

5 FLORA AND FAUNA

5.1 INTRODUCTION

This section of the Environmental Impact Statement (EIS) describes the potential impacts of the proposed Bandon Flood Relief Scheme (FRS) on flora and fauna and has been completed in accordance with the guidance set out by the Environmental Protection Agency in 'Guidelines on Information to be contained in Environmental Impact Statements' (EPA, 2000).

This section is based on published literature and field visits that were made to the site by ecologists working for McCarthy Keville O'Sullivan Ltd. and Ecofact Ltd. Visits were made during January, August and September 2011, January, March, April and May 2012. The site of the proposed works was surveyed extensively in order to assess the habitats and bird, mammal, fish and invertebrate populations in the area.

The survey work was carried out by the following ecologists: Pat Roberts (B.Sc. Env., MIEEM), Lorna Conway (B.Sc. Env.), Dr. Chris Peppiatt (Ph.D., MIEEM), Eoin McCarthy (B.Sc. Env.) and Jennifer Fisher (B.Sc. Ecology, AIEEM) from McCarthy Keville O'Sullivan and staff from Ecofact Environmental Consultants Ltd.

5.2 METHODOLOGY AND LIMITATIONS

An initial study area was determined as part of the Constraints Study which consisted of the channel, floodplain and immediate surrounding areas of the River Bandon extending along the main channel of the river as shown on Figure 5.1. This area encompassed approximately 15 kilometres of the River Bandon, tributaries and adjoining habitat up and downstream of the town of Bandon.

The habitats, flora and fauna of the Study area were initially assessed by means of a desk study of literature pertinent to the area and a windshield survey of the initial Study Area was completed on the 24th of January 2011 where general habitat types were observed and photographed. Detailed flora and fauna surveys were not completed at this time.

More detailed field surveys were then completed, limited to a more specific area which ranged from above the weir at Bandon to a point approximately seven kilometres downstream, on the basis of the initial design options provided. These surveys included habitat and flora mapping, bird, bat and mammal surveys and general observation work, in addition to detailed survey for fish species, Freshwater Pearl Mussel, Otter, Kingfisher and instream features.

The flora was surveyed through direct observation on-site and the habitats were classified initially from aerial photographs and subsequently ground-truthed at the site. Fauna were surveyed through direct observation of bird and mammal species or of their signs and calls. Habitat suitability was also assessed for the likely occurrence of other species, which would not be present due to seasonal factors.

Seasonal factors that affect distribution patterns and habits of species were taken into account when conducting the surveys and the potential of the site to support certain populations (in particular those of conservation importance that may not have been recorded during the field survey due to their seasonal absence or cryptic nature) was assessed.

Surveys were carried out on site during all seasons. Summer is usually the most appropriate time of year for ecological surveys, though even in summer some wintering species may not be recorded and thus surveys were carried out during all seasons.

A table summarizing the field surveys completed to date is provided below.

Survey Type	Dates of Survey	Survey Locations
Windshield habitat survey	24 th January 2011	Baxter's Bridge (Grid Ref: E144090 N054580) to Rockhouse (Grid Ref: E156270 N053920) 3.5km south of Inishannon
Instream survey of river features Suitability for Freshwater Pearl Mussel Otter and Bird Surveys	31 st August, 1 st & 2 nd September 2011	Weir in Bandon Town (Grid Ref: E148930 N055010) to the Bridge at Inishannon (Grid Ref: E154130 N057100)
Freshwater Pearl Mussel Stage 1 Survey	13 th and 14 th September 2011	Pre-selected locations between Weir in Bandon Town (Grid Ref: E148930 N055010) to the Bridge at Inishannon (Grid Ref: E154130 N057100)
Fish Stock Assessment	15 th , 16 th , 22 nd and 23 rd September 2011	Pre-Selected locations on the Bandon River between a location 2 kilometres upstream of Bandon Town (Grid Ref: E147068 N054739) and immediately downstream of Inishannon Bridge (Grid Ref: E154094 N057047) and on the Bridewell River approximately 2km upstream of the confluence with the Bandon River (Grid Ref: E154094 N057047)
Salmon Redd Count	12 th January 2012	Pre-selected locations between Weir in Bandon Town (Grid Ref: E148930 N055010) to the Bridge at Inishannon (Grid Ref: E147651 N053743)
Survey of all terrestrial elements of the scheme and Mill Stream Culvert	27 th March 2012	Visited sites of all the terrestrial elements of the scheme as finalised at that stage. Preliminary visit to the Mill Stream Culvert
Walked the entire study area with the engineers	26 th April 2012	Discussed construction methods and easement requirements along the entire route and on the Mill Stream
Bat Survey	10 th May 2012	Completed Bat Survey of the study area focusing on Bandon Bridge, The Mill Stream Culvert and areas where extensive vegetation removal is planned

Table 5.1 Summary of Ecological Surveys Completed to Date

The following sources were also used in the compilation of this section of the EIS:

- 1:50,000 scale Discovery series mapping;
- 1: 5000 OS Maps of the study area
- Aerial photography of the Study Area

- NPWS site synopses and database of information on designated sites and records of protected species.
- New Atlas of the British & Irish Flora (Preston et al., 2002)
- The Atlas of Breeding Birds in Britain and Ireland' (Sharrock, 1976), 'The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991' (Gibbons et al., 1993) and 'The Atlas of Wintering Birds in Britain and Ireland' (Lack, 1986)
- The EPA website <http://www.epa.ie/rivermap/data>
- The Water Framework Directive website www.WFD.ie

5.3 DESK STUDY

5.3.1 Designated Areas

With the introduction of the EU Habitats Directive (92/43/EEC) which was transposed into Irish law as the Natural Habitats Regulations, 1997, the European Union formally recognised the significance of protecting rare and endangered species of flora and fauna, and also, more importantly, their habitats. Member states were directed to provide lists of sites for designation.

Natural Heritage Areas

Natural Heritage Areas (NHAs) are heritage sites that were designated for the protection of flora, fauna, habitats and geological sites of national importance. Management of NHAs is guided by planning policy and the Wildlife (Amendment) Act 2000. It was from these NHAs that the most important sites were selected for international designation as SACs and SPAs.

Special Areas of Conservation and Special Protection Areas

There are two types of EU site designation, the Special Area of Conservation (SAC) and the Special Protection Area (SPA). SACs are designated for the conservation of flora, fauna and habitats of European importance and SPAs for the conservation of bird species and habitats of European importance. These sites form part of "*Natura 2000*" a network of protected areas throughout the European Union.

Annex I of the Habitats Directive lists certain habitats that must be given protection. Certain habitats are deemed 'priority' and have greater protection. Irish habitats include raised bogs, active blanket bogs, turloughs, heaths, lakes and rivers. Annex II of the Directive lists species whose habitats must be protected and includes Lesser Horseshoe Bat, Otter, Salmon and White-clawed Crayfish.

5.3.2 Designated Sites in the Vicinity of the Study Area

The National Parks and Wildlife Service publish synopses of the information regarding areas designated for conservation.

5.3.2.1 Natura 2000 sites

Screening for Appropriate Assessment (AA) under Article 6(3) of the EU Habitats Directive has been completed and is included as Appendix 5A. The following summarises the information from the AA Screening Document.

The nearest Natura 2000 sites (cSAC's or SPA's) are:

- Courtmacsherry Estuary cSAC (Site Code:001230)
- Courtmacsherry Bay SPA (Site Code:004219)

These designated areas are approximately 6.5 kilometres from the study area but are not part of the River Bandon catchment and are not connected via water to the study area. They are therefore unlikely to be affected by the proposed works. Other Natura 2000 sites in the area that are further away and similarly unlikely to be affected are listed below:

- Clonakilty Bay cSAC/SPA (Site Codes: 004081 & 000091)
- Old Head of Kinsale SPA (Site Code: 004021)
- Sovereign Islands SPA (Site Code: 004124)
- The Gearagh cSAC/SPA (Site Codes: 000108 & 004109)

The Bandon River cSAC (Site Code: 002171) is located approximately 20 kilometres upstream of the proposed flood relief works. This designated site is unlikely to be directly affected by the proposed works by virtue of its distance from them and the fact that it is upstream. The cSAC is, however, within the Bandon River catchment and the potential therefore exists for the site to be impacted upon by the proposed works. Negative impacts on fish stocks have the potential to impact on the the cSAC as Salmon (*Salmo Salar*) are a species protected under Annex II of the EU Habitats Directive and salmonid fish play a vital part in the lifecycle of Freshwater Pearl Mussel (*Margaritifera margaritifera*), which is one of the qualifying interests of the River Bandon cSAC.

On the basis of above, it was concluded in the Appropriate Assessment Screening exercise that impacts on the cSAC could be precluded on the basis of the design and mitigation included within the scheme. This screening document has been included as Appendix 5A.

5.3.2.2 Other Designated Sites

Three pNHAs are located along the course of the Bandon River within the study area. These are listed below and their full site synopses are provided as Appendix 5B. The designated sites within and surrounding the study area are shown in Figure 5.1

- Bandon Valley – West of Bandon pNHA (Site Code 001034). This site is important as it contains remnants of broadleaved oak woodland. The Bandon Valley is especially valuable for its woodlands and unmodified river bed.
- Bandon Valley – Above Inishannon pNHA (Site Code 001740). This area is important as it contains an example of oak woodland on steep valley sides. The Bandon Valley is especially valuable for its woodlands and unmodified river bed.
- Bandon River – Below Inishannon pNHA (Site Code 001515) This site is important for its wetlands including the extensive areas of Common Reed and the more diverse areas of wetland vegetation. The general flora surrounding Shippool Wood may also be of interest.

5.3.3 Flora

5.3.3.1 New Flora Atlas

A search was made in the *New Atlas of the British & Irish Flora* (Preston *et al.*, 2002) to find which rare or unusual plant species had been recorded in the 10 km squares in which the study area is situated, (W4,5 & W5,5) during the 1987-1999 atlas survey. Six species protected under the Flora Protection Order, were recorded in these 10km squares. These species are listed below together with their habitat requirements.

- Slender Cudweed (*Filago minima*). Sandy and gravelly places.
- Wood Cudweed (*Gnaphalium sylvaticum*). Upland pastures and damp sandy places.
- Pennyroyal (*Mentha pulegium*). Damp, sandy places.
- Lesser Snapdragon (*Misopates orontium*). Arable fields.
- Meadow Saxifrage (*Saxifraga granulata*). Sandhills and pastures.
- Killarney Fern (*Trichomanes speciosum*). Beside waterfalls, in crevices between boulders, under overhanging rocks and in similar dark, damp sheltered locations.

5.3.3.2 NPWS Records of Protected Species

The NPWS records of protected species in the area of the proposed development were obtained for the relevant 10 km squares, W4,5 and W5,5. The only records on this website were for the following plants Meadow Saxifrage (*Saxifraga granulata*) which was recorded in Bandon in 1900; Penny royal (*Mentha pulegium*), which was recorded in Ballinadee in 1883 and Lesser Snapdragon (*Misopates orontium*), which was recorded in Inishannon with no date provided.

5.3.4 Fish and Shellfish

5.3.4.1 Freshwater Pearl Mussel

Records of Freshwater Pearl Mussel in the Bandon River were gained from the EPA river monitoring staff (John Lucey, 1989. Pers.Comm.). Two out of the three records were located on the Upper Bandon, upstream of the proposed works and likely zone of influence. The other record was from the River Bandon within the study area. A single specimen was recorded close to the right bank opposite the inflow from the Brinny River in 1989 (Grid Ref: .1523 0575).

In addition, personal communication with local anglers revealed accounts of Freshwater Pearl Mussel being recorded close to Baxter's Bridge approximately five kilometres upstream of the weir in Bandon Town and empty shells being found downstream of the town following periods of high water.

5.3.5 Birds

5.3.5.1 Bird Atlases

'*The Atlas of Breeding Birds in Britain and Ireland*' (Sharrock, 1976), '*The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991*' (Gibbons *et al.*, 1993) and '*The Atlas of Wintering Birds in Britain and Ireland*' (Lack, 1986) were consulted for information regarding the distribution of birds in Ireland. However, it should be remembered that, for some species at least, more recent work has been carried out.

These atlases show data for breeding and wintering birds respectively in individual 10 km by 10 km squares. Table 5.2 shows those species found in the relevant 10 km squares, W4,5 & W5,5, that are recorded in the Breeding Birds Atlases and are also protected under the EU Birds Directive or mentioned on the Birds of Conservation Concern in Ireland (BoCCI) red list. Birds listed under Annex I are offered special protection by the EU Birds Directive. Those listed on the BoCCI Red List meet one or more of the following criteria:

- Their breeding population or range has declined by more than 50% in the last 25 years
- Their breeding population has undergone significant decline since 1900
- They are of global conservation concern

Common Name	Scientific Name	Breeding Atlas 68-72	Breeding Atlas 88-91	Annex I	BoCCI red list
Yellowhammer	<i>Emberiza citrinella</i>	Yes	Yes	No	Yes
Peregrine	<i>Falco peregrinus</i>	Yes	Yes	Yes	No
Barn Owl	<i>Tyto alba</i>	No	Yes	No	Yes
Kingfisher	<i>Alcedo atthis</i>	Yes	Yes	Yes	No

Table 5.2 Breeding Bird Atlas Data (W4,5 W5,5)

Two species listed in Annex I of the EU Birds Directive have been recorded as breeding within the relevant 10km square, in the Atlas of Breeding Birds namely Peregrine and Kingfisher. Peregrine require cliffs and rocky crags as nesting sites. Kingfisher require access to slow flowing, fish rich water for feeding and tall banks for nesting. The Bandon River provides suitable habitat for this species.

