



APPENDIX 1

AQUATIC BASELINE REPORT

Aquatic Baseline Report

Maughanaclea Renewable
Energy Development



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1. INTRODUCTION

1.1 Background

MKO has been appointed to conduct Aquatic Baseline Surveys and subsequent Aquatic Baseline Report for the area within and in the vicinity of the proposed Maughanaclea Renewable Energy Development (henceforth referred to as 'Proposed Project').

Desk studies and Aquatic Baseline Surveys were undertaken in June, August and October 2024 and August 2025. This report provides a baseline assessment of the aquatic condition of the lands within and in the vicinity of the Proposed Project and acts as an aquatic baseline record to which future records and monitoring can be compared.

1.2 Statement of Authority

Aquatic Baseline Surveys were undertaken by Kieran Sugrue (B.Sc.) and Mairead Kavanagh (B.Sc.) of MKO on 26th–28th June 2024 (eDNA surveys), and by Aran von der Geest Moroney (B.Sc.) Colin Murphy (B.Sc., M.Sc.), Aoife Joyce (B.Sc.) and Niamh Rowan (B.Sc.) of MKO on the 7th–9th August 2024 (River and Fisheries Habitat Assessment, Electrofishing surveys, Otter surveys, Q-value assessment of Proposed Wind Farm Survey Sites) and by Niamh Rowan and Mairead Kavanagh (B.Sc.) on 15th and 16th October 2024 ((River and Fisheries Habitat Assessment, Otter surveys, Q-value assessment of Proposed Grid Connection Survey Sites).

This report has been prepared by Niamh Rowan and has been reviewed by John Hynes. Niamh is an Ecologist with 2 years' experience in professional ecological consultancy. John is the Ecology Director at MKO with over 14 years' experience. Both Niamh and John have undertaken ecological surveys, Appropriate Assessments and Ecological Impact Assessments for a wide range of large-scale infrastructural projects such as wind farms, railways, roads and flood relief schemes.

1.3 Survey sites

The aquatic baseline surveys for the Proposed Wind Farm and Proposed Grid Connection took place in the vicinity of Kealkill and Dunmanway, Co. Cork. Locations for survey sites in the vicinity of the Proposed Wind Farm are shown in in Figure 1-1, locations for the Proposed Grid Connection survey sites are shown in Figure 1-2.

Improved agricultural grassland (GA1), Wet grassland (GS4), Conifer Plantation (WD4) and Wet Heath (HH3) are the dominant habitats surrounding the Proposed Survey sites. Aquatic Baseline surveys undertaken within the vicinity of the Proposed Wind Farm Site and along the Proposed Grid Connection covered both low order, upper reach streams and downstream, high order rivers. Nomenclature for surveyed watercourses follows that of the Environmental Protection Agency (EPA).

21 survey sites located across two hydrological sub catchments were selected within the vicinity of the Proposed Wind Farm. Five of these survey sites were located within the Mealagh_SC_010 sub catchment (Sub catchment ID: 21_20), with the remaining 16 survey sites located within the Coomhola_SC_010 sub catchment (Sub catchment ID: 21_19). Within the Mealagh_SC_010 sub catchment, surveys were conducted on the Mealagh_010 and Mealagh_020 watercourses. Within the Coomhola_SC_010 sub catchment, surveys were conducted on the Owvane (Cork)_010, Owvane (Cork)_020 and Owngar (Cork)_010.

11 survey sites located across the Bandon-Ilen and Dunmanus-Bantry-Kenmare hydrological catchments were selected along the Proposed Grid Connection. One survey site (GC 1) was located within the Suir Dunmanus-Bantry-Kenmare hydrological catchment (sub catchment Coomhola_SC_010), while the

remaining survey sites were located within the Bandon-Ilen hydrological catchment (GC 2 – GC 9 located within sub catchment Bandon_SC_010, GC 10 within sub catchment Bandon_SC_020 and GC 11 within sub catchment Bandon_SC_030). Within the Dunmanus-Bantry-Kenmare catchment, surveys were conducted along the Owngar River. Within the Bandon-Ilen catchment, surveys were conducted along the Bandon River. (Table 1-1, Table 1-2).

Table 1-1. Survey Site Locations within the vicinity of the Proposed Wind Farm

Survey Site no.	Watercourse name	EPA name	EPA code	Hydrological catchment	Hydrological sub catchment	X (ITM)	Y (ITM)
WF 1	Owvane (Cork)_010	Inchiroe	21I15	Dunmanus-Bantry-Kenmare	Coomhola_SC_010	512537	560092
WF 2	Owvane (Cork)_010	Inchiroe	21I15			512186	560066
WF 3	Owvane (Cork)_010	Owvane [Cork]	21O07			512068	559940
WF 4	Owvane (Cork)_010	Inchiroe	21I15			511860	560226
WF 5	Owvane (Cork)_010	Owvane [Cork]	21O07			510276	560304
WF 6	Owvane (Cork)_010	Owvane [Cork]	21O07			509837	560017
WF 7	Owngar (Cork)_010	Owngar [Cork]	21O04			512136	558105
WF 8	Owngar (Cork)_010	Owngar [Cork]	21O04			511482	557707
WF 9	Owngar (Cork)_010	Owngar [Cork]	21O04			511012	556450
WF 10	Owngar (Cork)_010	Owngar [Cork]	21O04			511388	556854
WF 11	Owngar (Cork)_010	Owngar [Cork]	21O04			509446	557433
WF 12	Owngar (Cork)_010	Owngar	21O19			509230	557482
WF 13	Owngar (Cork)_010	Maughanaclea	21M35			509352	555626
WF 14	Owngar (Cork)_010	Owngar [Cork]	21O04			507619	556781
WF 15	Owvane (Cork)_020	Owngar [Cork]	21O04			506432	556702
WF 16	Owvane (Cork)_020	Owvane [Cork]	21O07		504813	556633	
WF 17	Mealagh_010	Mealagh	21M01		Mealagh_SC_010	509370	553553
WF 18	Mealagh_010	Gortnacowly	21G90			509063	553759
WF 19	Mealagh_010	Mealagh	21M01			507119	554811
WF 20	Mealagh_010	Mealagh	21M01			507282	553916
WF 21	Mealagh_020	Mealagh	21M01			506464	552997

Table 1-2. Survey Sites along the Proposed Grid Connection

Survey Site no.	Watercourse name	EPA name	EPA code	Hydrological catchment	Hydrological sub catchment	X (ITM)	Y (ITM)	
GC 1	Owngar_(Cork)_010	Owngar_(Cork)_010	21O04	Dunmanus-Bantry-Kenmare	Coomhola_SC_010	511642	556306	
GC 2	Unmapped watercourse			Bandon-Ilen	Bandon_SC_010	513397	556927	
GC 3	Bandon_020	Glanycarney	20G19			513465	556800	
GC 4	Bandon_020	Bandon	20B02			514466	557330	
GC 5	Bandon_010	Bandon	20B02			518693	556750	
GC 6	Bandon_020	Shiplough	20S21			518845	555909	
GC 7	Bandon_020	Inchireagh	20I08			519758	556133	
GC 8	Bandon_020	Inchireagh	20I12			519957	556193	
GC 9	Bandon_020	Demesne	20D16			523390	554420	
GC 10	Bandon_030	Underhill	20U01			Bandon_SC_020	524044	553053
GC 11	Bandon_030	Bandon	20B02			Bandon_SC_030	524142	553028



Map Legend

- EIAR Site Boundary
- Proposed Grid
- Connection Route
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments
- WFD River Waterbodies
- Proposed Wind Farm Survey Sites
- Proposed Grid Connection Survey Sites

Freshwater Pearl Mussel eDNA survey results

- Negative
- Positive


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Map Legend

- EIAR Site Boundary
- Proposed Grid Connection Route
- WFD Hydrological Catchments
- WFD Hydrological Subcatchments
- WFD River Waterbodies
- Special Area of Conservation (SAC)
- Proposed Wind Farm Survey Sites
- Proposed Grid Connection Survey Sites

eDNA Survey Sites

- Negative
- Positive


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Project Title
Maughanaclea Renewable Energy Development

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2. METHODOLOGIES

2.1 Project Referencing

The 'Proposed Wind Farm study area' refers to the survey sites selected along watercourses upstream, downstream and within the Proposed Wind Farm Site, as shown in Figure 1-1. The 'Proposed Grid Connection study area' refers to the survey sites selected at points which the Proposed Grid Connection crosses watercourses, as shown in Figure 1-2.

2.2 River Habitat Assessment

Aquatic Habitat Assessments/ Appraisals were undertaken in order to determine the riverine habitat types present at each of the survey sites within and in the vicinity of the Proposed Wind Farm study area and Proposed Grid Connection study area. The survey design and methodologies were derived from current ecological best practice guidance documents. Habitats were classified in accordance with the national habitat classification system used in Ireland - A Guide to Habitats in Ireland (Fossitt (2000)).

Riverine habitat assessments were conducted utilising elements of the following methodologies and literature to characterise the selected survey sites along the watercourse:

- Environment Agency's '*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003),
- '*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (PE-ENV-01113)*' (TII, 2008),
- Irish Heritage Council's '*A Guide to Habitats in Ireland*' (Fossitt, 2000).

All survey sites were assessed in terms of the following variables:

- Channel width and depth.
- Bank profiles, including bank height and composition.
- Substrate type, listing substrate fractions in order of dominance.
- Flow type.
- Presence/absence of in-stream macrophyte and aquatic bryophytes
- Water clarity and colouration.
- Riparian vegetation composition.

The survey was devised to gather ecological baseline information including any habitat features that could potentially support protected Qualifying Interest (QI) species associated with EU designated sites within the wider area of the Proposed Project. In addition, surveys considered the potential presence of problematic invasive alien species, with an emphasis on Invasive Alien Species (IAS) listed on the First Schedule of the European Union (Invasive Alien Species) Regulations 2024 (S.I. No. 374 of 2024) and Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). The assessments have regard to the TII guidance document - *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance (GE-ENV-01105)* (TII, 2020).

During the site visit, additional information on any other species of local biodiversity value occurring within the Site was recorded in order to provide a complete baseline understanding of the Site.

2.3

Fisheries Habitat Assessment

An assessment of the riverine habitats at each survey site was undertaken to determine the potential for watercourses within the Proposed Wind Farm and Proposed Grid Connection study areas to support fish species, including Salmonids, Lamprey spp., and European eel, among other fish species likely to utilise watercourses within the Proposed Wind Farm and Proposed Grid Connection study areas.

Fisheries habitat assessments were conducted utilising elements of the following methodologies and literature to characterise the selected survey sites along the watercourses:

- Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003)
- Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000).
- Channels & Challenges. Enhancing Salmonid Rivers. Irish Freshwater Fisheries Ecology & Management Series (O'Grady, 2006)
- Life Cycle Unit method (Kennedy, 1984; O'Connor & Kennedy, 2002)
- NPWS Irish Wildlife Manuals lamprey surveys (O'Connor, 2004; O'Connor, 2006; and O'Connor, 2007)
- Evaluation of Habitat for Salmon and Trout. Department of Agriculture Fisheries Division. EU Salmonid Enhancement Programme (DOA-NI, 2005)
- Restoration of Riverine salmon habitats (Hendry, K. & Cragg-Hine, D., 1997)
- Ecology of the Atlantic Salmon, Conserving Natura 2000 Rivers (Hendry, K & Cragg-Hine, D., 2003)
- Habitat requirements of Atlantic salmon and brown trout in rivers and streams (Armstrong, J.D. et al., 2003)
- Ecology of the River, Brook, and Sea Lamprey (Maitland, 2003)
- Monitoring the River, Brook and Sea Lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus* (Harvey J. & Cowx I. 2003).
- The Eel: Biology and Management of Anguillid Eels (Tesch, F.W., 2007)

2.4

Electrofishing Surveys

Electro-fishing operations for the purpose of forming baseline fisheries data of the Proposed Wind Farm site were undertaken on the 7th–9th August 2024.

A 5- or 10-minute timed electrofishing survey was undertaken at each of the survey sites, to determine the presence/absence of fish species within the Proposed Wind Farm study area while adhering to best practice methodology (Electric Fishing in Wadeable Reaches, Central Fisheries Board (CFB, 2008)), as well as European standards for electrofishing (CEN, 2003). Two suitably qualified ecologists conducted electro-fishing operations at the electro-fishing locations as per Fig 1-1, using an E-fish EF-500B-SYS Electric Fishing Backpack System.

Fish captured during electro-fishing operations at each survey site were kept in a holding container with oxygenated water. To minimise stress to fish from elevated temperatures and low oxygen levels, frequent freshwater changes were carried out, alongside regular monitoring of water temperature within the holding container. Temperatures were carefully managed to ensure they did not exceed 20°C. All fish temporarily captured during the survey were identified to species and measured. All fish temporarily captured were allowed to recover and subsequently returned to the watercourse in the vicinity of where they were collected.

Biosecurity measures were followed as per Section 2.8 below.

2.5 Macroinvertebrate Surveys

A two-minute kick-sample and stone-wash, as well as a 1 min hand search of larger substrata or organic material (e.g., submerged tree limbs/vegetation) was performed at each of the survey sites, as per methodology used by the Environmental Protection Agency (EPA) as part of the Water Framework Directive (WFD) River Monitoring Programme (Toner *et al.*, 2005).

Dislodged fauna were caught in a one metre square standard hand net (250 mm x 250 mm, 300 mm bag depth, 1 mm mesh size) situated downstream of the sampler disturbing the stream/riverbed substrate. The sampler moved upstream and across the channel while performing the kick-sample to ensure all micro-habitats presents within the watercourse were surveyed. All material collected in the net was transferred via rinsing to a white heavy duty plastic tray (485 x 335 x 80mm) filled with water for identification of macroinvertebrates in situ. Large stones and organic material within the sample such as leaves, twigs, algae or bryophytes were examined for any macroinvertebrates present and subsequently removed from the tray.

Specimens present in the sample were identified to the lowest possible taxonomic level using the FBA Guide to Freshwater Invertebrates (Dobson *et al.*, 2012). The Q-value system assigns macroinvertebrate taxonomic groups to one of five WFD status pollution sensitivity groups (from A, most pollution sensitive to E, most pollution tolerant). The Q-value is calculated based on the relative abundance of Pollution Sensitive Group A and B taxa to Pollution Tolerant Group C, D and E taxa within the sample, and the surveyed stretch of watercourse is assigned an associated pollution status. The EPA Quality (Q)-Rating System is summarised in Table 2-1.

Table 2-1. EPA Quality (Q) Rating System.

Biotic Index	Quality Status	Quality Status	Quality Class	Condition
Q5, Q4-5	High	Unpolluted	Class A	Satisfactory
Q4	Good	Unpolluted	Class A	Satisfactory
Q3-4	Moderate	Slightly Polluted	Class B	Unsatisfactory
Q3, Q2-3	Poor	Moderately Polluted	Class C	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously Polluted	Class D	Unsatisfactory

2.6 Otter Surveys

Otter surveys were conducted as per TII (2008) guidelines (*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (PE-ENV-01113)*). This involved a search for all Otter signs, e.g., spraint, scat, prints, slides, trails, couches and holts both upstream and downstream of proposed survey sites. Within the Proposed Wind Farm study area, otter surveys were conducted 150m upstream and downstream of all survey points. Due to the small-scale nature of works proposed to be undertaken along the Proposed Grid Connection, as well as high levels of disturbance from the existing road, Otter surveys were conducted in the vicinity of the Proposed Grid Connection survey sites. In addition to the width of the rivers, a 10m riparian buffer (both banks) is considered to comprise part of the Otter habitat (NPWS 2009. Threat Response Plan: Otter (2009-2011)).

eDNA Surveys

The Proposed Wind Farm is located across the Owvane and Mealagh *Margaritifera* sensitive areas, which are both listed as catchments of extant Freshwater Pearl Mussel populations outside of the SAC populations listed in S.I. 296 of 2009. Much of the Proposed Grid Connection is located within the Bandon/Caha *Margaritifera* sensitive area, which is listed as a catchment of SAC populations of Freshwater Pearl Mussel listed in S.I. 296 of 2009.

The incidence of Annex II and V species white-clawed crayfish (*Austropotamobius pallipes*) has been recorded by NPWS within the same 10km hectad (W15) as the part of the Proposed Wind Farm study area and Proposed Grid Connection study area.

As such eDNA sampling for both freshwater pearl mussel (FPM) and white-clawed crayfish (WcC) were undertaken in select watercourses within the Proposed Wind Farm and Proposed Grid Connection study areas in June 2024, with eDNA sampling conducted at 12 no. Proposed Wind Farm survey sites and 9 no. Proposed Grid Connection route survey sites.

To detect populations FPM and WcC, or the presence of Crayfish Plague within the Proposed Wind Farm study area or Proposed Grid Connection study area, a composite water sample was collected from the watercourse at each of the selected eDNA survey sites between 26th–28th June 2024 and analysed for FPM, WcC and Crayfish Plague. eDNA survey sites were strategically chosen to maximise longitudinal (instream) coverage within the catchment, facilitating the likelihood of species detection.

Each composite (500ml) water sample was collected from each watercourse, with 20 x 25ml samples taken along the watercourse, for a representative geographic spread at the survey site. The composite sample was filtered and fixed on site using a sterile proprietary eDNA sampling kit. The sample was stored at room temperature and sent to the laboratory for analysis following return from the survey sites.

Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence. Whilst an eDNA approach is not currently quantitative, the detection of the target species' DNA indicates the presence of the species at and or upstream of the sampling point.

Biosecurity Measures

Biosecurity measures which were implemented followed *IFI Biosecurity Protocol for Field Survey Work*, (IFI, 2010). Due to increasingly prevalent spread of crayfish plague in Ireland and to prevent the spread of aquatic invasive species, all equipment was scrubbed and cleaned prior to and post works with Virkon Aquatic. Additionally, all equipment was cleaned with Virkon Aquatic between survey sites to minimise the potential for the spread of invasives between watercourses/ survey sites. Any instance of invasive species was recorded and conveyed to IFI via electrofishing data returns.

3. **DESK STUDY**

A Desk Study was conducted to gather baseline information from online sources and records on the aquatic habitats and aquatic dependent species within the vicinity of the Proposed Wind Farm and Proposed Grid Connection study areas.

In preparation of the desk study, the following sources were used to gather information:

- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA, Water Framework Directive (WFD),
- Review of OS maps and aerial photographs of the Proposed Wind Farm and Proposed Grid Connection study areas.

3.1 **EPA Water Quality**

The EPA Envision map viewer was consulted initially on 24th June 2024, 6th September 2024 and most recently on 9th January 2026 regarding the water quality status and risk of the rivers which comprise the Proposed Wind Farm and Proposed Grid Connection survey sites. Table 3-1 presents a summary of the waterbody WFD status for 2013-2018, waterbody WFD status for 2016-2021, waterbody WFD status for 2019-2024 and WFD 3rd Cycle River Waterbodies Risk Projection, as well as details of the corresponding Proposed Wind Farm and Proposed Grid Connection survey sites.

Table 3-1. WFD Status and Risk of surveyed watercourses within the vicinity of the Proposed Wind Farm and Proposed Grid Connection.

Proposed Wind Farm and Proposed Grid Connection survey sites	Watercourse	EPA code	Catchment	Sub Catchment	Waterbody WFD Status for 2013-2018	Waterbody WFD Status for 2016-2021	Waterbody WFD Status for 2019-2024	WFD 3rd Cycle River Waterbodies Risk Projection
Proposed Wind Farm Survey sites								
WF1	Owvane (Cork)_010	21O07	Dunmanus-Bantry-Kenmare	Coomhola_SC_010	High	High	High	Not at risk
WF 2	Owvane (Cork)_010	21O07						
WF 3	Owvane (Cork)_010	21O07						
WF 4	Owvane (Cork)_010	21O07						
WF 5	Owvane (Cork)_010	21O07						
WF 6	Owvane (Cork)_010	21O07						
WF 7	Owngar (Cork)_010	21O04			High	High	High	Not at risk
WF 8	Owngar (Cork)_010	21O04						
WF 9	Owngar (Cork)_010	21O04						
WF 10	Owngar (Cork)_010	21O04						
WF 11	Owngar (Cork)_010	21O04						
WF 12	Owngar (Cork)_010	21O04						
WF 13	Owngar (Cork)_010	21O04						
WF 14	Owngar (Cork)_010	21O04						
WF 15	Owngar (Cork)_010	21O04						
WF 16	Owvane (Cork)_020	21O07						



WF 17	Owvane (Cork)_020	21O07		Mealagh_SC_010								
WF 18	Mealagh_010	21M01			High	High	High	Not at risk				
WF 19	Mealagh_010	21M01										
WF 20	Mealagh_010	21M01										
WF 21	Mealagh_010	21M01										
WF 22	Mealagh_010	21M01										
WF 23	Mealagh_020	21M01							High	High	High	Not at risk
Proposed Grid Connection Survey sites												
GC 1	Owngar_(Cork)_010	21O04	Dunmanus-Bantry-Kenmare	Coomhola_SC_010	High	High	High	Not at risk				
GC 2	Unmapped watercourse		Bandon-Ilen	Bandon_SC_010	Unmapped watercourse							
GC 3	Bandon_020	20B02			Good	Moderate	Moderate	At risk				
GC 4	Bandon_020	20B02			Good	Good	Good	Not at risk				
GC 5	Bandon_010	21O07			Good	Moderate	Moderate	At risk				
GC 6	Bandon_020	20B02			Moderate	Moderate	Moderate	At risk				
GC 7	Bandon_020	20B02										
GC 8	Bandon_020	20B02			Moderate	Moderate	Moderate	At risk				
GC 9	Bandon_020	20B02										
GC 10	Bandon_030	20B02							Bandon_SC_020	Moderate	Moderate	Moderate
GC 11	Bandon_030	20B02			Bandon_SC_030	Moderate	Moderate	Moderate	At risk			

The EPA Envision map viewer was consulted most recently on 9th January 2026 regarding the water quality status of watercourses which comprise the Proposed Wind Farm and Proposed Grid Connection survey sites. There were 13 EPA monitoring points within the vicinity of the Proposed Wind Farm and Grid Connection Study areas (Table 3-2).

Table 3-2. EPA Water Quality Data

Watercourse	Sampling Station	Location	Sampling Year	Q-Value & Water Quality Status
Owngar (Cork)_010, downstream of survey site WF 11	Owngar (Cork) - SW of Ballynamought [Station Code: RS21O040200]	E 109403 N 57354.1	2003	Q4-5 - High
Owvane (Cork)_010, downstream of survey site WF 6	Bridge SW of Cappaboy [Station Code: RS21O070200]	E108849.38, N 59017.27	2020	Q4-5 - High
Owngar (Cork)_010, at survey site WF 15	Cahermoanteen Bridge [Station Code: RS21O040400]	E 106461.68, N 56637.04	2020	Q4-5 - High
Owvane (Cork)_020, upstream of survey site WF 16	Bridge NE of Kealkill [Station Code: RS21O070300]	E 104842.5, N 56568.91	2006	Q4 - Good
Owvane (Cork)_020	Owenbeg (Owvane) - Bridge u/s of Owvane River confluence Station Code: RS21O030400]	E 104451, N 56761.2	2003	Q4 - Good
Mealagh_010, upstream of WF 17	Bridge N of Keimeen [Station Code: RS21M010100]	E 111791, N 53311.9	2020	Q4-5 - High
Mealagh_010	Bridge South of Ards More [Station Code: RS21M010200]	E 106502, N 52936.6	2020	Q4-5 - High
Bandon_020, upstream of GC 11	Bandon, Bridge near River View [Station Code: RS20B020200]	E 124173, N 53023.3	1989	Q4 - Good
Bandon_020 River	Ardcahan Bridge [Station Code: RS20B020150]	E 124242.81, N 55701.51	2024	Q 3-4 - Moderate
Bandon_020 River	Bandon - Bridge u/s Ardcahan Br [Station Code: RS20B020100]	E 122739.85, N 56537.78	1989	Q 3-4 - Moderate
Bandon_010 River	Bandon - Bridge East of Keenrath Ho [Station Code: RS20B020050]	E 118718, N 56680.7	2024	Q4-5 - High
Caha_020 River , 0.75km east of the Proposed Grid Connection	Caha Bridge- [Station Code: RS20C010700]	E 124332.77, N 56013.32	2024	Q 3-4 - Moderate
Bandon_030 River	Dirty - Bridge u/s Bandon River confluence [Station Code: RS20D010100]	E 123530.149, N 52544.390	2006	Q4 - Good
Bandon_040 River	Manch Br [Station Code: RS20B020400]	E 129281.31, N 52079.94	2020	Q4 - Good
Bandon_030 River	Bealboy Br [Station Code: RS20B020300]	E 125677.46, N 51284.61	2024	Q 3-4 - Moderate

3.2 Salmonid River Status.

Watercourses designated as Salmonid Waters under S.I 293 (1988) are those fresh waters classified under the first schedule, which are ‘capable of supporting Salmon (*Salmo salar*), Trout (*Salmo trutta*), Char (*Salvelinus*) and Whitefish (*Coregonus*)’ species. No watercourses within the vicinity of the Proposed Wind Farm or Proposed Grid Connection are designated in the Salmonid Regulations (S.I. 293 / 1988).

