitat is identified by an environmental stakeholder.
- If significant populations are encountered, notify IFI EREP team and facilitate scientific studies if site deemed suitable by IFI.
- If significant populations are encountered, notify NPWS Ranger and local IFI Officer and conduct site visit as necessary.
- Combination of Mitigating Measures to be selected as applicable to the site while balancing the Flood Risk Management requirements and a sustainable approach to the conservation of Lamprey and/or Crayfish.
- Identify extent of channel applicable and the mitigating measures to apply.
- Inform Operational Staff of mitigating requirements.

Suite of relevant Mitigating Measures as follows:

On site measures

- Skip sections to retain intact habitat either in one long reach or multiple short reaches.
- Maintenance in an upstream direction to avoid secondary disturbance of a species moving downstream. Balance with the advantage of maintenance in a downstream direction where instream vegetation minimises siltation.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective. This is effective for Lamprey juveniles as they are in the silt. For Crayfish, cutting of “Flaggers” type vegetation is effective but cutting of “water celery” mat type vegetation is less effective as it can result in Crayfish being removed within the weed mass.

Forward planning measures

- Annual maintenance of the channel in shorter segments sequentially completing the same over a number of years. Balance with maintaining reasonably operational efficiency in terms of machinery moving, transport, access and egress.
- Longer time periods between maintenance cycles e.g. move from 4-6 years to 7 to 8 years. Balance with overall river ecology as longer maintenance cycles will lead to more heavy-scale works.
- Timing of maintenance to accommodate Lamprey spawning. Stakeholder consultations between OPW and local IFI for salmonid mitigating purposes, to include consideration of Lamprey spawning. This is to be applied to channels where Lamprey spawning habitat is known as informed by IFI or other stakeholder. For River & Brook Lamprey, no works on relevant spawning channel from end March to start of June subject to adjustment due to local knowledge of IFI. For Sea Lamprey, as they spawn during the summer months, restrictions from late April to early July are required. To be applied to channels where Sea Lamprey spawning is known as informed by IFI or other stakeholder and timing subject to adjustment due to local knowledge of IFI. Note that Sea Lamprey are much less widespread so envisaged that the scale of this mitigation will be very limited.
- Loosening spawning bed gravels. Stakeholder consultations between OPW and IFI for salmonid gravel loosening purposes, now to include consideration of Lamprey spawning as above.
- Enhance channel profile such as skewed cross section and promote deposition of silt along margins. Integrate with IFI discussions on planning the EREP to avail of enhancement opportunities particularly for channels where Lamprey or Crayfish presence is recorded.
- Modification of OPW structures which impede upstream fish migration. Identification of weirs as barriers to be as informed by IFI or other stakeholder. Where modification designs required, liaison with IFI EREP team to integrate the improvement works into the EREP project. Identification of a bridge apron step attained through ongoing site inspections by OPW Management Staff or other stakeholder. In consultation with IFI, steps at bridges to be modified by a

rock armour type ramp or similar. Envisaged that these measures will be of a limited scale on drained channels.

GIS Records:

- Where Lamprey or Crayfish are discovered, Operational Staff will have recorded the same on the Weekly Record Cards. Cards with species location information will be uploaded to the Records Database as stated in the National Recording Process.
- All new Lamprey spawning location information attained through stakeholder consultation to be recorded on the Records Database in accordance with the National Recording Process.
- All database records of species location will be uploaded to GIS by Environment Section.
- IFI EREP team conducting ongoing research on Lamprey & Crayfish as a component of the EREP works. Scientific data calculating species density for some sites will be developed and to be supplied by IFI to OPW and uploaded to GIS by Environment Section.

Otter

- Research to date indicates that Otters are widespread across all sizes of drainage channels nationally, hence it is prudent to assume that Otter use any particular site.
- In accordance with the Otter SOP, Operational Staff will walkover the works area one week in advance in conjunction with the Health & Safety assessment noting dense cover with access directly to the water that is to be avoided where feasible.
- In addition, any recognisable signs of Otter presence observed such as Spraints, Footprints or suspected Holts, will be recorded on the Weekly Record Cards. These signs were identified in Otter Awareness Training carried out across all regions in 2008.
- While holts are usually well concealed, where Operational Staff observe a suspected holt such as a burrow opening, in consultation with Management Staff, subject to flood risk management functions, no channel or bankside vegetation to be conducted within 30m of a known or potential Otter holt/resting site. If breeding is suspected at a holt site this buffer zone will be increased to 150m.

Bridge mammal crossing enhancement

- As a component of ongoing consultations with NPWS and other stakeholders, evidence may arise from time to time as to a particular spot for Otter road kill. Typically this can arise where the Otter always traverses the roadway as opposed to going through the bridge. While this scenario is not known to be a widespread issue in Ireland, the highest risk locations are on the National Primary Roads which have the heaviest traffic volumes.
- There are 170 National Primary Road bridges on OPW channels as listed in the table referenced below and Management Staff are to have particular regard to these locations if evidence arises on a possible road kill “hot spot”.

- Enhancement works will typically take the form of a bolt-on wildlife ledge or similar. Design and configuration is to be carried out in consultation with NPWS and relevant Local Authority.
- On an annual basis, Environment Section will review the national website www.biology.ie which records Otter road kill reports from the public. Any road kill location which overlaps with an OPW channel will be flagged by Environment Section to the relevant Management Staff.
- Current understanding is that Otter road kill is not a significant issue in Ireland. It's envisaged that while the justification for bridge mammal crossing works may arise for some scenarios, these measures will be of a limited scale on drained channels.

Freshwater Pearl Mussel

- GIS records from NPWS show the locations of the 91 known FWPM populations in Ireland.
- The following OPW channels have been identified as containing FWPM:

Channel	Scheme	Location	Most Recent Record
CH9	Corrib Headford	Oughterard	2009
C1/21/3	Moy	Approx 500yds from outfall to into L. Cullin	2004
C1 Sect M&N	Moy	Ballygallagart	2004
C1/21/14	Moy	Crossmolina	2008
C1	Dunmanway FRS	d/s of the Long Bridge	2003
C1	Owvane	Approx 1400 yds from outfall	2002
C1	Feale	d/s Listowel near Scartleigh cemetery	2006
**Owenaher	Moy	u/s of C1/54	1996
**Brown Flesk Ri	Maine	Trib of C1 Maine near Farranfore	1987
** Galey River	Feale	Approx 1400yds u/s of C1/18 near Ahavoher Br.	1950
**River Liffey	Ryewater	(Lucan) Approx 3.5km d/s C1 Ryewater outfall	1894

*** Although not on OPW channels - these channels may or may not contain populations of FWPM.*

Works in the vicinity which could impact on a possible population need to be considered in close consultation with local NPWS knowledge.

- While highly unlikely to have instream works in a FWPM habitat, if a new population located by Operational Staff during operations, works to cease.

- Notify NPWS and in consultation with NPWS, area to be skipped or non in-stream works carried out as agreed for the specific site.
- For operations in the vicinity of known populations, mitigating procedures to apply:
- Consult with NPWS and local IFI and conduct site visit as necessary.
 - Typically only selective non in-stream works adjoining the population.
 - Works such as removal of a fallen tree is to be completed by lifting clear of the channel to minimise any channel bed disturbance due to the branches being dragged.
 - Assess need for silt management procedures for works upstream of the population and implement in consultation with NPWS.

Swan & Duck Mussels

- Swan and Duck Mussels are not strictly a protected species, however they are of conservation interest.
- Both species are similar in appearance and habitat requirements and distinguishing between them is not necessary unless local environmental stakeholders can identify the exact species.
- As the Mussel SOP, if Operational Staff locate the same, Management Staff will be notified.
- Where significant populations are encountered notify NPWS Ranger and local IFI Officer, and where they are interested in visiting the site, facilitate a site visit as necessary.
- Identify extent of channel applicable and the mitigating measures to apply.
- Typical Mitigating Measures include:
- Operational Staff to observe spoil and return any Mussels to the channel whom are expected to recolonise the channel bed.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.
- Skip sections to retain intact habitat either in one long reach or multiple short reaches.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Record species presence on the Weekly Record Cards which will be recorded on the Records Database.

Kingfisher

- Avoid disturbing nesting sites in banks.
- Visual sightings of Kingfisher by Operational Staff to be recorded on the Weekly Record Cards.
- Sightings by Management Staff to be recorded on the Weekly Record Cards where works in progress or on other occasions, record by separate map or channel reference format.
- All sightings to be recorded on the Records Database in accordance with the National Recording Process.

- All database records of species location will be uploaded to GIS by Environment Section.
- On an annual basis, Environment Section will issue the records to Birdwatch Ireland whom will add to the national Kingfisher database.

Birds

- Removal of any abnormally dense layer of vegetation is to be executed between September and February (inclusive) to minimise impacts on nesting birds unless there are other overriding requirements such as Health & Safety.
- For SPAs containing important over-wintering bird populations, in consultation with the NPWS, regard to be given to timing or phasing of the works to minimise potential disturbance.

Bats

- While the removal of large mature trees is not typically a requirement of maintenance works, where the case arises, in consultation with NPWS, regard to be given to the likelihood of bat roosting habitat.
- Typical mitigating measure would be to leave tree in fallen position for 24hrs to allow any bats vacate.
- Masonry bridges offer niches and crevices suitable for bat roosts and where masonry bridges are scheduled for maintenance works, regard to be given to the likelihood of bat roosting habitat. Typical maintenance works at low level such as wing wall repair or underpinning foundations have limited potential to impact on bat roosts. Where the case arises that repair works are to be above the high water level such as the upper arch, in consultation with NPWS, assess the potential for the works impacting on bat roosts.
- Typical mitigating measure would be to contract a bat specialist to survey for bat presence before works commence, to avoid entombment of any bats.