Yellowhammer and Barn Owl have also been recorded in the relevant squares of the Atlases of Breeding Birds and are included on the BoCCI red list. Yellowhammer have a preference for agricultural land, with adjacent scrub, though may be found at the study area. Barn Owl utilise a variety of habitats such as woods, parkland and old ruined buildings and may be found within the study area.

In terms of wintering birds, Table 5.3 shows those species found in the 10 km squares W4,5 & W5,5 that are recorded in the Atlas of Wintering Birds in Britain and Ireland 1988-91 and are also protected under the EU Birds Directive or mentioned on the Birds of Conservation Concern in Ireland (BoCCI) red list.

Common Name	Scientific Name	Annex I	BOCCI red list
Whooper Swan	<i>Cygnus cygnus</i>	Yes	No
Kingfisher	<i>Alcedo atthis</i>	Yes	No
Lapwing	<i>Vanellus vanellus</i>	No	Yes
Curlew	<i>Numenius arquata</i>	No	Yes
Herring Gull	<i>Larus argentatus</i>	No	Yes
Blackheaded Gull	<i>Chroicocephalus ridibundus</i>	No	Yes
Yellowhammer	<i>Emberiza citrinella</i>	No	Yes

Table 5.32 Wintering Bird Atlas Data (M9,1)

Two birds recorded as wintering in the relevant 10 km square are protected under Annex I of the EU Habitats Directive: Whooper Swan and Kingfisher. Whooper Swan winter on large waterbodies and the surrounding grasslands and may be found within the study area. Kingfisher winter in similar habitats to their summer habitats and may be found in the area.

A further five birds that are listed on the BoCCI Red list were recorded in the atlas as being wintering in the area. These were Lapwing, Curlew, Yellowhammer, Black Headed Gull and Herring Gull. Lapwing winter on farmland and flat coastal areas. Curlew winter on mudflats and adjacent fields. Yellowhammer winter on agricultural land, with adjacent scrub. Black Headed Gull winter on a variety of habitats and Herring Gull winters on lakes, estuaries and open fields. All the above species are potentially found at the site of the proposed works.

5.3.6 Consultation

Consultation was undertaken with the following bodies:

- Inland Fisheries Ireland
- National Parks and Wildlife Service (NPWS) local ranger (Mr. Danny O'Keefe)
- Development Applications Unit of Department of Environment, Heritage and Local Government
- Environment Protection Agency
- Bat Conservation Ireland (Mrs Tina Aughney)
- An Taisce
- Irish Peatland Conservation Council
- Cork County Council
- Birdwatch Ireland;
- Irish Wildlife Trust
- Ballineen/Enniskeane Anglers
- Bandon Angling Association
- Bord na Móna
- Coillte Teoranta
- Dunmanway Salmon and Trout Anglers
- Earthwatch (Friends of the Earth Ireland)
- Waterways Ireland

Details of this correspondence are provided in Section 2 of the EIS.

A meeting with the Local Ranger from the National Parks and Wildlife Service was held on site in Bandon Town on the 24th January 2011. At this meeting, it was discussed that the pNHA's within the study area had been designated primarily for the protection of the broadleaved woodlands surrounding the river but that the area supported and had the potential to support species that are protected under Annex I of the EU Birds Directive and Annex II of the EU Habitats Directive. These species included the following that were specifically mentioned:

- Otter (*Lutra lutra*). Known from the study area.
- Freshwater Pearl Mussel (*Margaritifera margaritifera*)
- Lamprey spp. (*Lampetra* & *Petromyzon* spp.)
- Salmon (*Salmo salar*)
- Kingfisher (*Alcedo atthis*)

It was also concluded at this meeting that the river valley with the combination of fast flowing river, woodlands, agricultural grasslands and wetlands was of considerable biodiversity value.

The environment officer from the Inland Fisheries Ireland (Macroom) was also present at this meeting and gave the following information about the river and its value as a fishery:

The Bandon River is one of the premier salmonid fisheries in the South West Region, rising in the West Cork mountains and flowing for some 45 miles main channel length before discharging to the sea in Kinsale Harbour. It drains a catchment of approximately 235 sq. miles in area. The Bandon River offers a great variety of game fishing including salmon, sea trout and brown trout fishing. Salmon fishing is available over the vast majority of the main channel of the Bandon and extends upstream to Togher Castle in the upper reaches of the river. Sea trout are caught up to Ballineen. The vast majority of fishing on the Bandon is under private ownership or controlled by syndicates or angling associations.

A fish counter located on the weir (fish pass) in Bandon records the upward movement of salmon and sea trout. Table 5.4 shows the combined number of both species passing through the counter for 2010 on a monthly basis.

Month	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Salmon	4	7	16	32	87	215	539	172	275	1254	876	314

Table 5.4 Bandon Weir Fish Counter Data 2010

In total in 2010, 3791 fish were recorded passing through the counter. However fish movement over the weir is not exclusively through the fish pass. Fish can also navigate the weir independently of the pass. While no precise figure exists, local knowledge would suggest that fish passing through the counter represent only 60% of the total upward fish movement. On this basis it is estimated that in 2010 a total of approximately 6318 fish (adult salmon and sea trout) moved upstream over the weir in Bandon. This figure does not take into account returning fish, which spawned in the main channel downstream of the weir or in any of the tributaries which enter the main channel downstream of the weir e.g. Bridewell and Brinny Rivers.

With respect to catch statistics the average annual angling catch for the years 2003-2006 was 517 fish (salmon and sea trout > 40cm) per year for the Bandon system. For 2010 an angling quota of 350 fish and a draft net quota of 61 fish applied for the Bandon River.

The constraints study area established for the purpose of the Bandon Flood Relief Scheme Study encompasses an area from just east of Baxter's Bridge to Dunderrow. Between Baxters Bridge and Innishannon Bridge (where the river becomes tidal) virtually all of the main channel of the Bandon River can be categorized as salmonid spawning, nursery or angling waters. The lower reaches of the Bridewell and Brinny Rivers are principally spawning and nursery waters.

Within the study zone, fishing on the main Bandon River channel is controlled over varying distances by among others, the Bandon Angling Association. There are approximately 46 regularly used and recognized angling stretches and pools in the study zone. These pools are not alone significant in terms of angling but play a key function in facilitating the upstream movement of salmonids.

Within the Bandon town area the following redd count data is available for the years 2008, 2009 and 2010.

Bandon River, Mc Sweeney Quay
(Weir to Main Bridge)
2008- 17 redds
2009- 12 redds
2010- 14 redds

Bridewell River, Town Section
(Chapel to GAA entrance)
2008- 6 redds
2009 -0 redds
2010- 12 redds

In addition to salmonids, Freshwater Pearl Mussel, Lamprey and Eels have been recorded within the study area.

5.3.7 Water Quality

The EPA website <http://www.epa.ie/rivermap/data>, contains information regarding water quality in selected Irish rivers based on surveys carried out by the EPA. Information was gained from EPA monitoring stations on the Bandon River and the Brinny River within and upstream of the study area. Information is provided in the form of Q values. Q Values are used to express biological water quality and are based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Q1 indicates a seriously polluted water body and Q5 indicates unpolluted water of high quality. A value of Q 3 indicates moderately polluted water.

Information was gained on the Bandon River as a whole, including five monitoring points that were within or very close to the study area and nine that were located upstream. Baxter's Bridge is just upstream of the study area with four stations further downstream. The EPA report concluded that water quality in the Bandon River was *'Mostly satisfactory, with Good ecological quality, but only Moderate downstream of Dunmanway, Ballineen and Enniskean'*. It should be noted that the monitoring station located 1.5 km downstream of Bandon Bridge recorded moderately polluted status during the 1997, 2000 and 2003 surveys.

Information was also gained on the Brinny River including three monitoring points located within or very close to the study area and a further five that were located upstream. The EPA report concluded that water quality in the Brinny River was *'Satisfactory with Good and High ecological quality'*.

5.4 FIELD SURVEYS

The wider study area was first visited on the 24th January 2011. During this visit, the general habitat types within the study area were observed and photographed. The purpose of this was to observe the habitats in the area first hand and to a certain extent to ground truth the findings of the desk study that is detailed above. No detailed floral or faunal surveys were carried out during this visit. This survey commenced at Baxter's Bridge (Grid Ref: E144090 N054580) approximately 4.7 kilometres upstream of Bandon Town and continued down the river as far as Rockhouse (Grid Ref: E156270 N053920) that is located approximately 3.5 kilometres to the south of Inishannon.

A further and more detailed survey of a section of the Bandon River survey was carried on the 31st August, 1st & 2nd September 2011. The river was surveyed from the Weir in Bandon Town (Grid Ref: E148930 N055010) to the Bridge at Inishannon (Grid Ref: E154130 N057100). This was considered to be the section of river that could potentially be directly affected by the proposed works. The river was at low water during this period with the EPA gauge at Curranure (Grid Ref: E152964 N057127) reading less than 0.1 metres during this survey. A total of six surveyors were present during this survey. The river was

systematically walked and each feature (e.g. riffle, pool or glide) was defined visually and mapped using gps technology. These features were then described in terms of substrate conditions, flow path aquatic macrophytes, invertebrate communities and habitat variation and quality. Bathyscopes were used to view the substrate beneath the water. Substrates were classified by particle size and named in accordance with the EPA, Rivers and Streams Ecological Assessment Field Sheet. Dedicated surveys of the terrestrial bankside habitats and mammalian and avifaunal activity were also undertaken during this survey. Suitability of habitats for Freshwater Pearl Mussel (*Margaritifera margaritifera*) was also assessed during this survey with a view to carrying out a dedicated Stage 1 Pearl Mussel survey of the best selected habitats for this species along the river.

A dedicated Freshwater Pearl Mussel survey was carried out on the 13th & 14th September 2011 and a Salmon (*Salmo salar*) Redd Count was completed on the 12th January 2012.

A dedicated fish stock assessment was undertaken in the Bandon River on the 15th, 16th, 22nd and 23rd September 2011.

A Salmon Redd Survey was carried out on the 12th January 2012.

A dedicated Bat Survey was carried out on the 10th May 2012.

5.4.1 Flora

The habitats within the study area from Baxter's Bridge above Bandon Town to Rockhouse, downstream of Inishannon, are first described in general terms to provide an overview of the habitats in the area. This description is provided below. More detailed habitat surveys were carried out on the section of river between Bandon Town and Inishannon Bridge. The results of this survey are presented in Section 3.2.2.

5.4.1.1 Initial Description of Study Area

The Bandon River west of Bandon Town flows through fields of arable and pasture land with rolling hills and woodlands (Plate 5.1). The river is fringed over much of its course with a line of trees and wet woodland including Grey Sallow (*Salix cinerea oleifolia*), Alder (*Alnus glutinosa*) and Ash (*Fraxinus excelsior*) and is relatively fast flowing and shallow with a stony/gravelly bed (Plate 5.2). The woodlands in this area are designated for conservation under the Bandon Valley – West of Bandon pNHA and are primarily dominated by Oak (*Quercus robur*), Ash and Beech (*Fagus sylvatica*) with some Sycamore (*Acer pseudoplatanus*) (Plate 5.3). Rhododendron (*Rhododendron ponticum*) and Laurel (*Prunus lauroceratus*) are present in the woodlands but are not described in the site synopsis as being widespread.

Moving in an easterly direction, the river flows through the built up area of Bandon Town. A weir at the western side of the town has resulted in the deepening of a section of the river upstream of it and given this section of the river the appearance of a depositing section of river (Plate 5.4). Trees and pastoral fields border the river until it reaches the town, whereupon the channel becomes defined by a high stone wall on its southern bank and a lower wall and riverside walk on its northern bank. Below the weir, the river is once again, fast flowing with a substrate of gravels and bedrock.

Between Bandon Town and Inishannon, the Bandon River becomes wider but still remains relatively fast flowing and continues to have a stony and gravelly substrate. For much of its course in this area, the

riverbanks are lined with trees and woodland. The valley sides appear steeper and higher on this section of the river when compared with upstream of the town. Much of the steep valley sides support woodland that is dominated by Oak, Beech, Sycamore and Ash and designated for conservation under the Bandon Valley – Above Inishannon pNHA.

Downstream of Inishannon, the Bandon River becomes tidal and takes on the properties of an estuary with a muddy substrate and exposed mudflats at low tide (Plate 5.5). The banks of the river support reedswamps and wetland vegetation in some areas, whilst in other places they support deciduous and mixed woodland. Some of the woodland is very low lying and wet whilst other areas rise steeply away from the river and are clearly drier.

The Brinny River within the study area flows through a steep wooded valley and discharges to the Bandon River between Bandon Town and Inishannon. It is relatively fast flowing with a stoney/gravelly substrate (Plate 5.6).

The Bridewell River flows from the south west of Bandon Town into the Bandon River immediately downstream of the bridge in the town. This river flows through more open country than the Bandon River itself with less hills and woodland. The substrate of the river is stony and gravelly. It is extensively culverted within Bandon Town and at Oldchapel (Plate 5.7).

It should be noted that in various locations within the study area, the invasive species Japanese Knotweed (*Fallopia japonica*), Himalayan Knotweed (*Persicaria wallichii*), Himalayan Balsam (*Impatiens glandulifera*) and Water Fern (*Azolla filiculoides*) were encountered along the riparian corridor.



Plate 5.1 Bandon River valley to the east of Bandon Town showing rolling hills and woodlands



Plate 5.2 Bandon River to the west of the study area, showing the fast flowing river with fringing trees.



Plate 5.3 Bandon River between Bandon and Inishannon showing broadleaved woodland on the valley sides.



Plate 5.4 Bandon Weir as viewed from downstream



Plate 5.5 Bandon Estuary below Inishannon



Plate 5.6 Brinny River as viewed facing upstream from Downdaniel Bridge



Plate 5.7 Modified channel of the Bridewell River in Bandon Town.