3.3 NPWS Data

3.3.1 Freshwater Pearl Mussel

Proposed Wind Farm aquatic survey sites WF 1– WF 17 and GC 1 are located within the Owvane *Margaritifera* sensitive area, and survey sites WF 18– WF 21 are located within the Mealagh *Margaritifera* sensitive area, both of which are listed as catchments of other extant Freshwater Pearl Mussel populations outside of the SAC populations listed in S.I. 296 of 2009. Survey sites GC 2 – GC 11 are located within the Bandon/Caha *Margaritifera* sensitive area, which is listed as a catchment of SAC populations of Freshwater Pearl Mussel listed in S.I. 296 of 2009. NPWS Point data for Freshwater Pearl Mussel show records of Freshwater Pearl Mussel approx. 0.16km downstream of survey sites GC 10 and GC 11, approx. 1.7km upstream of survey site GC 5, and approx. 0.23km east of the eastern side of the Proposed Grid Connection (Grid ref: W 24154 55632).

3.3.2 White-clawed Crayfish

The incidence of Annex II and V species white-clawed crayfish (*Austropotamobius pallipes*) has been recorded by NPWS within the same 10km hectad (W15) as part of the Proposed Wind Farm study area and Proposed Grid Connection study area. There are no records of white-clawed crayfish within or directly adjacent to the Proposed Wind Farm or Proposed Grid Connection.

3.4 Inland Fisheries Ireland

Surveys were conducted by IFI as part of water sampling for the Water Framework Directive, in the immediate vicinity of the Proposed Wind Farm Study area and Proposed Grid Connection study area between July 2010 – August 2021. Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), sea trout (*Salmo trutta*), european eel (*Anguilla anguilla*), minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and three-spined stickleback (*Gasterosteus aculeatus*) were recorded during surveys.

Sampling of the Bandon River Catchment on 9th and 12th September 2019 saw a total of eight species recorded across 36 survey sites within the catchment. Species recorded included brown trout (0+ and 1+ and older), salmon (0+ and 1+ and older), European eel, minnow, stone loach, three-spined stickleback, lamprey sp. (*Petromyzontiformes spp.*) and pike (*Esox lucius*), with brown trout being the most abundant species (O’Briain *et al.*, 2019, Sampling Fish in Rivers 2019 – Bandon River Catchment, Factsheet No. 2019/03. National Research Survey Programme. Inland Fisheries Ireland).

Further sampling of the Bandon River Catchment took place between 30th August and 6th September 2021, with a total of seven fish species recorded across 35 sites. Brown trout was the most abundant species captured at all sites surveyed by IFI. Other species caught throughout the surveyed sites included salmon, European eel, lamprey (*Lampetra sp.*), minnow, stone loach and three-spined stickleback (Gordon *et al.*, 2021, Sampling Fish in Rivers 2021 – Bandon River Catchment, Factsheet No. 2021/5. National Research Survey Programme. Inland Fisheries Ireland).

Sampling of the Owvane (Cork) River Catchment by IFI between 23rd and 26th September 2024 saw a total of six fish species recorded across 13 sites, with brown trout being the most common and abundant species, caught at 12 of the 13 sites surveyed by IFI. Other species in order of caught across

the survey sites included salmon, European eel, minnow, roach and three-spined stickleback (Corcoran *et al.*, 2025, Sampling Fish in Rivers 2024 – Owvane River Catchment, Factsheet No. 7. National Research Survey Programme. Inland Fisheries Ireland).

The scoping response received from IFI on 15/01/2025 highlighted the Owvane, Melagh and Bandon Rivers and their tributaries as significant salmonid fisheries.

3.5 Annex I habitats

An incidence of Article 17 mapped 91E0 Alluvial woodland was present approx 0.1 km south of survey sites GC 10 and GC 11.

Distribution of the Annex I habitat *3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation* is mapped for the 10 km hectads in which the Proposed Wind Farm and Proposed Grid Connection survey sites are located (W05, W15, W16 and W25).

No other mapped instances of freshwater Annex I habitats were identified within or in the vicinity of the Proposed Wind Farm study area or within the Proposed Grid Connection study area.

3.5.1 FPO Macrophytes

Aquatic plant species protected under the Flora (Protection) Order 2022 (S.I. No. 235/2022) were not recorded within the 10km hectads of W05, W15, W16 or W25

4. FIELD SURVEY RESULTS

4.1 Aquatic Survey Results.

Field surveys carried out in the vicinity of the Proposed Wind Farm took place on the 7th–9th August 2024; field surveys in the vicinity of the Proposed Grid Connection took place on 15th and 16th October 2024. No significant constraints or limitations in gathering information were encountered.

Aquatic Baseline Surveys undertaken in the vicinity of the Proposed Wind Farm include:

- > River habitat assessment,
- > Fisheries habitat assessment,
- > Electrofishing surveys,
- > Macroinvertebrate surveys,
- > Otter Surveys
- > eDNA surveys

Aquatic Baseline Surveys undertaken along the Proposed Grid Connection include:

- > River habitat assessment,
- > Fisheries habitat assessment,
- > Macroinvertebrate surveys,
- > Otter Surveys

The below sections (4.1.1 & 4.1.2) summarise and describe the Proposed Wind Farm survey sites and the Proposed Grid Connection survey sites in line with the above survey types.

Appendix I presents a collated record of the species found at each survey site electrofishing was conducted on.

Appendix II presents a collated record of the Q-Values assigned across all survey sites.

4.1.1 Proposed Wind Farm Survey sites

4.1.1.1 WF Survey Site 1 (WF 1)

Survey site WF 1 was located on the upland reaches of the Inchiroe watercourse (Owvane (Cork)_010, EPA code: 21I15, IG Ref.: W 12506 60056). Properties of the watercourse at this sample location are provided in Table 4-1 and a representative photograph of the survey site is shown in Plate 4-1.

This section of **Eroding/Upland River (FW1)** was characterised by an upland, headwater channel morphology, dominated by compacted boulder and cobble channel substrate with interstitial gravels. The watercourse profile was comprised of a sequence of shallow pool-step formations interspersed with cobble riffle. While water levels were low at the time of survey (average depth 0.2m), with exposed cobbles throughout, flow was fast along the watercourse.

This watercourse featured steep sided banks composed of large boulders covered with an assemblage of common bryophyte species. Bankside vegetation featured bramble (*Rubus fruticosus agg.*) dominant scrub, with bird's-foot-trefoil (*Lotus corniculatus*), gorse (*Ulex europaeus*), fuchsia (*Fuchsia magellanica*) and St. Patrick's-cabbage (*Saxifraga spathularis*). The channel was largely natural in its profile, with the exception of the presence of a metal and concrete clear-span bridge structure at the upstream survey extent.

Habitats extending from both the right and left-hand banks featured **Wet grassland (GS4)**, **Improved agricultural grassland (GA1)** and marginal **Riparian woodland (WN5)**, with adequate marginal shading provided to the channel by semi-continuous grey will (*Salix cinerea*), with strips of **Conifer plantation (WD4)** beyond this, particularly along the left-hand bank.

Table 4-1. Properties of the watercourse at survey site WF 1.

Properties	Record
Average Depth (m)	0.2
Average Bank Width (m)	4.0
Average Wetted Width (m)	2.5
Flow	Low
Colouration	No distinct coloration
Clarity	Very Clear
Average Bank height (m)	LHB 2.0 RHB 1.8
Dominant Substrates	Boulder (>128mm): 30% Cobble (>32–128mm): 50% Gravel (8-32mm): 20%
Substratum Condition	Compacted



Plate 4-1. A representative photo of survey site WF 1

Although the watercourse displayed a varied channel substrate composition, with diverse flow patterns both laterally and longitudinally along the channel, the upgradient, headwater location of this survey site limited its fisheries potential. A mixture of large boulder, cobble and smaller patches of interstitial gravels provided localised juvenile salmonid habitat, which may be inaccessible to fish in the wider landscape of this watercourse. A lack of adequate areas of spawning gravels and overall compacted channel substrate provided negligible spawning habitat for all fish species, and overall shallow depth (with the exception of some deeper pools upstream of the bridge) saw inadequate holding habitat for adult salmonids. Overhanging willow trees and marginal boulder features provided complex marginal habitat suitable for eel but is likely unutilised due to the watercourse's inaccessibility and natural barriers to migration in the form of boulder and bedrock steps and small cascades throughout the wider

watercourse. Fine sediment beds were absent from the surveyed stretch of watercourse, with no suitable habitat for lamprey spp. ammocoetes. Therefore, despite substrate and flow pattern diversity, adequate shading and marginal refugia, this survey site provided overall poor fisheries habitat due to its inaccessible, upland location within this largely bedrock-boulder dominant section of the Owvane River.

No fish were recorded via 5-minute qualitative electrofishing survey at survey site WF 1.

No otter signs were observed at survey site WF 1. Otter foraging and commuting potential for this stretch of watercourse were assessed as low due to poor fisheries potential and overall shallow, headwater river morphology. No kingfisher burrows were identified at the time of survey.

Macroinvertebrate diversity and density were low and moderate, respectively. The Q rating assigned to survey site WF 1 was **Q3-4 – Moderate**, on the basis that at least one ‘very pollution sensitive’ Group A taxon was present in low numbers (2 *Chloroperlidae* sp. were identified); ‘Moderately Pollution sensitive’ taxa made up ~15% of the sample. ‘Pollution tolerant’ Group C species made up ~81% of the sample, with *Ancylus fluviatilis* being the dominant species. Group D and Group E taxa were absent from the sample. Results of Q-Value assessment are summarised in Table 4-2.

Table 4-2. Results of macroinvertebrate survey at survey site WF 1

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	2
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	7
Group C – Pollution Tolerant	<i>Ancylus fluviatilis</i>	10
	<i>Baetis rhodani</i>	5
	<i>Chironomidae</i>	4
	<i>Simuliidae</i>	15
	<i>Rhyacophila</i> sp.	4
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.2 WF Survey Site 2 (WF 2)

Survey site WF 2 was located on an upland stretch of the Inchiroe watercourse (Owvane (Cork)_010, EPA code: 21I15, IG Ref.: W 12236 60026). Properties of the watercourse at this sample location are provided in Table 4-3.

Similar to the upstream WF 1 survey site, this section of **Eroding/Upland River (FW1)** at survey site WF 2 was typical of an upland, headwater stream, dominated by bedrock with overlying compacted boulder and cobble channel substrate. The channel profile was largely natural and meandering, with boulder outcrops and bedrock steps creating small pool-step features along its length. A reinforced stone wall (classed as **Stone walls and other stonework (BL1)**) extending along the right-hand bank and joined with a concrete bridge structure and associated bridge apron, at the confluence of two headwater streams.

Water was shallow at the time of survey (with the exception of deeper holding pools, approx. 0.7m deep in the vicinity of the bridge), with fast flow across repeating riffle-glide sequences between bedrock and boulder step features.

Steep sided, earthen banks featured exposed boulder with exposed cobbles along the bank toe. Banks were vegetated with gorse, bramble, soft rush, nipplewort (*Lapsana communis*), creeping buttercup (*Ranunculus repens*) wild angelica (*Angelica sylvestris*) and St. Patrick's-cabbage. Hemlock water-dropwort (*Oenanthe crocata*) was present occasionally at the river margins. Bryophyte coverage on boulder outcrops included long-beaked water feather-moss (*Rhynchostegium riparioides*) and yellow fringe-moss (*Racomitrium aciculare*). Instream macrophytes were absent at this survey site. Individual alder (*Alnus glutinosa*) and willow (*Salix* spp.) trees provided some marginal shading to the watercourse

within a wider landscape dominated by agricultural grassland. Stands of the First Schedule and Third Schedule invasive species Japanese knotweed (*Reynoutria japonica*/*Fallopia japonica*) were noted adjacent to the road, a short distance downstream of survey site WF 2.

This stretch of the Inchiroe was of low fisheries value given its headwater profile, upland gradient and bedrock/boulder channel bed with step features throughout, all of which may preclude upward migration of fish. Salmonid or lamprey *sp.* spawning in the way of loose, mobile gravel beds and lamprey *sp.* nursery habitat in the way of fine sediment beds, were absent. Although channel substrate was varied and flow patterns diverse, with instream structural refuge suitable for nursery age salmonids, salmonid nursery classified as locally moderate-good would be largely inaccessible to migratory fish species, reflected in the 5-minute qualitative electrofishing survey results conducted at this survey site Table 4-4.

Deeper pools at the downstream extent may provide suitable moderate holding habitat for adult salmonid fish, with pools downstream of the bridge and apron structure more locally accessible to fish. A lack of submerged, marginal complexity in the form of root structures, overhanging trees bows or submerged boulder complexes, combined with fast flow and upland topography saw poor European eel habitat, particularly in the context of the downstream bridge apron which is likely impassable to fish.

No otter signs were observed at survey site WF 2. Otter foraging and commuting potential for this stretch of watercourse were assessed as opportunistic and moderate due to improved connectivity with deeper pools downstream of the bridge. However, with low fisheries potential and overall shallow, headwater river morphology, foraging and commuting are limited. No kingfisher burrows were identified at the time of survey.

Table 4-3. Properties of the watercourse at survey site WF 2.

Properties	Record			
Average Depth (m)	0.2			
Average Bank Width (m)	3.0			
Average Wetted Width (m)	2.0			
Flow	Fast			
Colouration	No distinct coloration			
Clarity	Very clear			
Average Bank height (m)	LHB	1.2	RHB	2.0
Dominant Substrates	Bedrock: 30% Boulder (>128mm): 30% Cobble (>32-128mm): 20% Gravel (8-32mm): 20%			
Substratum Condition	Compacted			



Plate 4-2. A representative photo of survey site WF 2

Table 4-4. Electrofishing results at survey site WF 2

Species	Length (cm)
Brown Trout (<i>Salmo trutta</i>)	5

Kick-sampling was carried out in areas of cobble riffle and glide. Macroinvertebrate diversity and density were moderate. The Q rating assigned to survey site WF 2 was **Q4—Good**, assigned on the basis that at least one Group A taxa was present in reasonable numbers relative to the sample. Group C were the dominant indicator group in this sample (~47%, comprising of 27 individuals from eight separate ‘Pollution Tolerant’ taxa), Group D ‘Very Pollution Tolerant’ taxa and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-5.

Table 4-5. Results of macroinvertebrate survey at survey site WF 2

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	4
	<i>Rhithrogena</i>	5
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	18
	<i>Leuctra sp.</i>	3
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	7
	<i>Chironomidae</i>	3
	<i>Elmidae</i>	2
	<i>Hydracarina</i>	1
	<i>Polycentropodidae</i>	1

	<i>Rhyacophila sp.</i>	1
	<i>Serratella ignita</i>	4
	<i>Simuliidae</i>	8
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.3 WF Survey Site 3 (WF 3)

Survey site WF 3 was located on the Owvane [Cork] (EPA code: 21O07, IG Ref.: W 12110 59900). Properties of the watercourse at this sample location are provided in Table 4-3 and a representative photograph of the survey site is shown in Table 4-6 below and a representative photograph of the survey site WF 3 is shown in Plate 4-3.

Table 4-6. Properties of the watercourse at survey site WF 3

Properties	Record			
Average Depth (m)	0.2			
Average Bank Width (m)	1.8			
Average Wetted Width (m)	1.4			
Flow	Low			
Colour	No distinct coloration			
Clarity	Very clear			
Average Bank height (m)	LHB	2.0	RHB	0.7
Dominant Substrates	Bedrock: 50% Boulder (>128mm): 25% Cobble (>32–128mm): 15% Gravel (8-32mm): 10%			
Substratum Condition	Compacted			



Plate 4-3. A representative photo of survey site WF 3

This section of **Eroding/Upland River (FW1)** at survey site WF 3 was characterised by a laterally confined, steep gradient channel with repeating pool-steps throughout boulder channel substrate, with accumulations of cobbles and gravels within pools atop a base layer of bedrock. Flow velocity across sequential steps was fast, with low flow (average depth of 0.2m) and exposed substrate at the time of survey. Channel and banks displayed no known signs of modification, with the exception of an inflow pipe coming from the right-hand bank at the upstream survey extent.

Similar to survey site WF 2, an assemblage of common bryophyte were abundant on boulder outcrops, while hemlock water-dropwort was present emergently. Bank face and top vegetation featured soft rush, nettle (*Urtica dioica*), willowherb (*Epilobium sp.*), yorkshire fog (*Holcus lanatus*), false oat-grass (*Arrhenatherum elatius*), bramble and dock (*Rumex sp.*). The watercourse was adequately shaded, with a continuous grey willow treeline along much of the left-hand bank

No fish were recorded via 5-minute qualitative electrofishing survey at this survey site, with the bedrock-headwater morphology of this section of watercourse, with several barriers to upward migration of fish in the form of cascade-pool-step formations, boulder outcrops and the natural accumulation of woody debris creating natural dams. A lack of suitably sized spawning gravel beds and the laterally confined nature of the channel provides negligible spawning habitat for both salmonid and lamprey species. Fine sediment beds suitable for lamprey ammocoetes were absent from this stretch of watercourse, and despite some instream complexity provided by boulder features and woody debris, swift flows and a steep gradient limited any potential european eel habitat. A lack of depth, even in pools within bedrock steps (max 0.4m deep) precluded any adult salmonid holding habitat. Therefore, fisheries potential was overall poor at survey site WF 3.

No otter signs were observed at survey site WF 3. Otter foraging and commuting potential for this stretch of watercourse were assessed as poor due to the upgradient profile at the survey site. No kingfisher burrows were identified at the time of survey.

Kick-sampling was carried out throughout areas of cobble and gravel accumulations within bedrock and boulder pools, with stone washing of mobile coarser substrate where present. Macroinvertebrate diversity and density were low, with a Q rating of **Q3–Poor** assigned to this survey site. This score was assigned on the basis that Group A taxa were absent from the sample. ‘Moderately Pollution Sensitive’ Group B taxa and ‘Pollution Tolerant’ Group C taxa each made up 50% of the sample. Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-7.

Table 4-7. Results of macroinvertebrate survey at survey site WF 3

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	9
	<i>Leuctra sp.</i>	1
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	6
	<i>Chironomidae</i>	1
	<i>Hydracarina</i>	1
	<i>Serratella ignita</i>	1
	<i>Simuliidae</i>	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.4 WF Survey Site 4 (WF 4)

Survey site WF 4 was located on the Inchiroe watercourse (Owvane (Cork)_010, EPA code: 21I15, IG Ref.: W 11820 60213), approx. 0.6km downstream of survey site WF 2. Properties of the watercourse at this sample location are provided in Table 4-8 below and a representative photograph of the survey site is shown in Plate 4-4.

Table 4-8. Properties of the watercourse at survey site WF 4

Properties	Record
Average Depth (m)	0.2 (with pools of up to 0.6)
Average Bank Width (m)	4.0
Average Wetted Width (m)	2.5
Flow	Low
Colour	No distinct coloration
Clarity	Clear
Average Bank height (m)	LHB 0.3 RHB 0.7
Dominant Substrates	Bedrock: 50% Boulder (>128mm): 20% Cobble (>32-128mm): 20% Gravel (8-32mm): 10%
Substratum Condition	Highly compacted



Plate 4-4. A representative photo of survey site WF 4.



Plate 4-5. A representative photo of bedrock and boulder step features at survey site WF 4.

This stretch of **Eroding/Upland River (FW1)** at survey site WF 4 was characterised by a series of step-pool features interspersed with cobble riffle and glide. Channel substrate was dominated by large boulders and cobbles atop a layer of bedrock. Water velocity was fast, with turbulent chute flow over bedrock step features and boulder outcrops (Plate 4-5). Water was clear, with no distinct colouration and no apparent siltation as a result of swift flows. Bryophyte coverage was abundant over exposed boulders and consistent with the common assemblage of species recorded at survey sites WF 1 and WF 2 further upstream along the Inchiroe watercourse.

Areas of flat topped low earthen left-hand bank were undercut features were sparsely vegetated with hard fern (*Blechnum spicant*), hawkbit (*Leontodon sp.*) and wood sedge (*Carex sylvatica*), with alder, grey willow and blackthorn (*Prunus spinosa*) trees extending from the banks into the channel and providing adequate shading to the watercourse. Boulder and bedrock outcrops with cobble deposits composed much of the right-hand bank. Habitats extending beyond the immediate riparian zone were largely **Wet grassland (GS4)**, with areas of sitka spruce (*Picea sitchensis*) treelines extending beyond the immediate bank tops.

No fish were caught via 5-minute qualitative electrofishing survey. One salmonid fish and 2 European eel were observed but not caught. In comparison to more upland survey sites along the Inchiroe river, survey site WF 4 offered more accessible fisheries habitat. While bedrock step features and boulder outcrops remained prominent features of this section of watercourse, flow continuity was improved to that of upstream survey sites. A lack of adequate areas of loose, mobile gravels saw an absence of any spawning habitat for salmonid or lamprey species.

However, channel substrate size variability and flow pattern diversity, combined with improved connectivity throughout this section of watercourse, provided locally moderate salmonid nursery. Holding pools, particularly areas of scour immediately downstream of small cascade features, provided areas of deeper water more suitable for adult salmonids. Areas of deeper marginal backwater, in conjunction with instream complexity provided by undercut banks, submerged boulders, root

structures and overhanging and encroaching tree limbs, created areas of locally moderate-good european eel habitat. A lack of any fine sediment beds and swift flows precluded any suitable lamprey ammocete habitat.

No otter signs were observed at survey site WF 4. However, commuting and foraging potential for this survey site were assessed as moderate. Low earthen or boulder banks did not provide suitable burrow habitat for kingfisher, although tree perches along the watercourse were abundant, with some areas of moderate velocity glide providing opportunistic foraging habitat. No kingfisher burrows were identified at the time of survey.

Kick-sampling was carried out in areas of cobble riffle and glide, downstream of faster flowing step-pool features. Macroinvertebrate diversity was moderate, while density was low. The Q rating assigned to survey site WF 4 was **Q4–Good**, assigned on the basis that at least one Group A taxa was present in reasonable numbers relative to the sample. Group C were the dominant indicator group in this sample (~44%, comprising of 16 individuals from seven separate ‘Pollution Tolerant’ taxa). Group D ‘Very Pollution Tolerant’ taxa and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-9.

Table 4-9. Results of macroinvertebrate survey at survey site WF 4

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	2
	<i>Ecdyonurus sp.</i>	6
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	9
	<i>Leuctra sp.</i>	3
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	6
	<i>Dicranota sp.</i>	1
	<i>Hydracarina</i>	1
	<i>Philopotamidae</i>	1
	<i>Rhyacophila sp.</i>	5
	<i>Serratella ignita</i>	1
	<i>Simuliidae</i>	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.5 WF Survey Site 5 (WF 5)

Survey site WF 5 was located on the Owvane [Cork] (EPA code: 21O07, IG Ref.: W 10318 60264), approx. 0.6km downstream of survey site WF 2. Properties of the watercourse at this sample location are provided in Table 4-10 below and a representative photograph of the survey site is shown in Plate 4-6.