Wetlands - Bogs, Fens & Turloughs

- All channels scheduled for maintenance which overlap SAC designations to be checked against the list of channels that impinge on Raised Bog, Fen habitat or Turloughs and have regard to any NPWS agreements noted *.
- OPW Management Staff to consult with NPWS for expert opinion as to any evidence of ongoing ecological decline of the Bog, Fen or Turlough and judgement on, if the drainage datum set by the Drainage Scheme and its maintenance is an ongoing contributing factor by affecting the hydrological regime of the same.
- Where a likely impact is identified, conduct site visit as necessary and in consultation with NPWS, mitigating measures to be selected such as:
- Skipping the channel in question while taking cognisance of the flood risk management requirements.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.
- Inspection by OPW line management to assess the possibility of over digging the channel below the original design datum. Presence of an existing water level control such as a bridge floor to be established and alternative reference datum to be installed if deemed warranted.

** Environment Section currently developing a list of channels which overlap with Raised Bog, Fen habitat and Turloughs within SACs. Channels that are subject to a previous NPWS agreement /understanding of the extent of maintenance will be recorded.*

Invasive Species – Plants

- Multiple invasive plant species are widespread nationally as described in the SOP and prudent to assume that one or more of these plants can be present on any works site.
- At present the OPW does not have any direct responsibility for the management of Invasive species. However to ensure OPW operations are not a vector for these invasives, measures are required to reduce the risk of spread.
- Ensure machine washing equipment transported to site for all appropriate machinery movements as described in the Invasive Species SOP.
- Ongoing EDM site audits by Environment Section will include confirmation that machine washing was executed in accordance with the SOP for the last applicable machine transfer.
- In some cases, OPW will assist other authorities in the control of invasive species. In these projects, the works are typically carried out in partnership between a number of authorities such as IFI, NPWS and relevant Local Authority. As scenarios arise where OPW are requested to assist in an invasive species control project, Management Staff are encouraged to support the multi-authority partnership model which will maximise resource efficiencies for all parties while still achieving a broader environmental good.

Invasive Species – Zebra Mussel

- Zebra Mussels are present in the River Shannon, Grand Canal and are in many lakes such as L Derg, L Ree, L Garra, L Key, L Derragh, Derravaragh, L Sheelin and L Corrib. This species is spreading and it is prudent to assume that works in any large sluggish river or near a lake has potential to contain Zebra Mussel.
- For any proposed works in the vicinity of potential Zebra Mussel waters, flag for Operational Staff and ensure particular attention to cleaning procedures for all equipment prior to removal from site.
- Any new location of Zebra Mussel uncovered during operations, notify NPWS and IFI for their information.
- Record on Weekly Record Sheet which will be uploaded on the Records Database in accordance with the National Recording Process.
- On an annual basis, Environment Section will collate the records nationally and issue to any relevant authorities to assist in tracking the species spread.

Tree Management

- A small portion of channels have more infrequent maintenance cycles typically where self cleaning gradients are present. These sites can entail abnormally dense tree cover which may be required to be managed for conveyance or fisheries purposes. Removal of any abnormally dense layer of vegetation is to

be executed between September and February (inclusive) to minimise impacts on nesting birds unless there are other overriding requirements.

- IFI requests to reduce “tunnelling” on drainage channels to be accommodated where feasible. OPW Management Staff to facilitate a site visit with the IFI Officer as required and devise a selective approach to the tree removal so as to retain a dappling of shade along the channel length.
- Excess woody vegetation to be collected and utilised by the following in order of preference:
 - Reused by adjoining landowner for domestic firewood.
 - Subject to landowners agreement, stockpile excess to form natural cover and niche habitat, preferably with some connection of cover to the channel e.g. along a hedge leading to the water.
 - Shred and spread along the adjoining top of bank allowing the material to degrade rapidly and recolonisation of the underlying vegetation.

Environmental Drainage Maintenance (EDM) Guidelines

- A portion of operational crews will be audited annually for implementation of the EDM Guidelines and other standard environmental procedures as adopted.
- Auditing will be carried out separately by both IFI and OPW Environment Section on a rotational basis to ensure all operational crews are audited at least once every three years.
- Audit results will be recorded on a standard format with the following feedback:
 - All audit results will be forwarded to the relevant Engineer for that Drainage Scheme within two working weeks.
 - In the event of an audit showing elements of unreasonable non-compliance with procedures, the relevant Engineer will be notified within one working day.
 - Audit results will be forwarded to OPW Systems Co-ordinator for inclusion in monthly regional benchmarking reports.
 - IFI EREP team will compile an overall summary of their findings in their end of year report under the EREP project.
- Design for Enhanced Maintenance works under EREP will include a design element for full scale implementation of the EDM Guidelines such as Boulder Replacement and Excavating Pools.
- Management Staff to ensure that as far as practical, all Operational crews have an opportunity to get experience on these projects.

OPW Standard Operating Procedures (SOPs)

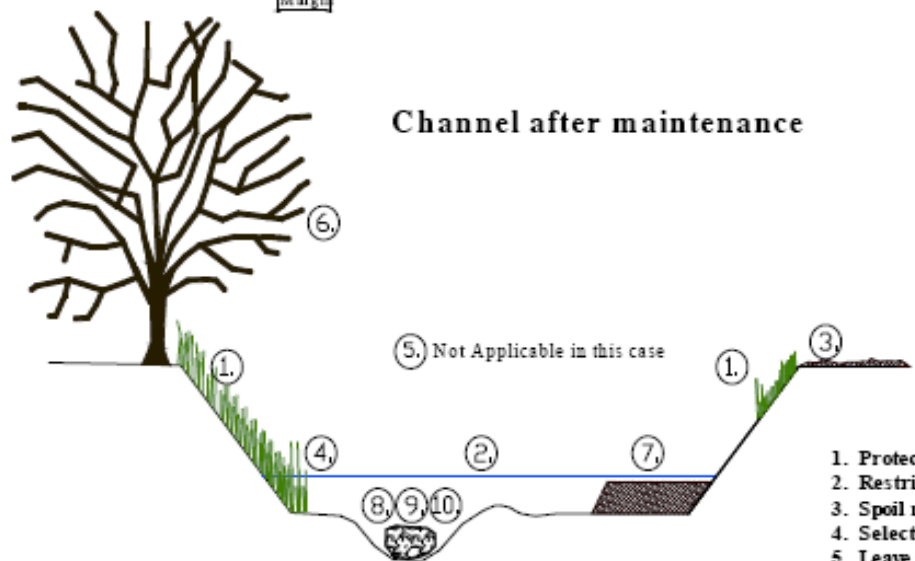
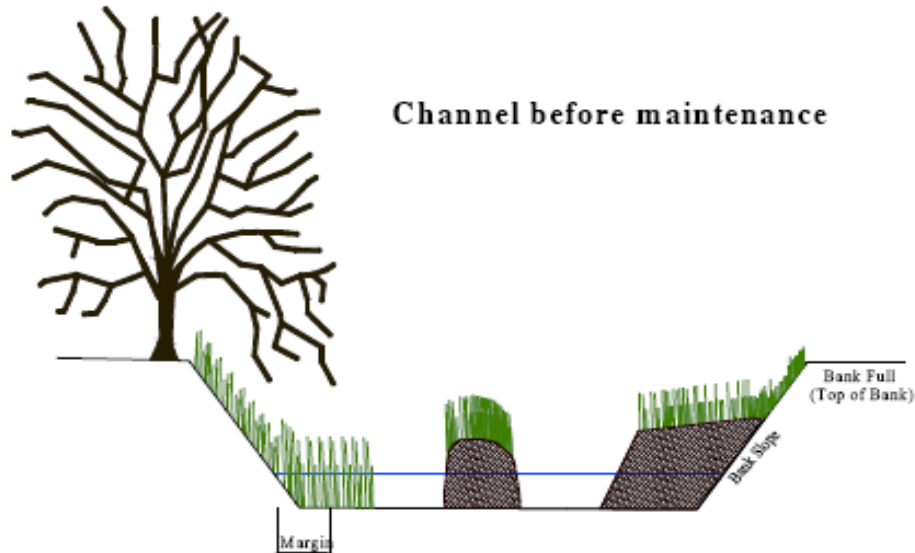
A total of 7 No. Standard Operating Procedures are applied during operational works. These SOPs set out actions designed to eliminate, or substantially reduce impacts to identified species and their associated habitats. These include:

- Environmental Drainage Maintenance Guidance Notes (10 Steps to Environmentally Friendly Maintenance)
- Lamprey SOP
- Crayfish SOP
- Otter SOP
- Mussel SOP
- Invasive Species SOP
- Zebra Mussel SOP

Environmental Drainage Maintenance Guidance Notes



10 Steps to Environmentally Friendly Maintenance



1. Protect bank slopes
2. Restrict maintenance to channel
3. Spoil management
4. Selective vegetation removal
5. Leave section untouched
6. Management of trees
7. Manage berm to form two stage channel
8. Replace stones and boulders
9. Loosen gravel beds
10. Re-profile channel bed

Environmental Strategies for Channel Maintenance



1. Protect bank slopes

- 1.1 Do not disturb the non-working bank slope
- 1.2 Minimise any effect on working bank
- 1.3 Leave margin of vegetation at foot of each bank slope



2. Restrict maintenance to channel

- 2.1 Remove only necessary silt – no new diggings
- 2.2 Remove instream material only
- 2.3 Retain marginal vegetation
- 2.4 Check spoil regularly. *See Lamprey & Crayfish SOPs*

3. Spoil Management

- 3.1 Maximise spoil placement on bank full line or spoil heaps **and**
- 3.2 Minimise spoil placement on bank slopes
- 3.3 Spread spoil as thinly as possible
- 3.4 Allow water to drain out of bucket over the water – lets small fish, lamprey and crayfish escape



4. Selective Vegetation Removal

- 4.1 Retain a band of vegetation on both sides at water's edge
- 4.2 Selectively manage instream vegetation
- 4.3 Maximise use of weed-cutting bucket
- 4.4 Avoid maintenance in coarse fish channels from 1st April to 1st July