5.4.1.2 Habitat Survey Between Bandon Town and Inishannon Bridge

Habitats present within and adjacent to the river channel in a more focussed study area were classified according to the guidelines set out in 'A Guide To Habitats in Ireland' (Fossitt, 2000), which classifies

habitats based on the vegetation present and management history. This smaller study area was located between Bandon Town and Inishannon Bridge and focussed on the areas likely to be directly affected by the proposed works and those immediately downstream. The habitats present are shown on the Habitat Map, Figure 5.2. The habitats recorded on or in the vicinity of the site of, the proposed development are listed below. The habitat names are followed by their corresponding habitat reference code (in brackets). A detailed description of the region and its flora is also provided below.

- Eroding River (FW1)
- Depositing River (FW2)
- Tree Line (WL2)
- Mixed Broadleaved Woodland (WD1)
- Mixed Broadleaved/Conifer Woodland (WD2)
- Wet Willow Alder Ash Woodland (WN6)
- Conifer Plantation (WD4)
- Improved Agricultural Grassland (GA1)
- Dry Meadow & Grassy Verges (GS2)
- Buildings & Artificial Surfaces (BL3)
- Flower Beds & Borders (BC4)
- Amenity Grassland (GA2)
- Scrub (WS1)
- Arable Crops (BC1)
- Exposed Sand, Gravel or Till (ED1)

A detailed survey of the river features was also completed. Detailed results are provided in Appendix 5C. The results have informed the habitat descriptions as outlined below.

The river itself was variable in form with the majority of sections best classified as an Eroding River (FW1) even though the stretch surveyed was close to the tidal sections at the mouth of the river (Plate 5.8). Over the majority of its course through the study area, the substrate of the river was comprised of larger sediments from boulders to gravels with finer silts and sands only abundant at the edges of the channel and in the deeper pools. There was also exposed bedrock at various locations along the study area. Some of the glides and pools however, were characteristic of a lowland Depositing River (FW2) with finer sediments and slower flows (Plate 5.9).

In general, the cover of aquatic macrophytes within the study area was sparse and species poor with a low diversity of species recorded. These included Water Crowfoot (*Ranunculus pencillatus*), which was the most frequent plant recorded and in places grew in dense floating mats that corresponded to the EU Habitats Directive Annex I Habitat 'Watercourses of plain to mountain levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)'. (Plate 5.10) The locations where this habitat was recorded are included on Figure 5.2. Other species that were recorded within the river channel included Canadian Pondweed (*Elodea Canadensis*), Water Starwort (*Callitriche* sp.) and Hemlock Water Dropwort (*Oenanthe crocata*) but these species grew sparsely and sporadically. The rocks in many areas supported growth of bryophytes including the aquatic moss (*Fontinalis antipyretica*) and filamentous algae. The filamentous algae was recorded in abundance during the surveys in August and September 2011 when the river was at low water at the end of a period of dry summer weather. The algae was far less abundant during the survey in January 2012, having been washed away by high winter flows.

The channel was on average between 25 and 30 metres wide with a total of 46 separate topographical features (e.g. Riffle, glide or pool) identified during the survey of the 6.9km study area. The survey was carried out during low water conditions and it is likely that many of these features would be drowned out at higher water levels. Details of these features as recorded during the river survey are provided in Appendix 5C. Whilst the sections of the river within the town of Bandon had clearly been managed with river walls, weirs and a relatively uniform flow path (Plate 5.11), the majority of the river downstream of the town supported a varied topography that would be associated with a natural channel. Features indicative of a natural channel included pools, riffles, small, gravelly islands and defined flow paths (thalwegs) (Plate 5.12). In some areas, the banks had been subject to some bank protection, channel maintenance and fishery improvement works. In other areas, there were long relatively featureless glides that were possibly managed sections of channel but could also have been naturally slow flowing, low gradient sections of the river. Overall, the gradient in the river between Bandon Town below the weir and the Bridge at Inishannon was approximately 1:640.

A number of tributaries enter the Bandon River within the study area. These include the following:

- The Bridewell, which flows into the Bandon River from the south just downstream of the main road bridge in the town.
- The Town Park Stream, which flows into the Bandon River from the north just downstream of the main road bridge in the town.
- The Brinny, which flows into the Bandon River approximately one kilometre upstream of Inishannon Bridge.
- The Millstream, which flows into the Bandon River approximately one kilometre downstream of Bandon bridge.
- An un-named Tributary that flows into the Bandon River from the north at a location close to the private access bridge near Kilpatrick (O'Driscoll's Bridge).
- A number of small drainage ditches along the course of the river in the study area.

The banks of the river within the study area comprised of various habitats. In areas downstream of Bandon Town and at the southern end of the study area, the river is surrounded by the flat grasslands of the floodplain, the banks were generally quite low (approximately 2-3 metres above bed level) and supported either grassy vegetation that was typically dominated by Reed Canary Grass (*Phalaris arundinacea*) and Nettle (*Urtica dioica*) (GS2) (Plate 5.13) or supported Tree Lines (WL2) with Alder (*Alnus glutinosa*), Willows (*Salix spp.*), Hawthorn (*Crataegus monogyna*) and Ash (*Fraxinus excelsior*) (Plate 5.14). A tree line of Lombardy Poplar was located close to the left bank downstream of the town. In some areas the banks supported scrubby vegetation including bramble and bracken scrub. Areas of bramble scrub were recorded downstream of the town on the right bank along with native and non-native tree species such as Cypress (*Cupressus sp.*). In many sections of the study area, there is growth of invasive species including Traveler's Joy (*Clematis vitalba*), Himalayan Balsam (*Impatiens glandulifera*), Japanese Knotweed (*Fallopia japonica*) and Himalayan Knotweed (*Persicaria wallichii*) (Plate 5.15).

Where the surrounding lands are steeper, the banks are often surrounded by woodlands and scrub. This is the case in much of the pNHA in the mid section of the study area and on the opposite bank from the Bandon town sewage treatment plant. The woodlands are mainly best classified as Mixed Broadleaved Woodland (WD1) with a dominance of Ash, Beech (*Fagus sylvatica*), Sycamore (*Acer pseudoplatanus*) and Oak (*Quercus Spp.*). In some areas where woodlands and tree lines are located along the banks, the trees grow out over the water with some fallen trees obscuring the channel (Plate 5.16). There is a small

area of Wet Willow Alder Ash Woodland (WN6) close to the right bank near Ballylangley. At one location within the study area, there is a small section of exposed sand (ED1) where the river has eroded a steep bank to form a cliff. This area is close to Kilbeg South and is surrounded by Tree lines and Scrub.

The grasslands within the floodplain comprise a range of habitats. There are fields that were being managed for Arable Crops (BC1) at the time of the field visits, located on the southern bank of the river upstream of the bridge at Inishannon. Fields of Improved Agricultural Grassland (GA1) were recorded at various locations within the study area with large fields evident on the northern bank near Kilbeg South and thinner strips located alongside the river as it passes through the steeper lands that are located within the Bandon Valley above Inishannon NHA. There are areas of grassland that are cut as lawns along the rivers edge. These are located adjacent to the right bank close to Bandon Town and also at various locations further downstream where sections of the bank appear to be actively managed for fishing access or as part of an estate/garden. A long section of amenity grassland is located adjacent to the left bank downstream of an access bridge (O'Driscoll's Bridge) to a private property to the north of the river (Plate 5.17). There was also a tree line comprising mainly of non-native species including Copper Beech, Cherry (*Prunus sp.*), Lime (*Tilia sp.*) and Maple (*Acer sp.*) in this area. A number of fields to the south of the river in the Ballylangley area were not under active management at the time of the field visits and supported rank growth of grasses along with some Bramble and Bracken Scrub and some wetter areas. Overall, these fields were best classified as Dry Meadows and Grassy Verges (GS2).

To the south of the river, the main road (BL3) runs at the base of the hill at the edge of the floodplain. In areas where the river runs close to the base of the hill, the road is located close to the right bank. In some sections there is a tree line between the road and the river, in others the road is located directly on top of the bank. In areas where the road is located close to the river, there is often bank protection works in the form of boulders placed at the edge of the channel (Plate 5.18). In the town of Bandon, both banks of the river are canalised with stone walls upstream of the road bridge. Downstream of the road bridge, only the right banks consists of a stone wall with the left bank comprising a steep bank with grassy and scrubby vegetation. Buildings and gardens were located at the top of this bank (Plate 5.19). The habitats within the town were best classified as Buildings and Artificial Surfaces (BL3) but also included gardens and ornamental planting that was best classified as Flower Beds and Borders (BC4) and Amenity Grassland (GA2) that was associated with the public areas.

The Bridewell River, which flows into the Bandon River immediately downstream of the main road bridge is surrounded by vertical walls and is extensively culverted within the town area. The substrate of this river is comprised of boulders, cobbles and gravels (Plate 5.20). The Mill Stream, which flows into the Bandon River approximately one kilometre downstream of the town and is culverted near the confluence with the Bandon River and again approximately 250 metres upstream. Between the two culverts the stream supports a gravelly substrate. The downstream sections of this stream are bordered by vegetation including Alder and Willow with grassy vegetation (Plate 5.2.1). Behind these bankside habitats are industrial gravelly yards on both banks. Continuing upstream, the stream passes a sewage treatment plant that is associated with a livestock mart and continues with the left bank adjacent to the mart car park before entering under a culvert beneath a minor road and emerging as a heavily shaded channel among trees alongside the Mart Building. The trees in this area are dominated by Elm (*Ulmus sp.*) with some Willow and Sycamore. From here, the stream enters a stone culvert of approximately 100 metres in length before emerging as a small stream with a gravelly substrate and in-stream vegetation including Water Crowfoot and Fools Watercress (*Apium nodiflorum*). This section of channel is surrounded by agricultural fields and supports bankside treelines that are dominated by Alder.



Plate 5.8 Bandon River close to the outfall of the Brinny River and exhibiting the characteristics of an eroding river with fast flows and substrate of large sediments.



Plate 5.9 Bandon River in deep pool section approximately 500 metres upstream of Inishannon Bridge.



Plate 5.10 Section of the river upstream of the outfall of the River Brinny near Ardnaglug supporting an example of the Annex I Habitat 'Watercourses of plain to mountain levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)'.



Plate 5.11 Highly managed section of channel in Bandon Town with river wall shown.



Plate 5.12 Series of pools and riffles upstream of the old railway crossing and showing natural variation in the channel morphology. Natural weirs enhanced to improve the fishery value of the river.



Plate 5.13 Low grassy bank bordering the river where there is an adjacent floodplain to the north near Ballyangley. Note also the presence of the Annex I Habitat 'Watercourses of plain to mountain levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)'.



Plate 5.14 Alder Tree Line on northern bank of the river just downstream of the previous plate near Ballyangley.



Plate 5.15 Invasive species Traveler's Joy and Japanese Knotweed on the river bank within Bandon Town



Plate 5.16 Woodlands on the river bank within the NHA in the middle section of the study area. Note the trees encroaching into the river channel.



Plate 5.17 Amenity grassland habitat and Ornamental tree line on the left bank of the river downstream of O'Driscoll's Bridge.



Plate 5.18 Section of the Bandon River at a location where the road is located close to the river and where rock armour has been employed to stabilise the bank.



Plate 5.19 Bandon River Immediately downstream of Bandon Bridge showing the overgrown and urban nature of the banks.



Plate 5.20 Bridewell River within Bandon Town



Plate 5.21 Mill Stream Adjacent to Mart Car Park

5.4.2 Significance of Flora

Of all the habitats recorded within the study area, the sections of the river that correspond to the Annex I Habitat 'Watercourses of plain to mountain levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)' are of the greatest significance from a botanical perspective as correspond to those protected under the EU Habitats Directive. The sections of the riverbed that have been undisturbed and have maintained their original morphology and topography are also of relatively high significance as they are recognized in the site synopsis for the River Bandon above Inishannon pNHA as being 'a rare habitat in a European context'.

The woodlands that surround the river support a dominance of non-native species, which are likely to have been planted in the past. They still, however, retain some native Oaks and small patches of semi-natural Oak woodland. Whilst not protected under the EU Habitats Directive, these woodlands provide an important local diversity to the ecology of the area. The majority of the woodland is also designated for conservation under the Bandon Valley above Inishannon pNHA, along with the river in the mid section of the study area. The tree lines, and small area of wet woodland that are also present in the study area are similarly un-protected at a European level but offer significant habitat diversity to the area.

The habitats with the least botanical significance are those which are either highly modified through agriculture, amenity or urbanization. These habitats include Arable Crops such as those located on the south bank upstream of Inishannon Bridge, Improved Agricultural Grassland such as that located throughout the study area and amenity grasslands that are located close to the urban area of Bandon Town and at various locations throughout the study area.

5.5 FAUNA

5.5.1 Birds

All bird species seen or heard during the field surveys were recorded and are shown in Table 5.5.