Table 4-10. Properties of the watercourse at survey site WF 5

Properties	Record
Average Depth (m)	0.3 (deeper glide of 0.6 at upstream survey extent)
Average Bank Width (m)	5.0
Average Wetted Width (m)	2.5
Flow	Slow–Moderate
Colour	No distinct coloration
Clarity	Clear but plumes of silt when disturbed
Average Bank height (m)	LHB 0.8 RHB 0.5
Dominant Substrates	Boulder (>128mm): 10% Cobble (>32–128mm): 20% Gravel (8–32mm): 30% Fine gravel (2–8mm): 30% Silt (<0.25mm): 10%

Substratum Condition	Loose
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Plate 4-6. A representative photo of survey site WF 5

Survey site WF 5 represented a naturally sinuous stretch of **Depositing/Lowland River (FW2)** dominated by gravel channel substrate, with gravel bank build up along the convex bank of meanders. At the downstream survey extent, the earthen left-hand bank displayed evidence of erosion, with exposed, poached earth bank face and undercut features. Little-to-no riparian buffer existed along the left-hand bank, with the exception of stands of soft rush. The right-hand bank extending beyond the sloping gravel deposits, was also a low, vegetated earthen bank. Bank reinforcement in the form of rock armour was present along the left-hand bank adjoining a 2-span concrete bridge and bridge apron, with flow only passing through the left-hand channel.

Moving downstream, encroaching bankside vegetation included dock (*Rumex sp.*), hart's-tongue fern (*Asplenium scolopendrium*), hard fern, ivy (*Hedera helix*), montbretia (*Crocsmia × crocosmiiflora*), ragwort (*Jacobaea vulgaris*), remote sedge (*Carex remota*), self-heal (*Prunella vulgaris*), and wood rush (*Luzula spp.*), with bramble **Scrub (WS1)** extending from the right-hand bank into the watercourse. Treelines along the right-hand bank consisted of sitka spruce, hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*) and holly (*Ilex aquifolium*). Treelines and overhanging vegetation provided shading to the channel margins, with a well sheltered stretch of watercourse upstream of the bridge. Land-use extending from the left-hand bank consisted of **Wet grassland (GS4)** currently being used for pasture. Stands of Japanese knotweed were identified downstream of the bridge structure.

Instream vegetation included occasional water crowfoot (*Ranunculus sp.*) and water starwort (*Callitriche spp.*), with moderate-slow flow along much of the survey stretch. Flow patterns consisted of glide and pool, with short sections of faster flowing cobble/gravel riffle interspersed throughout. Water had no evident colouration and was clear when undisturbed, with slight siltation evident underfoot.

Loosely compacted and relatively clean gravel beds with a variety of gravel sizes provided good salmonid and lamprey species spawning habitat, respectively. Marginal sheltering features such as overhanging marginal tree limbs, undercut banks and encroaching bankside vegetation created structural complexity and shade at the channel margins, and in conjunction with repeating riffle and glide, created locally good salmonid nursery. Localised patches of structured fine sediment beds provided moderate-good lamprey ammocoete nursery habitat, with no barriers to instream continuity

noted at the time of survey, allowing for migratory fish to access to these habitats. Deeper glide toward the upstream extent provided adequate depth for good salmonid holding, while slower flowing backwater amongst root structures and occasional marginal boulders also provided good european eel habitat. Therefore, fisheries potential at survey site WF 5 was assessed as overall good, providing habitat for a range of fish species and age classes.

Results for 10-minute qualitative electrofishing survey are shown in Table 4-11. Species recorded include Atlantic salmon, brown trout and european eel, with atlantic salmon being the most common species caught.

No otter signs were observed at survey site WF 5. However, commuting and foraging potential for this site were assessed as good, given the high fisheries value at this survey site and high connectivity throughout the wider watercourse. Sections of exposed earthen bank did not feature any kingfisher burrows, with heavily vegetated and bramble-dominant sections of bank further upstream assessed as unsuitable kingfisher burrow habitat. Tree limbs extending into the channel provided ample kingfisher perches overtop slow flowing glide, though no kingfisher were observed during the survey. No kingfisher burrows were identified at survey site WF 5 at the time of survey.

Table 4-11. Electrofishing results at survey site WF 5

Species	Length (cm)
Atlantic Salmon (<i>Salmo salar</i>)	7.1
Atlantic Salmon (<i>Salmo salar</i>)	6.9
Atlantic Salmon (<i>Salmo salar</i>)	7.0
Atlantic Salmon (<i>Salmo salar</i>)	7.1
Atlantic Salmon (<i>Salmo salar</i>)	8.6
Atlantic Salmon (<i>Salmo salar</i>)	8.6
Brown Trout (<i>Salmo trutta</i>)	13.4
Brown Trout (<i>Salmo trutta</i>)	14.2
Brown Trout (<i>Salmo trutta</i>)	13.1
Brown Trout (<i>Salmo trutta</i>)	8.9
European eel (<i>Anguilla anguilla</i>)	22.0
European eel (<i>Anguilla anguilla</i>)	19.0

Kick-sampling was carried out in areas of cobble and gravel riffle and glide. Macroinvertebrate diversity was moderate, and density was low. The Q rating assigned to survey site WF 5 was **Q4-5 – High**, on the basis that Group A- ‘Very Pollution Sensitive’ were well represented across 2 taxa, with Group A dominant relative to the rest of the sample. Group D ‘Very Pollution Tolerant’ was represented by a single taxon, while Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-12.

Table 4-12. Results of macroinvertebrate survey at survey site WF 5

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	10
	<i>Heptagenia sp.</i>	18
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	1
	<i>Limnephilidae</i>	1
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	1
	<i>Dicranota sp.</i>	4
	<i>Gammarus sp.</i>	1
	<i>Polycentropodidae</i>	4
Group D – Very Pollution Tolerant	<i>Naididae</i>	4
Group E – Most Pollution Tolerant	-	-

4.1.1.6 WF Survey Site 6 (WF 6)

Survey site WF 6 was located along a stretch of the Owvane [Cork] (EPA code: 21O07, IG Ref.: W 09944 59919), approx. 0.6km downstream of survey site WF 5. Properties of the watercourse at this sample location are provided in Table 4-13 below and a representative photograph of the survey site is shown in Plate 4-7.

Table 4-13. Properties of the watercourse at survey site WF 6.

Properties	Record			
Average Depth (m)	0.3 (deeper pools of 0.8 at downstream survey extent)			
Average Bank Width (m)	6.0			
Average Wetted Width (m)	5.0			
Flow	Moderate			
Colour	Slightly yellow in colour			
Clarity	Clear but plumes of silt when disturbed			
Average Bank height (m)	LHB	1.5	RHB	2.0-5.0 (highest point at steep sided clay/exposed rock banks and large rock armour)
Dominant Substrates	Boulder (>128mm): 5% Cobble (>32-128mm): 40% Gravel (8-32mm): 20% Fine gravel (2-8mm): 20% Sand (0.25-2mm): 5% Silt (<0.25mm): 5%			
Substratum Condition	Loose			



Plate 4-7. A representative picture of survey site WF 6

The stretch of **Depositing/Lowland River (FW2)** along which survey site WF 6 was located was characterised by a sinuous, slow flowing stretch of watercourse amid U-shaped valley, with a particularly steep, highly modified left-hand bank reaching 5m in height. Bank composition along the left side of the channel consisted of sections of eroded exposed earth, clay and rock, with large placed stone rock armour overgrown with vegetation at the upstream survey extent. The earthen right-hand

bank was lower in comparison, and heavily vegetated with a grey willow, hazel and blackthorn treeline, with bramble **Scrub (WS1)** and stands of Japanese knotweed throughout. Bankside vegetation included bracken (*Pteridium aquilinum*), false oat-grass, foxglove (*Digitalis purpurea*), wood speedwell (*Veronica montana*) and honeysuckle (*Lonicera periclymenum*). Habitats in the immediate vicinity of the survey site was dominated by **Scrub (WS1)** and roads (classed as **Buildings and artificial surfaces (BL3)**). Lesser Water-parsnip (*Berula erecta*) was present emergently.

The channel bed itself sloped to the right, with channel substrate consisting of loose gravels with occasional cobbles and marginal boulders along the right-hand bank. Fine sediment beds in shallower water persisted along the left-hand bank for much of the survey stretch. Flow patterns consisted of repeating sequences of pool-riffle-glide, with depth across gravel-cobble riffle approx. 0.3m. Deeper, slower flowing glide and pool reached up to 0.8m in depth along the right side of the channel.

Extensive gravel beds with a high degree of substrate variability provided good salmonid and lamprey spawning habitat. Fine sediment beds sheltered by overhanging vegetation along the left-hand bank provided localised good lamprey ammocoete nursery, with no apparent instream barriers that may limit the movement of migratory fish species throughout the watercourse. Deeper, slower flowing glide, particularly with submerged boulder features and overhanging bankside vegetation provide good adult salmonid holding habitat. Areas of marginal backwater with submerged root structures provided additional instream complexity suitable for good european eel habitat. Overall, a variety of channel substrate structure along sequences of pool-riffle-glide provided good fisheries habitat at survey site WF 6. The actively eroding right-hand bank may cause a slight degree of siltation throughout the watercourse, with areas of steep-sided bank unstable and at risk of collapse.

Results for 10-minute qualitative electrofishing survey are shown in Table 4-14. Species recorded include Atlantic salmon and brown trout.

Table 4-14. Electrofishing results at survey site WF 6

Species	Length (cm)
Atlantic Salmon (<i>Salmo salar</i>)	6.5
Atlantic Salmon (<i>Salmo salar</i>)	5.0
Atlantic Salmon (<i>Salmo salar</i>)	130
Atlantic Salmon (<i>Salmo salar</i>)	8.0
Brown Trout (<i>Salmo trutta</i>)	6.5
Brown Trout (<i>Salmo trutta</i>)	5.0
Brown Trout (<i>Salmo trutta</i>)	13.0

While the high-sided exposed sections of earth bank may provide suitable kingfisher burrow habitat, no burrows were identified at the time of survey. Slow flowing water with perches over deeper glide and pool, combined with good fisheries potential, provided good foraging and commuting habitat for kingfisher. No otter signs were identified at survey site WF 6, though foraging and commuting potential for otter is likely high, given the watercourses' continuity through the wider landscape.

Kick-sampling was carried out in areas of cobble and gravel riffle. Macroinvertebrate diversity was moderate, and density was low. The Q rating assigned to survey site WF 6 was **Q4 – Good**, on the basis that Group A- 'Very Pollution Sensitive' were represented across 2 taxa (1 of which well represented, ~23% of the sample). Group B 'Moderately Pollution Tolerant' species were similarly represented (2 taxa, ~21% of the sample), with Group C 'Pollution Tolerant' taxa being the dominant sensitivity group. Group D 'Very Pollution Tolerant' and Group E 'Most Pollution Tolerant' taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-15.

Table 4-15. Results of macroinvertebrate survey at survey site WF 6

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	10
	<i>Ecdyonurus sp.</i>	2
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	5

Group C – Pollution Tolerant	<i>Baetis rhodani</i>	6
	<i>Chironomidae</i>	7
	<i>Dicranota sp.</i>	3
	<i>Elmidae</i>	3
	<i>Gammarus sp.</i>	1
	<i>Hydracarina</i>	5
	<i>Lumbriculidae</i>	6
	<i>Philopotamidae</i>	1
	<i>Serratella ignita</i>	3
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.7 WF Survey Site 7 (WF 7)

Survey site WF 7 was located along a stretch of narrow **Eroding/Upland River (FW1)** (Owngar [Cork], EPA code: 21O04, IG Ref.: W 12178 58064). Properties of the watercourse at this sample location are provided in

Table 4-16 below and a representative photograph of the survey site is shown in Plate 4-8.

The surveyed stretch along survey site WF 7 consisted of a narrow, laterally confined upland peat stream, with highly brown, humic water colouration. Banks were composed of peat, with active erosion at the bank face, with bank top vegetation including with bird’s-foot trefoil, yorkshire fog, meadowsweet (*Filipendula ulmaria*), soft rush, jointed rush (*Juncus articulatus*), gorse, heather (*Calluna vulgaris*), purple moor grass (*Molinia caerulea*), loosewort (*Pedicularis palustris*), marsh thistle (*Cirsium palustre*), marsh ragwort (*Jacobaea aquatica*), marsh bedstraw (*Galium palustre*), and marsh woundwort (*Stachys palustris*). Emergent species included water-speedwell (*Veronica anagallis-aquatica*).

Slow was flow throughout dense mats of instream water crow-foot (*Ranunculus sp.*), with boulder and bedrock dominant substrate beneath. Shading from the banks was largely absent, while overhanging vegetation and areas of undercut bank provided some instream marginal refugia. No riparian buffer existed between **Wet Heath (HH3)** habitat extending beyond the right-hand bank. The watercourse was largely unmodified at the time of survey, with the exception of an under-road box culvert at the downstream survey extent.

Table 4-16. Properties of the watercourse at survey site WF 7.

Properties	Record
Average Depth (m)	0.4
Average Bank Width (m)	0.8
Average Wetted Width (m)	0.6
Flow	Slow
Colour	Highly brown, humic colouration- peat stained
Clarity	Turbid
Average Bank height (m)	LHB Sloping bank ranging from 0.3-2.5 RHB 0.8 (peat)
Dominant Substrates	Bedrock: 20% Boulder (>128mm): 65% Cobble (>32–128mm): 5% Gravel (8–32mm): 10%
Substratum Condition	Compacted



Plate 4-8. A representative picture of survey site WF 7.

Fisheries potential of this site was limited by the upland location and laterally confined nature of this peatland stream. Absence of mobile gravel substrate or fine silt/sand beds saw a lack of any salmonid or lamprey spawning habitat, or lamprey ammocoete nursery, respectively. Shallow depths and narrow channel width precluded any adult salmonid holding habitat, and lack of deeper pools with instream refuge also limited eel habitat, particularly in the context of the upgradient bedrock/boulder profile of the watercourse in the wider landscape. Salmonid nursery was locally poor and provides opportunistic habitat for resident brown trout. Results for 5-minute qualitative electrofishing survey are shown in Table 4-17, with two brown trout missed as a result of dense mats of instream vegetation.

The upland, headwater location and limited fisheries value of this site provided poor, opportunistic foraging and commuting habitat for otter, with no otter signs observed at the time of survey. The upland, exposed profile of the watercourse at survey site WF 7 did not provide suitable habitat for kingfisher burrows or commuting and foraging. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

Table 4-17. Electrofishing results at survey site WF 7

Species	Length (cm)
Brown Trout (<i>Salmo trutta</i>)	10.1
Brown Trout (<i>Salmo trutta</i>)	11.0

Kick-sampling was carried out between areas of bedrock in patches of interstitial gravels and cobble. Macroinvertebrate diversity and density were both low. The Q rating assigned to survey site WF 7 was **Q2-3 – Poor**, on the basis that Group A- ‘Very Pollution Sensitive’ taxa and Group B ‘Moderately Pollution Tolerant’ taxa were absent from the sample, with Group C taxa (21 individuals across 6 taxa) only few in number. Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-18.

Table 4-18. Results of macroinvertebrate survey at survey site WF 7

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	<i>Chironomidae</i>	3
	<i>Elmidae</i>	3
	<i>Hydracarina</i>	3
	<i>Lymnaeidae</i>	3
	<i>Serratella ignita</i>	3
	<i>Simuliidae</i>	6
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.8 WF Survey Site 8 (WF 8)

Survey site WF 8 was located along a stretch of the Owngar [Cork] (EPA code: 21O04, IG Ref.: W 11596 57701). Properties of the watercourse at this sample location are provided in

Table 4-19 below and a representative photograph of the survey site is shown in Plate 4-9.

Survey site WF 8 consisted of a boulder dominant stretch of **Eroding/Upland River (FW1)**, with moderate velocity flow across repeating pool-riffle-glide sequences over a slight upland gradient. Water was slightly humic in colour due to upstream peat streams and peat bank composition. The watercourse was highly shaded by encroaching willow trees (*Salix spp.*), with dense patches of bracken along much of the survey stretch. Bankside vegetation also featured bramble, common bent (*Agrostis capillaris*), common figwort (*Scrophularia nodosa*), creeping buttercup, false oat-grass, male fern (*Dryopteris filix-mas*), marsh horsetail (*Equisetum palustre*), polypody (*Polypodium vulgare*), self-heal, and wild angelica. Bryophyte coverage included abundant common tamarisk-moss (*Thuidium tamariscinum*) on trees, as well as river feather-moss (*Brachythecium rivulare*) and greater water-moss (*Fontinalis antipyretica*) on boulders and submerged instream. Water crow-foot (*Ranunculus sp.*) was present occasionally in patches along the survey stretch.

A two-span concrete bridge structure was present at the upstream survey extent, with the watercourse passing through the right-hand channel, with an earth/gravel bank accumulation under the left-hand bridge span. A secondary channel converged with the main watercourse from the left-hand bank, from behind the vegetated earth/gravel bar.

Table 4-19. Properties of the watercourse at survey site WF 8

Properties	Record		
Average Depth (m)	0.3		
Average Bank Width (m)	4.0		
Average Wetted Width (m)	2.5		
Flow	Moderate		
Colour	Slightly brown, humic colouration- peat stained		
Clarity	Clear		
Average Bank height (m)	LHB	Sloping bank ranging from 0.3-0.8	RHB Sloping bank ranging from 0.2-0.7
Dominant Substrates	Boulder (>128mm): 40% Cobble (>32-128mm): 30% Gravel (8-32mm): 20%		
Substratum Condition	Compacted		



Plate 4-9. A representative picture of survey site WF 8

Nursery and holding habitat for salmonid fish was assessed as locally good given the high channel substrate variability and diversity of flow patterns both across repeating riffle and glide, with the presence of deeper pools and submerged boulder refuge for adult salmonids. Marginal, slower flowing water amongst exposed root structures and coarse submerged channel substrate provided moderate european eel habitat. However, in the context of the headwater profile and cascade-pool-step profile of the Owngar river, access to such fisheries habitat for eel and adult salmonid habitat is likely limited. The dominance of coarse, compacted substrate along the survey stretch saw poor spawning habitat for all fish species, and moderately swift flows throughout this bedrock-boulder watercourse saw an absence of any fine substrate beds suitable for lamprey ammocoete nursery. Results for 5-minute qualitative electrofishing survey are shown in Table 4-20.

No otter signs were observed at survey site WF 8 at the time of survey, with foraging and commuting habitat for otter assessed as moderate in the context of upland gradient and bedrock cascade-pool-step channel. The upland eroding nature of the watercourse at survey site WF 8 did not provide suitable habitat for kingfisher burrows or significant suitable commuting and foraging. Perches over areas of pool and glide may provide opportunistic kingfisher foraging habitat. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

Table 4-20. Electrofishing results at survey site WF 8

Species	Length (cm)
Brown Trout (<i>Salmo trutta</i>)	12.0
Brown Trout (<i>Salmo trutta</i>)	9.5
Brown Trout (<i>Salmo trutta</i>)	11.5
Brown Trout (<i>Salmo trutta</i>)	6.5

Kick-sampling was carried out amongst cobble and gravel riffle between areas of bedrock. Macroinvertebrate diversity and density were high. The Q rating assigned to survey site WF 8 was **Q4-5 – High**, on the basis that Group A– ‘Very Pollution Sensitive’ were represented across 3 taxa. Group

C ‘Pollution Tolerant’ taxa were relatively dominant, making up ~86% of the sample. Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-21.

Table 4-21. Results of macroinvertebrate survey at survey site WF 8

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	7
	<i>Heptagenia sp.</i>	6
	<i>Rhithrogena sp.</i>	2
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	8
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	15
	<i>Chironomidae</i>	40
	<i>Elmidae</i>	49
	<i>Philopotamidae</i>	1
	<i>Rhyacophila sp.</i>	2
	<i>Serratella ignita</i>	7
	<i>Simuliidae</i>	30
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.9 WF Survey Site 9 (WF 9)

Survey site WF 9 was located along a stretch of the Owngar [Cork] (EPA code: 21O04, IG Ref.: W 11054 56410). Properties of the watercourse at this sample location are provided in Table 4-22 below and a representative photograph of the survey site is shown in Plate 4-10.

This stretch of **Eroding/Upland River (FW1)** could not be electrofished or kick-sampled at the time of survey due to highly turbulent, high velocity cascading flow along steep gradient bedrock/boulder cascade-pool-step sequences. The watercourse was located within a ravine-like channel with high sided, steep banks. Water was slightly turbid at the time of survey due to turbulent flows, with no distinct water colouration. Channel substrate was characterised by boulder and bedrock outcrops (with accumulated cobble/gravel at the river margins, where visible), with water depth was up to 1m in areas of scour pool between cascade and step features. The channel and banks were unmodified, with a single-span stone bridge at the upstream survey extent.

Land-use extending from the left-hand bank consisted of mosaic **Wet grassland (GS4)** and **Improved agricultural grassland (GA1)** and featured cuckoo flower (*Cardamine pratensis*), creeping buttercup, dandelion (*Taraxacum officinale*), heath rush (*Juncus squarrosus*), meadow buttercup (*Ranunculus acris*), ribwort plantain (*Plantago lanceolata*), sorrel (*Rumex acetosa*), sweet vernal grass (*Anthoxanthum odoratum*) and soft rush. A treeline along the right-hand bank provided a high degree of shading to the channel and consisted of hawthorn, grey willow, ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*) and rowan (*Sorbus aucuparia*), with bramble and fuchsia throughout.

Table 4-22. Properties of the watercourse at survey site WF 9

Properties	Record
Average Depth (m)	0.8
Average Bank Width (m)	3.0
Average Wetted Width (m)	3.0
Flow	Torrential
Colour	No distinct colouration
Clarity	Slightly turbid as a result of turbulent water at the time of survey
Average Bank height (m)	LHB 2.0 RHB 2.0
Dominant Substrates	Bedrock: 40% Boulder (>128mm): 30% Cobble (>32–128mm): 20%

	Gravel (8–32mm): 10%
Substratum Condition	Compacted



Plate 4-10. A representative picture of survey site WF 9

Fisheries habitat of this stretch of the Owngar river at survey site WF 9 was limited by the steep gradient and upland location, with sequential bedrock steps and boulder outcrops creating natural barriers to upward migration for fish species. Fast flows saw a lack of any fine sediment or gravel deposition, with no suitable salmonid or lamprey spawning habitat and lamprey ammocoete nursery habitat. Area of deeper water and adequate shading provided *Good* localised adult salmonid, with marginal refuge amongst coarse substrate providing *Moderate* juvenile eel habitat.

No otter signs were observed at survey site WF 9 at the time of survey, with foraging and commuting habitat for otter assessed as moderate in the context of upland gradient and bedrock cascade-pool-step channel. The upland eroding nature of the watercourse at WF 9 did not provide suitable habitat for kingfisher burrows or significant suitable commuting and foraging. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

4.1.1.10 WF Survey Site 10 (WF 10)

Survey site WF 10 was located along a stretch of the Owngar [Cork] (EPA code: 21O04, IG Ref.: W 11430 56813). Properties of the watercourse at this sample location are provided in Table 4-23 below and a representative photograph of the survey site is shown in Plate 4-11.

This stretch of **Eroding/Upland River (FW1)** featured fast-torrential flow over a slight gradient, with boulder and cobble substrate overlying bedrock outcrops. Gravels accumulated in areas of pool at the head of pool-cascade bedrock sequences, although flows were largely too turbulent for any fine substrate deposition throughout the watercourse.

Straight-sided peat banks were vegetated with wild angelica, bird's-foot trefoil, creeping buttercup (*Ranunculus repens*), foxglove, gorse, hawkbit *sp.*, ling heather (*Calluna vulgaris*), heath milkwort (*Polygala serpyllifolia*), jointed rush, polypody, self-heal and tormentil (*Potentilla erecta*), with eared willow (*Salix aurita*) throughout. The left-hand bank featured more sparse vegetation and was comparatively less shaded due to areas of poached and actively eroding bank face and top. Habitats extending from both banks featured a mosaic of **Wet heath (HH3)** and **Wet grassland (GS4)** with lands along the left-hand bank used for grazing.