- 4.5 Retain 1/3 to 1/2 of instream floating type vegetation, such as *Ranunculus* (water crowfoot) – see photo to right



5. Leave sections untouched

- 5.1 If channel capacity is not affected, leave section alone



Environmental Strategies for Channel Maintenance



6. Management of Trees

- 6.1 Remove trees that are blocking the flow
- 6.2 Tree-cutting window 1st September to 28th February



- 6.3 Remove overhanging branches to known flood level

- 6.4 Use saw secateurs for removal, not excavator bucket

- 6.5 Manage Trees to reduce very heavy shading
- 6.6 Manage briars and scrub.
See Otter SOP



7. Manage berms to form two-stage channels

- 7.1 Retain berm where channel capacity is not affected
- 7.2 Remove top of berms to low flow levels
- 7.2 Remove vegetation and soil from gravel berms
- 7.3 Replace sod to the berm where feasible
- 7.4 Only narrow berms if 'excessively' wide for the channel (i.e. greater than a third of the channel width)



8. Replace stone and boulders

- 8.1 Reinststate boulders and gravels as removed by maintenance operations
- 8.2 Reinststate suitably sized boulders into channel from spoil heaps where feasible
- 8.3 Boulders should be placed at or below low flow level and spaced out

9. Work in gravel bed channels

- 9.1 Loosen or toss bed gravels to wash out fines
- 9.2 Only considered between 1st July and 30th September
- 9.3 No work in gravel bed / spawning channels in fisheries 'closed season'
Note: This varies locally check with local IFI



Environmental Strategies for Channel Maintenance



10.1 Excavate bed to form deeper pool areas and shallow riffles



10.2 Overdeepen the channel along one side and place spoil on opposite side –particularly on curves and bends

10.3 Use existing boulders to form simple low-level structures



10.4 Record where such works are carried out

BROOK, RIVER & SEA LAMPREY STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Actions during Maintenance Operations

- Machine gangs to closely observe the spoil three times daily for Lamprey (and Crayfish).
- Where Lamprey encountered:
 - Contact area Foreman immediately.
 - Foreman to contact Engineering Staff in line with the Environmental Management Protocols.
 - Record the location and abundance of Lamprey on the time card.

Measures as directed by Foreman to minimise impact may include:

- Skip a defined stretch of channel.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.



Lamprey in the spoil

RIVER, BROOK & SEA LAMPREY IDENTIFICATION CARD



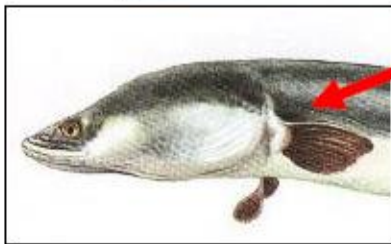
Gill Pores



Lamprey and young eels can look very similar. These key identifying features can be used to distinguish the two species

Lamprey:

- Gill Pores (Holes)
- No Fins
- No Jaw
- Average length 8 to 15cm (3 to 6 inches)



No Gill pores

Eels: No Gill Pores

Paired Fins

Jawed Mouth

Average length 65cm (26 inches)

Juvenile Lamprey:

- Juvenile Lampreys live in the sediment.
- It is in this juvenile phase that they can be removed from the sediment during maintenance.



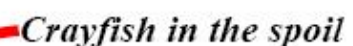
Adult Lamprey:

- Largest is the Sea Lamprey species.
- Also are River and Brook Lamprey
- Length from 30 to 60cm (12 to 24 inches).



- Machine gangs to closely observe the spoil three times daily for Crayfish (and Lamprey).
- Where Crayfish encountered:
 - Contact area Foreman immediately.
 - Foreman to contact Engineering Staff in line with the Environmental Management Protocols.
 - Record the location and abundance of Crayfish on the time card.

- Skip a defined stretch of channel.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.



WHITE-CLAWED CRAYFISH

Identification

- Resemble small lobsters.
- Colour varies from light to dark green-brown, with large front claws.
- Adults typically 7cm - 10cm (3" - 4") long.
- Juveniles can be as small as 2cm (1") long.
- Prefer channels with
 - dense weed cover (flaggers / watercelery) or
 - with a mixture of rocks / gravels that provide crevices for cover.



OTTER

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Week before Maintenance Operations begin:

- Operational staff will walkover works area one week in advance in conjunction with the PRA noting areas of dense cover with access directly to the water. (As identified during Otter Awareness Training)
- These areas of suitable cover should be avoided where feasible during maintenance.
- Suspected presence of an Otter holt to be reported immediately to area Foreman, who will contact Engineering Staff in line with the Environmental Management Protocols.
- Signs of Otter presence observed such as Spraints, Footprints or suspected Holts, to be recorded on the Weekly Record Cards.

Measures to minimise disturbance may include:

- Retain suitable cover where possible.
- Areas of dense scrub to be avoided by large plant.
- Skip stretch of channel in proximity of suspected holt.



Otters

- Widespread presence on OPW channels.
- Shy animals and not normally seen.
- Adults 1 metre long and weigh 10kg.
- Streamlined profile.

OTTER

Holts

- Usually well concealed.
- Typically burrows, or spaces under banks, tree roots or dense cover.



Spraints

- Found on rocks, paths, channel junctions.
- Dark, oily, sweet smelling.

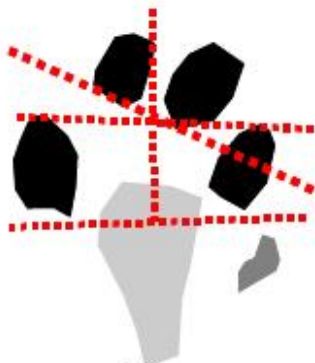


Suitable areas of cover

Dense bankside vegetation, particularly where there is direct covered access to the water.
Any isolated clumps of dense vegetation giving cover along an open length of channel.

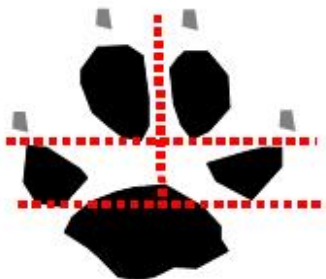


Foot-prints



Otter

(Non-symmetrical toes)



Dog

(Symmetrical toes)



Fox



Badger



Mink

MUSSELS

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

FRESH WATER PEARL MUSSELS

Before Maintenance Operations begin:

- Maintenance must not commence where a known population of Fresh Water Pearl Mussel exists (as listed in the Environmental Management Protocols).
- In the unlikely event of new population of Fresh Water Pearl Mussel being encountered during maintenance,
 - **All works must cease immediately.**
 - Contact area Foreman.
 - Record the location of Mussels on the time card.

Measures to minimise disturbance may include:

- Placing of straw bales to prevent movement of silt.
- Any exceptional / emergency works to be carried out in close consultation with the NPWS.
- For exceptional / emergency works e.g. fallen tree obstruction – these to be lifted clear of the channel to prevent disturbing the channel bed.

MUSSELS



Fresh Water Pearl Mussels (*Margaritifera margaritifera*)

- Shells very thick & heavy – shaped like a kidney.
- Shell colour is dark-brown – black, to blue & black.
- Adults range in length from approx. 6 cm – 12 cm (2.5 – 5 inches) and can live for over 100 years.
- Suitable rivers are reasonably fast flowing, with very clean, good quality water, gravel bed, preferably with large cobbles.



Not to be confused with Duck & Swan Mussel

- Egg-shaped shells 12 -16cm (5-6 inches) long.
- Thin shiny shells, usually brownish yellow with traces of green.
- Found in slow moving water.
- If encountered, contact area Foreman and return Mussels to channel.
- Record location of Mussels on time card



INVASIVE SPECIES STANDARD OPERATING PROCEDURE – ARTERIAL DRAINAGE MAINTENANCE

Measures to reduce the risk of spread of invasive species

All excavators, weed cutting boats, tractors, dumpers & other machinery employed on maintenance must be thoroughly cleaned down using a power washer unit prior to being;

- (a) transported by Low- Loader**
- (b) moving to another catchment within the Region**
- (c) moving to another Region.**

Notify your supervisor immediately if you see any of the invasive species listed.

*Full details of all species are available in the CFB's
Field guide to the Identification of Aquatic Invasive Species*



Giant Hogweed

Found on the banks of many rivers throughout Ireland.

Can grow to a height of 4 metres.

Seeds are carried by water and spread very quickly.

!!!Avoid contact with the sap of this plant as it can cause extensive lesions or blistering of the skin.



Japanese Knotweed

Grows up to 2-3m in height along roadsides and river corridors throughout the country.

Even a tiny piece of this plant can produce a new plant.

Leaves are heart-shaped with a pale stripe down the centre.

In Summer cream flowers arise from the tips of the red-flecked stems.



Himalayan Balsam

Grows in dense strands up to 3m high, and is found widespread across Ireland along banks of rivers.

Seed pods explode scattering seeds.

Dies back in Autumn exposing bare banksides to erosion.

White or pink flowers, smooth hollow stem, oval shaped pointed leaves with jagged edges.



Curly waterweed – *Lagarosiphon major*

Found in lakes and slow flowing waterways up to 6m deep.

Spread by fragmentation from one watercourse to another on boat hulls, trailers, outboard motors or angling equipment.

Significant weed stands located in Lough Corrib.



Zebra Mussels

Distinctive stripy shell, very small (1-3cm).

Attach in clusters to hard surfaces – boats, pipes, buoys.

Refer to the [Zebra Mussel Standard Operating Procedure](#).

All photographs courtesy of Central Fisheries Board

ZEBRA MUSSEL

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE



Actions for Maintenance Operations

1) Zebra Mussels detected on site

- Where Zebra Mussels are found, remark on the extent of Mussels on the Weekly Report Card and notify the Foreman/Technician.
- Technicians/Engineers to notify Environment Section of location and grid reference.
- Environment Section to update the National Database.