Species	Scientific Name	Legal Protection
Wood Pigeon	<i>Columba palumbus</i>	-
Little Egret	<i>Egretta garzetta</i>	Annex I birds Directive
Heron	<i>Ardea cinerea</i>	-
Kingfisher	<i>Alcedo atthis</i>	Annex I birds Directive
Chiff Chaff	<i>Phylloscopus collybita</i>	-
Chaffinch	<i>Fringilla coelebs</i>	-
Rook	<i>Corvus frugilegus</i>	-
Grey Wagtail	<i>Motacilla cinerea</i>	-
Dipper	<i>Cinclus cinclus</i>	-
Mallard	<i>Anas platyrhynchos</i>	-
Black Headed Gull	<i>Chroicocephalus ridibundus</i>	BoCCI Red List
Heron	<i>Ardea cinerea</i>	-
Robin	<i>Erithacus rubecula</i>	-
Blackbird	<i>Turdus merula</i>	-
Cormorant	<i>Phalacrocorax carbo</i>	-
Hooded Crow	<i>Corvus corone</i>	-
Magpie	<i>Pica pica</i>	-
Pied Wagtail	<i>Motacilla alba</i>	-
Swift	<i>Apus apus</i>	-
Swallow	<i>Hirundo rustica</i>	-
Jackdaw	<i>Corvus monedula</i>	-
Wren	<i>Troglodytes troglodytes</i>	-
Sand Martin	<i>Riparia riparia</i>	-

House Sparrow	<i>Passer domesticus</i>	
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Table 5.5 Birds species recorded during the site visit and their conservation status

The bird species recorded were typical of the habitats found within the study area. Two of the bird species recorded on the field visits are protected under Annex I of the EU Birds Directive; Kingfisher and Little Egret. It is unlikely that Little Egret breed in this stretch of river as they prefer marshier or estuarine habitats. It is likely that Kingfisher breed within or close to the study area, though no nests were identified during the survey. The locations where these two Annex I species were recorded is shown on Figure 5.3. The only species listed on the Birds of Conservation Concern in Ireland (BoCCI) Red List that was recorded was Black Headed Gull. This species uses a wide range of habitats and was recorded throughout the study area. The criteria for red listed species are described above.

5.5.2 Mammals

The study area between the weir in Bandon Town and the bridge at Inishannon was searched for signs of Mammal activity with dedicated surveys undertaken for Otter and Bats. Other species recorded included Badger (*Meles meles*), the feeding signs of which were recorded on the north bank approximately 500m metres upstream of Inishannon Bridge and Mink (*Mustela vison*), a likely (indistinct) print of which was recorded on the southern bank close to the old railway line near Curranure. Other species that are likely to occur in the area but were not recorded include Fox (*Vulpes vulpes*), Rat (*Rattus norvegicus*) and Stoat (*Mustela erminea*).

5.5.2.1 Otter

A dedicated survey for signs of Otter activity was undertaken during the river survey in August/September 2011. Numerous signs of Otter activity were recorded in the form of spraints and prints throughout the study area and an Otter was briefly sighted on the south bank of the river close to Kilbeg South. Signs of Otter activity were recorded on 25 of the 46 river features that are described in Appendix 5C. No holts were identified during the survey but the river banks and tributaries offer good habitat for holts with good vegetative cover in many areas.

5.5.2.2 Bats

A bat survey was carried out on the 10th May 2012. This survey involved a daytime search of the two structures with the potential to be impacted upon by the proposed works and a night time bat detector survey of these two same two structures and also areas where significant tree removal is proposed. The locations where the bat surveys were carried out are shown on Figure 5.3. A brief survey of the bridge was also carried out in August 2011 and is detailed below.

Daytime Survey

The two structures that were searched were Bandon Bridge along with the river walls in that area and also the Mill stream culvert. These structures were searched for signs of activity such as bats, droppings, urine staining, holes and cracks with little or no cobwebs. Particular attention was paid to features that had potential to support bat roosts. The daytime survey involved wading the rivers and streams and using a torch and binoculars to thoroughly examine the structures. The Mill Stream culvert was waded from the downstream end for a distance of approximately 60 metres until it ran into a concrete pipe, through which access was not possible. It was then accessed from the upstream end for approximately 5 metres until the same pipe was encountered.

Both the bridge and culvert were constructed in part of stone. Both structures supported features such as cracks and holes that offered potential as bat roosting habitat. The river walls were in general, well pointed but also supported cracks and holes that could have supported bat roosts.

Despite this potential, no evidence of bat activity was recorded during the daytime survey.

Night time Detector Survey

The night time detector survey was carried out on the evening of the 10th May and morning of the 11 May 2012. During this survey, two Petersen Ultrasound D200 heterodyne bat detectors were used to pick up the echolocation calls of any bats on the site. One detector was set to 45KHz in order to pick up the majority of bat calls. The other was set to 110 KHz to pick up the echolocation calls of Lesser Horseshoe Bats (*Rhinolophus Hipposideros*). As bats were encountered, where possible, a positive identification to species level was made. Information on the behaviour was also recorded where available. The dusk survey was initiated at 21:15 at sunset and continued until 23:30. The dawn survey was initiated at 04:15 and terminated at 05:35

During the dusk survey period, the weather was overcast with a light wind. Temperatures remained steady at 10 Celsius throughout the survey period. During the dawn survey the weather was similarly overcast but was calm with temperatures ranging between 6 Celsius at the start of the survey and 6.5 Celsius at the termination. These weather conditions were considered generally suitable for the carrying out of a bat survey but were a little below the recommended 7 Celsius (*Bat Conservation Trust – Good Practice Guidelines*) during the dawn survey.

Bandon Bridge

This area was surveyed from 21:15 until 22:08 during the evening survey and from 05:00 until 05:35 during the dawn survey. The first bat recorded was a Leisler's (*Nyctalus leisleri*) at 21:15. This bat was recorded high over the river. Soprano Pipistrelle (*Pipistrellus pygmaeus*) was the next species recorded at 21:35. Two bats fed continuously around the bridge from that time until the survey of the area was terminated at 22:08. In addition, a number of individuals were recorded feeding along the river in this area. During the dawn survey, a lone Soprano Pipistrelle was recorded feeding around the bridge. No bats were recorded entering or leaving roosts in this area.

A bat survey of the bridge was also undertaken on the evening of 30th August 2011. The survey was carried out at the Bridge in Bandon town for a period of 30 minutes around sunset to observe bat activity in the vicinity of the bridge and to search for potential roosts within the bridge itself. The survey began at 21:15 and was terminated at 21:45. The weather was clear and still with the air temperature recorded at 16 Celsius. These conditions are considered suitable for the carrying out of bat surveys according to the Bat Conservation Trust guidelines. Three species of Bat were recorded during the 30 minute survey period. These were Soprano Pipistrelle, Leisler's, and a probable Daubentons.

Multiple Soprano Pipistrelles were recorded feeding close to the river walls just upstream of the bridge with at least four individuals recorded. This feeding activity persisted for the duration of the survey. There was one contact with a Myotis bat and although this bat was not seen, it was recorded close to the river and was likely to have been a Daubenton's. A Leisler's Bat was recorded high over the river during the survey period.

Trees, Riparian Vegetation and Buildings near Cluid Housing and Weir

A survey of this area was undertaken from 22:10 until 22:36 during the evening survey. During this period, there was continuous feeding activity from a small number of Soprano Pipistrelles associated with the river but little activity associated with the terrestrial elements of the survey area. Leisler's were also recorded flying high over the study area during this period. Particular attention was also paid to the hydro-electric building but no bat activity was recorded. No bats were recorded in this area during the dawn survey.

Tree Line and River Bank between Roundabout and Mill Stream

This area was surveyed between 22:42 and 23:05 during the dusk survey and 4:15 and 4:36 during the dawn survey. Little bat activity was recorded on the tree line away from the river during the survey with only brief recordings of Soprano Pipistrelle in this area. However, the river itself in the vicinity of the Mill Stream and surrounding areas supported continuous feeding activity with Common Pipistrelle (*Pipistrellus pygmaeus*), Soprano Pipistrelle and Daubentons Bat (*Myotis daubentoni*) all recorded in this area during both the dawn and dusk surveys.

Mill Stream Culvert

This area was surveyed from 23:10 until 23:30 during the dusk survey and from 04:38 until 05:55. Little bat activity was recorded in this area during either survey. Contacts were made with Soprano and Common Pipistrelles along the road during the dusk survey with no contacts made near the culvert itself. A brief contact was made with a bat, most likely to be a Brown Long Eared Bat (*Plecotus auritus*) was recorded in the trees immediately downstream of the culvert during the dawn survey along with a Soprano Pipistrelle feeding along the road in the area.

Conclusions

Whilst the bridge and the culvert both have potential to support roosting bats, no conclusive evidence was recorded during the survey. There was little activity surrounding the culvert but there was constant Soprano Pipistrelle feeding activity around the bridge and walls. It is possible that small numbers of this species roost within these areas but no evidence of a significant roost was recorded.

The terrestrial elements of the study area such as the vegetation around Cluid House and the tree line between the roundabout and Mill Stream did not appear to be of particular significance as bat habitat with relatively little activity at these locations. The river itself did however offer important feeding areas for bats with constant feeding activity recorded throughout the survey period. Retention of riparian vegetation is important where possible as a source of shelter and also insect habitat.

5.5.3 Fish

5.5.3.1 Fish Stock Survey

A fish stock assessment was undertaken by Ecofact Ltd. on the Lower River Bandon during September 2011. The results of this survey are provided in full in Appendix 5D and are summarised below.

5.5.3.2 Survey Sites and Methods

A total of 12 sites were examined as part of the current fish stock assessment. Four locations on the River Bandon were examined downstream of the proposed flood relief scheme near Inishannon. The River

Bandon was surveyed at six locations within the stretch directly affected by the proposed flood relief scheme. Two locations were surveyed upstream of the proposed scheme; one on the Bandon River and another on the Bridewell River, a tributary of the Bandon River. The locations of the study sites are given in Table 5.4. The fish stock assessment involved electrical fishing, sweep sampling and snorkeling.

The survey was carried out under authorisation from the Department of Communication, Energy and Natural Resources under Section 14 of the Fisheries Act (1980). Electrical fishing specifically for salmonids was carried out at each site following the methodology outlined in the manual "*Methods for the Water Framework Directive - Electric fishing in wadable reaches*" by CFB (2008). Portable electrical fishing units (Smith Root-LR 24 Model) were used during the assessment. At sites for the assessment of juvenile salmonids, fishing was carried out continuously for 20 minutes at each site and captured fish were collected into a container of river water. Fish species other than salmon and trout were also recorded in this component of the survey. Following completion of the fishing, the dimensions and physical habitat characteristics of the site were recorded.

Electrical fishing for European eel was also carried out at each location by focusing on rocky substrate. During this survey, an area of 5m² (ca. 2.2m X 2.2m) was examined semi-quantitatively.

Quantitative electrical fishing for juvenile lampreys was carried out at each location. An area of 3m² was examined at each location. This was achieved by placing a netted frame enclosing an area of 1m² at each of three sub-sites at each survey location. Electrical fishing within the enclosure followed methodology outlined in O'Connor (2004). Lampreys were measured to the nearest millimetre (Standard Length), weighted to the nearest 0.1g and identified using the keys given in Gardiner (2003). Larvae of the two *Lampetra* species which occur in Ireland (*L. planeri* and *L. fluvialitis*) are impossible to separate by external examination. However, as transformation proceeds, the different development trajectories of the two species become apparent and identification is possible based on size of transforming individual and physical characteristics.

During the electrical fishing surveys, an assistant held an insulated dip net for collecting fish that failed to be captured by the operator.

Sweep sampling was undertaken along the margins of the river at each site. A dip net (mesh size 1mm; 40 cm x 40 cm frame, handle length 182 cm) was submerged and quickly swept through the water and aquatic/emergent vegetation, each sweep lasting 2-3 seconds. A total of 20 sweeps at random locations along the river was carried out at each site. Table 5.5 shows the locations of the survey sites and the fish surveys carried out at each site.

Captured fish for each survey type were anaesthetised after individual surveys using a solution of 2-phenoxyethanol. All captured fish were identified and measured to the nearest mm using a measuring board. Subsequent to this the fish were allowed to recover in a container of river water. All fish were released alive and spread evenly over the sampling area. Results of the investigations are presented using Catch per Unit Effort (CPUE) indices; fish number/m² and fish number/minute.

At each site, a reach of river was also surveyed by snorkeling, a reach being defined as 'a section of stream at least twenty times longer than its average channel width that maintains homogenous channel morphology, flow, and physical, chemical and biological characteristics' (Flosi and Reynolds, 1994). During this assessment an attempt was made to record all fish species seen. This survey mainly targeted

adult fish (i.e. adult salmon and sea trout). However, conditions were generally suboptimal for this type of assessment due to elevated water levels and ongoing dredging works on the river (see below).

5.5.3.2.1 Limitations of the Survey

Advance survey work was carried out on the 4th to 5th September to select sites for the subsequent survey. River levels were low and ideal for survey work at this time. The license to undertake the survey was unfortunately not in place at this time, and the River Bandon went into flood shortly after this. Actual survey work and sampling was undertaken on the 15th and 16th September and on the 22nd and 23rd September 2011. With water levels, seasonal constraints and ongoing river dredging works, these were the only windows available for this survey. It is noted that water levels on the 15th September and 22nd September were higher than normal. Water levels on the following days (17th and 23rd September) were slightly lower, but still considered elevated. Water clarity was good on all survey dates with the exception of the 22nd September when work had to be abandoned due to deterioration in water visibility. This was caused by dredging works in Bandon. Turbidity levels were still slightly elevated on the 23rd September.

The juvenile salmonid survey was by its nature, semi-quantitative. Attempts were made to close off the areas selected for salmonid electrical fishing using heavy duty fine mesh stop nets. These nets were set up to enclose the area but these could not be stabilised due to the slightly elevated water levels experienced at the time of the survey. The boundary of the surveyed area at each location therefore was chosen to comprise of a bank of the river, and where possible other features that limited fish from swimming from the survey area were utilised as boundaries (e.g. exposed rock, high gradient riffles in the channel). However, this approach is likely to have lowered catch efficiency for salmonids. However, this will not have affected the overall evaluation of the fish populations in the study area. Snorkeling work was also affected by the environmental constraints discussed above, but extensive qualitative snorkeling surveys were completed. Surveys for lampreys were completed successfully with all areas successfully enclosed at each site using a mesh box.