Instream refuge in the way of large boulder features with eddy flow amid faster glide provided localised moderate salmonid nursery, particularly along undercut banks with overhanging vegetation. Deeper glide and scour pool also provided locally moderate adult salmonid holding habitat. While marginal refuge with submerged sheltering features was present, swift flows may preclude significant suitable European eel habitat. The dominance of bedrock and the overall absence of spawning gravels at this survey site provided poor salmonid and lamprey spawning habitat. Due to the absence of fine silt and sand beds, suitable burrowing habitat for lamprey ammocoetes was considered negligible. Results for 5-minute qualitative electrofishing survey are shown in Table 4-24.

Table 4-23. Properties of the watercourse at survey site WF 10

Properties	Record			
Average Depth (m)	0.4 (deeper pool up to 0.7)			
Average Bank Width (m)	3.5			
Average Wetted Width (m)	3.0			
Flow	Fast			
Colour	Humic colouration as a result of surrounding peat			
Clarity	Slightly turbid			
Average Bank height (m)	LHB	1.2	RHB	1.8
Dominant Substrates	Bedrock: 50% Boulder (>128mm): 20% Cobble (>32-128mm): 15% Gravel (8-32mm): 15%			
Substratum Condition	Compacted			



Plate 4-11. A representative picture of survey site WF 10

No otter signs were observed at survey site WF 10 at the time of survey, with foraging and commuting habitat for otter assessed as moderate in the context of the headwater location of the watercourse. The upland eroding nature of the watercourse at WF 10 did not provide suitable habitat for kingfisher burrows or significant suitable commuting and foraging. Perches in the way of overhanging tree bows were largely absent from the watercourse, and peat banks (where exposed and unvegetated) did not offer suitable burrowing habitat. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

Table 4-24. Electrofishing results at survey site WF 10

Species	Length (cm)
Brown Trout (<i>Salmo trutta</i>)	6.5
Brown Trout (<i>Salmo trutta</i>)	14.9

Kick-sampling was carried out amongst cobble and gravel riffle between areas of bedrock. Macroinvertebrate diversity and density were high. The Q rating assigned to survey site WF 10 was **Q4-5 – High**, on the basis that Group A- ‘Very Pollution Sensitive’ were well represented across 3 taxa (~26% of the sample). Group B ‘Moderately Pollution Sensitive’ taxa were represented by 15 specimens from the *Leuctra* genus. Group C ‘Pollution Tolerant’ taxa were dominant relative to the total sample, making up ~52% of the sample. Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-25.

Table 4-25. Results of macroinvertebrate survey at survey site WF 10

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	12
	<i>Isoperla sp.</i>	3
	<i>Heptagenia sp.</i>	30
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	15
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	10

	<i>Chironomidae</i>	10
	<i>Gammarus sp.</i>	1
	<i>Hydropsychidae</i>	9
	<i>Hydracarina</i>	20
	<i>Philopotamidae</i>	4
	<i>Rhyacophila sp.</i>	3
	<i>Serratella ignita</i>	5
	<i>Simuliidae</i>	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.11 WF Survey Site 11 (WF 11)

Survey site WF 11 was located along a stretch of the Owngar [Cork] (EPA code: 21O04, IG Ref.: W 09481 57393). Properties of the watercourse at this sample location are provided in Table 4-26 below and a representative photograph of the survey site is shown in Plate 4-12.

This stretch of **Eroding/Upland River (FW1)** displayed a moderate gradient across a series of cobble-riffle, boulder outcrops and bedrock steps at the downstream survey extent. A ford crossing with placed boulders, which spanned the channel width created an area of deep, slow flowing impounded water, with depths in excess of 1m at the single-span concrete and metal bridge at the upstream survey extent. Water was fast flowing downstream of the rock ramp along the more naturalised cobble-gravel channel substrate, with a series of falls and steps which may act as instream barriers to migratory fish species.

Table 4-26. Properties of the watercourse at survey site WF 11

Properties	Record			
Average Depth (m)	0.4 (deeper pool up to 0.7)			
Average Bank Width (m)	6.0			
Average Wetted Width (m)	6.0			
Flow	Slow upstream of rock ramp, fast downstream of rock ramp			
Colour	Slightly brown			
Clarity	Slightly turbid			
Average Bank height (m)	LHB	0.1 (at ford crossing) sloping to 2.0	RHB	0.1 (at ford crossing) sloping to 2.0
Dominant Substrates	Bedrock: 5% Boulder (>128mm): 10% Cobble (>32–128mm): 25% Gravel (8–32mm): 60%			
Substratum Condition	Loose			

Earthen banks were reinforced in sections with rip-rap and large boulders, with evidence of historic embankment. A ford crossing was observed within the survey stretch at survey site WF 11. Bankside vegetation included bracken, bramble, wild angelica, soft rush, meadowsweet, gorse, self-heal and montbretia. Shading was largely absent from the channel with the exception of marginal shading provided by Willow *sp.*, hazel, spruce and ash treelines toward the downstream survey extent. Habitats extending beyond both banks consisted of riparian buffers of **Scrub (WS1)** and agricultural and pastoral land.

Despite the presence of abundant, relatively loose gravel beds, channel substrate displayed a slight degree of siltation and filamentous green algal growth, clogging interstitial spaces between gravels which are essential to optimal spawning grounds. Therefore, spawning habitat for salmonid and lamprey species was assessed as poor. Flow was also slow and impounded in areas of gravel dominant channel bed and thus limiting to optimal spawning habitat. Areas of enhanced diverse flow across gravel and cobble riffle downstream of the rock ramp provided localised moderate salmonid nursery, although gradient features such as steps and cascades throughout the wider watercourse may limit

juvenile salmonid access to these habitats. The build-up of fine sediment beds around the channel margins were assessed as providing moderate burrowing habitat for lamprey ammocoetes. However, these fine sediment beds may be frequently disturbed and more compacted in the vicinity of the ford crossing. Areas of deep pool upstream of the rock ramp, in conjunction with marginal refuge provided by overhanging vegetation and rock armour provided moderate-good adult salmonid holding habitat. Similarly, areas of slower flowing, deep marginal water provided locally good european eel habitat. Due to prohibitive depths upstream of the rock ramp, these areas of deep pool and glide could not be surveyed via electrofishing. Results for 5-minute qualitative electrofishing survey are shown in Table 4-27.

No otter signs were observed at survey site WF 11 at the time of survey. However, foraging and commuting habitat for otter was assessed as good. Deep, slow flowing water upstream of the bridge structure provided good commuting and foraging habitat for kingfisher, although banks overgrown with scrub or reinforced with rip-rap limited kingfisher burrow habitat. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.



Plate 4-12. A representative picture of survey site WF 11

Table 4-27. Electrofishing results at survey site WF 11

Species	Length (cm)
Minnow (<i>Phoxinus phoxinus</i>)	5.5
Minnow (<i>Phoxinus phoxinus</i>)	5.0
Minnow (<i>Phoxinus phoxinus</i>)	6.0
Minnow (<i>Phoxinus phoxinus</i>)	8.0

Kick-sampling was carried out amongst cobble and gravel riffle. Macroinvertebrate diversity and density were low. The Q rating assigned to survey site WF 11 was **Q3– Poor**, on the basis that Group A– ‘Very Pollution Sensitive’ were absent from the sample. Group B ‘Moderately Pollution Sensitive’ taxa were poorly represented (1 individual from one taxa), with Group C ‘Pollution Tolerant’ taxa dominating the sample. The results of the kick-sample are summarised in Table 4-28.

Table 4-28. Results of macroinvertebrate survey at survey site WF 11

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	1
Group C – Pollution Tolerant	<i>Chironomidae</i>	10
	<i>Corixidae</i>	5
	<i>Dysticidae</i>	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.12 WF Survey Site 12 (WF 12)

Survey site WF 12 was located along a stretch of the Owngar [Cork] (EPA code: 21O19, IG Ref.: W 09272 57442). Properties of the watercourse at this sample location are provided in Table 4-29 below and a representative photograph of the survey site is shown in Plate 4-13.

This fast flowing, steep gradient stretch of **Eroding/Upland River (FW1)** featured cascade-pool-step features and chute and freefall flow along the survey extent. Marginal slower flow was present amongst overhanging tree bows and exposed root structures, particularly in deeper holding pools up to 1.2m in depth. Channel substrate was predominantly bedrock, with boulder outcrops and localised cobble and gravel accumulations overtop. Siltation was not evident, though water was humic in colour but clear.

Earthen banks with exposed boulder and roots were vegetated with bracken, bramble, hard fern, hart’s-tongue fern, ivy, plantain (*Plantago sp.*), polypody, soft, St. Patrick’s cabbage and wild angelica. Habitats extending beyond both banks consisted of **Riparian woodland (WN5)** featuring oak (*Quercus sp.*), holly, hazel and willow (*Salix sp.*), which provided good shading to the channel. *Fontinalis antipyretica* was present instream.

Banks exhibited evidence of historic embankment and reinforcement (stone walls) at the upstream survey extent. The watercourse was culverted beneath the road via a 3-span pipe culvert. A secondary unmapped channel adjoined the river.

Table 4-29. Properties of the watercourse at survey site WF 12

Properties	Record			
Average Depth (m)	0.4 (with pools of 1.2)			
Average Bank Width (m)	1.8			
Average Wetted Width (m)	1.5			
Flow	Fast			
Colour	No distinct colouration			
Clarity	Clear			
Average Bank height (m)	LHB	Uneven banks ranging from 0.2-2	RHB	Uneven banks ranging from 0.2-2

Dominant Substrates	Bedrock: 40% Boulder (>128mm): 25% Cobble (>32–128mm): 25% Gravel (8–32mm): 10%
Substratum Condition	Semi-compacted

As a result of the upland, bedrock-dominant profile of the watercourse and swift flows, salmonid and lamprey spawning habitat were largely absent from the channel. Diverse channel substrate sizes and flow variability along the channel created instream refuge assessed as moderate juvenile salmonid nursery. Areas of deeper pool created localised good salmonid holding habitat, with areas of marginal backwater and areas of scour which featured exposed root structures and submerged boulders providing moderate eel habitat. However, fast flow and steep gradient may limit eel utilisation of such habitats. Results for 5-minute qualitative electrofishing survey are shown in Table 4-30. Additionally, 10 salmonid fish and 1 eel were observed but not caught.

No otter signs were observed at survey site WF 12 at the time of survey. Foraging and commuting habitat for otter was assessed as moderate and was limited by the upland, steep gradient river profile. While localised areas of deep holding pools were present, with overhanging tree bows suitable for perches, the overall eroding, upland nature of the watercourse at survey site WF 12 limited any significant suitable foraging habitat for kingfisher. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

Table 4-30. Electrofishing results at survey site WF 12

Species	Length (cm)
Brown Trout (<i>Salmo trutta</i>)	9.0
Brown Trout (<i>Salmo trutta</i>)	8.5



Plate 4-13. A representative picture of survey site WF 12

Kick-sampling was carried out through cobble and gravel channel substrate. Macroinvertebrate diversity and density were low and moderate, respectively. The Q rating assigned to survey site WF 12 was **Q3– Poor**, on the basis that Group A– ‘Very Pollution Sensitive’ were absent from the sample. Group B ‘Moderately Pollution Sensitive’ taxa made up ~15% of the sample, with Group C ‘Pollution Tolerant’ taxa dominating the sample. The results of the kick-sample are summarised in Table 4-31.

Table 4-31. Results of macroinvertebrate survey at survey site WF 12

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	2
	<i>Leuctra sp.</i>	2
	<i>Limnephilidae</i>	2
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	7
	<i>Chironomidae</i>	3
	<i>Gammarus sp.</i>	1
	<i>Limnius sp.</i>	21
	<i>Simuliidae</i>	3
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.13 WF Survey Site 13 (WF 13)

Survey site WF 13 was located along a stretch of the Maughanaclea watercourse (EPA code: 21M35, IG Ref.: W 09397 55594). Properties of the watercourse at this sample location are provided in Table 4-32 below and a representative photograph of the survey site is shown in Plate 4-14.

This survey site consisted of an upland stretch of **Eroding/Upland River (FW1)** amid wider sitka spruce **Conifer plantation (WD4)** habitat. The watercourse was a narrow, laterally confined headwater peat stream with negligible bankside shading. Bank top vegetation included soft rush, foxglove, self-heal, cleavers (*Galium aparine*), spear thistle (*Cirsium vulgare*) and *Poa sp.* grass. Felled tree limbs traversed the watercourse at several points, creating woody debris dams and creating significant barriers to fish migration.

The upland location, steep gradient and peat dominant substrate (gravels absent) saw limited spawning habitat for all fish species. Lack of deeper water and the narrow nature of the watercourse provided negligible adult salmonid and european eel holding habitat. Fine sediments suitable for lamprey nursery was absent. Barriers to migration both in the form of woody dams and bedrock channel morphology in the wider landscape limited access to this stretch of watercourse. No fish were recorded via 5-minute qualitative electrofishing survey at this survey site.

No otter signs were observed at survey site WF 13 at the time of survey, with no significant suitable habitat for otter foraging or commuting along this stretch of watercourse. Similarly, suitable kingfisher foraging, commuting or burrowing habitat was absent from the survey site. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

Table 4-32. Properties of the watercourse at survey site WF 13

Properties	Record			
Average Depth (m)	0.3			
Average Bank Width (m)	0.7			
Average Wetted Width (m)	0.6			
Flow	Moderate			
Colour	Highly brown, humic colouration			
Clarity	Slightly turbid			
Average Bank height (m)	LHB	1.0	RHB	1.0
Dominant Substrates	Boulder (>128mm): 10% Cobble (>32-128mm): 20% Peat: 70%			
Substratum Condition	Loose			



Plate 4-14. A representative picture of survey site WF 13

Kick-sampling was carried out in areas of shallow glide. Macroinvertebrate diversity and density were low. The Q rating assigned to survey site WF 13 was **Q3– Poor**, on the basis that Group A– ‘Very Pollution Sensitive’ were absent from the sample. Group B ‘Moderately Pollution Sensitive’ taxa were poorly represented, with Group C ‘Pollution Tolerant’ taxa making up ~63% of the sample. 2 Group E ‘Most Pollution Tolerant’ *Chironomus sp.* from one taxon were present in the sample. The results of the kick-sample are summarised in Table 4-33.

Table 4-33. Results of macroinvertebrate survey at survey site WF 13

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	<i>Baetidae</i>	1
Group C – Pollution Tolerant	<i>Elmidae sp.</i>	3
	<i>Polycentropodidae sp.</i>	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	<i>Chironomus sp.</i>	2

4.1.1.14 WF Survey Site 14 (WF 14)

Survey site WF 14 was located along a stretch of the Owngar [Cork] (EPA code: 21O04, IG Ref.: W 07659 56722). Properties of the watercourse at this sample location are provided in Table 4-34 below and a representative photograph of the survey site is shown in Plate 4-15.

This stretch of **Eroding/Upland River (FW1)** featured a ford crossing which spanned the channel width. This barrier created different flow patterns, with deeper, slow flowing impounded water upstream and faster flow along a slight gradient with cobble riffle downstream of the rock ramp. Evidence of cattle entry and livestock evidenced along the left-hand bank via poached and sloping earth banks.

Channel substrate was predominantly composed of cobble both along the survey stretch, with repeating riffle-glide sequences. A variety of boulder, cobble and gravel substrate across the channel supported diverse flow patterns and created instream refuge assessed as locally good salmonid nursery habitat. In submerged macrophyte species were absent but hemlock water-dropwort was present abundantly at the channel margins, with algal growth apparent across channel substrate. The channel was well shaded along its length, by overhanging ash, willow and sycamore trees at the downstream survey extent and by encroaching bramble, bracken, hawthorn, and blackthorn riparian zones at the upstream extent, with montbretia throughout. Bankside vegetation adjacent to **Improved agricultural grassland (GA1)** habitat included silverweed (*Potentilla anserina*), knapweed (*Centaurea nigra*) and yorkshire fog.

Isolated areas of loose, mobile, clean gravels limited suitable spawning habitat at this survey site, with sediment often covered in a degree of filamentous green algae, particularly upstream of the rock ramp. Fine sediment beds suitable for lamprey ammocoetes were present occasionally at the channel margins and behind the rock ramp. However, the presence of the rock ramp as a barrier to migration, as well as the downstream gradient may limit access to these suitable areas of slower flow. Areas of deep, slow flow, particularly upstream of the rock ramp, provided good adult salmonid holding habitat. Marginal submerged root structures and encroaching vegetation added instream complexity to areas of backwater, creating good european eel habitat. Two eel were observed but not caught electrofishing. Results for 10-minute qualitative electrofishing survey are shown in Table 4-35.

No otter signs were observed at survey site WF 14 at the time of survey, although this watercourse offered with significant suitable habitat for foraging or commuting otter. Similarly, areas of slow flow, combined with abundant perches, provided suitable kingfisher foraging and commuting habitat. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

Table 4-34. Properties of the watercourse at survey site WF 14

Properties	Record
Average Depth (m)	0.4 (with deeper glide up to 0.7)
Average Bank Width (m)	7.0
Average Wetted Width (m)	5.5
Flow	Moderate-Fast
Colour	Slightly brown
Clarity	Clear when undisturbed, with a slight degree of siltation underfoot
Average Bank height (m)	LHB 0.5 RHB 1.5
Dominant Substrates	Boulder (>128mm): 30% Cobble (>32–128mm): 35% Gravel (8–32mm): 25% Silt (<0.25mm): 10%
Substratum Condition	Semi-compacted



Plate 4-15. A representative picture of survey site WF 14

Table 4-35. Electrofishing results at survey site WF 14

Species	Length (cm)
Brown Trout (<i>Salmo trutta</i>)	7.8
Brown Trout (<i>Salmo trutta</i>)	17.0
Brown Trout (<i>Salmo trutta</i>)	20.0
Brown Trout (<i>Salmo trutta</i>)	9.0
Brown Trout (<i>Salmo trutta</i>)	5.0
Brown Trout (<i>Salmo trutta</i>)	6.0

Kick-sampling was carried out amongst cobble and gravel riffle between areas of bedrock. Macroinvertebrate diversity and density were high. The Q rating assigned to survey site WF 14 was **Q3-4 – Moderate**, on the basis that Group A- ‘Very Pollution Sensitive’ and Group B ‘Moderately Pollution Sensitive’ taxa were present in ‘few’ numbers. Group C ‘Pollution Tolerant’ taxa were dominant relative to the total sample, making up ~90% of the sample. Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-36.

Table 4-36. Results of macroinvertebrate survey at survey site WF 14

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	2
	<i>Heptagenia sp.</i>	2
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	3
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	10
	<i>Chironomidae</i>	40
	<i>Hydracarina</i>	6
	<i>Serratella ignita</i>	4
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.15 WF Survey Site 15 (WF 15)

Survey site WF 15 was located along a stretch of the Owngar [Cork] (EPA code: 21O04, IG Ref.: W 06473 56661). Properties of the watercourse at this sample location are provided in Table 4-37 below and a representative photograph of the survey site is shown in Plate 4-16.

This stretch of bedrock-dominant **Eroding/Upland River (FW1)** displayed a steep gradient, terminating in a bedrock waterfall (approx. 1.0m in height), with fast flow over top. Scour pools (in excess of 1m) at the foot of the waterfall graded into sequences of moderate velocity glide and cobble riffle at the downstream survey extent. A three-span stone arch bridge was present along the survey stretch (no bridge apron), with the watercourse flowing through the central span only. Livestock access to the watercourse was evidenced by sloping, poached banks downstream of the bridge. Habitats extending from both banks consisted of agricultural land.

Both shading and marginal cover were high, with overhanging tree limbs from mixed treelines consisting of hawthorn, willow (*Salix spp.*), ash, alder, rowan and holly providing marginal refuge for fish species. Bankside vegetation featured montbretia, meadowsweet, bracken, bramble, soft rush, gorse, willowherb (*Epilobium sp.*), coltsfoot (*Tussilago farfara*), with water-pepper (*Persicaria hydropiper*) present emergently. Water was slightly turbid, with no submerged vascular macrophytes but luxuriant algal growth over coarser substrates.

The presence of loose gravels provided moderate-good salmonid and lamprey species spawning habitat downstream of the bridge. Moderate-good juvenile salmonid nursery was provided throughout a variety of channel substrate sizes and associated diverse flow patterns, with marginal shading along the banks. Deeper pools, particularly at the foot of the waterfall, provided localised good adult salmonid holding habitat, with the presence of submerged and overhanging root structure and tree limbs and boulder complexes providing good eel habitat in areas of slower flowing backwater. Fine sediment beds were largely absent from this stretch of watercourse, with poor lamprey nursery habitat at this survey site. Results for 10-minute qualitative electrofishing survey are shown in Table 4-38.

No otter signs were observed at survey site WF 15 at the time of survey, although this watercourse offered good habitat for foraging and commuting otter. Areas of slow flow with tree limbs extending into the watercourse provided potential kingfisher perches, although no kingfisher were observed utilising the watercourse at the time of survey. No kingfisher burrows were identified in the vicinity of the survey site.

Table 4-37. Properties of the watercourse at survey site WF 15

Properties	Record			
Average Depth (m)	0.3 (pools of 1.0 downstream of waterfall)			
Average Bank Width (m)	8.0			
Average Wetted Width (m)	7.0-8.0			
Flow	Moderate-Fast			
Colour	Slightly brown			
Clarity	Slightly turbid			
Average Bank height (m)	LHB	1.0	RHB	1.0-1.7
Dominant Substrates	Bedrock: 10% Boulder (>128mm): 20% Cobble (>32-128mm): 20% Gravel (8-32mm): 50%			
Substratum Condition	Loose (gravels)			



Plate 4-16. A representative picture of survey site WF 15

Table 4-38. Electrofishing results at survey site WF 15

Species	Length (cm)
Brown Trout (<i>Salmo trutta</i>)	19.0
Brown Trout (<i>Salmo trutta</i>)	20.0
Brown Trout (<i>Salmo trutta</i>)	15.5
Brown Trout (<i>Salmo trutta</i>)	6.0
Brown Trout (<i>Salmo trutta</i>)	7.5
Minnow (<i>Phoxinus phoxinus</i>)	5.0
Minnow (<i>Phoxinus phoxinus</i>)	8.5
Minnow (<i>Phoxinus phoxinus</i>)	6.0
European eel (<i>Anguilla anguilla</i>)	30.0

Kick-sampling was carried out amongst cobble and gravel riffle between areas of bedrock. Macroinvertebrate diversity and density were high. The Q rating assigned to survey site WF 16 was **Q3-4 – Moderate**, on the basis that Group A- ‘Very Pollution Sensitive’ and Group B ‘Moderately Pollution Sensitive’ taxa were present in ‘few-common’ numbers, with Group B being the dominant pollution sensitivity group (~56% of the sample). Group C ‘Pollution Tolerant’ taxa made up ~33% of the sample, while Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-39.

Table 4-39. Results of macroinvertebrate survey at survey site WF 15

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Ecdyonurus sp.</i>	5
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	24
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	10
	<i>Serratella ignita</i>	4
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.116 WF Survey Site 16 (WF 16)

Survey site WF 16 was located along a stretch of the Owvane [Cork] River (EPA code: 21O07, IG Ref.: W 04748 56561). Properties of the watercourse at this sample location are provided in Table 4-40 below and a representative photograph of the survey site is shown in Plate 4-17.

This bedrock-dominant section of **Eroding/Upland River (FW1)** featured large boulder and bedrock outcrops, as well as steeply sloping, sheer faced exposed bedrock banks. The upstream end of the survey extent was characterised by bedrock/boulder cascade sequences with chute and free flow and deep scour pool features. Moving downstream toward a single-span concrete bridge structure at the downstream survey extent, flow was characterised by repeating sequences of moderate velocity glide (over top of finer substrates) and cobble riffle. Flow was slower in marginal areas with deposition of finer substrates. Surrounding habitat consisted of **Amenity grassland (improved) (GA2)**, with marginal willow (*Salix spp.*) and bramble scrub and alder and hawthorn treeline. Bankside vegetation featured St. John's-wort (*Hypericum perforatum*), self-heal, ribwort plantain, marsh ragwort, marsh woundwort, nettle, creeping buttercup, bird's-foot trefoil and gorse, as well as butterfly-bush (*Buddleja davidii*) and stands of the First Schedule and Third Schedule invasive species Himalayan balsam (*Impatiens glandulifera*). *Fontinalis antipyretica* was abundant over rock outcrops.