2) Maintenance close to R. Shannon or infested lakes

- Where a machine is working close to the R. Shannon or an infested lake, ensure that prior to the machine transferring to a new site, buckets and tracks are thoroughly cleaned of any material such as silt or vegetation.
- Ganger / Driver to visually inspect the bucket, tracks and any equipment that was in the water to ensure no Mussels are present.

3) Maintenance close to outlets/inlets of any lakes

- Where a machine is working close to any lake, ensure that prior to machine transferring to a new site, buckets are clean of any material such as silt or vegetation.
- Ganger / Driver to visually inspect the bucket and other equipment that was in the water to ensure no Mussels are present.

4) Boats and other equipment

- Boats or other water based equipment that is to be transferred between river catchments should be thoroughly cleaned on the outside, drained of any bilge water and inspected for the presence of Mussels.
- If it's suspected that the equipment was in contact with Zebra Mussel waters, steam clean the hull and trailer and leave the boat or equipment out of water for four weeks prior to moving.

OPW Role

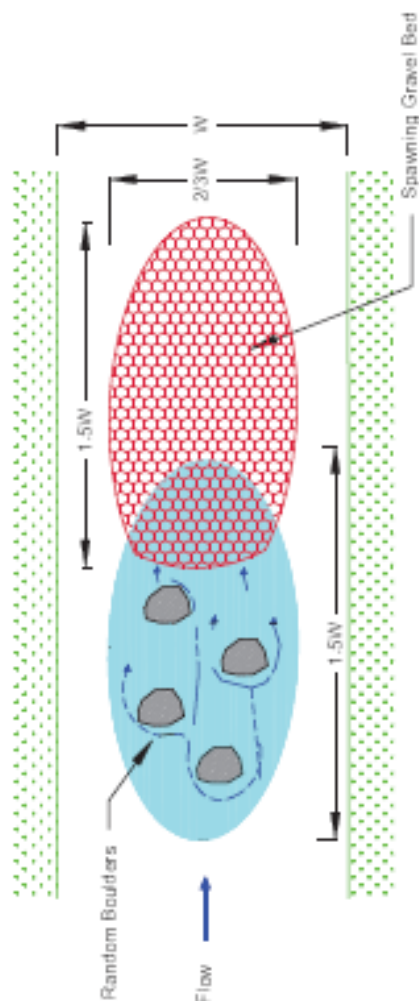
Although it is a relatively low risk, OPW could spread Zebra Mussels if aquatic vegetation or excavated material containing Mussels is inadvertently transported to another non-infested channel. Adult Mussels can survive for up to four weeks out of water hence its critical not to transport the same. Larvae are tiny and barely visible but will not survive on a machine bucket if there is no silt, stones or vegetation to shelter it.



Environmental Threat

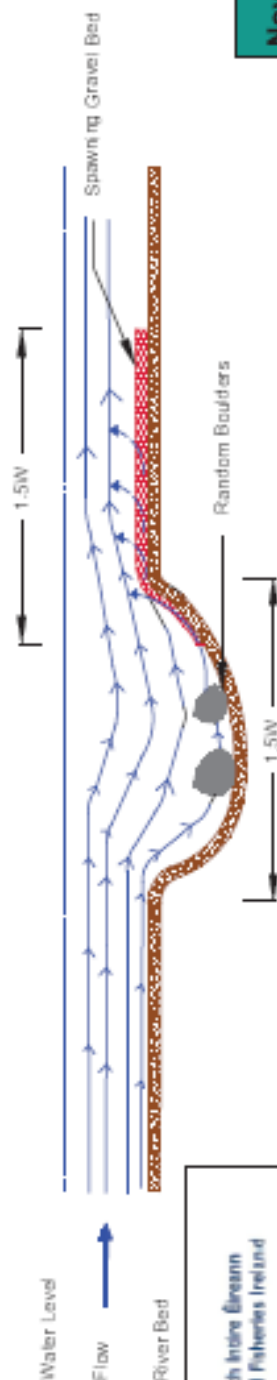
Zebra Mussels are thumbnail-sized black & orange striped shellfish. They grow into dense clusters and attach to any underwater hard surface. They are an invasive species that damage the natural ecology of the infested waters. They expand into catchments through been transported by man's activities e.g. transferring fishing boats. Once in a particular lake or river, if conditions are favourable, they will multiply and spread with the currents. It is envisaged that they will keep expanding their territory unless man makes a concerted effort to prevent transport of the Mussels into non-infested waters.

Detail 1: Centre Channel Pool with Gravel Bed

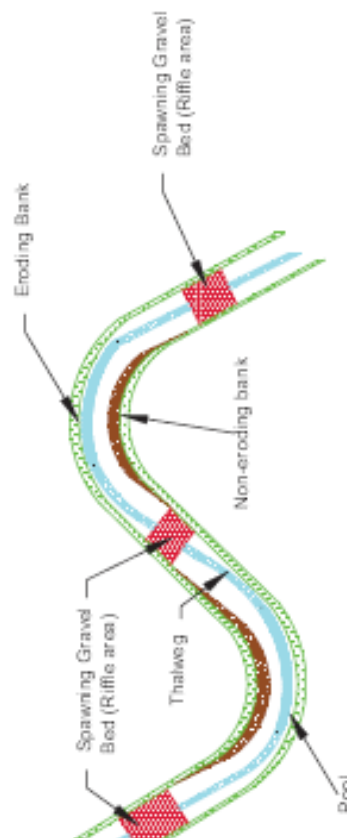
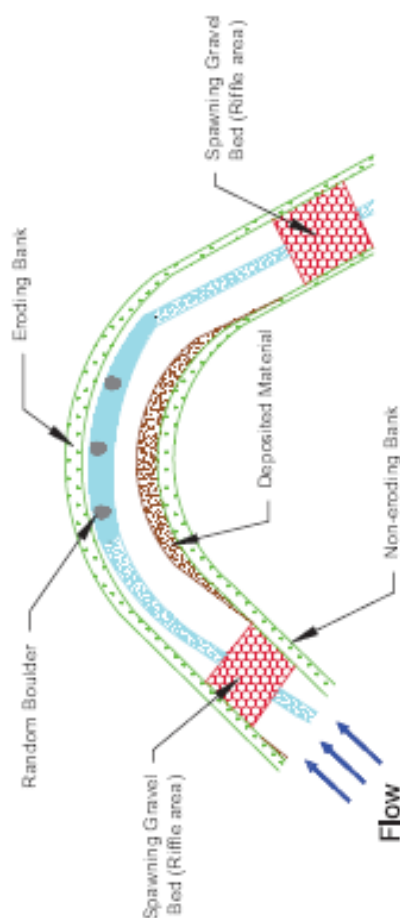


NOTES:

1. Pool length = 1.5 times channel base-width
2. Pool should be constructed in the centre of the channel with a width occupying approximately $\frac{2}{3}$ of channel base-width and should be egg-shaped
3. Gradually slope down to the deepest point in the centre and taper back up towards the tail and both sides
4. The depth of the pool varies according to the size of the channel. Typically the pool depth below low water level, ranges from 0.9m for smaller channels up to 1.5m for larger channels
5. Start to place gravel at tail of pool (downstream end)
6. Gravel bed and pool should be equal in length (1.5 times channel base-width)
7. Gravel bed should be 350-400mm deep
8. Place a number of boulders in pool in a triangular or diamond pattern depending on the size of channel
9. Ensure boulders are large enough to remain in place during flood flows
10. Pool spacings along the channel should be 5 to 7 times the channel base width or follow F1 design

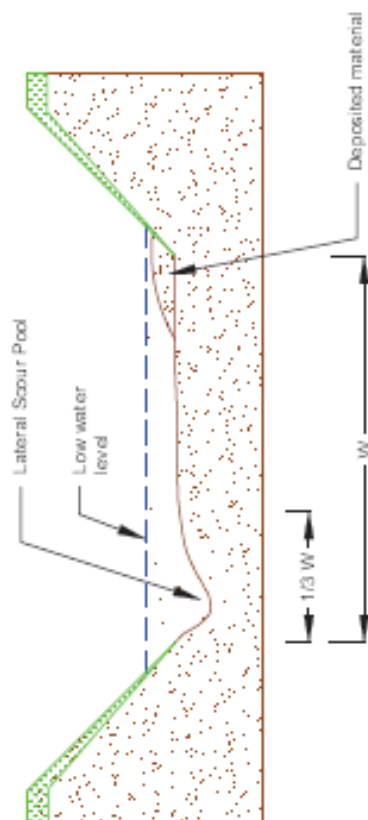


Detail 2: Lateral Scour Pool with Gravel Bed



NOTES:

1. Pool width approximately $\frac{1}{3}$ of channel base-width placed on eroding side of channel
2. Pool should be banana shaped
3. Gradually slope down to deepest point in the centre and taper back up towards the tail and both sides
4. The depth of the pool varies according to the size of the channel. Typically, the pool depth below low water level, ranges from 0.9m for smaller channels up to 1.5m for larger channels
5. Gravel bed placed on existing riffle area - See IRI Design
6. Place a number of boulders in the pool in a triangular or diamond pattern
7. Excavate thalweg to a depth of approximately 0.5m below summer water level
8. Deposit excavated material on inside of bend to form a berm if no berm present



Detail 3: Grave | Bed Detail

NOTES:

- Gravel bed should be 350mm-450mm deep
- Gravel bed should occupy the full channel cross section
- Gravel should be washed rounded stones of varying particle sizes as detailed in Table 1 for trout and Table 2 for salmon
- Sample existing spawning gravels to confirm similarity with gravels as supplied by quarry supplier

Table 1: Trout

Type	Grade	% Composition
Cobble	64-190 mm	0
Very coarse gravel	32-64 mm	30
Coarse gravel	16-32 mm	35
Medium gravel	8-16 mm	35