Site	Location	NOS Grid Reference	Fish surveys carried out				
			Salmonid semi-quantitative electrical fishing	Juvenile lamprey quantitative electrical fishing	Eel semi-quantitative electrical fishing	Sweep netting	Snorkelling
1	Bandon River immediately downstream of N71 Inishannon Bridge, ca. 6km downstream of Bandon	W54094 57047	✓	✓	✓	✓	✓
2	Bandon River ca. 200m downstream of the River Brinny confluence, ca. 5.2km downstream of Bandon	W53279 57497	✓	✓	✓	✓	✓
3	Bandon River adjacent to car parking area at Ardnaclog. Ca. 4.8km downstream of Bandon	W53013 57189	✓	✓	✓	✓	✓
4	Bandon River ca. 4km downstream of Bandon	W52340 57676	✓	✓	✓	✓	✓
5	Bandon River ca. 3.2km downstream of Bandon	W51604 57006	✓	✓	✓	✓	✓
6	Bandon River ca. 2.5km downstream of Bandon	W51455 56702	✓	✓	✓	✓	✓
7	Bandon River ca. 2km downstream of Bandon	W50964 56241	✓	✓	✓	✓	✓
8	Bandon River ca. 1km downstream of Bandon	W50280 55600	✓	✓	✓	✓	✓
9	Bandon River immediately downstream of Bandon Bridge	W48961 55104	✓	✓	✓	✓	✓
10	Bandon River downstream of the weir in Bandon	W49015 55095	✓	✓	✓	✓	
11	Bandon River ca. 2km upstream of Bandon	W47068 54739	✓	✓	✓	✓	✓
12	Bridewell River approximately 2km upstream of the Bandon River confluence	W47651 53743	✓	✓	✓	✓	✓

Table 5.5 Locations of the Survey Sites and the Fish Surveys carried out at each Site.

5.5.3.2.2 Discussion of Results

Over the 12 sites surveyed a total of 1,605m² of habitat was surveyed for juvenile salmonids; 60m² was surveyed for European eel; while a total of 36m² of suitable habitat was surveyed for lamprey. The current survey also included 240 sweep net samples within the study area. The survey resulted in the capture of 2,256 fish in total, comprising eight species. The most common species recorded was Atlantic salmon *Salmo salar*, followed by minnow *Phoxinus phoxinus*. Additional fish species recorded include three-spined stickleback *Gasterosteus aculeatus*, stone loach *Barbatula barbatula*, European eel *Anguilla anguilla* and flounder *Platichthys flesus*. The relative abundance of all species recorded during the current survey is shown in Figure 5.4.

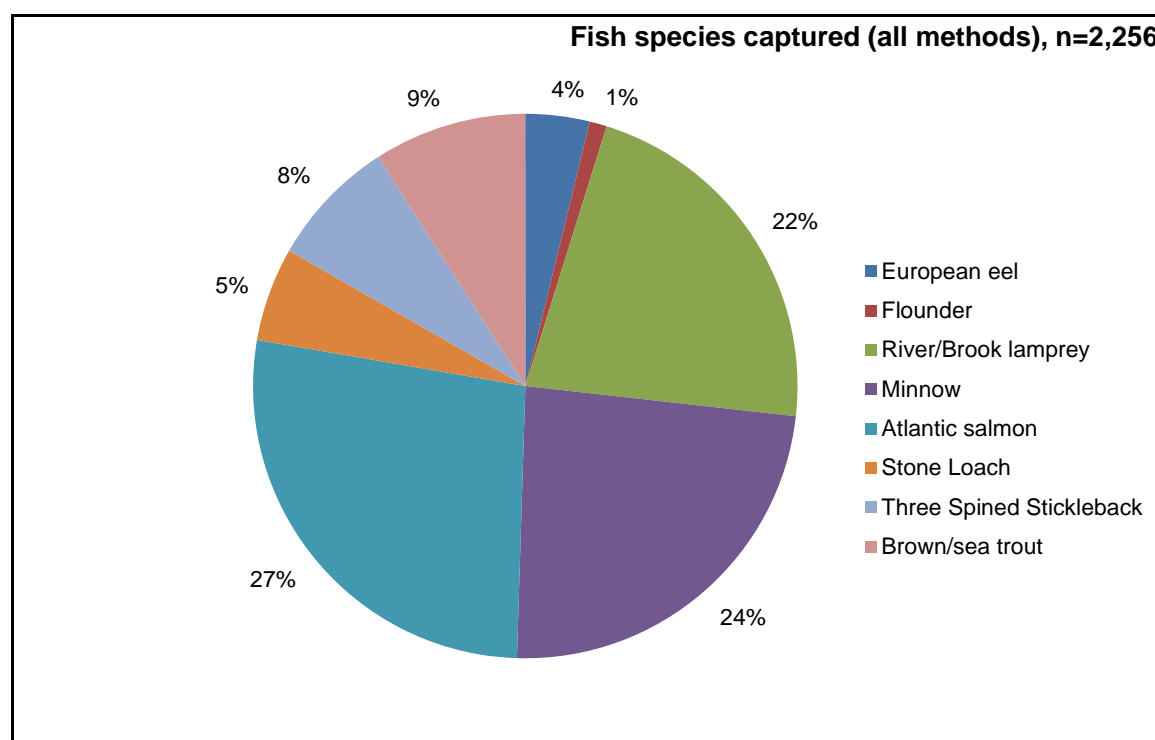


Figure 5.4 Fish species compositor (all methods combined) for the September 2011 fish stock assessment on the Bandon River.

A total of 495 juvenile lamprey were recorded, with both river lamprey *Lampetra fluviatilis* and brook lamprey *L. planeri* populations present. Based on the examination of transformers, it is confirmed that the population of juvenile lampreys downstream of Bandon weir includes (and may be dominated by) River lampreys. Bandon weir has been identified as being an impassable barrier to lampreys, and the lampreys upstream of this weir are identified as brook lampreys. This is corroborated with evidence collected during the examination of transforming lampreys in this area. No sea lamprey were recorded during the current survey, and it is confirmed that this species is absent from the River Bandon. Brown trout *Salmo trutta* (n=205) were recorded throughout the study area, with sea trout also recorded during the snorkel surveys. Brown trout numbers were found to be very low in the lower reaches of the Bandon to Inishannon, with numbers increasing upstream to Bandon town and upstream of Bandon weir. This may be due to competition by the Atlantic salmon population which dominates this stretch of the river. Adult salmon and sea trout were observed throughout the study area during September 2011.

This stretch of the river is identified as a significant and highly productive stretch for Atlantic salmon within the study area. The densities of juvenile lampreys recorded were considered to be exceptional, and amongst the highest ever recorded in Ireland. No lampreys were recorded in the stretch of river affected by dredging in 2010/2011.

Atlantic salmon, River lampreys and Brook lampreys are listed under Annex II of the EU Habitats Directive. The lower river also provides significant habitats for the European eel which has been listed as 'Critically endangered' and is now 'Red Listed' according to the recently published 'Red List No. 5: Amphibians, Reptiles & Freshwater Fish' (King *et al.*, 2011).

The lower River Bandon has exceptional juvenile salmon populations. The current survey has confirmed that salmon spawn throughout the lower river. . The lower River Bandon is less important in relation to trout populations. This may to some degree be related to habitats; however competition from the large

salmon populations may also be a factor. Adult sea trout and salmon were observed throughout the lower river during the current survey, and the study area is a nationally important salmonid angling area.

The lower River Bandon also has exceptional juvenile lamprey populations. The current survey was undertaken during September, which is about a month too early for that recommended for rivers which contain both *Lampetra* species (Gardiner, 2003). However, it was concluded that many of the transformers recorded during the current survey were *L. fluvialitis*. All of these transformers lampreys were less than 11cm and in the size range reported for *L. fluvialitis* (Gardiner, 2003). One almost fully transformed individual identified as being River lamprey *Lampetra fluviatilis*. It is considered, based on the geographical location, that most of the population here probably are *L. fluvialitis* (rather than *L. planeri*). However, both of these Annex II species are almost certainly present. There was a good size range of juvenile lampreys present at this site, with several age classes ranging from young of the year to transformers. This is considered to be an exceptional spawning and nursery area for river lampreys (and probably brook lampreys). Sea lamprey was confirmed absent.

The existing weir at Bandon presents an obstacle to River lamprey upstream migration. The available spawning and juvenile silt bed habitats downstream of this weir are therefore of increased importance in the context of the Bandon River catchment. Impacts affecting this stretch of the river below the weir would have the potential to result in direct and indirect adverse impacts on this Annex II species. It is also noteworthy that juvenile salmonid stocks below the weir are dominated by salmon. Therefore the weir may also act as a partial barrier to this species.

5.5.3.4 Salmon Redd Survey

A survey to count Salmon (*Salmo salar*) redds was undertaken on a section of the Bandon River from Bandon Town downstream as far as Inishannon bridge on the 12th of January 2012. The study area is shown in Figure 5.3.

The following methodology was used to carry out the redd survey:

- Prior to commencing the survey of a stretch of river, the banks were walked and suitable or most likely spawning habitats were noted for particular attention along with any suspected redds. Where possible, bridges were used to provide additional vantage points.
- Surveyors entered the river at the downstream end of each section and systematically walked upstream along the river channel using bathyscopes where necessary to view features beneath the water. Care was taken not to step upon any redds encountered.
- Redds were identified by the following features:
 - Raised pile of gravel in the stream bed with shallow depression upstream.
 - Over one metre wide and 1.5-2 metres in length (depression and pile)
 - Gravels generally finer in the trailing pile than in the depression.
 - Gravels often clean and having shown signs of recent disturbance.
- Width and length of redd was recorded in addition to GPS location.
- Four surveyors were used to ensure good coverage of the river bed in the study areas.
- Survey was undertaken in mid January at the first opportunity following the main spawning season in Late November/December where the river was at a suitably low level.

During the survey period, the water level was at between 0.5 & 0.6m at the EPA Curranure gauge. This was higher than would have been preferred but still allowed much of the river to be accurately surveyed. Some potential spawning areas were however inaccessible for wading and too deep to be surveyed from the bank. Water levels in the river had been high for the preceding months and had prohibited earlier surveying at the end of December or earlier in January.

Visibility within the water column was initially relatively good with only slight coloration, though visibility was impaired by the presence of deep water in places. During the course of the survey, turbidity in the water column increased to levels that hindered the survey effort.

Limitations of the survey were the conditions and timing of the survey which were sub-optimal. Earlier surveying would not have been possible, however, due to high water levels and surveying later in the season would have been further from the main spawning period and therefore likely to record fewer redds.

Six separate stretches of river were surveyed as shown in Figure 5.3. Five salmon redds were recorded. Four of these were close to the left bank just upstream of the footbridge in Bandon Town. The other was approximately 530 metres upstream of O'Driscoll's Bridge. The redds that were identified were obvious and clearly identifiable with no similar structures recorded in the other areas surveyed.

5.5.3.4.1 Results of Salmon Redd Survey

Redd Count One

This count was undertaken in a shallow glide with gravels that are suitable for spawning between the main road bridge in Bandon and the weir. (Grid Ref: E148933 N55018 to E149264 55071). All sections of riverbed were surveyed and four redds were identified close to the left bank upstream of the pedestrian footbridge. Grid refs: 1. E49026 N55050. 2. E49024 N55053. 3. E49018 N55054. 4. E49014 N55054.

It was considered that visibility and depth allowed a comprehensive survey of this area to be carried out. This was the only area where data from previous surveys undertaken by the IFI (Previously South Western Regional Fisheries Board) was available. Previous counts followed an unknown methodology and it is not known what time(s) of year they were undertaken. The results of the previous redd counts in this area are provided in Table 5.6 below:

Year	Redds Identified
2008	17
2009	12
2010	14

Table 5.6 Previous Redd Counts in this stretch of River (IFI)

Even though conditions were good for surveying and significantly less redds were recorded during this survey than in previous searches of the same area, it is not necessarily the case that less Salmon spawned in this area. It may be that the river was visited earlier in the season or several times during the spawning season in previous years.

The remains of two dead Salmon were recorded in this area. They had presumably spawned and subsequently died.

Redd Count Two

This count was undertaken in riffles and glides close to the parking area and fast food trailer at Ardnaglug both up and downstream. (Grid Ref: E1152819 N57313 to E153150 N57287). The downstream section was very fast flowing with a deeper area close to the left bank. The gravelly areas close to the right bank were surveyed in this section with the rest of the river providing sub optimal spawning habitat that was too deep to survey successfully. The whole width of the river was surveyed upstream of the parking area.

No Redds were found during this part of the survey.

Redd Count Three

This count was undertaken in glides with some riffle and good potential salmonid spawning gravels (Grid Ref: E151984 N57240 to E152308 N57644). The majority of the channel in this area was surveyed. No Redds were recorded.

Redd Count Four

This count was undertaken on a short stretch of glide close to a private vehicular bridge (O'Driscoll's Bridge) (Grid Ref: E151618 N56848 to E151650 N56947). In this area, the water was deep and visibility was poor. Survey abandoned due to poor conditions. No redds found.

Red Count Five

This count was undertaken in glide/riffle with spawning gravels present (E151458 N56622 to E151546 N56720). The water continued to be turbid with impaired visibility. Survey abandoned in deep water. No redds found.

Redd Count Six

This count was undertaken in glides/riffles with spawning gravels present (E151083 N56315 to E151373 N56503). On the downstream sections, the left bank of the river was surveyed with the right bank being too deep. For the upstream sections, the right bank was surveyed with the left bank being too deep. One redd was recorded in this area (Grid Ref: E151339 N56496).