While the channel featured repeating boulder outcrops and bedrock steps, flow continuity was maintained continuous along the survey stretch for salmonid and eel species, with gaps between boulders allowing for areas of attraction flow. Pools within cascade-pool-step features provided deep holding pools, assessed locally as good for adult salmonid holding habitat. Areas of undercut bank below the most prominent bedrock and boulder step feature, combined with overhanging bankside vegetation in areas of marginal backwater, provided locally good European eel habitat. A high degree of channel substrate variability created diverse flow patterns along the survey stretch. While instream macrophytes and the refuge they provide were absent from the channel, eddy flow created around submerged boulder features provided ample salmonid nursery, assessed as moderate-good (limited by the lack of shading to the centre of the channel). Areas of gravel throughout the survey stretch provided localised moderate-good salmonid spawning habitat, although the presence of step features may preclude spawning lamprey species from accessing any suitable spawning habitat. Marginal fine sediments in areas of slower flow, downstream of boulder steps provided moderate potential lamprey ammocoete habitat in areas of lower gradient with a higher degree of shading. However, no lamprey were caught during electrofishing. Results for 10-minute qualitative electrofishing survey are shown in Table 4-41.

No otter signs were observed at survey site WF 16 at the time of survey. This survey site was assessed as offering only moderate opportunistic commuting and foraging habitat, given the steep bedrock gradient in parts of the watercourse and existing levels of human disturbance in the area. Areas of slower flow downstream may provide some opportunistic foraging habitat for kingfisher. No kingfisher were observed utilising the watercourse at the time of survey and no kingfisher burrows were identified in the vicinity of the survey site at the time of survey.

Table 4-40. Properties of the watercourse at survey site WF 16

Properties	Record
Average Depth (m)	0.3 (pools of 1.0 downstream of waterfall)
Average Bank Width (m)	7.0
Average Wetted Width (m)	6.0-7.0
Flow	Moderate-Fast
Colour	Slightly brown
Clarity	Slightly turbid
Average Bank height (m)	LHB 1.0 RHB 1.0-1.7
Dominant Substrates	Bedrock: 30% Boulder (>128mm): 20% Cobble (>32-128mm): 20% Gravel (8-32mm): 20%

Substratum Condition	Loose (gravels only), compacted boulders
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Plate 4-17. A representative picture of survey site WF 16

Table 4-41. Electrofishing results at survey site WF 16

Species	Length (cm)
Minnow (<i>Phoxinus Phoxinus</i>)	7.9
Minnow (<i>Phoxinus Phoxinus</i>)	5.9
Minnow (<i>Phoxinus Phoxinus</i>)	5.9
Minnow (<i>Phoxinus Phoxinus</i>)	5.1
Minnow (<i>Phoxinus Phoxinus</i>)	5.2
Minnow (<i>Phoxinus Phoxinus</i>)	5.1
Minnow (<i>Phoxinus Phoxinus</i>)	7.4
Minnow (<i>Phoxinus Phoxinus</i>)	5.3
Minnow (<i>Phoxinus Phoxinus</i>)	5.5
Minnow (<i>Phoxinus Phoxinus</i>)	5.4
Minnow (<i>Phoxinus Phoxinus</i>)	5.3
Minnow (<i>Phoxinus Phoxinus</i>)	5.2
Minnow (<i>Phoxinus Phoxinus</i>)	5.1
Minnow (<i>Phoxinus Phoxinus</i>)	5.0
Minnow (<i>Phoxinus Phoxinus</i>)	6.0
Minnow (<i>Phoxinus Phoxinus</i>)	4.0
Minnow (<i>Phoxinus Phoxinus</i>)	5.0
Minnow (<i>Phoxinus Phoxinus</i>)	5.0
Minnow (<i>Phoxinus Phoxinus</i>)	6.0
Minnow (<i>Phoxinus Phoxinus</i>)	6.5
Minnow (<i>Phoxinus Phoxinus</i>)	5.5
Atlantic salmon (<i>Salmo salar</i>)	8.5
Atlantic salmon (<i>Salmo salar</i>)	11.8
Atlantic salmon (<i>Salmo salar</i>)	12.0

Atlantic salmon (<i>Salmo salar</i>)	5.9
Atlantic salmon (<i>Salmo salar</i>)	9.2
Atlantic salmon (<i>Salmo salar</i>)	11.4
Atlantic salmon (<i>Salmo salar</i>)	12.2
Brown trout (<i>Salmo trutta</i>)	14.4
Brown trout (<i>Salmo trutta</i>)	14.5
European eel (<i>Anguilla anguilla</i>)	14.0
European eel (<i>Anguilla anguilla</i>)	16.0
European eel (<i>Anguilla anguilla</i>)	16.0
European eel (<i>Anguilla anguilla</i>)	14.0
European eel (<i>Anguilla anguilla</i>)	28.0
European eel (<i>Anguilla anguilla</i>)	24.0

Kick-sampling was carried out amongst cobble and gravel riffle. Macroinvertebrate diversity and density were high. The Q rating assigned to survey site WF 16 was **Q4 – Good**, on the basis that at least one Group A- ‘Very Pollution Sensitive’ taxa was present in reasonable numbers, relative to the other taxonomic groups across the sample. Group C ‘Pollution Tolerant’ taxa made up ~60% of the sample, while Group D ‘Very Pollution Tolerant’ made up ~5% of the sample. Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-42.

Table 4-42. Results of macroinvertebrate survey at survey site WF 16

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Chloroperlidae</i>	4
	<i>Ecdyonurus sp.</i>	4
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	4
	<i>Sericostomatidae</i>	1
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	4
	<i>Chironomidae</i>	6
	<i>Hydropsychidae</i>	6
	<i>Polycentropodidae</i>	2
	<i>Serratella ignita</i>	4
Group D – Very Pollution Tolerant	<i>Hirudinea</i>	1
	<i>Naididae</i>	1
Group E – Most Pollution Tolerant	-	-

4.1.1.17 WF Survey Site 17 (WF 17)

Survey site WF 17 was located along a stretch of the Mealagh River (EPA code: 21M01, IG Ref.: W 09411 53512). Properties of the watercourse at this sample location are provided in Table 4-43 below and a representative photograph of the survey site is shown in Plate 4-18.

This stretch of **Eroding/Upland River (FW1)** watercourse featured cobble-dominant channel substrate, with an exposed cobble bank extending along the left-hand bank at the time of survey. The watercourse channel sloped to the right, with continuous deeper pools at the river margin adjacent to boulders along right-hand bank. Flow patterns consisted of repeating sequences of moderate velocity cobble riffle and slower flowing glide and pool. Water was clear when undisturbed, with only a slight degree of siltation evident.

Occasional ash, hawthorn and will (*Salix sp.*) trees provided moderate shading, particularly to the channel margins along the right-hand bank. Bankside vegetation included bird’s-foot trefoil and wild angelica, with patches of encroaching bramble and gorse scrub extending into the watercourse. Habitats extending beyond both banks consisted of **Improved agricultural grassland (GA1)**, with riverbanks likely historically embanked. Hemlock water-dropwort was present occasionally along the channel margins.

Consistent pool-riffle-glide sequences provided a variety of flow patterns, water velocity and water depth across the channel, suitable for several fish age classes (namely brown trout). Deeper pool along the right-hand bank, with overhanging tree bows and submerged boulder features provided good adult salmonid holding habitat. Areas of undercut bank and areas of submerged root structures in slower flowing glide and pool also provided moderate European eel habitat. A lack of any fine sediment beds provided negligible lamprey ammocoete nursery habitat. Gravels were present interstitially throughout cobbles, providing overall moderate salmonid and lamprey spawning habitat.

Table 4-43. Properties of the watercourse at survey site WF 17

Properties	Record	
Average Depth (m)	0.3 (pools of 0.8)	
Average Bank Width (m)	5.0	
Average Wetted Width (m)	2.0-4.0	
Flow	Moderate	
Colour	No distinct colouration	
Clarity	Clear when undisturbed	
Average Bank height (m)	LHB 0.2-1.0	RHB 1.2
Dominant Substrates	Bedrock: 5% Boulder (>128mm): 10% Cobble (>32-128mm): 55% Gravel (8-32mm): 30%	
Substratum Condition	Semi-compacted	



Plate 4-18. A representative picture of survey site WF 17

No otter signs were observed at survey site WF 17 at the time of survey, although this watercourse offered with some good commuting and foraging habitat. Potential foraging and commuting habitat was also abundantly present for kingfisher, particularly in areas of slow flowing glide with abundant overhanging tree limbs at the downstream survey extent. No kingfisher were observed utilising the

watercourse at the time of survey. No kingfisher burrows were identified in the vicinity of the survey site at the time of survey. Results for 10-minute qualitative electrofishing survey are shown in Table 4-44.

Table 4-44. Electrofishing results at survey site WF 17

Species	Length (cm)
Brown trout (<i>Salmo trutta</i>)	17.0
Brown trout (<i>Salmo trutta</i>)	14.5
Brown trout (<i>Salmo trutta</i>)	13.5
Brown trout (<i>Salmo trutta</i>)	11.5
Brown trout (<i>Salmo trutta</i>)	12.5
Brown trout (<i>Salmo trutta</i>)	11.5
Brown trout (<i>Salmo trutta</i>)	12.5
Brown trout (<i>Salmo trutta</i>)	11.0
Brown trout (<i>Salmo trutta</i>)	6.0
Brown trout (<i>Salmo trutta</i>)	5.5
Three-spined stickleback (<i>Gasterosteus aculeatus</i>)	4.0
Three-spined stickleback (<i>Gasterosteus aculeatus</i>)	5.5

Kick-sampling was carried out amongst cobble riffle and glide. Macroinvertebrate diversity and density were moderate. The Q rating assigned to survey site WF 17 was **Q4 – Good**, on the basis that at least one Group A– ‘Very Pollution Sensitive’ taxa was present in reasonable numbers, relative to the other taxonomic groups across the sample. Group C ‘Pollution Tolerant’ taxa made up ~44% of the sample, while Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-45.

Table 4-45. Results of macroinvertebrate survey at survey site WF 17

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Dinocras cephalotes</i>	1
	<i>Ecdyonurus sp.</i>	3
	<i>Perla bipunctata</i>	6
Group B – Moderately Pollution Sensitive	<i>Glossomatidae sp.</i>	19
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	2
	<i>Elmidae sp.</i>	3
	<i>Polycentropodidae sp.</i>	3
	<i>Rhyacophila sp.</i>	1
	<i>Serratella ignita</i>	6
	<i>Simuliidae sp.</i>	8
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.18 WF Survey Site 18 (WF 18)

Survey site WF 18 was located along a stretch of the Gortnacowly River (EPA code: 21G90, IG Ref.: W 09104 53717). Properties of the watercourse at this sample location are provided in Table 4-46 below and a representative photograph of the survey site is shown in Plate 4-19.

This stretch of historically **Eroding/Upland River (FW1)** exhibited evidence of a high degree of channel modification, with reprofiling of banks to create steep sided, exposed earth bank faces which sloped into an area of livestock poaching and cattle access into the watercourse. Bank heights ranged from low sloping earthen banks at the agricultural crossing to approx. 2.5m in height, where steep sided earthen banks displayed abundant bryophyte coverage.

Channel substrate was largely composed of compacted, coarse boulder and cobble substrate, with a high degree of siltation throughout. Flow velocity was moderate, with a slight yellow/brown colouration.

The water was clear when undisturbed, but silt plumes were evident underfoot. Water depth was shallow along much of the surveyed stretch (max depth of 0.1m).

Shading was absent at the upstream survey extent, with some shading to the channel margins at the downstream survey extent in areas of encroaching bankside vegetation, including gorse, fuchsia, bramble and blackthorn. A short section of holly and willow (*Salix sp.*) tunnelled the watercourse and provided excessive shading. Vegetation along the sparse riparian buffer included soft rush, bracken fern, dandelion, daisy (*Bellis perennis*), foxglove, herb-robert (*Geranium robertianum*) and clover (*Trifolium sp.*). Habitats extending beyond the banks consisted of **Improved agricultural grassland (GA1)**.

Fisheries habitat for all species was assessed as poor-negligible, given the highly modified nature of the channel, semi-compacted nature of channel substrate, shallow water, heavy siltation and barriers to migration, particularly at the waterfall (approx. 1.2m in height) present at the upstream survey extent.

No fish were recorded via 5-minute qualitative electrofishing survey at this survey site, with two minnows observed but not caught. Otter spraint was observed on a boulder, with this stretch of watercourse likely used opportunistically for commuting. No suitable kingfisher habitat was present along the survey stretch, with no kingfisher burrows present at the time of survey, including in areas of newly resection earth bank downstream of the small waterfall. No kingfisher were observed utilising the watercourse in the vicinity of survey site WF 18 at the time of survey.

Table 4-46. Properties of the watercourse at survey site WF 18

Properties	Record
Average Depth (m)	0.05
Average Bank Width (m)	2.0 (3.0 at area of livestock crossing/recent bank resectioning)
Average Wetted Width (m)	1.5
Flow	Moderate
Colour	Yellow/brown
Clarity	Slightly turbid
Average Bank height (m)	LHB 0.6-2.5 RHB 1.2-2.5
Dominant Substrates	Bedrock: 30% Boulder (>128mm): 30% Cobble (>32-128mm): 30% Gravel (8-32mm): 10%
Substratum Condition	Semi-compacted



Plate 4-19. A representative picture of survey site WF 18

Kick-sampling was carried out amongst cobble riffle and glide. Macroinvertebrate diversity and density were moderate. The Q rating assigned to survey site WF 18 was **Q3 – Poor**, on the basis that at Group A– ‘Very Pollution Sensitive’ taxa were absent from the sample, with only one individual in 1 Group B– ‘Moderately Pollution Sensitive’ taxa present in low numbers. Group C ‘Pollution Tolerant’ taxa were the dominant pollution sensitivity group, making up ~92% of the sample. Group D ‘Very Pollution Tolerant’ were absent from the sample, while Group E ‘Most Pollution Tolerant’ taxa was represented by *Chironomus sp.* The results of the kick-sample are summarised in Table 4-47.

Table 4-47. Results of macroinvertebrate survey at survey site WF 18

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	1
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	15
	<i>Chironomidae</i>	10
	<i>Simuliidae</i>	10
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	<i>Chironomus sp.</i>	2

4.1.1.19 WF Survey Site 19 (WF 19)

Survey site WF 19 was located along a stretch of Mealagh River (EPA code: 21M01, IG Ref.: W 07161 54770). Properties of the watercourse at this sample location are provided in Table 4-48 below and a representative photograph of the survey site is shown in Plate 4-20.



Plate 4-20. A representative picture of survey site WF 19

This survey site represented a laterally confined stretch of **Eroding/upland River (FW1)** amid wider **Wet grassland (GS4)**. This watercourse featured pool-riffle-glide sequences, with short falls over boulder outcrops. This watercourse was largely unmodified with the exception of an under-road pipe culvert at the downstream survey extent. Submergent macrophytes included water starwort (*Callitriche sp.*), and water crowfoot (*Ranunculus sp.*) Bankside vegetation included purple moor grass, soft rush, bracken fern, foxglove, marsh thistle, gorse and nettle.

Fisheries habitat was assessed as overall poor. Although gravel was present along the surveyed stretch, the laterally confined nature of the channel with instream barriers to migration (bedrock steps and falls), limited utilisation of any gravels for spawning salmonid or lamprey species. Fine sediment beds suitable for lamprey nursery were absent from the channel, while shallow depths precluded any significant adult salmonid holding habitat. Submerged instream refuge features such as undercut banks or instream root structures required for european eel habitat were also absent. Salmonid nursery was similarly limited, with the exception of instream refuge provided by macrophytes.

No fish were recorded via 5-minute qualitative electrofishing at this survey site. No otter signs were observed at this survey site at the time of survey. Although some poor-quality commuting and foraging habitat is present, multiple barriers to continuity throughout the watercourse likely limit otter utilisation. No suitable kingfisher habitat was present along this largely exposed survey stretch, with no kingfisher burrows present at the time of survey. No kingfisher were observed utilising the watercourse in the vicinity of survey site WF 20 at the time of survey.

Table 4-48. Properties of the watercourse at survey site WF 19

Properties	Record
Average Depth (m)	0.1-0.3
Average Bank Width (m)	1.0
Average Wetted Width (m)	1.0
Flow	Moderate
Colour	Slightly brown
Clarity	Slightly turbid
Average Bank height (m)	LHB 1.2 RHB 1.2
Dominant Substrates	Bedrock: 20% Boulder (>128mm): 10% Cobble (>32-128mm): 30% Gravel (8-32mm): 40%
Substratum Condition	Compacted (with loose areas of gravel)

Kick-sampling was carried out throughout pool, riffle and glide along this survey stretch. Macroinvertebrate diversity and density were both low. The Q rating assigned to survey site WF 19 was **Q2-3 – Poor**, on the basis that at Group A- ‘Very Pollution Sensitive’ and Group B- ‘Moderately Pollution Sensitive’ taxa were absent from the sample. Group C ‘Pollution Tolerant’ taxa represented the only pollution sensitivity group recorded in the sample, with *Baetis rhodani* being the dominant species present. The results of the kick-sample are summarised in Table 4-49.

Table 4-49. Results of macroinvertebrate survey at survey site WF 19

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	11
	<i>Chironomidae</i>	5
	<i>Polycentropodidae</i>	1
	<i>Rhyacophila sp.</i>	2
	<i>Simuliidae</i>	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.20 WF Survey Site 20 (WF 20)

Survey site WF 20 was located along a stretch of Mealagh River (EPA code: 21M01, IG Ref.: W 07324 53875). Properties of the watercourse at this sample location are provided in Table 4-50 below and a representative photograph of the survey site is shown in Plate 4-21.

This shallow stretch of **Eroding/upland River (FW1)** featured boulder steps and outcrops, which created flow diversity laterally across the channel. Steep sided banks approx. 1.5-1.8m in height were undercut, with dense bankside vegetation which encroached into the channel, providing marginal refugia and a high degree of shading to the channel. Bankside vegetation include bracken fern, soft rush, hawthorn, bramble, willowherb (*Epilobium sp.*), hart's-tongue fern, fuchsia, meadow buttercup and Yorkshire fog, with willow (*Salix spp.*) trees throughout. Instream macrophytes were absent, with the exception of *Fontinalis antipyretica* present instream coarse substrates. Habitats extending beyond the banks consisted of **Improved agricultural grassland (GA1)** and pastoral land.

Water velocity was moderate, and water was clear, with a slight yellow/brown colouration. Channel substrate was predominantly coarse, semi-compacted cobble, with interstitial gravels and a moderate degree of overlying silt. Channel modifications were not evident, with the exception of an embanked left-hand bank.

Channel bed substrate was assessed as being too coarse and compacted to provide suitable salmonid or lamprey species spawning habitat, while instream refuge in the way of channel substrate size and flow pattern diversity, in conjunction with undercut banks and overhanging vegetation provided overall moderate salmonid nursery habitat. Potential lamprey nursery habitat was assessed as negligible, given the absence of fine sediment beds along the survey stretch. Lack of any deeper glide or pool saw negligible habitat for both adult salmonids and european eel.

Results for 5-minute qualitative electrofishing survey are shown in Table 4-51. Four salmonid fish were observed but not caught during electrofishing.

No otter signs were observed at this survey site at the time of survey, although potential commuting and foraging habitat were assessed as Good. No suitable kingfisher burrow habitat was present along this survey stretch, with no kingfisher burrows present at the time of survey. No kingfisher were observed utilising the watercourse in the vicinity of survey site WF 20 at the time of survey.



Plate 4-21. A representative picture of survey site WF 20

Table 4-50. Properties of the watercourse at survey site WF 20

Properties	Record			
Average Depth (m)	0.05-0.2			
Average Bank Width (m)	3.0			
Average Wetted Width (m)	1.5			
Flow	Moderate			
Colour	Slightly yellow/brown			
Clarity	Clear			
Average Bank height (m)	LHB	1.8	RHB	1.5

Dominant Substrates	Boulder (>128mm): 25% Cobble (>32–128mm): 60% Gravel (8–32mm): 10% Silt (<0.25mm): 5%
Substratum Condition	Semi-compacted

Table 4-51. Electrofishing results at survey site WF 20

Species	Length (cm)
Brown trout (<i>Salmo trutta</i>)	17.0

Kick-sampling was carried out amongst cobble-dominant riffle and glide. Macroinvertebrate diversity and density were moderate. The Q rating assigned to survey site WF 20 was **Q4 – Good**, on the basis that at least one Group A– ‘Very Pollution Sensitive’ taxa was present in reasonable numbers, relative to the other taxonomic groups across the sample. Group C ‘Pollution Tolerant’ taxa made up ~60% of the sample, with *Baetis rhodani* being the dominant species, while Group D ‘Very Pollution Tolerant’ was represented by a single individual in one taxa, while Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-52

Table 4-52. Results of macroinvertebrate survey at survey site WF 20

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Early instar plecoptera</i>	1
	<i>Ecdyonurus sp.</i>	7
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	3
	<i>Leuctra sp.</i>	7
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	15
	<i>Dicranota sp.</i>	2
	<i>Polycentropodidae</i>	1
	<i>Serratella ignita</i>	3
	<i>Simuliidae</i>	8
Group D – Very Pollution Tolerant	<i>Naididae</i>	1
Group E – Most Pollution Tolerant	-	-

4.1.1.21 WF Survey Site 21 (WF 21)

Survey site WF 21 was located along a stretch of Mealagh River (EPA code: 21M01, IG Ref.: W 06505 52956). Properties of the watercourse at this sample location are provided in Table 4-53 below and a representative photograph of the survey site is shown in Plate 4-22.

Table 4-53. Properties of the watercourse at survey site WF 21

Properties	Record		
Average Depth (m)	0.5		
Average Bank Width (m)	8.0		
Average Wetted Width (m)	8.0		
Flow	Moderate		
Colour	No distinct colouration		
Clarity	Clear		
Average Bank height (m)	LHB	1.5	RHB 3.0
Dominant Substrates	Bedrock: 5% Boulder (>128mm): 30% Cobble (>32–128mm): 35% Gravel (8–32mm): 30%		
Substratum Condition	Semi-compacted		

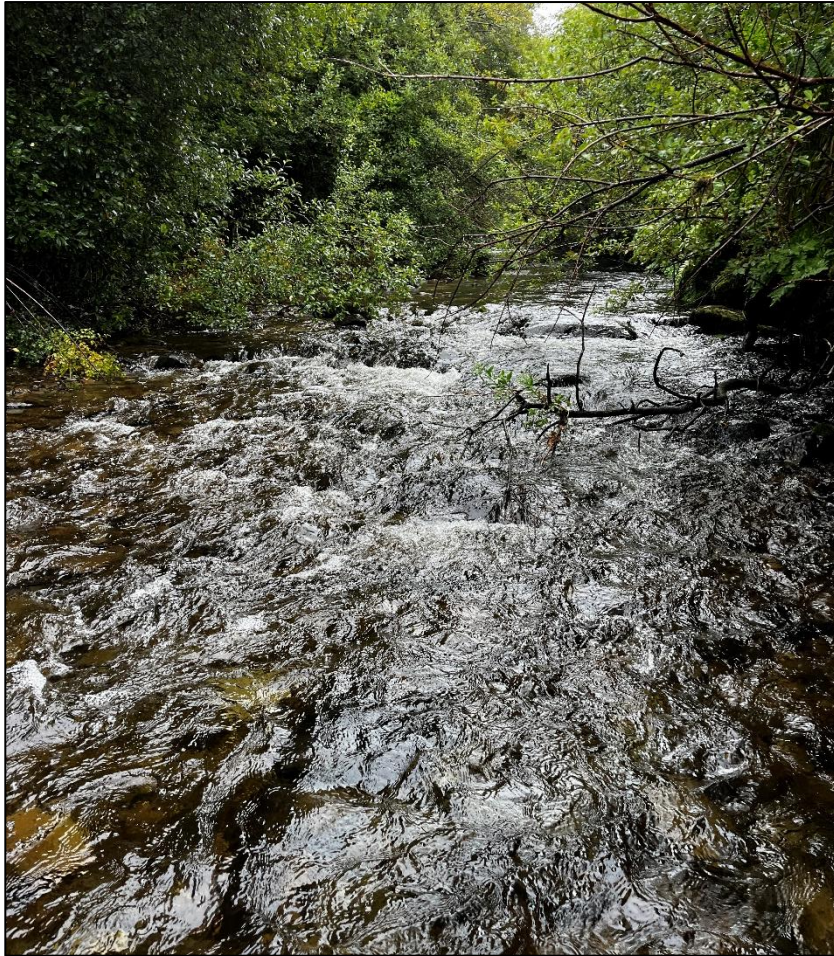


Plate 4-22. A representative picture of survey site WF 21

This stretch of **Eroding/upland River (FW1)** featured coarse, semi-compacted cobble/boulder-dominant channel substrate, with little-to-no siltation as a result of swift flows. Instream cover in the way of submerged macrophytes was high, with patches of water crowfoot (*Ranunculus sp.*) and water starwort (*Callitriche sp.*) present throughout. Cladophora was also present atop channel bed substrate and on the concrete bridge apron associated with the 2-span, flathead concrete masonry bridge. Water velocity was moderate and water was clear, with no apparent colouration.