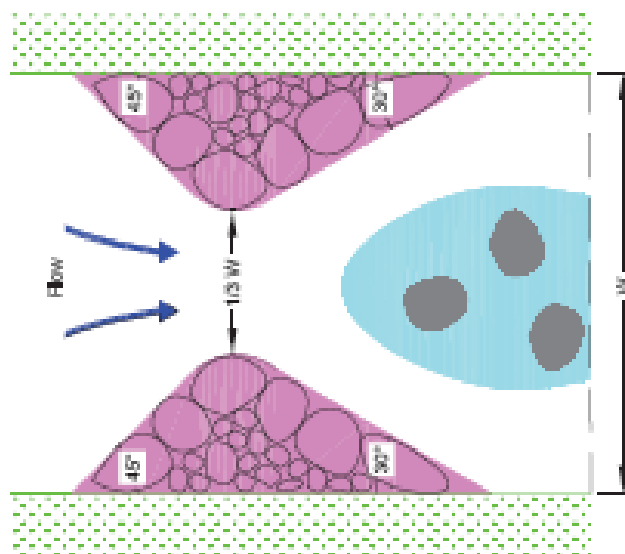
Trout: Percentage composition of gravel required

Table 2: Salmon

Type	Grade	% Composition
Cobble	64-190 mm	10
Very coarse gravel	32-64 mm	35
Coarse gravel	16-32 mm	25
Medium gravel	8-16 mm	30

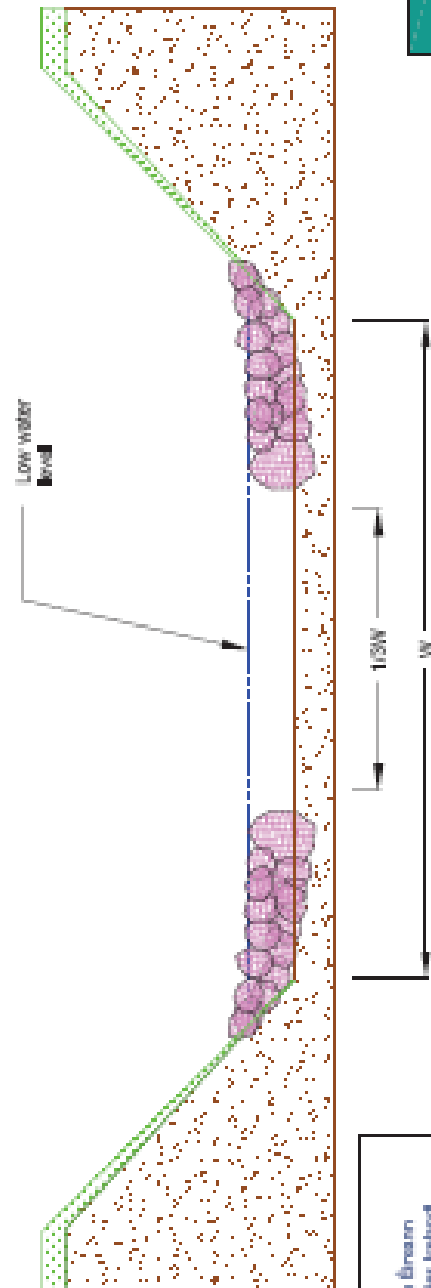
Salmon: Percentage composition of gravel required

Detail 4: Paired Stone Deflectors

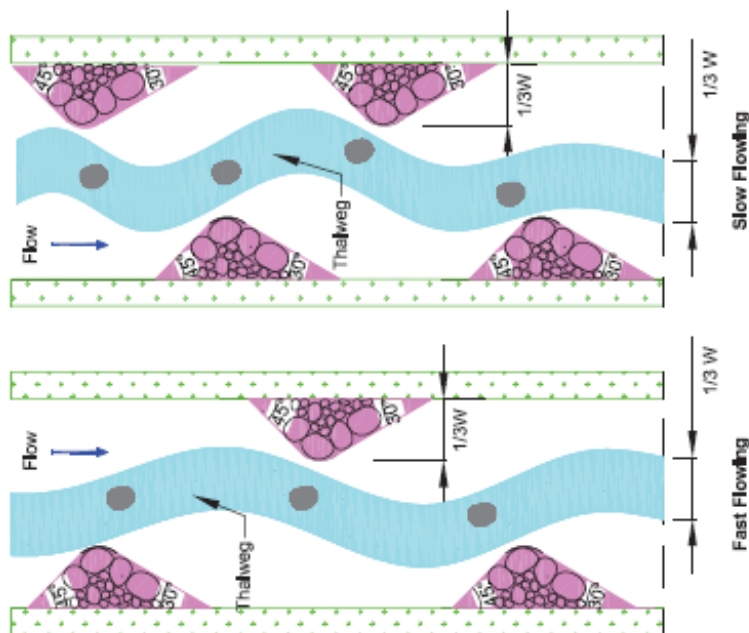


NOTES:

1. 45° angle on upstream slope
2. 30° angle on downstream slope
3. Deflector should slope down from bank
4. Stones at outer tip of deflector should be partially buried and the top of the stones should not be higher than low water level
5. These boulders should be the largest available to ensure they can withstand the energy in the channel
6. Use material excavated from pool to backfill deflectors. If no excess material is on site, backfill deflectors with broken stone
7. A space of $\frac{1}{3}$ channel base-width should be left between the paired deflectors

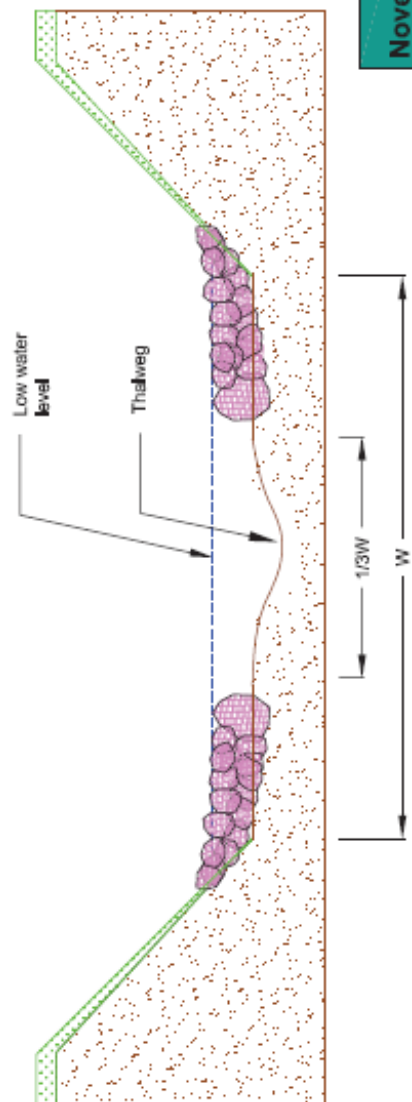


Detail 5: Alternating Stone Deflectors

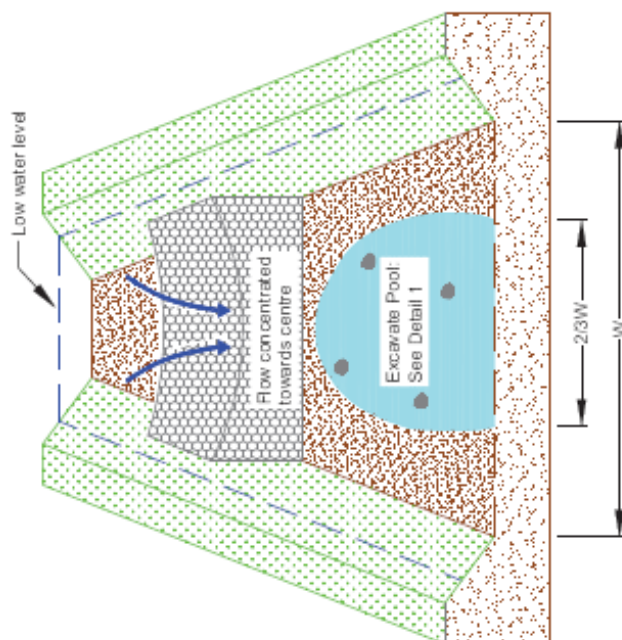


NOTES:

1. 45° degree angle on upstream slope.
2. 30° degree angle on downstream slope.
3. Deflector should slope down from bank.
4. Stones at outer tip of deflector should be partially buried and the top of the stones should not be higher than low water level.
5. Deflector width should be $\frac{1}{3}$ of channel base width.
6. In fast flowing rivers deflectors should not overlap.
7. In slow flowing wide channels deflectors should overlap.
8. Cover deflectors with scraw/vegetation where available.