5.5.3.5 Conclusion

Five redds were identified as part of the survey. The redds that were identified were obvious and clearly identifiable with no similar structures recorded in the other areas surveyed. It is likely that redds were under-recorded during the survey for the following reasons:

1. Survey undertaken too long after main spawning season and after a long period of high water. Many of the redds may have not been obvious following erosion due to high flows.
2. The water levels were still high and it was not possible to count many parts of the river and access all locations safely.
3. Turbidity impaired visibility during the latter stages of the survey.

The survey is unlikely to have resulted in an accurate count of the amount of the Salmon redds in the river during the late 2011/early 2012 spawning season for the above reasons. The results do however confirm previous evidence of Salmon spawning in this section of the Bandon River.

5.5.4 Invertebrates**5.5.4.1 Freshwater Pearl Mussel Survey**

A dedicated survey for Freshwater Pearl Mussel (*Margaritifera margaritifera*) was carried out on the 31st August, 1st, 2nd, 13th and 14th September 2011 under licence from the National Parks & Wildlife Service (Licence No. C124/2011). The study area from the Bridge at Inishannon to the weir in Bandon Town was first waded by two surveyors using bathyscopes searching for Freshwater Pearl Mussel and signs thereof. During this survey, the most suitable habitat for Pearl Mussel within the study area was also identified. A more targeted Pearl Mussel survey was undertaken in the areas identified as being most suitable in the initial surveys and areas where Freshwater Pearl Mussel had been recorded in the past.

During the targeted survey, six surveyors waded up the river in a linear arrangement and thoroughly searched for Freshwater Pearl Mussel using bathyscopes and snorkels where necessary. The areas surveyed are shown on Figure 5.3. This survey was undertaken in accordance with the Irish Wildlife Manual No.12. '*Margaritifera margaritifera* Stage 1 and Stage 2 survey guidelines'. The river was classified as a high priority river because there are known records from upstream and historical records from within the study area. The conditions were considered suitable for carrying out the survey with good visibility within the water column and nebulosity at less than 50%. The water levels were slightly elevated at the start of the survey but reduced during the survey period.

No live Freshwater Pearl Mussel were recorded during the survey but a single valve was recorded just downstream of the bridge in Bandon during the initial survey. This valve was in poor condition and is highly likely to have been washed down from upstream (where they are known to be present). It was further concluded that the substrate in the town itself was unlikely to support pearl mussel as it consisted of shifting gravels, which were unlikely to be stable enough to provide good habitat.

During the phase one survey, only two small fragments of shell were recorded. These were very battered and thus also likely to have been washed in.

Subsequent anecdotal evidence from local anglers suggests that shells are regularly seen in the town after floods and live mussels have been seen at Baxters Bridge (above Bandon Town).

On the basis of the surveys undertaken, it is unlikely that Freshwater Pearl Mussel are present within the study area though habitats within the river appear suitable for this species. The locations where the fragments of shell were recorded are shown on Figure 5.3.

5.5.4.2 Macroinvertebrates

Kick samples of aquatic macro-invertebrates were taken in representative amounts of differing habitats within the river. Some were taken in riffle areas, others in glides and pools.

The results of this survey are provided in Appendix 5E. In general, the invertebrate communities that were recorded indicated water of a high quality with samples taken in riffle areas ranging from unpolluted status (Q5) to slightly polluted (Q3) and the majority of the samples registering Q4 and Q3/4. This is slightly higher than the findings of the EPA who recorded moderately polluted status during the 1997, 2000 and 2003 surveys. From a monitoring station located 1.5 km downstream of Bandon Bridge. The results may not however be directly comparable given that the sample habitats may differ.

The samples taken in glides and pools recorded invertebrate communities that were more typical of the less well oxygenated habitats. Overall, species diversity was good with approximately 40 genera recorded

during the surveys and an average of 8 genera recorded in each sample. In some samples the density of species was high and dominated by a small number of genera, whilst in others it was lower and often more diverse. In many of the deeper glides and pools, there was a heavy cover of algae at the time that the kick samples were taken. This is often an indicator of organic pollution in the watercourse. It should however be noted that the samples were taken at the end of the summer at low water levels. During river surveys in early January 2012, there was considerably less algae in the river, it having been washed away by the strong winter flows.

5.5.5 Significance of Fauna

The River Bandon within the study area is of considerable significance for a number of faunal species.

This section of river is described in the fish stock survey report as having exceptional juvenile salmon populations. This survey also confirms that salmon spawn throughout the lower river.

The same report describes the lower River Bandon also having exceptional juvenile lamprey populations. Both River lampreys and Brook lampreys are thought to be present.

Both of the above species are listed on Annex II of the EU Habitats Directive. In addition, the river and surrounding vegetation provide habitat for two further species that are protected under European legislation. These are Otter (Annex II, Habitats Directive) and Kingfisher (Annex I, Birds Directive). No proof of either of these species breeding within the study area was recorded during the surveys but both species were observed during surveys and on this basis and the presence of suitable habitat, there is a high likelihood that they breed in the area. No evidence of Freshwater Pearl Mussel (Annex II, Habitats Directive) being present in the study area was recorded

In addition to the above species that are protected under European Legislation, the study area includes a wide diversity of aquatic and terrestrial habitats. The river itself has a varied morphology and a relatively undisturbed bed. This provides suitable habitat for a wide range of aquatic species. The woodlands, tree lines and bank side vegetation provide cover and feeding areas for a wide range of mammal and birds.

5.6 IMPACTS AND MITIGATION MEASURES

5.6.1 Do Nothing/Current Scenario

If the proposed works were not to go ahead, it is likely that the current regime of management and maintenance on the river will continue with the nature of the river being maintained essentially as it is at present. It is likely that maintenance works would include the removal of debris and built up of sediments in the town and around the bridges along with bank protection works where necessary. It is likely that these works will be undertaken in consultation with the IFI to minimise impacts on the Bandon River fishery. It is also likely that the river would still flood Bandon Town periodically (since 1975, serious flooding in the town has occurred on five occasions).

5.6.1 Loss of Habitat

5.6.1.1 Instream Habitat

The proposed works will involve the dredging of the Bandon River from the weir in Bandon Town to O'Driscoll's Bridge near Kilbeg, a distance of approximately 3.6 kilometres. The riverbed will be dredged

to a depth of approximately 1.8 metres immediately below the weir in Bandon Town and will grade towards a location at O'Driscoll's Bridge where the dredge depth will meet the existing bed level. This will change the average gradient of the river from approximately 1: 740 to approximately 1:1,000. This will permanently and significantly alter the nature of the channel. Whilst the overall existing gradient is approximately 1:740, it should be noted that the river is at a considerably flatter gradient over much of the course with a limited number of short sections that are steeper (approximately six locations). None of the existing shallow gradients will be made shallower a result of the proposed works. Much of the river in this area will have an increased gradient following completion of the works. At present the section of river between the weir in Bandon and O'Driscoll's Bridge includes a diversity of habitats that include spawning and nursery areas for Salmonids (in particular Atlantic Salmon) along with holding pools and lies for adult fish. The river topographical survey identified 23 no. separate features within this section of the river including 15 glide/pools and eight riffles. The fish stock survey indicated that the sections of the river within the town that were regularly maintained had a reduced morphological complexity when compared with other sections of the river that are less managed. This has reduced habitat diversity within the river channel and reduced its value as a fishery. It is likely that there will be a reduction in the diversity of morphology within the river channel following the proposed works.

5.6.1.2 Loss of Habitat for Salmonid spawning and Juvenile Fish

Permanent Significant Negative Impact

The fish stock survey confirmed that the section of river to be directly affected by the proposed works provides exceptional habitat not only for Salmonid spawning but also the juvenile stages of these fish. It is highly unlikely that this diversity of habitats will be maintained following the completion of the proposed works as the gradient of the river will be decreased thus limiting the potential for fast flowing water (riffle and well oxygenated habitats) within the works footprint. These are the most important habitats for spawning and juvenile Salmonid species.

Mitigation Measures

- A diagram of the mitigation described below is provided in Figures 5.5 – 5.8
- Whilst the works will result in a more or less even gradient of 1:1000 throughout the study area, a defined thalweg or flow path has been designed to provide variation of habitat and gradient throughout the study area. This thalweg will emulate the existing conditions in the river, insofar as is possible, with steep gradients in the areas where these gradients currently exist and shallower gradients with pools in the areas where the pre-works flow is slow. Given that the overall gradient of the river will change from approximately 1: 740 to 1: 1000, the steeper sections of channel within the thalweg will be shortened in length to accommodate the change. It is not anticipated that the gradient in the slower flowing sections will be significantly altered. The river has four significant steeper sections within the study area and these will be retained in a shortened form within the thalweg of the dredged channel. These steeper sections are located close to the bridge in Bandon Town, just upstream of the sewage treatment works, at a section of river known locally as rough hole and an area just upstream of the termination of works at O'Driscoll's Bridge.
- As is the case in the existing channel, the thalweg will be more defined in the steeper sections and less so in the slower flowing sections. It will be approximately 10 metres wide on the fast flowing, steep sections of channel and 5 metres wide on the slower flowing sections.
- The creation of the thalweg will not only ensure that diversity of gradient in the channel is maintained to some extent, it will also provide habitat for fish at low flow conditions where a

dredged channel without a thalweg may prove too shallow to support healthy fish populations in dry weather conditions. It is likely that the area outside the thalweg will also provide suitable conditions for juvenile Salmon in all but dry weather flows. Rivers with a similar gradient (1:1000) in Ireland such as the Boyne and Clare Rivers provide good conditions for juvenile Salmon.

- The thalweg will be lined with rounded boulders of approximately 300mm diameter, particularly in the steeper sections. This will provide the ideal substrate for young Salmonid fish and will be similar to the existing substrate in these areas. This substrate provides a habitat for macro-invertebrates that provide food for fish whilst also providing an area where young fish can hold station to feed in a strong current. The use of rounded boulders in the slower flowing sections of the thalweg will be of a lesser importance as depositing conditions may occur here. Rubble mats that are constructed of broken stone will be constructed in the slower flowing sections. Each mat will cover approximately half of the width of the channel and will be constructed to be below the surface in dry weather flow. The mats will originate alternately from each bank of the thalweg. These mats will not only provide an ideal substrate for the production of macro-invertebrates as food for fish, they will also provide further diversity of flow and habitat within otherwise flat and straight sections of channel. In some places, where the gradient allows, the rubble mats will be placed across the entire width of the thalweg to create a riffle.
- Where pools are provided at the outside of meander bends and at the bottom of the steeper riffle areas, large boulders will be placed to aid in the scouring of the pool and the prevention of silting. These large boulders will also provide additional habitat diversity within the channel. Gravels will be placed in the downstream tail of these pools to provide salmonid spawning habitat. Similar gravels will also be placed just upstream of the steeper areas of channel, again to provide suitable spawning habitat and to replicate the existing situation in the river.
- It is anticipated that much of the material for use as substrate in the post works channel will be excavated from the existing channel. This material will, where possible, be graded and stored on the bankside during excavation for re-use during construction of the mitigation.
- Whilst the excavation works are likely to initially result in a substrate of exposed bedrock, particularly at the upstream end of the study area, the gradient of 1:1000 will create conditions that are likely to promote the deposition of cobbles, gravels and some sand. It is likely that this will provide a suitable substrate for growth of Water Crowfoot (*Ranunculus pinnatifidus*). This is an important plant for providing cover for fish and also supporting the production of macro invertebrates, which are an important food source for fish. Growth of this plant can develop into stands of vegetation that corresponded to the EU Habitats Directive Annex I Habitat 'Watercourses of plain to mountain levels with the *Ranunculus fluitans* and *Callitriche-Batrachium* vegetation (3260)'. These habitats are present in the existing channel within the river. There will inevitably be some variation of habitat and gradient within the channel outside the thalweg though this is likely to be limited by the design of the flood relief scheme.
- Pools will be excavated in the thalweg. These will be excavated to a maximum depth in the centre of the pool of approximately 1.3 metres (dry weather flow) and 10 metres long. They will be roughly the shape of half an egg, rather than square or angular. They will be located to emulate natural conditions in the river. They will be positioned at the outside of meander bends and also at the base of the created riffle areas. These are the areas where they occur in the existing channel.

- Large boulders will be placed within these pools to facilitate scouring to keep the pool clear and to provide cover as fish lies. These will be below the water surface at dry weather flow so as not to interfere with angling.
- The weir in Bandon Town has been identified as a block to the upstream passage of River Lamprey and an impediment to the upstream passage of Salmon at present. The proposed works have the potential to exacerbate this by effectively increasing the height of the weir, thereby preventing all upstream migration. This will be mitigated through the construction of a rock ramp. This ramp will be approximately 112 metres in length and five metres in width. It will be sloped at a gradient of 1: 24.5 and will be constructed using large boulders with a constant flow of water of at least approximately 300 mm over them. This gradient and flow will allow the passage of fish over the weir during any flow conditions. There will be an excavated pool at the base of the ramp with a defined thalweg leading up to it so that migrating fish are guided toward the ramp as opposed to the weir. This mitigation has been successfully employed in various locations around Ireland and will ensure that the passage of Lamprey over the weir is not blocked and the passage of Salmon is not impeded. This will improve on the existing situation.
- During the construction phase, minor changes to the design must be provided for to ensure that the mitigation is effective. The works will be overseen by an ecologist and ideally the mitigation will be constructed in conjunction with the IFI. The main excavation of the channel and thalweg will be undertaken in the initial phase of works with habitat creation works and other mitigation undertaken afterwards once the initial works have been completed. This will allow the careful placement of boulders, gravels and rubble mats in the locations that they will work most effectively.
- An ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.