Bankside vegetation provided moderate-high shading, on the left- and right-hand banks, and included willow sp., bracken fern, wild angelica, hawthorn, montbretia, creeping buttercup, bramble, self-heal, hart's-tongue fern, willowherb (*Epilobium sp.*), as well as ash and rowan trees, with overhanging vegetation and tree limbs providing sheltering marginal features.

The dominance of coarse, semi-compacted channel substrates along the survey limited significant suitable spawning habitat for salmonid or lamprey species. Instream refuge provided by abundant instream vegetation and varied channel substrate across repeating riffle sequences, in combination with shading provided by overhanging tree limbs and marginal vegetation, provided good salmonid nursery.

Deep pools (up to 1.2m in depth) provided good-excellent adult salmonid holding habitat. Instream refuge in the way of instream roots, submerged boulder features and overhanging vegetation in areas of slower marginal backwater limited optimal adult eel habitat. The absence of any fine, well-structured sediment beds saw a lack of any suitable nursery habitat for burrowing lamprey ammocoetes. Results for 10-minute qualitative electrofishing survey are shown in Table 4-54.

No otter signs were observed at this survey site at the time of survey, although potential commuting and foraging habitat were assessed as Good. No kingfisher burrows were identified, with no kingfisher were observed utilising the watercourse in the vicinity of survey site WF 21 at the time of survey.

Table 4-54. Electrofishing results at survey site WF 21

Species	Length (cm)
Minnow (<i>Phoxinus Phoxinus</i>)	5.5
Brown Trout (<i>Salmo trutta</i>)	6.0
Brown Trout (<i>Salmo trutta</i>)	6.5
Brown Trout (<i>Salmo trutta</i>)	12.5
Brown Trout (<i>Salmo trutta</i>)	17.5
Brown Trout (<i>Salmo trutta</i>)	11.5
Brown Trout (<i>Salmo trutta</i>)	11.5
Brown Trout (<i>Salmo trutta</i>)	11.5
Brown Trout (<i>Salmo trutta</i>)	11.5
Brown Trout (<i>Salmo trutta</i>)	18.0
Brown Trout (<i>Salmo trutta</i>)	8.5
Brown Trout (<i>Salmo trutta</i>)	17.0

Kick-sampling was carried out amongst cobble-dominant glide. Macroinvertebrate diversity and density were low. The Q rating assigned to survey site WF 21 was **Q34 – Moderate**, on the basis that only one Group A– ‘Very Pollution Sensitive’ taxa was present in ‘few’ numbers, relative to the other taxonomic groups across the sample. Group B ‘Moderately Pollution Tolerant’ taxon *Leuctra sp.* were dominant in the sample. Group C ‘Pollution Tolerant’ taxa made up 50% of the sample. Group D ‘Very Pollution Tolerant’ and Group E ‘Most Pollution Tolerant’ taxa were absent from the sample. The results of the kick-sample are summarised in Table 4-55.

Table 4-55. Results of macroinvertebrate survey at survey site WF 21

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Perla bipunctata</i>	1
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	2
	<i>Leuctra sp.</i>	7
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	5
	<i>Dysticidae</i>	4
	<i>Serratella ignita</i>	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.1.22 Dystrophic Lake (FL1) habitat

Two lakes classified as **Dystrophic Lakes (FL1)** were recorded within the Proposed Wind Farm study area, one to the northern parcel of the Proposed Wind Farm, northwest of the proposed location of proposed turbine 2 (T2) (Plate 4-23) and the second, Lough Nabirree, to the southern parcel of the Proposed Wind Farm, southwest of proposed turbine 13 (T13) (Plate 4-24). These lake habitats have links to the *Annex I habitat ‘Natural Dystrophic lakes and ponds (3160)’*.

Lake margins were characterised by peaty substrate, with the water humic in colouration due to high levels of peat. Yellow water lily (*Nuphar lutea*) was recorded growing on both lakes. Lake margin species included cuckoo flower (*Cardamine pratensis*), purple moor grass (*Molinia caerulea*), common cottongrass (*Eriophorum angustifolium*), soft rush (*Juncus effusus*), common sedge (*Carex nigra*), bottle sedge (*Carex rostrata*) and marsh lousewort (*Pedicularis palustris*).



Plate 4-23. A representative photo of the **Dystrophic lake (FL1)** north of the proposed turbine 2 (T2)



Plate 4-24. A representative photo of the **Dystrophic lake (FL1)** southwest of the proposed turbine 13 (T13)

4.1.2 Proposed Grid Route Survey sites

4.1.2.1 GC Survey Site 1 (GC 1)

Survey site GC 1 was located along a stretch of the Owngar [Cork] (EPA code: 21O04, IG Ref.: W 11682 56266). Properties of the watercourse at this sample location are provided in Table 4-56 below and a representative photograph of the survey site is shown in Plate 4-25.

This stretch of **Eroding/Upland River (FW1)** consisted of a steep gradient watercourse with repeating cascade-pool-step features along the survey stretch. Channel substrate was dominated by bedrock features and boulder outcrops, with areas of cobble and gravel deposits accumulated within slower flow at pool margins. Water depth ranged from 0.2m over top of bedrock features, to up to 0.6m within scour pools downstream of bedrock falls.

The watercourse was located within a wider riparian ravine with strips of willow **Riparian woodland (WN5)**, as well as fuchsia, hawthorn, blackthorn and rowan trees vegetating the high sided, steep earthen banks. Other bank top vegetation included hard fern and hard shield fern (*Polystichum aculeatum*) St Patrick's cabbage, primrose (*Primula vulgaris*) and dog violet (*Viola riviniana*).

Water was very at the time of survey, with no distinct water colouration. The channel and banks were unmodified, with a single-span stone bridge at the upstream survey extent.

Fisheries habitat of this stretch of the Owngar river at GC 1 was limited by the steep gradient and upland location, with sequential bedrock steps and boulder outcrops creating natural barriers to upward migration for fish species. Fast flows saw a lack of any fine sediment or gravel deposition, with a lack of suitable salmonid or lamprey spawning habitat or fine sediment beds suitable for lamprey ammocoete nursery habitat. Areas of deeper water and good shading provided by riparian treelines provided well sheltered adult salmonid holding habitat assessed locally as good. Areas of undercut banks, exposed root structures and more sheltered flow behind bedrock and boulder features may also provide localised moderate-good salmonid nursery. However, these sheltered areas suitable as standalone habitat for juvenile and adult salmonids or european eel may be inaccessible all of these species as result of high velocity flows and steep gradient.

No otter signs were observed at survey site GC 1 at the time of survey, with foraging and commuting habitat for otter assessed as moderate in the context of upland gradient and bedrock cascade-pool-step channel. The upland eroding nature of the watercourse at survey site GC 1 did not provide suitable habitat for kingfisher burrows or significant suitable commuting and foraging. No kingfisher burrows were identified in the vicinity of the survey site and no kingfisher were observed utilising the watercourse at the time of survey.

Table 4-56. Properties of the watercourse at survey site GC 1

Properties	Record			
Average Depth (m)	0.4			
Average Bank Width (m)	5.0			
Average Wetted Width (m)	3.0			
Average Bank height (m)	LHB	1.8	RHB	2.5
Flow	Fast			
Colour	No distinct colouration			
Clarity	Very Clear			
Dominant Substrates	Bedrock: 40% Boulder (>128mm): 25% Cobble (>32-128mm): 25% Gravel (8-32mm): 10%			
Substratum Condition	Compacted			



Plate 4-25. A representative photo of survey site GC 1

Kick sampling was undertaken in areas of cobble and gravel between bedrock and boulder steps. Macroinvertebrate diversity and density were low. The Q rating assigned to survey site GC 1 was **Q4 – Good**, on the basis that at least one ‘very pollution sensitive’ Group A taxon was present in reasonable numbers, relative to the sample; ‘Pollution sensitive’ taxa made up ~26% of the sample (7 individuals across four taxa in Groups A and B). ‘Pollution tolerant’ Group C species made up ~74% of the sample, with *Simuliidae sp.* being the dominant species. Taxa from Groups D and E were absent. Results of kick sampling are summarised in Table 4-57.

Table 4-57 Results of macroinvertebrate sample at survey site GC 1.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Dinocras cephalotes</i>	2
	<i>Ecdyonurus sp.</i>	3

Group B – Moderately Pollution Sensitive	<i>Leuctra sp.</i>	1
	<i>Glossomatidae</i>	1
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	5
	<i>Gammarus sp.</i>	4
	<i>Simuliidae</i>	11
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.2 GC Survey Site 2 (GC 2)

Survey site GC 2 was located along an unmapped watercourse (IG Ref.: W 13439 56886). This watercourse consisted of an upland, steep gradient stretch of modified **Eroding/upland River (FW1)**. The upstream survey extent consisted of a narrow, laterally confined section of watercourse between straight sided earthen banks. Moving downstream, the watercourse channel widened, with low sloping, poached banks at points of livestock crossing.

Table 4-58. Properties of the watercourse at survey site GC 2

Properties	Record
Average Depth (m)	0.1
Average Bank Width (m)	0.7-3.0
Average Wetted Width (m)	1.0
Average Bank height (m)	LHB 0.2-1.0 RHB 0.2-1.0
Flow	Torrential
Colour	Slightly yellow
Clarity	Clear when undisturbed, turbid underfoot
Dominant Substrates	Bedrock: 10% Boulder (>128mm): 20% Cobble (>32-128mm): 40% Gravel (8-32mm): 20% Silt (<0.25mm): 10%
Substratum Condition	Compacted

Channel substrate was dominated by cobble and boulder, with interstitial gravels and areas of earth instream along the largely undefine channel margins of the sections of watercourse which meandered through the surrounding **Wet grassland (GS4)** pastoral land. Vegetation along the watercourse included soft rush and ragwort along the watercourse. The upstream survey extent shaded with hawthorn and fuchsia, with hard fern and St. Patrick's cabbage along the banks.

Despite channel substrate variability and refuge between boulder and cobble at the upstream survey extent, the watercourse was mostly highly modified in nature, with an under-road pipe culvert at the upstream extent. Therefore, this watercourse offered overall poor fisheries habitat, with negligibly wetted sections of watercourse, a high level of siltation throughout sections of the watercourse passing through pastoral land and a lack of any riparian buffer.

No otter signs were observed at this survey site at the time of survey, with foraging and commuting habitat for otter assessed as poor, given the highly modified nature of the watercourse, which lacked a riparian buffer, shading and any suitable holting or couch habitat along the surveyed stretch. This survey site similarly did not provide suitable habitat for kingfisher burrows or significant suitable commuting and foraging. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

Kick-sampling was carried out amongst available areas of shallow cobble riffle. Macroinvertebrate diversity and density were low at this survey site. The Q rating assigned to this additional watercourse crossing between GC 1 and GC 2 was **Q3 –Poor**, on the basis that ‘Very pollution sensitive’ Group A and ‘Moderately Pollution sensitive’ taxa were absent from the sample; taxa from Groups D and E were also absent. ‘Pollution tolerant’ Group C species made up 100% of the sample, with *Gammarus sp.* being the dominant species. Results of kick sampling are summarised in Table 4-59



Plate 4-26. A representative picture of the watercourse at survey site GC 2

Table 4-59. Results of macroinvertebrate sample at survey site GC 2.

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	<i>Ancylus fluviatilis</i>	3
	<i>Asellus aquaticus</i>	1
	<i>Gammarus sp.</i>	6
	<i>Hydropsychidae</i>	1
	<i>Simuliidae</i>	1
	<i>Tipulidae</i>	2
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.3 GC Survey Site 3 (GC 3)

Survey site GC 3 was located along a stretch of the Glanycarney (EPA code: 20G19, IG Ref.: W 13507 56760). Properties of the watercourse at this sample location are provided in Table 4-60 below and a representative photograph of the survey site is shown in Plate 4-27.

Table 4-60. Properties of the watercourse at survey site GC 3

Properties	Record
Average Depth (m)	0.35
Average Bank Width (m)	4.0
Average Wetted Width (m)	3-3.5
Average Bank height (m)	LHB 0.4-1.0 RHB 0.6-2m
Flow	Fast
Colour	Slightly yellow
Clarity	Very clear
Dominant Substrates	Bedrock: 30% Boulder (> 128mm): 25% Cobble (>32-128mm): 30% Gravel (8-32mm): 10% Silt (<0.25mm): 5%
Substratum Condition	Semi-compacted cobbles, loose gravels



Plate 4-27. A representative picture of survey site GC 3

This section of watercourse was characterised a series of bedrock substrate overlain with boulders and cobble, with cascade-pool-steps along a step gradient. Flow was turbulent at the time of survey, with channel depth ranging from 0.2m over sections of cobble and boulder riffle in the vicinity of the single-span stone arch bridge, to 0.5m in scour pools amongst bedrock steps. Water was very clear when undisturbed, with slight yellow colouration. Siltation was not apparent in the watercourse, with dominance of coarse, large substrates as a result of swift flows.

Bank modifications included a stone retaining wall along the left-hand bank, extending downstream of the bridge. The upstream bridge face consisted of concrete, with a concrete wall extending along the earth bank upstream of the bridge. A secondary channel joined the watercourse, with turbulent and torrential flow over a short, steep gradient dominated by boulder channel substrate, from the left-hand bank. Sections of earthen bank were poached at the downstream survey extent. Fine sediment beds were absent from the survey stretch (with only shallow, overlying patches of silt in the vicinity of the bridge), and therefore lamprey ammocoete nursery was negligible. Scour pools present among the bedrock step features were 0.6m at the deepest points, with torrential flow throughout. Therefore, in the context of habitat accessibility, optimal salmonid holding habitat and European eel habitat were assessed as poor.

The bankside featured occasional willow (*Salix sp.*) and hawthorn trees, which provided intermittent shading from the left-hand bank. Bankside vegetation included rusty back fern (*Asplenium ceterach*), hard shield fern, gorse, herb robert, creeping buttercup and meadow buttercup. Habitats surrounding the watercourse consisted of pastoral **Wet grassland (GS4)** and **Dry heath (HH2)** with ling heather, gorse, purple moor grass and bilberry (*vaccinium myrillus*)

Spawning habitat for salmonid and lamprey was largely absent to the dominance of bedrock and boulder channel bed substrate, and the upgradient, headwater morphology of this stretch of watercourse. Localised salmonid nursery habitat among more sheltered, marginal areas of cobble and boulder riffle were assessed as good, although sequential bedrock steps may preclude upstream migration of fish to access these habitats.

No otter signs were observed at survey site GC 3 at the time of survey, with foraging and commuting habitat for otter assessed as moderate and likely opportunistic. The overall exposed and upland nature of the watercourse did not provide suitable habitat for kingfisher burrows or significant suitable commuting and foraging habitat. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

The kick sample was taken in areas of shallower cobble riffle. Macroinvertebrate diversity and density were low at this survey site. The Q rating assigned to survey site GC 3 was **Q3 –Poor**, on the basis that ‘Very pollution sensitive’ Group A and ‘Moderately Pollution sensitive’ taxa were absent from the sample; taxa from Groups D and E were also absent. ‘Pollution tolerant’ Group C species made up 100% of the sample, with *Gammarus sp.* being the dominant species. Results of kick sampling are summarised in Table 4-61.

Table 4-61. Results of macroinvertebrate sample at survey site GC 3

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	<i>Ancylus fluviatilis</i>	2
	<i>Gammarus sp.</i>	4
	<i>Physidae</i>	1
	<i>Polycentropodidae</i>	1
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.4 GC Survey Site 4 (GC 4)

Survey site GC 4 was located along an upland tributary of the Bandon (EPA code: 20B02, IG Ref.: W 14508 57290). Properties of the watercourse at this sample location are provided in Table 4-62 below and a representative photograph of the survey site is shown in Plate 4-28

This stretch of highly modified **Eroding/upland River (FW1)** was highly poached, with low, undefined bank margins. The wetted watercourse ranged from approx. 0.5m to 3.0m at the widest point,

meandering uncontained within the wider **Wet grassland (GS4)** Habitats. The watercourse was braided across the field at several points. The watercourse was shallowly wetted and was dominated by compacted cobble substrate, with interstitial areas of finer substrates. Areas of poached watercourse also featured a high proportion of earthen substrate within the watercourse,

Flow patterns were mostly riffle, with the exception of free fall flow at the raised pipe culvert at the upstream survey extent. The under-road pipe culvert acted as a complete barrier to upstream migration of fish species and otter (Plate 4-29). Water depth was shallow, with the exception of a small pool (approx. 0.25m deep) directly downstream of the pipe. Water was clear when undisturbed but exhibited a high degree of siltation underfoot.

The watercourse was intermittently shaded by individual hawthorn, holly and grey and eared willow trees and gorse scrub. Vegetation along the wet grassland watercourse margins included soft rush, jointed rush, marsh bedstraw, creeping buttercup and foxglove. Instream vegetation included occasional mats of water starwort and lesser spearwort (*Ranunculus flammula*).

Table 4-62. Properties of the watercourse at survey site GC 4

Properties	Record
Average Depth (m)	0.05-0.1
Average Bank Width (m)	0.5-3.0
Average Wetted Width (m)	0.5-3.0
Average Bank Height (m)	LHB 0.1 RHB 0.1
Flow	Fast
Colour	Slight brown colouration
Clarity	Clear when undisturbed
Dominant Substrates	Cobble (>32-128mm): 40% Gravel (8-32mm): 20% Fine gravel (2-8mm): 20% Silt (<0.25mm): 20%
Substratum Condition	Compacted

This watercourse offered poor fisheries habitat, with negligibly wetted sections of watercourse throughout sections of the watercourse passing through pastoral land, lacked a significant riparian buffer and exhibited a high degree of siltation. The watercourse lacked deep pools for suitable adult salmonid holding habitat, or deeper areas of refuge suitable for european eel. Lamprey ammocoete nursery was also absent along the survey stretch. Although areas of more defined channel with cobble-dominant riffle provided localised areas of potential salmonid nursery, the watercourse as a whole was poorly connected. The under-road pipe culvert acted as a complete barrier to all migratory fish.

No otter signs were observed at survey site GC 4 at the time of survey, with foraging and commuting habitat for otter assessed as poor, given the highly modified nature of the watercourse, which lacked a riparian buffer, adequate water depth or any significant suitable holding or couch habitat along the surveyed stretch. This survey site did not provide suitable habitat for kingfisher burrows given the low, sloping nature of the banks, or significant suitable commuting and foraging. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

The kick sample was taken in areas of available cobble and gravel riffle. Macroinvertebrate diversity and density were low at this survey site. The Q rating assigned to survey site GC 4 was **Q3 –Poor**, on the basis that ‘Very pollution sensitive’ Group A and ‘Moderately Pollution sensitive’ taxa were absent from the sample; taxa from Group E were also absent. ‘Pollution tolerant’ Group C species made up ~93% of the sample, with *Gammarus sp.* being the dominant species. Results of kick sampling are 4-63.



Plate 4-28. A representative picture of survey site GC 4



Plate 4-29. A representative picture of the pipe culvert at the upstream survey extent of GC 4

Table 4-63 Results of macroinvertebrate sample at survey site GC 4

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	2
	<i>Chironomidae</i>	1
	<i>Elmidae</i>	1
	<i>Gammarus sp.</i>	4
	<i>Gerris sp.</i>	2
	<i>Simuliidae</i>	2
	<i>Tipulidae</i>	1
Group D – Very Pollution Tolerant	<i>Asellus aquaticus</i>	1
Group E – Most Pollution Tolerant	-	-

4.1.2.5 GC Survey Site 5 (GC 5)

Survey site GC 5 was located along an upland tributary of the Bandon (EPA code: 20B02, IG Ref.: W 18735 56710). Properties of the watercourse at this sample location are provided in Table 4-64 below and a representative photograph of the survey site is shown in Plate 4-30.

This stretch of **Eroding/upland River (FW1)** consisted of repeating pool-steps along bedrock and boulder channel substrate through the centre of the channel, with a three-span stone arched bridge and associated bridge apron. Flow was torrential at the time of survey, with areas of slower flow and cobble and gravel deposits at the river margins. Water was very clear, with slight yellow colouration. Slight siltation was observed amongst finer gravel deposits along the channel margins but was largely absent throughout swifter flows and coarser substrate through the centre of the channel. The water was in spate at the time of survey, with evidence of flooding around the instream bridge abutments and marginal banks in the form of abundant woody debris.

The channel was well shaded along much of the survey extent, with treelines of alder, ash, holly, sessile oak (*Quercus petraea*), sycamore and grey willow extending along both banks. Bankside vegetation included bramble, hart's tongue fern, creeping buttercup, foxglove, bramble, meadowsweet, polypody, herb robert, hard shield fern, bracken, creeping bent (*Agrostis stolonifera*), tormentil (*Potentilla erecta*) and rosebay willowherb (*Chamaenerion angustifolium*). Instream vegetation included abundant mats of water crowfoot (*Ranunculus sp.*) and *Rhynchostrigium riparioides*, with emergent hemlock water dropwort along cobble banks. The bridge apron was also covered with occasional filamentous green algae. Abundant *Ranunculus sp.* coverage at this survey site is associated with the Annex I habitat '3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation'.

Abundant mobile, relatively clean gravel beds with swift, well aerated flows both upstream and downstream of the bridge provided localised areas of good salmonid and lamprey spawning habitat. However, the raised bridge apron may act as a barrier to upstream migration of lamprey. Consequently, potential spawning habitat for lamprey species was assessed as moderate. Despite the presence of marginal fine gravel and silt beds, flows may also preclude access to lamprey ammocoete nursery habitat, particularly during high, spate flows such as at the time of survey. Abundant instream macrophyte coverage, in combination with high channel substrate variability and associated flow pattern diversity provided good salmonid nursery habitat. Deeper pools both upstream and downstream of the bridge also provided good-excellent adult salmonid holding habitat, with areas of marginal backwater with sheltering undercut banks providing good-excellent eel habitat.

Table 4-64. Properties of the watercourse at survey site GC 5

Properties	Record
Average Depth (m)	0.4

Average Bank Width (m)	6.0-8.0			
Average Wetted Width (m)	5.0-8.0			
Average Bank Height (m)	LHB	1.0	RHB	1.0
Flow	Torrential			
Colour	Slightly yellow			
Clarity	Very clear			
Dominant Substrates	Bedrock: 20% Boulder (> 128mm): 20% Cobble (>32-128mm): 30% Gravel (8-32mm): 20% Fine gravel (2-8mm): 10%			
Substratum Condition	Compacted cobble and boulder, loose gravels			



Plate 4-30. A representative picture of survey site GC 5

No otter signs were observed at survey site GC 5 at the time of survey. However, given the good fisheries potential and overall high connectivity along the watercourse, this survey site provided excellent potential otter foraging and commuting habitat. High sided, exposed earth banks suitable for kingfisher burrowing were largely absent from the survey site. However, habitat for kingfisher commuting and foraging were assessed as good, with abundant perches available over deep, slower flowing glide and pool. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

The kick sample was taken in areas of cobble and gravel riffle. Macroinvertebrate diversity and density were moderate at this survey site. The Q rating assigned to survey site GC 5 was **Q4 –Good** on the basis that ‘Very pollution sensitive’ Group A and ‘Moderately Pollution sensitive’ taxa were present in ‘few-common’ numbers, relative to the rest of the sample. Taxa from Groups D and E were absent. ‘Pollution tolerant’ Group C species made up ~63% of the sample, with *Simuliidae sp.* being the dominant species. Results of kick sampling are summarised in Table 4-65.