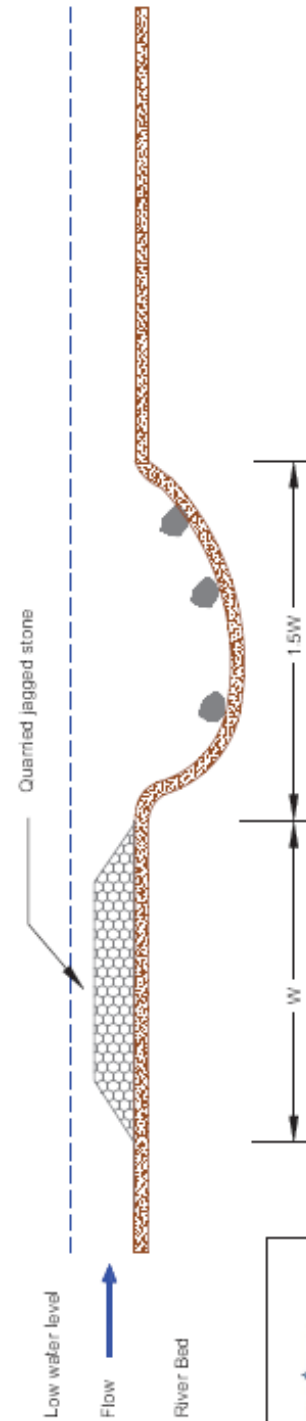


Detail 6: Rubble Mat

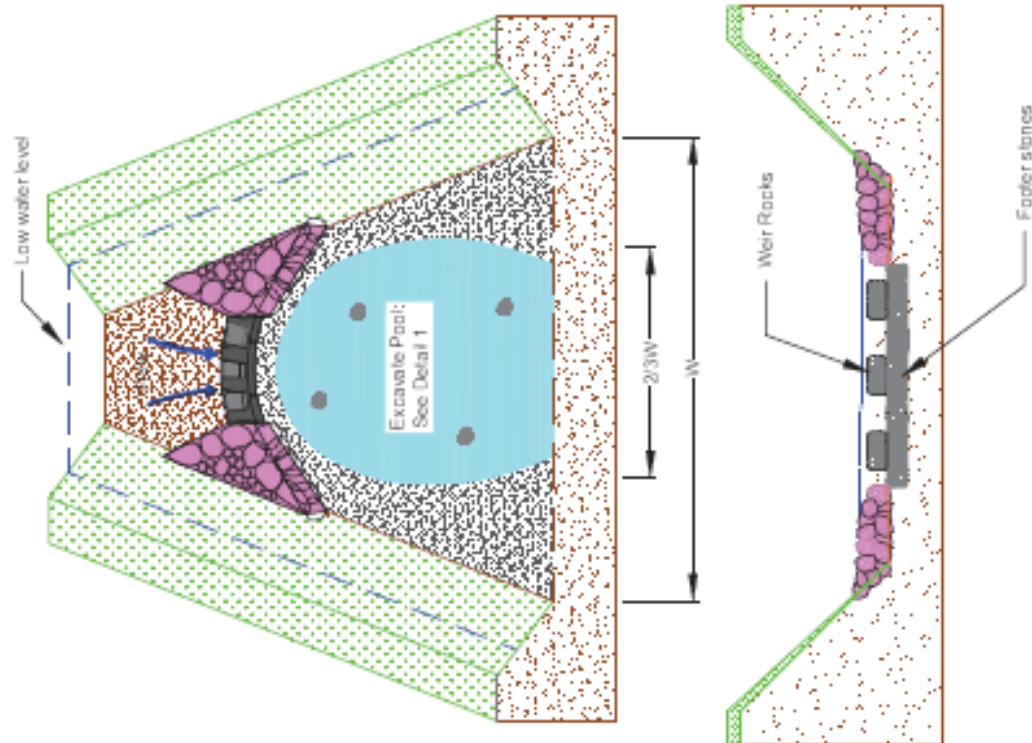


NOTES:

1. Rubble mat consists of broken quarried stone (150 - 250mm)
2. Rubble mat length equal to channel basewidth
3. Stone placed below low water level from bank to bank
4. Gulley should be made through the rubble mat concentrating flow towards centre of channel
5. Excavate a pool downstream of the mat (See Detail 1: Centre Channel Pool)
6. Height of rubble mat will vary according to water depth - Follow IFI Design

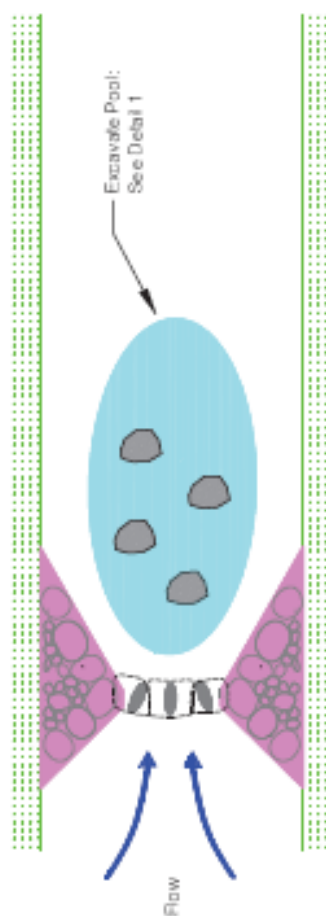


Detail 7: Vortex Stone Weir

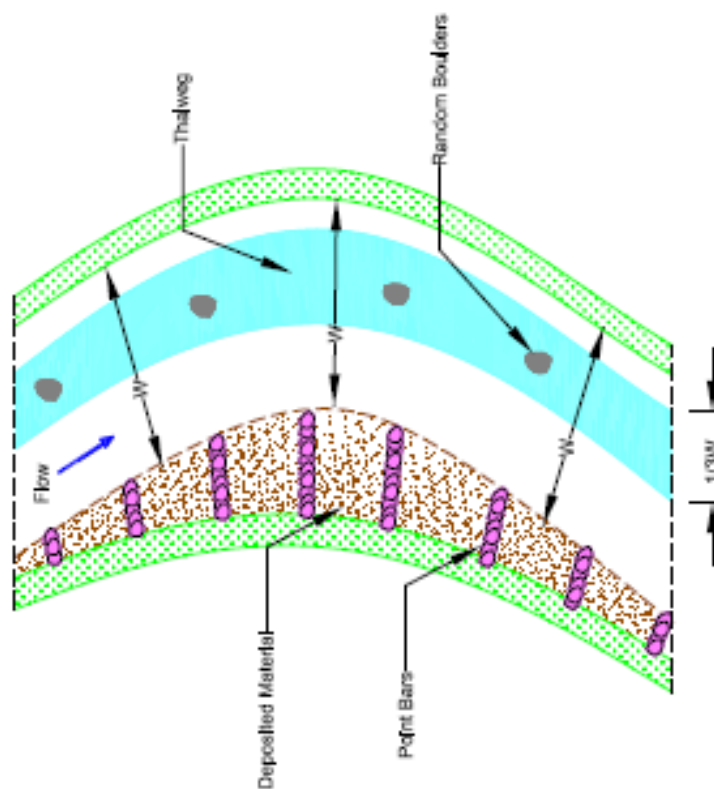


NOTES:

1. Stone deflectors or a series of rocks are built into both banks to direct flow towards centre of channel
2. A line of foster stones, arched upstream are buried across the central channel area. These foster stones to be buried so the surface is flush with bed of the channel
3. These weir rocks are placed on top of the foster stones. The tops of these rocks are exposed by a few centimeters in low flow and are fully submerged in high flow.
4. Foster stones should ideally have a flat flagstone profile, which are larger than the weir stones and form a splash apron to prevent scour
5. Excavate a pool downstream of the weir (see Detail 1: Centre Channel Pool)



Detail 8: Point Bars



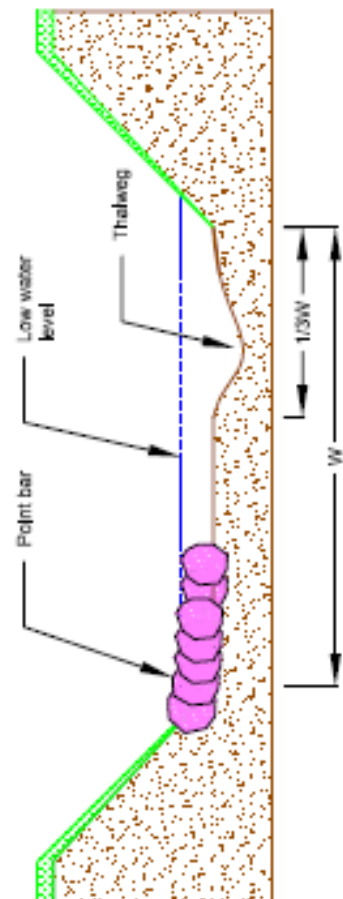
NOTES:

Deflector construction on bends:

1. Typically point bars should be constructed for approximately 1/3 channel basewidth
2. The outer lip of the point bars should form a contour which is parallel to the opposite bank
3. Typically point bars should be spaced approximately 10m apart and built at right angles to the bank (See J1 design for spacing)
4. Excavate a trench along the line of the point bars. Boulders of approximately 0.5 tonnes should be placed into the trench so that they are partially buried into the trench
5. Slope each baffle such that the boulder closest the bank protrudes slightly above low water level and the boulder at the outer edge of the point bar should protrude slightly below low water level

Thalweg

1. Place excavated material from the thalweg between the baffles
2. Place random boulders into the thalweg



4.0 Mitigation and Monitoring

4.1 Environmental Management System

All works carried out as part of this Programme are done in accordance with OPW's Environmental Management Protocols and Standard Operating Procedures.

Environmental River Enhancement Programme

The Arterial Drainage Maintenance Service of Engineering Services, OPW is carrying out the Environmental River Enhancement Programme (EREP). The enhancement works consist of both capital enhancement and enhanced maintenance. These works focus on river corridor improvements to salmonid channels with target specific actions on 100 kilometres of Scheme channel per annum, with pre and post measurement of biodiversity taking place on the channels in the relevant sub-catchments scheduled to benefit from these works. The identification of these channels, the carrying out of biodiversity assessments, the preparation of a five year programme of work and post biodiversity change assessments forms part of the work programme to be delivered by the service provider i.e. Inland Fisheries Ireland. It also involves making the assessment data available in a form that will allow completion of hydromorphological assessments.

The enhancement works are being carried out using OPW staff and machinery with the IFI's staff working alongside OPW supervisory staff. All materials required for the construction of in-stream structures, gravel and fencing is being supplied by OPW.

Environmental Training

Environmental training of all staff is an ongoing process. Technical and Operational Staff have completed formal training in environmental river maintenance in 2004, and again in 2010 which contained the more recent environmental practice. This training was developed and delivered by Inland Fisheries Ireland as part of the EREP. The training programme delivered included presentations in river corridor ecology, maintenance strategies involving both 'enhanced maintenance' and 'capital enhancement', and OPW's Environmental Management Protocols and SOPs.

The formal approach to EREP Training is complimented with on-site training. Regular site visits from IFI and OPW's Environment Section provide further guidance and advice to operational staff. Auditing of operational staff on the implementation of the Environmental Drainage Maintenance Guidance Notes (Ten Steps to Environmentally Friendly Maintenance) is also carried out under EREP.