Residual Impact

It is likely that the nature of the channel will be altered in that the overall gradient will be lowered. However, the proposed mitigation will ensure that habitat diversity is maintained within the channel to some degree with riffle, pool and glide features included in the mitigation design. Even with the mitigation in place, there will be some loss of area of the steepest sections of channel that provide the best juvenile salmon habitat. Whilst this will be reduced, it will be retained within the thalweg at similar locations to where it is located at present. In addition, the overall gradient of 1:1000 outside the thalweg has been modeled to provide flows of over 0.5 m/s at all but dry weather flows. This is likely to provide suitable habitat for juvenile salmonids. Gravels placed above and at the tail of excavated pools are likely to provide spawning habitat. In addition, the habitats outside the thalweg are likely to support aquatic macrophytes that will act as a substrate for macroinvertebrate growth as will the rubble mats placed in the slower flowing sections of the thalweg. This is likely to provide the necessary food for the salmonid species. This impact has been reclassified as Permanent Moderate Negative Impact. However, monitoring of the channel on an annual basis at least until one year after the first maintenance will be necessary to ensure that the predictions are correct and to ensure that adjustments can be made if necessary.

5.6.1.3 Loss of Habitat for Lamprey Species within the study area

Permanent Significant Negative Impact

The Bandon River has been identified in the fish stock survey as being of considerable importance for River and Brook Lamprey. As with the Salmonid species, the loss of habitat diversity in general and the potential loss of both spawning habitat and sediments to suit the juvenile stages of the Lamprey lifecycle is likely to result in a significant negative impact although it is possible that depositing conditions, suited to the juvenile stages of Lamprey species, may be created by the proposed works in the long term.

Mitigation Measures

- Mitigation as described in section 4.2.1.2 provides diversity of habitat that has been designed to provide depositing conditions suitable for juvenile Lamprey. The provision of spawning habitat is also included within the mitigation design.
- The provision of the rock ramp will open up the wider Bandon Catchment to River Lamprey as the barrier to their migration will be removed.
- During the construction phase, minor changes to the design must be provided for to ensure that the mitigation is effective. The works will be overseen by an ecologist and ideally the mitigation will be constructed in conjunction with the IFI. The main excavation of the channel and thalweg will be undertaken in the initial phase of works with habitat creation works and other mitigation undertaken afterwards once the initial works have been completed. This will allow the careful placement of boulders, gravels and rubble mats in the locations that they will work most effectively.
- An ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.

Residual Impact

It is likely that with the above mitigation included, the proposed works will result in a Permanent Significant positive Impact. This is because the proposed works will greatly increase the habitat area available within the Bandon catchment and have also been designed to include the provision of a diversity of habitats suitable for the various life stages within the works area.

5.6.1.4 Impact on Aquatic Invertebrates

Permanent Slight Negative Impact

The reduction in the amount of fast flowing well oxygenated water that will inevitably result from the reduction in gradient is likely to alter the nature of the aquatic invertebrate communities within the channel. At present, there is a diverse range of macroinvertebrates within the river channel, many of which are associated with clean riffle habitats, which are present in this section of the river. It is highly likely that there will be a reduction in species diversity as a result of the proposed works. The invertebrate communities within the river following the proposed works are likely to resemble those currently found in the deep glides and pools at present. This is included as a slight negative impact as, although the diversity may be reduced, the density of macroinvertebrates may not be reduced with new habitats created

Mitigation Measures

- Mitigation as described in Section 5.6.1.2.

Residual Impact

It is likely that with the above mitigation included, the proposed works will result in a Permanent Negligible Negative Impact as there will be ample habitat for macroinvertebrate production within the thalweg and throughout the channel. It is likely that there will be a shift towards species that prefer slightly slower water.

5.6.1.5 Impacts on Floral Communities within the Channel

Potential Permanent Moderate Negative Impact

Sections of the river within the works area support a botanical habitat that corresponds to the EU Habitats Directive Annex I Habitat '*Watercourses of Plain to Montane Level with the Ranunculion fluitantis and Callitriche-Batrachion vegetation* (3260). This in-stream vegetation is not only a protected habitat but also provides cover and feeding areas for fish species. It is likely that the habitats created by the proposed works may result in the growth of a different range of aquatic macrophytes than are currently present within the channel. These may resemble the plant communities that are associated with depositing rivers.

Mitigation Measures

- Whilst the excavation works are likely to initially result in a substrate of exposed bedrock outside the thalweg, particularly at the upstream end of the study area, the gradient of 1:1000 will create conditions that are likely to promote the deposition of cobbles, gravels and some sand. It is likely that this will provide a suitable substrate for growth of Water Crowfoot (*Ranunculus pinnatifidus*), but may also provide substrate for a different range of plant species.
- During the construction phase, minor changes to the design must be provided for to ensure that the mitigation is effective. The works will be overseen by an ecologist and ideally the mitigation will be constructed in conjunction with the IFI. The main excavation of the channel and thalweg will be undertaken in the initial phase of works with habitat creation works and other mitigation undertaken afterwards once the initial works have been completed. This will allow the careful placement of boulders, gravels and rubble mats in the locations that they will work most effectively.
- An ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.

Residual Impact

If the conditions can be created in the channel for the propagation of this habitat, it is likely that this impact can be negated.

5.6.2 Bankside Habitat

Temporary Significant Negative Impact

The proposed works will involve the loss of much of the bankside habitat to provide easement for the construction period. In addition, there will be an embankment constructed over a section of the right bank downstream of the town. Bankside vegetation within the works area includes habitats such as tree lines, woodlands, scrub and individual trees that greatly increase the habitat and species diversity associated with the river. This vegetation also provides cover and shelter for many faunal species including invertebrates, birds and mammals.

Of particular note are Otter, which are present throughout the proposed works area and utilise the cover that is present on river banks. This species is protected under Annex II of the EU Habitats Directive and

its use of the area is likely to be significantly affected by the proposed works through temporary loss of habitat.

Bankside tress and woodlands also have the potential to provide cover and shelter for bat species and the associated invertebrates provide a valuable food source for these species.

Though none were found, the banks within the works area provide, in a few places, steep earthen banks that provide suitable habitats for nesting Kingfisher. The overhanging trees and bankside branches also provide hunting perches for this species.

In addition to the above, bankside vegetation provides diversity, cover and shade for aquatic species and whilst a completely shaded river would be detrimental to aquatic life, a river benefits greatly from partial shading. Invertebrates associated with the bankside vegetation also provide a food source for aquatic species.

Some other areas of the bank within the works footprint are bordered by fields of grassland and support steep banks with little tall vegetation (mainly grassy vegetation).

Mitigation Measures

- The existing bankside habitat will be retained insofar as is possible. It will however be necessary for the contractor to access the river throughout the works area. To facilitate this much of the bankside habitat will be necessary for use as a construction easement. To mitigate this impact, sensitive areas of the bankside such as woodlands and wetlands have been avoided. In addition, where tree lines are present along the banks, at least 50% will be retained with a maximum of 25 metres removed to facilitate access at any one point. A minimum of 25 metres will be retained adjacent to sections that are removed and areas that are to be retained will be fenced off with protective fences.
- In general, natural regeneration of the banks will be encouraged. However, If necessary replanting and rehabilitation of the banks to replace and enhance the bankside habitats that are lost as part of the proposed works will be undertaken. Any replanting and habitat creation will use native species that are currently present in the area and will be designed in collaboration with an ecologist. The planting will be designed to facilitate maintenance of the channel in the future.
- The only exceptions to this are located just downstream of the town where a defence wall will be replaced and elongated along the right bank and Cypress trees that cast a deep shade over the channel at present will be removed. Provision will also be made for angler access but this will be small scale and unobtrusive.
- Dedicated Otter holt surveys will be undertaken in advance of the proposed works. These surveys will be carried out in accordance with the *NRA Guidelines for the Treatment of Otters prior to the construction of National Road Schemes*. Though no holts were recorded during the river surveys, it is possible that their may be holts present by the time that the works are undertaken and if they are found to be present, active holts will be avoided or treated according to the above guidelines.
- Dedicated Kingfisher surveys will be undertaken in advance of the proposed works. Although no nests were identified during the river surveys, it is possible that they are present and that they may move into the area prior to the outset of the proposed works. If a nesting pair are recorded in

the pre-commencement surveys, no works will be carried out within 50 metres of the nest during the breeding season (March-August inclusive).

- The works will include replanting and rehabilitation of the banks to replace and enhance the bankside habitats that are lost as part of the proposed works. This replanting and habitat creation will use native species that are currently present in the area and will be designed in collaboration with an ecologist. The planting will be designed to facilitate maintenance of the channel in the future.
- During the construction phase, minor changes to the design must be provided for to ensure that the mitigation is effective. The works will be overseen by an ecologist and ideally the mitigation will be constructed in conjunction with the IFI. The main excavation of the channel and thalweg will be undertaken in the initial phase of works with habitat creation works and other mitigation undertaken afterwards once the initial works have been completed. This will allow the careful placement of boulders, gravels and rubble mats in the locations that they will work most effectively.
- An ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.

Residual Impact

It is likely that, with the mitigation in place this impact will be reduced to a *Short Term Slight Negative Impact*.

5.6.3 Surrounding Habitats

Short Term Slight Negative Impact

The habitats surrounding the site of the proposed works include various agricultural and wooded areas. These surrounding habitats will be impacted upon by through machine access, construction compounds, stock piling of materials and other activities associated with operations of this nature. Detailed locations of these features will be finalised by the appointed contractor but will be informed by the mitigation prescribed below.

Mitigation Measures

- Where possible all features of this project that are not associated directly with the river will be centred on agriculturally managed lands and will avoid ecologically sensitive areas such as woodlands, wetlands and scrub.
- All such features will be fenced off at the outset of works to avoid un-necessary disturbance of habitats outside the works footprint.
- The utilized lands will be fully reinstated following completion of the works.
- Any stockpiles of material will be located away from the river and will be consolidated to prevent run off or erosion. If necessary long term stockpiles of gravels or boulders will be fenced off or covered

Residual Impact

It is likely that, with the mitigation in place this impact will continue to be a *Short Term Slight Negative Impact*.

5.6.4 Disturbance

5.6.4.1 Disturbance to Salmon

Temporary Significant Negative Impact

In addition to the habitat loss described above, the proposed works have the potential to impact negatively on the resident fish stocks in the river and those migrating through the works area. through disturbance The proposed works will inevitably reduce the habitat available and could also hinder the passage of fish up or downstream. Direct impacts involve physical disturbance of fish and indirect impacts involve smothering of downstream spawning beds and fish with suspended solids. The hindrance of migrating fish has the potential to impact on the populations throughout the entire Bandon catchment not just those within the works area.

Mitigation Measures

- Instream works will only be undertaken during the period May – September inclusive, to minimise the impact on Salmon, as outlined in IFI Guidelines regarding permission for instream works. This avoids the main periods of migration and spawning for the species.
- Works will be designed to avoid the blocking of the river and approximately 60% of the width of the river will be subject to works at any one time.
- Measures described in Section 5.6.1.2 below will be put in place to minimise the impacts of suspended solids in the water column.
- Works will be carried out between the hours of 8:00 and 6:00 leaving the river undisturbed for 14 hours each day

Residual Impact

It is likely that, with the mitigation in place this impact will overall constitute a *Temporary Moderate Negative Impact*.

5.6.4.2 Disturbance to Lamprey Species

Short Term Significant Negative Impact

The proposed works have the potential to significantly impact on River and Brook Lamprey populations within the works area. Resident populations of these species could be impacted in a number of ways. The juveniles are highly likely to be present in the soft sediments at the sides of the river and in the pools (as evidenced in the fish stock survey) and will be directly affected as the sediments are removed. In addition, the proposed works will be undertaken in the period when adult Lamprey spawn and could potentially directly and indirectly impact on the reproduction of these species. Direct impacts involve physical disturbance of spawning fish and indirect impacts involve smothering of spawning beds and fish with suspended solids. It was necessary to carry out works during the spawning period for this species (April – July) as there are water level and Salmonid constraints involved in carrying out the works during the winter period.

Mitigation Measures

- The mitigation as described in Section 5.6.1.2 will apply equally to the impacts on Lamprey species.
- Additional mitigation will include electro-fishing of work areas prior to outset of the works and relocation of adult and juvenile Lamprey to areas upstream of the works and upstream of Bandon weir.

Residual Impact

It is likely that, with the mitigation in place this impact will continue to be a *Short Term Significant Negative Impact*.

5.6.4.3 Ongoing Maintenance**Periodic Permanent Moderate Negative Impact**

It is anticipated that the ongoing maintenance associated with the proposed works will involve the removal of deposits that are exposed and above low water levels at intervals of approximately every 5 years. These works will involve the in-stream working of excavators to remove deposited material and could potentially result in disturbance to the resident fish populations both directly and indirectly through the suspension of sediments. The works will however be isolated in their locations and also much smaller in scale than the original dredging works. The works will only involve the removal of gravels at levels above the dry water flow with no deeper excavations proposed.

Mitigation Measures

- The proposed maintenance works will be undertaken during the period August –September inclusive to avoid the sensitive periods for Salmon and Lamprey species and during periods of low flow to minimise the potential for sediment transfer.

Residual Impact

It is likely that, with the mitigation in place this impact will constitute to a *Periodic Permanent Minor Negative Impact*

5.6.4.4 Disturbance to Bats**Short Term Minor Negative Impact**

The proposed works will involve works on two structures that were considered likely to support bat roosts. The majority of the trees that will be lost were considered unlikely to support significant roosting habitat given that most were relatively immature and without the potential for significant cavities. Any features that were considered to have potential as bat roosting sites were surveyed and no evidence of significant roosts being present was recorded. However, there is still potential for the proposed works to impact on bat species in these areas if bats move into the area in advance of the works.