Table 4-65. Results of macroinvertebrate sample at survey site GC 5

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Ecdyonurus sp.</i>	2
	<i>Perla bipunctata</i>	2
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	1
	<i>Sericostomatidae</i>	8
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	4
	<i>Elmidae</i>	1
	<i>Hydropsyche</i>	6
	<i>Piscicola sp.</i>	1
	<i>Simuliidae</i>	10
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.6 GC Survey Site 6 (GC 6)

Survey site GC 6 was located along a section of the Shiplough (EPA code: 20S21, IG Ref.: W 18887 55868). Properties of the watercourse at this sample location are provided in Table 4-66 below and a representative photograph of the survey site is shown in Plate 4-31.

This section of **Eroding/upland River (FW1)** comprised compacted cobble substrate with repeating riffle and glide flow. Water velocity was moderate at the time of survey, with depth ranging from 0.1m marginally along the left-hand bank 0.6m in areas of deeper pool and glide along the right-hand bank. Siltation was evident over top of channel substrate, particularly in the vicinity of the single-span concrete bridge structure and downstream at a point of historical bank poaching, with abundant fly tipping. Woody debris accumulations were also observed at several points along the river margins. An outflow pipe joined the watercourse from the right-hand bank, with boulder rock armour reinforcement and embankment approx. 2.0m in height along this bank. The left-hand bank was composed of low sloping earth

The watercourse was well shaded, with an alder, grey willow and holly along both banks. Bankside vegetation included ivy, bramble, foxglove, herb robert, creeping buttercup and speedwell (*Veronica sp.*), with marginal hemlock water dropwort and *Pellia sp.* growing on exposed banks. Water crowfoot (*Ranunculus sp.*) was present abundantly instream in the vicinity of the bridge structure.

Table 4-66. Properties of the watercourse at survey site GC 6

Properties	Record
Average Depth (m)	0.4
Average Bank Width (m)	3.0
Average Wetted Width (m)	2.8
Average Bank Height (m)	LHB 0.5-2.0 RHB 2.0
Flow	Moderate
Colour	No distinct colouration
Clarity	Very clear when undisturbed
Dominant Substrates	Boulder (> 128mm): 20% Cobble (>32-128mm): 40% Gravel (8-32mm): 15% Fine gravel (2-8mm): 10% Silt (<0.25mm): 15%
Substratum Condition	Compacted



Plate 4-31. A representative picture of survey site GC 6

While riffle-glide sequences over gravel and cobble provided accelerated flow, the compacted nature of substrata and degree of siltation meant that potential spawning gravel was relatively immobile and laden with finer sediments. Therefore, salmonid and lamprey spawning habitat were assessed as poor. Instream refugia provided by water crowfoot and channel substrate, as well as undercut banks and crevices between rock armour provided moderate salmonid nursery. Marginal glide along the right-hand bank provided moderate adult salmonid holding habitat, while areas of overhanging trees and shelter along marginal boulders also provided moderate european eel habitat. Fisheries habitat was overall limited by the high level of siltation throughout the watercourse, as well as abundant fly tipping and historic livestock access toward the downstream survey extent.

No otter signs were observed at survey site GC 6 at the time of survey, with potential commuting and foraging potential for otter assessed as poor-moderate. Habitat for kingfisher commuting and foraging were assessed as poor, with occasional perches but a lack of burrowing habitat due to rock armour along steep sided banks. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

Diversity and abundance of macroinvertebrates were moderate and high, respectively. The Q rating assigned to survey site GC 6 was **Q4 –Good**, on the basis that at least 1 Group A taxon was present in ‘reasonable’ numbers relative to the rest of the sample. Group C ‘Pollution Tolerant’ taxa were the dominant pollution sensitivity group, making up ~82% of the sample. A single group D taxon was present in low numbers, while Group E ‘Most Pollution Tolerant’ taxa were absent. Results of kick sampling are summarised in Table 4-67.

Table 4-67. Results of macroinvertebrate sample at survey site GC 6

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Ecdyonurus sp.</i>	2
	<i>Heptagenia sp.</i>	1
	<i>Perla bipunctata</i>	3

Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	1
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	2
	<i>Chironomidae</i>	25
	<i>Elmidae</i>	3
	<i>Gammarus sp.</i>	2
	<i>Hydracarina</i>	1
	<i>Simuliidae</i>	20
Group D – Very Pollution Tolerant	<i>Asellus aquaticus</i>	4
Group E – Most Pollution Tolerant	-	-

4.1.2.7 GC Survey Site 7 (GC 7)

Survey site GC 7 was located along a section of the Inchireagh (EPA code: 20I08, IG Ref.: W 19801 56093). Properties of the watercourse at this sample location are provided in Table 4-68 below and a representative photograph of the survey site is shown in Plate 4-32.

This shallow, narrow, laterally confined section of **Eroding/Upland River (FW1)** was dominated by semi-compacted cobble substrate, with interstitial gravels. Flow was moderate velocity across riffle sequences. The channel was well shaded amongst thin strips of **(Mixed) broadleaved woodland (WD1)** along both banks, consisting of alder, downy birch (*Betula pubescens*) and holly. Bank top vegetation included male fern, hard fern, bramble and primrose, with Overleaf peltia (*Pellia epiphylla*) abundant on the low, exposed earthen banks. Common tamarisk-moss was abundant on both trees and banks.

Channel modifications were not know, with natural undercutting along both banks. An under-road two-span stone bridge culvert was present within the survey stretch, with the watercourse passing through the right-hand span only. A black pipe passed through the watercourse and under the culvert.

Cobbles and gravels were largely unsilted, with accelerating flows overtop. However, channel substrate was considered too coarse and compacted within a laterally confined channel to provide optimal spawning habitat for lamprey or salmonid species. Cobble riffle with diverse flow patterns and marginal shelter along undercut banks and overhanging vegetation provided moderate juvenile salmonid nursery habitat. Adult salmonid holding habitat was absent due to a lack of deeper water, while moderate marginal habitat was present for juvenile European eel. Fine sediment beds were absent from the survey stretch, with negligible lamprey nursery habitat, Negligibly wetted sections of watercourse under the box culvert may act as a barrier to migratory fish species.

Table 4-68. Properties of the watercourse at survey site GC 7

Properties	Record
Average Depth (m)	0.2
Average Bank Width (m)	1.0
Average Wetted Width (m)	0.8
Average Bank Height (m)	LHB 0.5 RHB 0.5
Flow	Moderate
Colour	Slight yellow colouration
Clarity	Very clear
Dominant Substrates	Boulder (> 128mm): 20% Cobble (>32–128mm): 50% Gravel (8-32mm): 20% Fine gravel (2-8mm): 10%
Substratum Condition	Semi-compacted



Plate 4-32. A representative picture of survey site GC 7

No otter signs were observed at survey site GC 7 at the time of survey, with potential commuting and foraging potential for otter assessed as poor as a result of the shallow watercourse and presence of a barrier in the form of partially unwetted under-road culvert. Habitat for kingfisher commuting and foraging were assessed as poor, with lack of any significant suitable burrowing habitat due to sloping, vegetated woodland watercourse banks. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

Kick sampling was performed across shallow cobble and gravel riffle. Diversity and abundance of macroinvertebrates were low. The Q rating assigned to survey site GC 7 was low **Q34 –Moderate** on the basis that at least one Group A ‘Very Pollution Sensitive’ taxa was present in ‘few-common’ numbers. Group B ‘Moderately Pollution Sensitive taxa’ were absent from the sample, while Group C ‘Pollution Tolerant’ taxa were the dominant pollution sensitivity group, making up ~77% of the sample. Group D was represented by one *Glossiphonidae sp.* leech, while Group E ‘Most Pollution Tolerant’ taxa were absent. Results of kick sampling are summarised in Table 4-69.

Table 4-69. Results of macroinvertebrate sample at GC 7

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Isoperla sp.</i>	1
	<i>Rhithrogena sp.</i>	2
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	2
	<i>Dicranota sp.</i>	1
	<i>Philopotamidae</i>	1
	<i>Polycentropodidae</i>	7
	<i>Simuliidae</i>	2
Group D – Very Pollution Tolerant	<i>Glossiphonidae</i>	1
Group E – Most Pollution Tolerant	-	-

4.1.2.8 GC Survey Site 8 (GC 8)

Survey site GC 8 was located along a section of the Inchireagh (EPA code: 20I12 IG Ref.: W 20000 56152). Properties of the watercourse at this sample location are provided in Table 4-70 below and a representative photograph of the survey site is shown in Plate 4-33.

Table 4-70. Properties of the watercourse at survey site GC 8

Properties	Record
Average Depth (m)	0.2
Average Bank Width (m)	3.0
Average Wetted Width (m)	1.0
Average Bank Height (m)	LHB 2.0 RHB 1.2
Flow	Fast-Torrential
Colour	Slight yellow colouration
Clarity	Very clear
Dominant Substrates	Bedrock: 45% Boulder (> 128mm): 25% Cobble (>32-128mm): 10% Gravel (8-32mm): 10% Fine gravel (2-8mm): 10%
Substratum Condition	Loose cobble and gravel within bedrock pools



Plate 4-33. A representative image of survey site GC 8

This survey site represented a steep, laterally confined section of **Eroding/Upland River (FW1)**, dominated by bedrock pools and steps, with marginal boulders and fine substrate accumulations within sheltered sections of pool. Flow was fast-torrential over the high gradient steps and falls at the time of survey, with water depth ranging from 0.2m in shallow flow over bedrock, up to 0.6m in the pool directly downstream of the raised, under-road box culvert, which may act as a complete barrier to upstream migrating fish. Water was very clear with a slight yellow colouration; no siltation was apparent in the watercourse with the exception of silt overlain channel substrate within the pool at the foot of the box culvert.

Upstream of the box culvert, the watercourse consisted of a steep gradient, highly modified section of stream through an ornamental garden, with high step water features, assessed as a complete barrier to fish species. Downstream of the box culvert, the right-hand earthen bank was heavily undercut.

The channel was well shaded downstream of the culvert, with a continuous treeline of hazel along the left-hand bank. Submerged instream macrophytes were absent in this stretch of high energy flow, but bryophytes including smaller lattice-moss (*Cinclidotus fontinaloides*) and long-beaked water feather-moss (*Rhynchostegium riparioides*) were present on boulders throughout the watercourse. Bankside vegetation included male fern, gorse, ivy and yellow pimpernel (*Lysimachia nemorum*). Habitats extending from the left-hand bank beyond the riparian treeline included bramble **Scrub (WS1)** and **Buildings and artificial surfaces (BL3)**, with **Improved agricultural grassland (GA1)** extending beyond the right-hand bank, with little-to-no riparian buffer between the watercourse and habitat from the right-hand bank.

The bedrock-boulder substrate and high-energy flow of the watercourse provided negligible lamprey or salmonid species spawning habitat at this survey site. Although localised slower flow may provide refuge amongst areas of marginal cobble and undercut banks, the step-pool features throughout the watercourse may limit accessibility for juvenile salmonid fish. Pools up to 0.4m within the watercourse (0.6m at the foot of the culvert) provided some localised deeper water for adult salmonids. However, the steep gradient and upland morphology of this channel may again limit access to these habitats by salmonids. Lamprey ammocoete nursery in the form of fine sediment beds in slower flowing areas of water were absent, while areas of limited marginal refuge for eel were also assessed as inaccessible for the species.



Plate 4-34. A representative picture of the under-road box culvert and raised apron at the upstream survey extent of GC 8.

No otter signs were observed at survey site GC 8 at the time of survey, with potential commuting and foraging potential for otter assessed as poor as a result of the upland, steep gradient nature of the watercourse, barriers to migration in the form of under-road culverts and upstream ornamental features within the river and overall poor fisheries habitat. Habitat for kingfisher commuting and foraging were assessed as poor, with a lack of significant suitable burrowing habitat. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

Kick sampling was performed across shallow cobble and gravel riffle. Diversity and abundance of macroinvertebrates were low. The Q rating assigned to survey site GC 8 was low **Q34 –Moderate** on the basis that one Group A ‘Very Pollution Sensitive’ taxa and one Group B ‘Moderately Pollution Sensitive’ taxa was present in ‘few-common’ numbers. Group C ‘Pollution Tolerant’ taxa were the dominant pollution sensitivity group, making up ~61% of the sample. Group D was represented by one *Glossiphoniidae sp.* leech and one *Naididae sp.*, while Group E ‘Most Pollution Tolerant’ taxa were absent. Results of kick sampling are summarised in Table 4-71.

Table 4-71. Results of macroinvertebrate sample at GC 8

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	<i>Ecdyonurus sp.</i>	4
Group B – Moderately Pollution Sensitive	<i>Limnephilidae</i>	1
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	3
	<i>Hydropsyche</i>	3
	<i>Philopotamidae</i>	1
	<i>Potamopyrgus antipodarum</i>	2
	<i>Zygoptera</i>	2
Group D – Very Pollution Tolerant	<i>Glossiphoniidae</i>	1
	<i>Naididae</i>	1
Group E – Most Pollution Tolerant	-	-

4.1.2.9 GC Survey Site 9 (GC 9)

Survey site GC 9 was located along a section of the Demesne, a tributary of the Bandon (EPA code: 20D16 IG Ref.: W 23433 54379). Properties of the watercourse at this sample location are provided in Table 4-72 below and a representative photograph of the survey site is shown in Plate 4-35.

Table 4-72. Properties of the watercourse at survey site GC 9

Properties	Record
Average Depth (m)	1.4
Average Bank Width (m)	4.0
Average Wetted Width (m)	3.5-3.8
Average Bank height (m)	LHB 1.0 RHB 0.8-1.0
Flow	Very slow flow
Colour	Brown
Clarity	Clear when undisturbed
Dominant Substrates	Cobble (>32-128mm): 20% Gravel (8-32mm): 20% Fine gravel (2-8mm): 20% Silt/Clay (<0.25mm): 60%
Substratum Condition	Loose



Plate 4-35. A representative picture of survey site GC 9

This section of **Depositing/Lowland River (FW2)** was characterised by deep, slow flowing water and soft-sediment channel bed substrate. The channel was naturally sinuous throughout the wider watercourse, with historically straightened sections of watercourse in the vicinity of the single-span concrete bridge structure. Concrete retaining walls extended from the bridge along approx. 10m of the banks.

Water was clear but brown in colour, with fine sediments and clay easily disturbed and remaining readily in suspension. Banks were earthen and historically embanked and featured wild angelica, creeping buttercup and marsh thistle, with encroaching eared and grey willow trees, gorse and bramble scrub along the left-hand bank, providing limited marginal shading. Areas further upstream of areas of willow and bramble scrub were largely unshaded. Habitats extending from both the right- and left-hand banks was **Improved agricultural grassland (GA1)**.

Emergent vegetation included occasional branched bur-reed (*Sparganium erectum*), Floating Sweet-grass (*Glyceria fluitans*), Brooklime (*Veronica beccabunga*) and Fool's-watercress (*Helosciadium nodiflorum*) with dense instream mats of Broad-leaved Pondweed (*Potamogeton natans*). Rough-stalked feather-moss (*Brachythecium rutabulum*) and pointed spear-moss (*Calliergonella cuspidata*) were present on boulders along the bank.

Lamprey and salmonid species spawning habitat were absent from the watercourse due to a lack of any clean, mobile, adequately sized gravels and prohibitively deep waters. Instream macrophyte may provide some localised refuge for juvenile salmonid nursery. However, the density of macrophytes which spanned the channel width limited the quality of juvenile salmonid habitat. Adequate river depth provided moderate holding habitat for adult salmonids (namely brown trout), while the slow flowing water with a high degree of instream vegetation may also provide moderate eel habitat, as well as overall moderate-good habitat for a range of coarse fish species. Habitat for lamprey ammocoetes in the form of well structured fine sediment beds were absent from the survey stretch at survey site GC 9.

No otter signs were observed at survey site GC 9 at the time of survey, with potential commuting and foraging potential for otter assessed as moderate and opportunistic. While this survey site exhibited some fisheries potential, dense mats of instream vegetation may preclude commuting and foraging of otter throughout the area. Habitat for kingfisher commuting and foraging were assessed as poor, with a lack of significant suitable burrowing habitat. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

Due to prohibitive depths, kick-sampling could not be performed. Consequently, sweep netting of instream vegetation was undertaken along the surveyed stretch. Due to the overall lotic, slow-imperceptibly flowing nature of the watercourse, as well as the inability to perform kick-sampling, the Q rating assigned to survey site GC 9 **Q3/0–Poor**. Group A ‘Very Pollution Sensitive’ taxa were absent. ‘Moderately Pollution Sensitive’ Group B was represented by a single taxon, while Group C ‘Pollution Tolerant’ taxa were the dominant pollution sensitivity group, making up ~95% of the sample. Group D and Group E ‘Most Pollution Tolerant’ taxa were absent. Results of kick sampling are summarised in Table 4-73.

Table 4-73. Results of macroinvertebrate sample at GC 9

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	<i>Leptophlebiidae</i>	2
Group C – Pollution Tolerant	<i>Chironomidae</i>	1
	<i>Corixidae</i>	3
	<i>Dysticidae</i>	20
	<i>Zygoptera</i>	15
Group D – Very Pollution Tolerant	-	-
Group E – Most Pollution Tolerant	-	-

4.1.2.10 GC Survey Site 10 (GC 10)

Survey site GC 10 was located along a section of the Underhill, a tributary of the Bandon (EPA code: 20U01 IG Ref.: W 24088 53055). Properties of the watercourse at this sample location are provided in Table 4-74 below and a representative photograph of the survey site is shown in Plate 4-36.

Table 4-74. Properties of the watercourse at survey site GC 10

Properties	Record
Average Depth (m)	0.1-0.4
Average Bank Width (m)	2.4-5.0
Wet Width (m)	2.4-5.0
Bank Height (m)	LHB 0.0 RHB 0.0
Flow	Very slow flow
Colour	Highly brown in colour
Clarity	Turbid
Dominant Substrates	Silt/Clay (<0.25mm): 100%
Substratum Condition	Loose

This highly modified section of **Depositing/Lowland River (FW2)** consisted of a wide, undefined channel with no perceptible flow. Water was brown in colour and turbid even when undisturbed, with fine sediments remaining readily in suspension. This section of watercourse meandered across an area of waterlogged **Wet grassland (GS4)**, with sections of the channel fully vegetated with species including brooklime, marsh bedstraw, meadowsweet, silver weed, cleaver, creeping buttercup, soft rush, bracken, creeping bent, germander speedwell (*Veronica chamaedrys*) and ribwort plantain. Willow (*Salix spp.*) trees were present occasionally throughout the wider wet grassland. Habitats extending beyond the undefined banks included **Recolonising bare ground (ED3)** and **Buildings and artificial surfaces (BL3)**.

At the upstream survey extent, the watercourse opened up into an area with reduced vegetation coverage underneath a concrete bridge structure, which flow terminating upstream of the bridge. The watercourse upstream of the bridge was diverted into a narrow, ditch-like watercourse. Channel substrate was composed entirely of loose clay and silt sediments, with coarse cobble or gravel substrates absent. Historic poaching at the watercourse margins was evident across the watercourse, with abundant fly tipping in the wider vicinity.

Overall, the highly modified nature of this watercourse, with uncontained channel margins provided poor fisheries habitat. A lack of any gravel substrate or suitable flow, and the presence of excessive mats of instream vegetation precluded any significant suitable spawning habitat for salmonid or lamprey species. Additionally, salmonid and lamprey nursery habitat were absent due to a lack of any coarse substrate refugia, diverse flow patterns or well-structured fine sediment beds, respectively. Adult salmonid holding habitat and European eel habitat was absent as a result of lack of adequate deep water and flows. This watercourse likely only provided suitable habitat for minnow and three-spined stickleback.



Plate 4-36. A representative picture of survey site GC 10

In the context of the close proximity between survey site GC 10 and GC 11 (GC 11 along the River Bandon), this watercourse may provide opportunistic poor otter habitat, with limited fisheries potential along the watercourse at GC 10. Habitat for kingfisher commuting and foraging were assessed as poor, with a lack of significant suitable burrowing habitat. However, similar to otter, the close proximity of survey site GC 10 to the mainstem River Bandon may see this watercourse used opportunistically for commuting throughout the wider area. No kingfisher burrows were identified in the vicinity of the survey site, and no kingfisher were observed utilising the watercourse at the time of survey.

Kick-sampling was carried out throughout soft sediment, with sweep netting throughout instream vegetation within the survey stretch. The Q rating assigned to GC 10 **Q2-3-Poor** on the basis that Group A 'Very Pollution Sensitive' taxa and Group B 'Moderately Pollution Sensitive' taxa were absent from the sample, while Group C 'Pollution Tolerant' taxa were the dominant pollution sensitivity

group, making up ~69% of the sample. Group D and Group E ‘Most Pollution Tolerant’ taxa were each represented by a single taxon. Results of kick sampling are summarised in Table 4-73.

Table 4-75. Results of macroinvertebrate sample at GC 10

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	-	-
Group C – Pollution Tolerant	<i>Bithyniidae</i>	2
	<i>Dysticidae</i>	1
	<i>Eiseniella sp.</i>	1
	<i>Gammarus sp.</i>	3
	<i>Hydracarina</i>	7
	<i>Lymnaeidae</i>	1
	<i>Planorbidae</i>	3
Group D – Very Pollution Tolerant	<i>Naididae</i>	7
Group E – Most Pollution Tolerant	<i>Chironomus sp.</i>	1

4.1.2.11 GC Survey Site 11 (GC 11)

Survey site GC 11 was located along a section of the mainstem River Underhill, a tributary of the Bandon (EPA code: 20B02 IG Ref.: W 24179 53024). Properties of the watercourse at this sample location are provided in Table 4-76 below and a representative photograph of the survey site is shown in Plate 4-37.

Table 4-76. Properties of the watercourse at survey site GC 11

Properties	Record
Average Depth (m)	1.0
Average Bank Width (m)	25.0
Average Wetted Width (m)	15.0-20.0
Average Bank Height (m)	LHB 0.5-1.2 RHB 1.4
Flow	Fast
Colour	Slightly brown
Clarity	Clear
Dominant Substrates	Boulder (> 128mm): 10% Cobble (>32–128mm): 30% Gravel (8-32mm): 30% Fine gravel (2-8mm): 30%
Substratum Condition	Semi-compacted

This section of **Depositing/Lowland River (FW2)** was in full spate at the time of survey, with fast flowing, deep water in excess of 1m through the centre of the channel. Channel substrate was a mixture of cobble, gravel and fine gravel deposits, with some larger boulder substrates occasionally through the channel. Siltation was not evident overtop of channel substrate. A 6-span bridge structure with five in-stream abutments and an associated concrete bridge apron was present within the survey stretch. The bridge apron was submerged at the time of survey and therefore did not pose a complete barrier to migratory fish species. Flow patterns consisted of smooth glide and riffle over areas of shallower marginal cobble and gravel deposits, with slower flowing impounded water around deposits of woody debris upstream of the bridge. The channel banks did not display any known modifications.

Earthen banks were undercut, with exposed cobble and boulder substrate and root structures from riparian treelines, consisting of ash, aspen (*Populus sp.*), basket willow (*Salix viminalis*), crack willow (*Salix fragilis*), eared willow, grey willow, hawthorn and sycamore. Bankside vegetation included hogweed (*Heracleum sphondylium*), creeping buttercup, nettle, bramble, ragwort, wood speedwell, ivy, guelder rose (*Viburnum opulus*), tufted hair-grass (*Deschampsia cespitosa*) and ribwort plantain, with

stands of the First Schedule and Third Schedule invasive species rhododendron (*Rhododendron ponticum*) along the bank tops. Other invasive species included cherry laurel (*Prunus laurocerasus*) and broad-leaved bamboo (*Sasa palmata*). Marginal and emergent macrophytes included watercress (*Nasturtium officinale*), with instream water crowfoot (*Ranunculus sp.*) throughout the channel. Treelines provided good marginal shading along both riverbanks, while the centre of the channel was largely unshaded due to average channel width of 25m. *Ranunculus sp.* coverage at this survey site is associated with the Annex I habitat '3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation'.