In addition, other environmental training takes place as deemed beneficial, e.g. in 2008, the majority of operational staff were trained in Otter Awareness. This course, provided by the Department of Zoology, Trinity College Dublin, included presentations on otter ecology, and on-site identification of otter signs and suitable habitat.

Geographical Information Systems (GIS)

GIS systems are now a significant tool to manage both the existing and future environmental information and to this effect, the Drainage Maintenance Service has recently digitised the original Drainage Scheme maps. GIS systems allow the rapid and accurate transfer of geographical environmental data and it is hoped to contain

all maintenance work programmes, fishery information such as spawning reaches, environmentally designated areas e.g. SACs, other sensitive sites such as habitats of protected species and general habitat information in this format.

Ecological Impact Assessments

The annual Arterial Drainage Maintenance Programme is screened for potential impacts on Natura 2000 Sites. Channels identified as having the potential to impact on a Natura 2000 Sites are subject to Appropriate Assessment under Article 6(3) of the Habitats Directive. These Appropriate Assessments are carried out by external Ecological Consultants.

Recent practice for any new localised flood alleviation project is to carry out an Appropriate Assessment if the works overlap with a Natura 2000 Site or an ecological assessment if the works are not within a Natura 2000 Site but still need to have regard to the broader protected habitats and species such as Annex IV species, Wildlife Acts or Flora Protection Order.

Environmental Impact Assessments

European Communities (Environmental Impact Assessment) Regulations, 1989 to 2006 transposes the EIA requirements with recent further changes to the EIA thresholds been introduced through the Planning and Development (Amendment) (No. 2) Regulations 2011. The most applicable class of development relevant to drainage maintenance and 'Designation' projects is in respect of Canalisation. The thresholds are where canalisation and flood relief works, where the immediate contributing sub-catchment would exceed 500 hectares or where more than 2 hectares of wetland would be affected or where the length of river channel on which works are proposed would be greater than 2 km.

Arterial drainage maintenance works are considered to be sub-Environmental Impact Assessment threshold as the operations are maintaining the river corridor but are not canalising any new lengths.

Planning & Development

While there is an extensive range of Planning and Development legislation, the most applicable current legislation is the Planning and Development Regulations, 2001 and the Planning & Development Acts 2000 to 2010. This legislation exempts from planning permission, works under an Arterial Drainage Scheme. These drainage works and the associated maintenance, forming part of a scheme have been confirmed by a Minister and have gone through a public exhibition process in accordance with the Arterial Drainage Acts 1945 and 1995.

4.2 Monitoring Programme

Monitoring of this Programme is made up of two components. The first addresses the on-site implementation of OPW's Environmental Management Protocols and Standard Operating Procedures. The second is a scientific monitoring programme, carried out under the EREP, assessing the impacts of routine maintenance and 'capital enhancement' projects on the river corridor biodiversity.

Auditing

External auditing of operational staff, on the implementation of the Environmental Drainage Maintenance (EDM) Guidance Notes (Ten Steps to Environmentally Friendly Maintenance), is carried out by Inland Fisheries Ireland, as part of the EREP. These audits inform the OPW of the level of compliance with the Environmental Management Protocols and Standard Operating Procedures, with particular focus on the EDM Guidance Notes. External auditing covers approximately one-third of OPW drainage machine crews annually.

Auditing (both internal and external) provides an opportunity to assess the level of compliance with Environmental Management Protocols and SOPs. It also allows for discussion on any difficulties encountered and experimental works that could be applied. The OPW Foreman is present throughout the audit along with the entire machine gang. A section of recently maintained channel is examined along with the next section to be maintained. This gives a good idea of pre-maintenance conditions and enables recommendations to be made about maintenance should proceed, should changes be required. The audit form is forwarded to the relevant Engineer within 14 days upon a satisfactory audit. If the audit highlights unsatisfactory compliance with the OPW Environmental Drainage Maintenance guidelines and SOPs the relevant OPW Engineer is notified within 24 hours.

A rating system was developed and is recorded in OPW's Internal Management System. Ratings are monitored by both IFI and OPW to identify any issues with particular machine crews, or any difficulties with particular aspects environmental maintenance.

Audit Ratings

Rating %	Category
0-50	Bad
51-59	Poor
60-70	Moderate
71-84	Good
85-100	Very Good

Audit results are reported to OPW Management Staff throughout the year and presented in the IFI's Annual EREP report. Presentations are delivered on the auditing and recommended improvements at an annual meeting had with IFI's EREP Team and OPW's Engineers, Technicians and Foremen.

Internal auditing is carried out by OPW's Environment Section. A number of OPW/IFI audits are carried out in tandem annually for standardisation purposes. A standard audit form is used by both IFI and OPW's Environment Section (**OPW Site Audit Form V.1**).

OPW Site Audit Form V.1											
OPW Region:				Scheme:							
Foreman:				Channel: (name & code)							
Driver(s)				Section: (chg-chg)							
Auditor:				Date & Time:							
Site surveyed from:		LHB RHB		Photographs:							
GPS Ref:				Water level:							
				Machine number:							
				Red book		present	<input type="checkbox"/>	absent	<input type="checkbox"/>		
				Spill kit		present	<input type="checkbox"/>	absent	<input type="checkbox"/>		
Wetted/Base width (<1m, 1-3m, 3-6m, 6-10m, 10-15m, >15m)											
Velocity rating (slow, moderate, fast, flood)				Weather conditions:							
Bed type											
200m minimum maintained section walked?						If not, what distance walked?					
200m unmaintained section walked?						If not, what distance walked?					
Suitable habitat in reach?		YES	NO	Crayfish (in spoil)		Abundant	<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>
Annex spp./habitats (Recorded on site)				Lamprey (in spoil)		Abundant	<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>
				Abundant (>11 individuals), Common (5 - 10 individuals), Rare (1 - 4 individuals) per 5m ² of bank top							
				Floating-leaved vegetation		Abundant	<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>
				Circle % cover in reach: Abundant (30-70% cover), Common (3-10% cover), Rare (< 3% cover)							
Invasive Species		Species Name:									
% cover in reach: Abundant (30-70% cover), Common (3-10% cover), Rare (< 3% cover)				Abundant		<input type="checkbox"/>	Common	<input type="checkbox"/>	Rare	<input type="checkbox"/>	
Exercising Due Diligence (Skipped Section)		<input type="checkbox"/>									
Maintenance Constraints:				Working Bank		Woodland	Tillage	Fencing			
				Non Working Bank		Woodland	Tillage	Fencing			
Comments on Audit Findings:											
Outstanding Issues:											
Result: _____											
						Compliant	Grade 1	Grade 2	Grade 3		
1. PROTECTING BANK SLOPES						Applicable	<input type="checkbox"/>	<input checked="" type="checkbox"/>	%	%	%
1.1: Has the non-working bank been disturbed? (slope and Bankfull)								10-15	15-30	30-100	
1.2: Has the working bank slope been disturbed? (mechanically)								15-30	30-60	60-100	
Re profiling		<input type="checkbox"/>	Scraping	<input type="checkbox"/>	Inappropriate bank protection	<input type="checkbox"/>	Fine material	<input type="checkbox"/>			
Other (list):											
2. CONFINING WORKS TO CHANNEL CENTRE						Applicable	<input type="checkbox"/>	<input checked="" type="checkbox"/>	%	%	%
2.1: Is maintenance retaining 10-15% channel width vegetation on the working margins						See Section 4					
2.2: Is maintenance retaining 10-15% channel width vegetation on the non-working margins											
2.3: Is the quantity/type of spoil being removed appropriate?								10 - 20	20-30	>30	
Gravel/cobble		<input type="checkbox"/>	Marl/boulder clay	<input type="checkbox"/>	Dragging gravel to margins	<input type="checkbox"/>					
2.4: Is spoil is checked for lamprey/crayfish at least 3 times a day as per SOPs? Yes/No						See Section 4.4 - 4.5 for Tall Reeds/Flaggers		moderate	poor	none	
3. Spoil Management						Applicable	<input type="checkbox"/>	<input checked="" type="checkbox"/>	%	%	%
3.1 Is spoil being placed in the best location?		Spoil heap/bank top		<input type="checkbox"/>			70-50	50-30	<30		
W/ bank slope		<input type="checkbox"/>	NW/bank slope	<input type="checkbox"/>	Inside fence	<input type="checkbox"/>	Spoil spread on NW/bank slope the only option?		Yes	No	
Is spoil visibly slipping back into channel?		<input type="checkbox"/>	Restrictions:								
3.2: Is spoil spread thinly ?								moderate	poor	Bad	
3.3: Is driver allowing water to drain from bucket? (observe driver for 3 minutes; if possible)								40-60	<40		

		Compliant	Grade 1	Grade 2	Grade 3
4. Vegetation Management	Applicable	✓	%	%	%
Timing					
4.1 Outside coarse fish spawning season (April 1st to July 1st) <i>If Relevant</i>					
Tall Reeds/Flaggers	Relevant				
4.2 Is vegetation management Interfering with nesting birds (March 1st to Aug 3 1st: Wildlife Act)		YES	NO		
4.3 Is maintenance opening the centre of the channel ONLY? (maximum open area is 75-80% of width)			80-70	70-50	<50
4.4: Where crayfish are present, are additional wider areas of vegetation being retained? (1/3 channel width retained)				20-15	<10
4.5: Where lamprey are present, are additional wider areas of vegetation being retained?(1/3 channel width retained)				20-15	<10
Floating-leaved vegetation (Annex habitat)	Relevant				
Ranunculus sp. (% cover =)					
Pondweed sp. (% cover =)					
4.6: Is maintenance attempting to remove floating pondweed with the normal bucket?		NO	YES		
4.7: Is floating leave pondweed being skipped/retained? (Retain 50-33% of total reach)			33 - 25	25-15	<15
4.8: Is ranunculus being retained/skipped in the Channel? (Retain 50-33% of total reach)			33 - 25	25-15	<15
Water celery/cress:	Relevant				
4.9: Is the driver skimming off water celery vegetation only?		100-60	60-40	<40	
4.10: Is there an avoidance of digging the channel bed?			60-40	<40	
4.11: Is the driver trying to retain water celery on margins?		100-60	60-40	<40	
4.12: The driver is implementing enhanced maintenance in a channel with <1m base width					
Weed-cutting boat/bucket	Relevant				
4.13: Is it cutting the channel centre vegetation ONLY? (maximum open area is 75-80% of width)			70-50	50-30	<30