Mitigation Measures

- A bat survey of the bridge, culvert and other areas identified with bat potential will be carried out in advance of the works being carried out to verify the absence of bats at these locations. Surveys will be undertaken not more than two weeks in advance of the works being undertaken. If bats are found to be present, mitigation will be put in place in accordance with the Bat Mitigation Guidelines for Ireland (Irish Wildlife Manual 25)
- Bat boxes will be installed on trees in the area and on the bridges and culverts to provide additional habitat for these species.

Residual Impact

It is likely that, with the mitigation in place this impact will be negated.

5.6.5 Migration of Fish

Permanent Significant Positive Impact

The weir in Bandon Town has been identified as a block to the upstream passage of River Lamprey and an impediment to the upstream passage of Salmon at present. The proposed works have the potential to exacerbate this by effectively increasing the height of the weir, thereby preventing all upstream migration. This will be mitigated through the construction of a rock ramp. This ramp will be approximately 112 metres in length and five metres in width. It will be sloped at a gradient of 1: 24.5 and will be constructed using large boulders with a constant flow of water of at least approximately 300 mm over them. This gradient and flow will allow the passage of fish over the weir during any flow conditions. There will be an excavated pool at the base of the ramp with a defined thalweg leading up to it so that migrating fish are guided toward the ramp as opposed to the weir. This mitigation has been successfully employed in various locations around Ireland and will ensure that the passage of Lamprey over the weir is not blocked and the passage of Salmon is not impeded. This will improve on the existing situation.

Provision for Fish passage up the Bridewell River and Mill Stream following the completion of works has also been made. Denil style fish ladders will be included on these rivers with a gradient of approximately 1: 4.5. In addition to this fish ladder type of pass, a Lamprey pass will be included in the design. This Lamprey passage will involve the use of specialised matting that provides a substrate onto which Lamprey can grip to allow passage over relatively steep gradients. This design has been used to good effect at various locations throughout Ireland and abroad and a similar design is shown in Plate 5.22 below.

In order to verify the impact of the mitigation, an ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.

A new culvert will be constructed adjacent to an existing culvert on the Mill Stream. The existing culvert is approximately 105 metres in length and has a light port at approximately half way between each end. The culvert has a natural stone substrate at its lower end but upstream of the light port consists of two concrete pipes. The proposed culvert will take the water that currently flows in the existing culvert during dry weather conditions with the old culvert being retained to act as an overflow channel during flood conditions.



Plate 5.22. Fish Ladder with Lamprey Access to the side. Similar to that which will be installed on the Bridewell River and Mill Stream.

The new culvert will be constructed using a 2.1m wide by 1.5m high (internally) box culvert that will be lined with imported natural bed material. The gradient will be approximately 1: 135 and the bed of the culvert will be set below the level of the intended bed so that when the 200mm of natural bed material is imported, the river bed is at a continuous level without any step or weir which, may act as an impediment to fish passage. A light port has been included in the design of the culvert and will be located at approximately half way between the ends of the culvert in a similar position to the existing light port.

Whilst the constraints of the site do not allow for perfect conditions for fish passage through the culvert, the existing situation has been improved with the removal of the concrete pipe section. The culvert has been designed taking into account the principles set out in the IFI Guidelines (Eastern Regional Fisheries Board – Requirements for the Protection of Fisheries Habitat During Construction and Development Works at Development Sites)

The new culvert route will be excavated in the dry and a connection made to the Mill Stream upon completion of the works.

A fish Counter will be constructed at the top of the rock ramp. This will be constructed with guidance from the IFI and will allow for the passage of Lamprey over the weir. This may require a small section of matting (as in the plate above) at the edge of the counter. It will be five metres in width to cover the entire top of the rock ramp. It will consist of a series of electroplates that register fish movement over the weir. It will also be fitted with a camera to verify records. It will be constructed at a low gradient of no more than 1:5 and if possible nearer 1:10 to facilitate easier passage for fish. There will be a depth of water of at least 0.15 metres on the counter at dry weather flow. A similar counter in use by the IFI on the Owenboliska River is shown in Plate 5.23.



Plate 5.23. Fish Counter in use on the Owenboliska River, Oughterard, Co. Galway.

5.6.6 Impacts on Water Quality

5.6.6.1 Siltation

Temporary Significant Negative Impact

The proposed development has the potential to negatively impact on water quality downstream of the proposed works through the mobilization of suspended solids due to in-stream works and surface run-off of silt during the construction phase. Stockpiled excavated material could pose a threat to surface water quality should it not be stored a sufficient distance from the watercourse. Whilst there is naturally occurring transfer of sediments within the river, the proposed works are likely to significantly increase the sediment load during the period that they are carried out. This may affect species of conservation concern such as Atlantic Salmon, Lamprey and Otter and may lead to the pollution of habitats downstream of the proposed works. There will be damage to the river-bank during in-stream works. If left unconsolidated, the river-banks may cause persistent scouring and siltation of the watercourse over time.

Mitigation Measures

- The proposed works will only take place over approximately 60% of the width of the river at any one time.
- Works will only be undertaken in the period May – September inclusive to avoid the periods of greatest sensitivity for Salmonids.
- Whilst the methodology for carrying out these works has not been finalised at this point, it will include measures to minimise the suspension and transfer of sediment downstream. These measures are likely to include the use of silt barriers downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas,

cofferdamming and dewatering of works areas where concrete and other building works are proposed.

- Works will only be undertaken during normal working hours (8:00 – 6:00) thus allowing the river to run clean for 14 hours per day.
- Rock will be broken out in such a manner as to ensure that fish passage up the river is possible at all times. Either the broken rock will be graded to ensure that there is never an insurmountable lip or portable rock ramps or fish ladders will be employed to allow continued fish passage.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete. In areas where concrete is required within the river channel such as the bridge piers and flood defence walls, a dry working area will be created or pre-cast solutions will be used.
- There will be no refueling of machinery within the river channel. Refueling will take place at designated locations at distances of greater than 30 metres from the watercourse.
- No vehicles will be left unattended when refueling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated works compound at a location that is removed from the river. All other construction materials and plant will be stored in this compound. The compound will also house the site offices and portaloo toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.
- During the construction phase, minor changes to the design must be provided for to ensure that the mitigation is effective. The works will be overseen by an ecologist and ideally the mitigation will be constructed in conjunction with the IFI. The main excavation of the channel and thalweg will be undertaken in the initial phase of works with habitat creation works and other mitigation undertaken afterwards once the initial works have been completed. This will allow the careful placement of boulders, gravels and rubble mats in the locations that they will work most effectively.
- An ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.
- The obvious compaction of salmonid gravels and /or the creation of new silt berms in river reaches downstream of the proposed works zone, while unlikely, could occur. Should this happen any silted gravel shoals will subsequently be tossed and new silt berms generated by the scheme will be removed as part of the works programme.

Residual Impact

It is likely that, with the mitigation in place this impact will constitute a *Temporary Moderate Negative Impact*. This residual impact will be fully identified as the works method statements become finalised and mitigation measures become finalised.

5.6.6.2 Contamination

Short Term Moderate Negative Impact

The use of potential contaminants (such as concrete products, oils, fuels and lubricants) on site during construction may impact on surface water quality if released to the river. Concrete used in the construction works associated with the river walls could be released into the river. Fuels and oils from machinery working within the river are also potential pollutants.

Mitigation Measures

- All concrete works will be carried out in dry conditions with no in-stream pouring of concrete. In areas where concrete is required within the river channel such as the bridge piers, a dry working area will be created or pre-cast solutions will be used.
- There will be no refueling of machinery within the river channel. Refueling will take place at designated locations at distances of greater than 30 metres from the watercourse.
- No vehicles will be left unattended when refueling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated works compound at a location that is removed from the river. All other construction materials and plant will be stored in this compound. The compound will also house the site offices and portaloo toilets. This compound will either be located on ground that is not prone to flooding or will be surrounded by a protective earth bund to prevent inundation.
- All vehicles will be regularly maintained and checked for fuel and oil leaks.

Residual Impact

It is likely that, with the mitigation in place this impact will constitute a *Temporary Minor Negative Impact*.

5.6.7 Spread of Invasive Species

Permanent Moderate Negative Impact

The study area supports extensive growth of invasive plant species including Himalayan Balsam (*Impatiens glandulifera*), Japanese Knotweed (*Fallopia japonica*) and Himalayan Knotweed (*Persicaria wallichii*). The proposed works have the potential to result in the spread of these species through soil and bankside disturbance. This could have the effect of destroying the native floral communities and also bank destabilisation as bare earth will pervade during the winter.

Mitigation Measures

- A programme of works to eradicate and control the spread the above invasive species will be started prior to the outset of works. This will follow the '*Knotweed Code of Practice*' (*English Nature*)
- All plant and equipment used by the appointed contractor will be cleaned and disinfected prior to the commencement of works in the Bandon River to ensure that invasive species are not introduced to the Bandon system.

Residual Impact

It is likely that, with the mitigation in place this impact will constitute a *Long Term Moderate Positive Impact* as there is no control of these invasive species currently in place.

5.6.8 Impacts on Designated Sites

The two sites that are designated for conservation that have the potential to be affected by the proposed works and the impacts thereon are considered below. The Bandon Valley (above Inishannon) pNHA will be directly impacted by the proposed works. The Bandon River cSAC is the only Natura 2000 site within the catchment (albeit upstream) and impacts on this site have been discounted following a review of the scheme design and construction proposals. This has been fully assessed in the Appropriate Assessment process shown in Appendix 5A.

5.6.8.1 Bandon River cSAC

This cSAC is located upstream of the proposed works but could potentially be affected if the upstream migration of fish (Salmon) was impeded. Measures described in Section 5.6.1.2 above have been included to ensure that fish continue to pass through the works area in their migration to the wider catchment upstream. These include avoidance of works in the main periods of migration, mitigation to avoid excessive siltation and not blocking the river along with the provision of a rock ramp to facilitate easier upstream passage than currently exists. The impacts on this cSAC are unlikely to be significant.

5.6.8.2 Impacts on Bandon Valley (above Inishannon) pNHA

Habitat Loss

Permanent Moderate Negative Impact

The proposed works will involve the dredging of the river for a distance of approximately 550 metres at the upstream end of the designated site. This will be the very end of the works area and will involve only dredging to a depth of between 0.5 and 0.3 metres. It will however constitute modification of the bed of the river in this location. The site synopsis for this designated site states the following:

The Bandon Valley is especially valuable for its woodlands and unmodified river bed.

The bed will be modified for a distance of approximately 550 metres within this designated site. This constitutes approximately 10% of the total of the river located within the pNHA. It is unlikely that there will be any impact on the woodlands associated with this site as they are primarily located downstream of the proposed works and it is not anticipated that adjacent water levels will be altered. The bankside vegetation within the pNHA is likely to be affected by the proposed works and is likely to include the loss of tree lines and other bankside vegetation.

Mitigation Measures

- The mitigation for habitat loss associated with the proposed works is discussed in Section 4.2 and includes design measures including the creation of variation in channel morphology where possible including a varied flowpath (thalweg) and features such as random boulders and deflectors within the channel. Mitigation described in this section also includes retention of as much bankside habitat as possible and replacement of any that is lost as part of the construction process.

Residual Impact

It is likely that, with the mitigation in place this impact will constitute a *Permanent Minor Negative Impact*

Siltation within the pNHA, Downstream of the Works***Short Term Significant Negative Impact***

The proposed works have the potential to negatively impact on water quality downstream within the pNHA through the mobilization of suspended solids due to in-stream works and surface run-off of silt during the construction phase. Whilst there is naturally occurring transfer of sediments within the river, the proposed works are likely to significantly increase the sediment load during the period that they are carried out. This may affect species of conservation concern such as Atlantic Salmon, Lamprey and Otter and may lead to the pollution of habitats within the pNHA. There will be damage to the river-bank during in-stream works. If left unconsolidated, the river-banks may cause persistent scouring and siltation of the watercourse over time.

Mitigation Measures

- The mitigation associated with this impact is discussed in Section 4.4 and includes the following elements:
- The proposed works will only take place over approximately 60% of the width of the river at any one time.
- Works will only be undertaken in the period May – September inclusive to avoid the periods of greatest sensitivity for Salmonids.
- Whilst the methodology for carrying out these works has not been finalised at this point, it will include measures to minimise the suspension and transfer of sediment downstream. These measures are likely to include the use of silt barriers downstream of the works areas and removal of any accumulated silt, construction of silt sumps downstream of the works areas, cofferdamming and dewatering of works areas where concrete and other building works are proposed.
- Works will only be undertaken during normal working hours (8:00 – 6:00) thus allowing the river to run clean for 14 hours per day.
- All works undertaken on the banks will be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.

Residual Impact

It is likely that, with the mitigation in place this impact will constitute a *Short Term Moderate Negative Impact*. This residual impact will be fully identified as the works method statements become finalised and mitigation measures become finalised.

5.7 SUPERVISION AND MONITORING

Whilst the prescribed mitigation in this document has been described as accurately as possible it is important that during the construction phase, there is the potential to adjust and amend the proposals as the work proceeds. To this end, minor changes to the design must be provided for to ensure that the mitigation is effective. The works will be overseen by an ecologist and ideally the mitigation will be constructed in conjunction with the IFI. The main excavation of the channel and thalweg will be undertaken in the initial phase of works with habitat creation works and other mitigation undertaken afterwards once the initial works have been completed. This will allow the careful placement of boulders, gravels and rubble mats in the locations that they will work most effectively.

An ongoing scheme of monitoring will be undertaken. This will follow on from the initial baseline fish stock survey and will be carried out annually until one year following the first maintenance of the channel.