Habitats in the wider vicinity of the watercourse consisted of narrow strips of **Riparian woodland (WN5)** at the downstream survey extent, **Scrub (WS1)**, **Improved agricultural grassland (GA1)** and **Buildings and artificial surfaces (BL3)**

Large areas of marginal gravel and cobbles beds with swift flows overtop were present along the channel margins and assessed locally as moderate for spawning salmonid and lamprey species, with good connectivity throughout the wider River Bandon. Optimal spawning habitat was limited due to the semi-compacted nature of the channel substrate. Instream refuge was present abundantly instream in the form of vegetation coverage, substrate variability and associated flow pattern diversity across the channel and provided good juvenile salmonid nursery, particularly at the channel margins. Adult salmonid holding habitat assessed as good was present along the survey stretch, with deep pool and glide and overhanging tree bows upstream of the bridge. These areas of slow marginal flow, in conjunction with exposed root structures and encroaching bankside vegetation, provided moderate-good European eel habitat. Marginal fine sediment deposits were occasional along the survey stretch, providing localised moderate lamprey nursery habitat, although fast flows in the vicinity of the bridge may limit significant suitable lamprey ammocoete nursery habitat.

No otter signs were identified at survey site GC 11, although the mainstem Bandon provides excellent potential commuting and foraging habitat for these species. Earthen banks were either low and undercut or heavily vegetated, with no significant suitable kingfisher burrow habitat at GC 11. However, similar to otter, this uninterrupted stretch of **Depositing/Lowland River (FW2)** provided excellent potential foraging and commuting habitat for kingfisher, with perches available for fishing both upstream and downstream of the bridge. No kingfisher burrows were identified at survey site GC 11 at the time of survey and no kingfisher were observed at the time of survey.



Plate 4-37. A representative picture of survey site GC 11

Kick-sampling was carried out throughout cobble and gravel riffle in accessible depths along the left side of the channel. The Q rating assigned to survey site GC 11 **Q3–Poor** on the basis that Group A ‘Very Pollution Sensitive’ taxa were absent from the sample, Group B ‘Moderately Pollution Sensitive’ taxa were present in ‘few’ numbers across two taxa. Group C ‘Pollution Tolerant’ taxa made up ~53% of the sample, with 8 individuals across 7 taxa. Group D ‘Very Pollution Tolerant’ taxa made up ~27% of the sample, while Group E ‘Most Pollution Tolerant’ taxa were absent. Results of kick sampling are summarised in Table 4-77.

Table 4-77. Results of macroinvertebrate sample at GC 11

Indicator Group	Taxon	Abundance
Group A – Very Pollution Sensitive	-	-
Group B – Moderately Pollution Sensitive	<i>Glossomatidae</i>	1
	<i>Sericostomatidae</i>	2
Group C – Pollution Tolerant	<i>Baetis rhodani</i>	2
	<i>Limnius sp.</i>	1
	<i>Lumbriculidae</i>	1
	<i>Philopotamidae</i>	1
	<i>Potamopyrgus antipodarum</i>	1
	<i>Tipulidae</i>	1
	<i>Simuliidae</i>	1
Group D – Very Pollution Tolerant	<i>Glossiphonidae</i>	3
	<i>Naididae</i>	1
Group E – Most Pollution Tolerant	-	-

4.2

eDNA Results

Environmental DNA (eDNA) surveys were undertaken on watercourses at 12 no. Proposed Wind Farm survey sites and 9 no. Proposed Grid Connection survey sites (locations shown in Figure 1-1 and Figure 1-2). Survey sites were chosen to give the best chance of detecting eDNA of target species and to aid in determining approximate area of presence of such species if positive results were garnered.

Freshwater pearl mussel and white-clawed crayfish were tested for at each location, with positive freshwater pearl mussel results at survey sites GC 5 (12/12 replicates), GC 6 (4/12 replicates) and GC 11 (1/12 replicates). There were no positive results for freshwater pearl mussel eDNA at any of the Proposed Wind Farm survey sites. There were no positive results for white-clawed crayfish eDNA at any of the Proposed Wind Farm or Proposed Grid Connection survey sites.

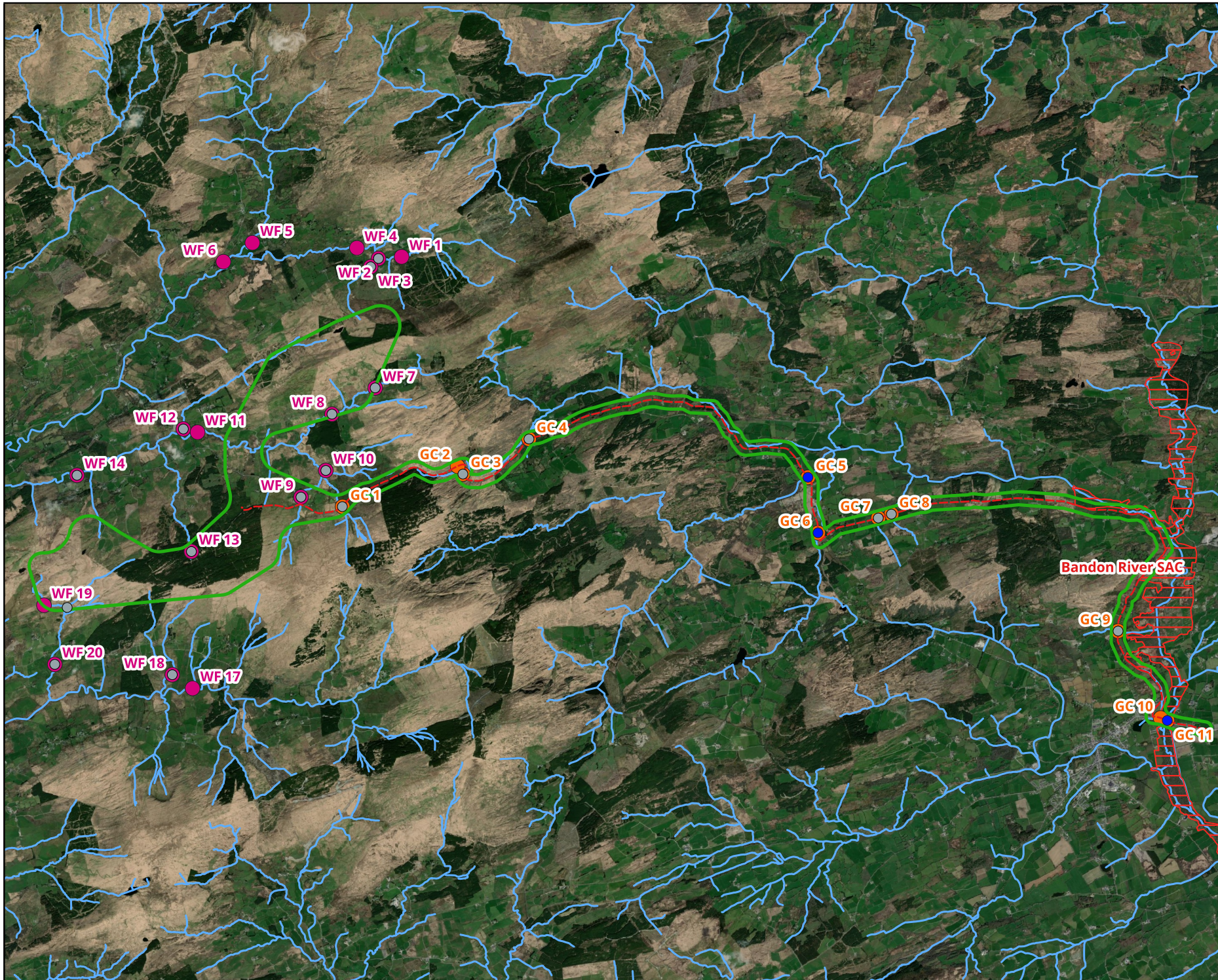
All eDNA results can be found in Appendix III. Freshwater Pearl Mussel eDNA results for survey sites are shown in Figure 4-1.

4.3

Otter Survey Results

Watercourses along the Proposed Wind Farm survey site and Proposed Grid Connection survey sites were surveyed for signs of otter.

Otter spraint was recorded at survey site WF 18. No other otter signs were recorded at the Proposed Wind Farm survey site or Proposed Grid Connection survey sites at the time of survey. No otter holts or couches were observed in the vicinity of the Proposed Wind Farm or Proposed Grid Connection survey sites at the time of survey.



Map Legend

- EIAR Site Boundary
 - Proposed Grid Connection Route
 - WFD River Waterbodies
 - Special Area of Conservation (SAC)
 - Proposed Wind Farm Survey Sites
 - Proposed Grid Connection Survey Sites
- Freshwater Pearl Mussel eDNA survey results
- Negative
 - Positive


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Drawing Title
Freshwater Pearl Mussel eDNA survey results

Project Title
Maughanaclea Renewable Energy Development

Drawn By NR	Checked By JH
Project No. 240225	Drawing No. Figure 4-1
Scale 1:75,000	Date 26.03.2026

5. DISCUSSION

5.1 Proposed Wind Farm Aquatic Baseline Assessment

Watercourses surveyed in the vicinity of the Proposed Wind Farm consisted primarily of **Eroding/Upland Rivers (FW1)**, with steep, headwater, bedrock-dominant morphology at survey sites WF 1 – WF 4, WF 8 – WF 10, WF 20 and WF 21, while survey sites WF 7 and WF 13 were upland, narrow, laterally confined peat streams within **Wet Heath (HH3)** and **Conifer Plantation (WD4)** habitats. Habitats surrounding the Proposed Wind Farm aquatic survey sites consisted predominantly of **Improved agricultural grassland (GA1)**, **Wet grassland (GS4)**, **Conifer Plantation (WD4)** and **Wet Heath (HH3)**. Survey sites WF 5 and WF 6 comprised sections of **Depositing/Lowland River (FW2)**, with slower flow and fine sediment-dominant channel substrate. Survey sites such as WF 11 and WF 15 exhibited some historic evidence of modification, with the placement of rock ramps laterally across the watercourse creating deep areas of slow, impounded flow, more typical of an FW2 section of river, within an otherwise FW1 watercourse. These survey sites also exhibited evidence of enrichment, with filamentous green algae atop channel substrate. WF 18 was the most highly modified survey site, with extensive bank alterations.

Survey sites WF 1 – WF 4 and WF 9 exhibited limited fisheries potential as a result of their upland gradient, torrential flows and headwater, often bedrock-dominant, channel morphology, which acted as natural barriers to migratory fish species. Survey sites WF 8, WF 10, WF 20 and WF 21 offered localised moderate-good fisheries habitat for juvenile brown trout. However, overall fisheries potential for a range of fish species and age classes was limited by inaccessibility as a result of the headwater location and bedrock cascade-pool-step features within the wider riverine landscape. The upland, narrow and laterally confined nature of the peat stream at WF 7 again limited fisheries potential for all species other than juvenile brown trout, while high degrees of modification at WF 13 and WF 18 likely precluded migratory fish access to these survey sites. The presence of an instream rock ramp spanning the channel at WF 11, in combination with downstream bedrock steps, cascades and falls, may limit connectivity for fish species. Survey sites WF 5, WF 6 and WF 16 provided the highest quality overall fisheries potential, with a range of instream habitat, diverse flow patterns and marginal refugia and shelter which provided fisheries habitat for several fish species.

Q-value scores calculated for the survey sites in the vicinity of the wind farm ranged from **Q2-3 – Poor** (WF 7 and WF 20) to **Q3-4 – Moderate**, **Q4 – Good** and **Q4-5 – High** (WF 5, WF 8, WF 10).

There were no positive results for freshwater pearl mussel or white-clawed crayfish eDNA at any of the wind farm survey sites.

No otter holts or couches were identified at the survey sites in the vicinity of the Proposed Wind Farm. Otter signs in the form of spraints were found at survey site WF 18, indicating that otter actively utilise the Gortnacowly (a tributary of the Mealagh River). Given the high fisheries potential and good connectivity of other survey sites within the vicinity of the Proposed Wind Farm, it is very likely that otter actively utilise these watercourses for commuting and foraging. No kingfisher burrows were observed utilising the watercourses in the vicinity of the Proposed Wind Farm survey sites, with no kingfisher burrows identified at the time of survey.

Proposed Grid Connection Aquatic Baseline Assessment

Watercourses surveyed as part of the Proposed Grid Connection (GC 1 – GC 8) were located along sections of **Eroding/Upland River (FW1)**, with survey sites GC 1 – GC 4 and GC 8 characterised by steep gradient, bedrock and boulder dominant watercourses, with poor accessibility for migratory fish species. Both survey site GC 2 and GC 4 exhibited signs of historic modification, with largely undefined channel margins as the watercourse meandered through the surrounding **Wet grassland (GS4)** habitats. Survey sites GC 9 – GC 11 were located along sections of **Depositing/Lowland Rivers (FW2)**.

Overall, survey sites GC 5 and GC 11 provided the overall highest quality fisheries habitat, with suitable gravel beds for spawning habitat, instream refuge for juvenile salmonids in the form of submerged vegetation coverage, substrate variability and associated flow pattern diversity across the channel, and suitable adult salmonid holding habitat, with deep pool and glide, particularly at the river margins adjacent to riparian treelines. Areas of slower flow, in conjunction with complex submerged features such as exposed root structures, also provided suitable European eel habitat. *Ranunculus sp.* coverage at survey sites GC 5 and GC 11 are associated with the Annex I habitat '3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation'.

In addition to wet grassland, habitats surrounding much of the grid connection survey sites consisted of **Improved agricultural grassland (GA1)**, **(Mixed) Broadleaved Woodland (WD1)**, **Riparian woodland (WN5)**, **Recolonising bare ground (ED3)** and **Buildings and artificial surfaces (BL3)**.

eDNA surveys conducted along the Proposed Grid Connection survey sites gave positive freshwater pearl mussel results at survey sites GC 5 (12/12 replicates), GC 6 (4/12 replicates) and GC 11 (1/12 replicates). There were no positive results for white-clawed crayfish eDNA at any of the Proposed Grid Connection survey sites.

No otter holts or couches were identified at the survey sites along the Proposed Grid Connection. No otter signs such as spraints or prints were identified at the survey sites at the time of survey. Given the high fisheries potential and good connectivity of survey sites such as GC 5 and GC 11, it is very likely that otter actively utilise these watercourses for commuting and foraging. No kingfisher burrows were identified utilising the watercourse along the Proposed Grid Connection, with no kingfisher burrows identified at the time of survey.

6.

CONCLUSION

This report provides a comprehensive baseline of aquatic habitats in the vicinity of the Proposed Project.

The aquatic baseline assessments for both the Proposed Wind Farm survey site and Proposed Grid Connection survey sites identified predominantly **Eroding/Upland Rivers (FW1)** with limited fisheries potential as a result of morphological constraints in the way of steep gradients, predominantly bedrock channel bed substrate, and barriers to fish migration in the form of cascade-pool-step and fall features at survey sites WF 1 – WF 3, WF 7, WF 9 and GC 1 – GC 4. Survey sites WF 5, WF 6 and GC 9 – GC 11 were located along sections of **Depositing/Lowland Rivers (FW2)**. Select survey sites (e.g., WF 5, WF 6, WF 16, GC 4 and GC 10) provided good quality fisheries value, exhibiting habitats suitable for a range of fish species, as well overall good suitable habitat for other aquatic species such as otter.

Evidence of historic bank (WF 18) or instream modifications with signs of enrichment (WF 11, WF 15) were recorded at several survey sites. Fisheries potential of survey sites such as WF 13 were limited by the wider highly modified conifer plantation habitat.

eDNA surveys conducted at survey sites within the vicinity of the Proposed Wind Farm provided negative results for both freshwater pearl mussel and white-clawed crayfish, with negative results for white-clawed crayfish along the Proposed Grid Connection survey sites. Positive results for freshwater pearl mussel occurred at Proposed Grid Connection survey sites GC 5, GC 6, and GC 11.

No otter holts, couches, or kingfisher burrows were identified at the survey sites at the time of survey, although otter activity was confirmed at WF 18 (spraint) and is considered likely across other survey sites which exhibited high connectivity and good fisheries potential.

Overall, while the majority of upland watercourses exhibited limited fisheries value due to natural morphological constraints and steep gradients, select reaches provided ecologically important habitat for salmonids, European eel and otter.

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APPENDIX I

ELECTROFISHING RESULTS AT PROPOSED WIND FARM SURVEY SITES



Appendix I: Electrofishing species records at survey locations in the vicinity of the Proposed Wind Farm					
Survey Location	Fish Species				
	European eel (<i>Anguilla anguilla</i>)	Brown trout (<i>Salmo trutta</i>)	Atlantic salmon (<i>Salmo salar</i>)	Minnow (<i>Phoxinus phoxinus</i>)	Three-spined stickleback (<i>Gasterosteus aculeatus</i>)
WF 1	—	—	—	—	—
WF 2	—	1	—	—	—
WF 3	—	—	—	—	—
WF 4	2 (missed*)	2 (missed*)	—	—	—
WF 5	2	4	6	—	—
WF 6	2	4	—	—	—
WF 7	—	2	—	—	—
WF 8	—	4	—	—	—
WF 9	Not fished due to deep water and torrential flow				
WF 10	—	2	—	—	—
WF 11	—	—	—	4	—
WF 12	—	2	—	—	—
WF 13	—	—	—	—	—
WF 14	2 (missed*)	6	—	—	—
WF 15	1	5	—	3	—
WF 16	6	2	7	21	—
WF 17	—	10	—	—	2
WF 18	—	—	—	—	—
WF 19	—	—	—	—	—
WF 20	—	1 (and 4 missed*)	—	—	—
WF 21	—	11	—	1	—

* Missed, i.e. not caught during electrofishing



APPENDIX II

**Q-VALUE RESULTS AT PROPOSED
WIND FARM AND PROPOSED GRID
CONNECTION SURVEY SITES**



Appendix II: Q-Values at all Survey Locations (Proposed Wind Farm and Proposed Grid Connection Underground Cable Route)	
Survey Location	Q-Value and WFD Status
Proposed Wind Farm	
WF 1	Q3 - 4 – Moderate
WF 2	Q4 – Good
WF 3	Q3 – Poor
WF 4	Q4 – Good
WF 5	Q4-5 – High
WF 6	Q4 – Good
WF 7	Q2-3 – Poor
WF 8	Q4-5 – High
WF 9	Not kick-sampled due to deep water and torrential flow
WF 10	Q4-5 – High
WF 11	Q3 – Poor
WF 12	Q3 – Poor
WF 13	Q3 – Poor
WF 14	Q3 - 4 – Moderate
WF 15	Q3 - 4 – Moderate
WF 16	Q4 – Good
WF 17	Q4 – Good
WF 18	Q3 – Poor
WF 19	Q2-3 – Poor
WF 20	Q4 – Good
WF 21	Q3 - 4 – Moderate
Proposed Grid Route	
GC 1	Q4 – Good
GC 2	Q3 – Poor
GC 3	Q3 – Poor
GC 4	Q3 – Poor
GC 5	Q4 – Good
GC 6	Q4 – Good
GC 7	Q3 - 4 – Moderate
GC 8	Q3 - 4 – Moderate
GC 9	Q3/0 – Poor
GC 10	Q2-3 – Poor
GC 11	Q3 – Poor



APPENDIX III

**eDNA RESULTS AT SELECT
PROPOSED WIND FARM AND
PROPOSED GRID CONNECTION
SURVEY SITES**

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Issue Date: 26.07.2024
Received Date: 12.07.2024

eDNA Report

Technical Report



SureScreen Scientifics

Folio No: 3134-2024
Purchase Order: 240225C
Contact: MKO
Issue Date: 26.07.2024
Received Date: 12.07.2024

eDNA Analysis

Summary

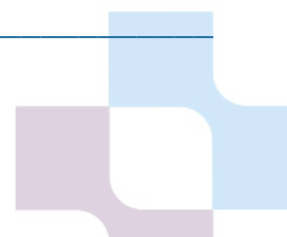
When aquatic organisms inhabit a waterbody such as a pond, lake or river they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm the presence or absence of the target species within the waterbody.

Results

Lab ID	Site Name	OS Reference	Target Species	Sample Integrity Check	Result	Positive Replicates
FK2164	GC 5	W 18713 56654	Freshwater pearl mussel	Pass	Positive	12
			White-clawed crayfish	Pass	Negative	0
FK2146	WF 3	W 12110 59894	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2159	GC 9	W 23450 54360	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2155	WF 9	W 11054 56408	Freshwater pearl mussel	Pass	Negative	0

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			White-clawed crayfish	Pass	Negative	0
FK2157	WF 8	W 11548 57631	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2167	GC 4	W 14516 57273	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2152	GC 11	W 24183 53018	Freshwater pearl mussel	Pass	Positive	1
			White-clawed crayfish	Pass	Negative	0
FK2149	WF 12	W 09303 57416	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2163	WF 10	W 07162 54765	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2162	GC 8	W 20006 56146	Freshwater pearl mussel	Pass	Negative	0
			White-clawed	Pass	Negative	0



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crayfish						
FK2160	WF 20	W 07328 53872	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2153	WF 14	W 07655 56729	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2147	WF 7	W 12181 58045	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2154	GC 7	W 19801 56085	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2148	WF 18	W 09100 53717	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2156	WF 2	W 12247 60012	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0



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FK2165	GC 6	W 18892 55836	Freshwater pearl mussel	Pass	Positive	4
			White-clawed crayfish	Pass	Negative	0
FK2151	WF 19	W 07513 54733	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2161	GC 1	W 11679 56223	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2158	GC Site 3 (repeat)	W 13518 56751	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0
FK2150	WF 13	W 09398 55571	Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Negative	0

Matters affecting result: none

Reported by: Chelsea Warner

Approved by: Chelsea Warner



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Methodology

Samples have been analyzed for the presence of target species eDNA following readily available and scientifically published eDNA assays and protocols.

The analysis is conducted in two phases. The sample first goes through an extraction process where the filter is incubated in order to obtain any DNA within the sample. The extracted sample is then tested via real-time PCR (also called q-PCR) for each of the selected target species. This process uses species-specific molecular markers (known as primers) to amplify a select part of the DNA, allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines amplification and detection of target DNA into a single step. With qPCR, fluorescent dyes specific to the target sequence are used to label targeted PCR products during thermal cycling. The accumulation of fluorescent signals during this reaction is measured for fast and objective data analysis. The primers used in this process are specific to a part of mitochondrial DNA only found in each individual species. Separate primers are used for each of the species, ensuring no DNA from any other species present in the water is amplified. If target species DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If target DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent the risk of false positive and false negative results. True positive controls, negative controls, and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared. Stages of the analysis are also conducted in different buildings at our premises for added security. SureScreen Scientifics Ltd is ISO9001 accredited and participates in Natural England's proficiency testing scheme for GCN eDNA testing.

Interpretation of Results

Sample Integrity Check: Laboratory Arrival:

When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results. Any samples which fail this test are rejected and eliminated before analysis.

Degradation and Inhibition check:

Analysis of the spiked DNA marker to see if there has been degradation or inhibition of the kit or sample, between the date it was made to the date of analysis. Degradation of the spiked DNA marker may indicate a risk of false negative results. If inhibition is detected, samples are purified and re-analyzed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result:

Presence of eDNA (Positive/Negative/Inconclusive)

Positive: DNA was identified within the sample, indicative of species presence within the sampling location at the time the sample was taken or within the recent past.

Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for species presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. Even a score as low as 1/12 is declared positive. 0/12 indicates negative species presence.

Negative: eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of species absence, however, does not exclude the potential for species presence below the limit of detection.

Inconclusive: Controls indicate inhibition or degradation of the sample, resulting in the inability to provide conclusive evidence for species presence or absence.