5. Skipping Sections (Where appropriate)	Applicable	✓			
5.1: Were appropriate sections skipped?		YES			
5.2: Reason for skipping:					
Power cables	<input type="checkbox"/>	Good Gradient	<input type="checkbox"/>	Lamprey/Crayfish present	<input type="checkbox"/>
Maintenance not required	<input type="checkbox"/>	Gravel section	<input type="checkbox"/>	Otter holt	<input type="checkbox"/>
Kingfisher/ Swan nest	<input type="checkbox"/>	Wetlands - Bogs, Fens & Turloughs	<input type="checkbox"/>	Mature tree line	<input type="checkbox"/>
Swan & Duck Mussels	<input type="checkbox"/>	Invasive Plants Species	<input type="checkbox"/>	Freshwater Pearl Mussel	<input type="checkbox"/>
Other (list):				Channel not accessible	<input type="checkbox"/>

6. Tree Management	Applicable	✓	%	%	%
Timing					
6.1 Appropriate tree management is only permissible from September 1st to February 28th under the Wildlife Act					
Tree cutting					
6.2 What is the purpose of the tree cutting?					
Conveyance	<input type="checkbox"/>	habitat enhancement	<input type="checkbox"/>	access	<input type="checkbox"/>
Other (list)					
6.3 What equipment is being used?				Machine bucket	
Secateurs	<input type="checkbox"/>	chain saw	<input type="checkbox"/>	hand saw	<input type="checkbox"/>
Tree shears	<input type="checkbox"/>				
6.4 How much tree cover is being retained on the banks in the channel reach?			70-50	50-25	<25
removing fallen/low trees	<input type="checkbox"/>	opening sections over riffles	<input type="checkbox"/>	Selective tree cutting	<input type="checkbox"/>
opening limited sections for access	<input type="checkbox"/>				
Other (list):					
6.5: Is tree cutting retaining the variety of trees present/diversity?					
6.6: Is tree cutting retaining a diversity of bankside vegetation? (trees/Scrub/Shrub)					
6.7: Manage scrub - Otter & Birds SOP			80-70	70-50	
6.8: Woody habitat placed in field / bank slope/top as wildlife refuges?					
6.9: Avoidance of damage to tree cover during the closed season					

7. Berm Management	Applicable	✓		Infrastructure	<input type="checkbox"/>
7.1: Retain berms (no maintenance)					
7.2 Managed to the basic berm protocol?			80-70	70-50	<50
7.3 Berm re-sodding done where appropriate (berm width / sod character)					
Gravel Berm					
7.4: How gravel berm has been managed?			moderate	poor	bad
gravel drawn to bank toe	<input type="checkbox"/>	gravel removed from channel	<input type="checkbox"/>	Gravel used downstream in channel	<input type="checkbox"/>
Other (list):					

8. Replacing stone and boulders back in the channel	Applicable	✓	%	%	%
8.1: Are materials being returned to the channel (boulders/cobble/gravel) from diggings?				70-50	<50
8.2: Is readily available and appropriately sized stone from adjoining locations being placed into the channel?			60-40	<40	
8.3: Is there a reason for not placing stone material into the channel, if stone available?			No		
If Yes (List):					

9. Gravel Bed Channels	Applicable	✓	%	%	%
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9.1: Is instream maintenance taking place between 1st July and 30th September, without consultation with IFI?					
9.2: Loosen or toss bed gravels to wash out fines			70-40	<40	
9.3: Are measures present to prevent sediment and silt flowing downstream between Autumn-Spring?					

	Compliant	Grade 1	Grade 2	Grade 3
10. New Excavations in the channel - simple structures	✓	%	%	%
10.1: Is the bed being excavated to form deeper pool areas and shallow riffles?		70-50	<50	
10.2: Is the channel being deepened on one side and spoil placed on the opposite side?		70-50	<50	
<i>Opportunity to use existing spoil to form simple structures?</i>	✓	%	%	%
10.3. Alternating/ paired deflectors		70-50	<50	
Rubble mat				
Simple weir				
Random boulder array				

Count No of Applicable Steps:

Scoring for Applicable sections:	Totals:				
----------------------------------	---------	--	--	--	--

< 4 Steps	Total Marks	Total score
1 Yellow = -15		
1 Orange = -30		
1 Red = -70		
Total Negative Mark		
1 Green = +15%		
Total Positive Mark		

To Calculate Score: 100 - (Total Negative Mark + Total Positive Mark)

This score represents % compliance (a negative is possible)

Example: No of Sections: 6, Scores: 1 Orange, 2 yellow and 1 Green Mark

(1 orange = -25, 2 yellow = -20, 1 green = +10, ∴ Total = -35

100 - 35 = 65

Total Score
Compliance =

Between 5 - 7 Steps	Total Marks	Total score
1 Yellow = -10		
1 Orange = -25		
1 Red = -70		
Total Negative Mark		
1 Green = +10%		
Total Positive Mark		

Total Score
Compliance =

Between 8 - 10 Steps	Total Marks	Total score
1 Yellow = -10		
1 Orange = -20		
1 Red = -70		
Total Negative Mark		
1 Green = +10%		
Total Positive Mark		

Total Score
Compliance =

Ratings

0 - 50 = Bad

51 - 59 = Poor

60 - 70 = Moderate

71 - 84 = Good

85 - 100 = Very good

Additional Comments:

Scientific Monitoring

The EREP biological monitoring programme assesses the impacts of routine maintenance and 'capital enhancement' projects on the river corridor biodiversity. Fish, flora, birds, macro-invertebrates, lamprey and crayfish are monitored across a selection of sites. The physical changes in the channels are also monitored. Monitoring of these aspects have been ongoing to varying degrees as a component to the EREP project. Results have showed considerable variance and for some elements, difficult to show definitive trends. Monitoring is reviewed periodically and altered as required.

River Corridor Biodiversity

EREP monitoring to date has indicated that often changes seen across the whole site can be interlinked. Enhancement of the physical regime can greatly improve channel diversity, through the creation of riffle/glide/pool sequences, addition of spawning gravels and bank protection.

Physical changes to the channel often result in changes in the floral communities, as a more diverse bed material is available. Species such as *Ranunculus* and *Scirpus* tend to favour gravely bed material will softer sediment attracts species like *Sparganium*.

Changes to the aquatic, marginal and riparian vegetation can often result in changes to the invertebrate communities. Increased vegetation cover and diversity often correspond with increased invertebrate diversity and abundance.

Physical Monitoring

Physical monitoring includes pre and post works monitoring of a number of variables. Variables measured include bank-full width, wetted width, channel length, depth velocity and canopy cover.

The Water Framework Directive (WFD) requires information on hydromorphological conditions, along with biological quality and physio-chemical conditions, in order to determine the ecological status of any given water-body. A classification of 'High Ecological Status' cannot be assigned to a water-body unless the hydromorphological conditions are high also. If the hydromorphological condition of a water-body has not been determined and the system has been subject to drainage, then that catchment is deemed to be "probably at risk". Therefore the EREP has included monitoring of hydromorphology in its monitoring programme.

The River Hydromorphology Assessment Technique (RHAT) monitoring system has been approved as the appropriate method to determine hydromorphological status of a channel and is being used for WFD monitoring.

RHAT is used to monitor hydromorphological condition of a selection of channels under EREP. The data collected will feed back to the Environmental Protection Agency (EPA) and contribute to the overall national assessments on channel morphology.

Floral Monitoring

Three vegetation types are surveyed under the floral monitoring programme. These include:

- Aquatic (in-channel) vegetation
- Marginal vegetation
- Riparian vegetation

A walkover survey of the entire site is used to compile a species inventory of riparian and in-stream species. Quantitative assessments are also carried out within the sites. Tree surveys also form part of this monitoring process and include information of composition and abundance of tree cover.

Macro-invertebrate Monitoring

The macro-invertebrate communities of a river respond quickly to change and are a good reflection of conditions in the short term. Their assemblages reflect changes in habitat as well as changes in water quality, as most species have a preference for either fast or slow flowing water, sheltered or exposes areas and silt or cobbles. Sampling is carried out at both experimental and control sites, and a species inventory list compiled.

Fish Sampling

While the primary focus for the EREP fish stock survey is on salmon and brown trout, data from all species encountered during surveys are recorded. Data collected provides information on population, distribution, age-structure for any species encountered.

Bird Population Studies

Bird surveys are carried out a selection of sites, using standard survey methods used by Bird Watch Ireland and other relevant agencies. The key objectives of the bird studies are to:

- Record the abundance, species richness and distribution of bird species in OPW channels, and
- Assess the impacts of drainage and drainage maintenance on bird species based on this data.

To this end, surveying is conducted on:

- Various habitat types within the river corridor.
- Sites pre and post maintenance.
- Non-drained channels and drained channels

Lamprey & Crayfish Studies

OPW funded studies to examine the effects of Arterial Drainage Maintenance operations on lamprey and white-clawed crayfish have been ongoing since 2006. Ecological Impact Assessments (EclA) were carried out on both species, by the then Central Fisheries Board. Further research was recommended in these EclAs, which resulted in the continuation of studies of both species as part of the EREP. Surveying of both species includes monitoring of population size and age structure, prior to, and in a series of years post maintenance.