APPENDIX 6-3

AQUATIC BASELINE REPORT

Aquatic baseline report for the proposed Gannow Renewable Energy Development, Co. Galway

Triturus

Prepared by Triturus Environmental Ltd. for MKO

October 2024

Please cite as: Triturus (2024). Aquatic baseline report for Gannow Renewable Energy Development, Co. Galway. Report prepared by Triturus Environmental Ltd. for MKO. October 2024.

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by MKO to conduct baseline aquatic and fisheries surveys to inform EIAR preparation for the proposed Gannow Renewable Energy Development (hereafter referred to as the Proposed Project), located approximately 9.5km east of Athenry, Co. Galway (**Figure 2.1**). Undertaken on a catchment-wide scale, this report provides a baseline assessment of the aquatic ecology including fisheries, biological water quality, protected species and habitats in the vicinity of the Proposed Project. Aquatic surveys were undertaken in August 2024.

1.2 Project referencing

The Proposed Project will be known as the Gannow Renewable Energy Development and for the purposes of the EIAR:

- The 'Proposed Project' refers to the entirety of the project ('Proposed Wind Farm' and 'Proposed Grid Connection' as described below) for the purposes of this EIA in accordance with the EIA Directive. The Proposed Project is described in detail in Chapter 4 of this EIAR.
- The 'Proposed Wind Farm' refers to the 8 no. turbines and associated foundations and hardstanding areas, including access roads, underground internal cabling, permanent meteorological mast, temporary construction compounds, peat and spoil management, biodiversity enhancement, tree felling, site drainage, operational stage signage, 38kV onsite substation, and all ancillary works and apparatus.
    - The 'proposed turbines' refers to the 8 no. turbines associated with the Proposed Wind Farm as outlined above.
- The 'Proposed Grid Connection' refers to the 38kV underground cabling connection from the proposed onsite 38kV substation to the existing Cashla 220kV substation, and all ancillary works and apparatus.
- The 'Site' refers to the primary study area for the EIAR, as delineated by the EIAR Site Boundary in green as shown on Figure 1-1 of the EIAR and encompasses an area of approximately 884 hectares.
- The 'Proposed Wind Farm site' refers to the portion of the Site containing the proposed turbines and ancillary infrastructure but excluding the portion of the Site surrounding the Proposed Grid Connection.

1.3 Project description

A full description of the Proposed Project is provided in the accompanying Environmental Impact Assessment Report (EIAR).

2. Methodology

2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the Proposed Project were considered as part of the current assessment. This included sites in vicinity of the proposed EIAR Site Boundary (the Site), inclusive of watercourse crossings associated with the Proposed Wind Farm and the Proposed Grid Connection. Thus, a total of *n*=15 sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1**). The flow paths and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

The Proposed Project survey area is located in a lowland karstic area approximately 10km west of Athenry, Co. Galway within the Raford_SC_010 and Clarinbridge_SC_010 river sub-catchments (**Table 2.1, Figure 2.1**). Aquatic survey sites were present on the Raford River (EPA code: 29R01), Cappaghinanool Stream (29C60), Attimon Beg River (29A03), Clarinbridge River (20C02), Toorkeel Stream (29T06), Glennagloughaun Stream (29G17), Shoodaun River (29S03) and a small number of unnamed drainage channels (no EPA codes) (**Table 2.1**).

The Proposed Project and all associated infrastructure are not located within a European site, although there is downstream hydrological connectivity (via the Raford, Clarinbridge and Attimon Beg Rivers) with the Rahasane Turlough SAC (000322), Rahasane Turlough SPA (004089), Galway Bay Complex SAC (000268) and Inner Galway Bay SPA (004031).

Please note this aquatic baseline report should be read in conjunction with the final EIAR prepared for the Proposed Project. More specific aquatic methodology is outlined below and in the appendices of this report.

2.2 Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the Proposed Project site were conducted on the 20th and 21st August 2024. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Table 2.1, Figure 2.1**). Surveys at each of these sites included a fisheries assessment (electro-fishing and or fisheries habitat appraisal), white-clawed crayfish survey, macrophyte and aquatic bryophyte survey and (where suitable) biological water quality sampling (Q-sampling) and macro-invertebrate sweep sampling. This holistic approach informed the overall aquatic ecological evaluation of each site in context of the Proposed Project and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth, channel form) including associated evidence of historical drainage

- Substrate type and relative condition, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition and bordering land use practices

Table 2.1 Location of *n*=15 aquatic survey sites in the vicinity of the Site.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Raford River	29R01	Derrynamanagh	562418	729269
A2	Cappaghinanool Stream	29C60	Cappaghnanool	561859	729211
A3	Raford River	29R01	Island	564734	727097
A4	Raford River	29R01	Raford Bridge	560815	726125
A5*	Raford River	29R01	Clogharevaun	558099	724243
B1	Drainage channel	n/a	Cappanasruhaun	561111	730178
B2	Drainage channel	n/a	Cappanasruhaun	560745	729911
B3	Attimon Beg River	29A03	Cappanasruhaun	560491	729895
B4	Attimon Beg River	29A03	Killimor	559830	728139
B5	Attimon Beg River[1]	29A03	Kiltullagh North	556958	725406
C1	Clarinbridge River	29C02	Ballynanulty	558407	730750
C2	Drainage channel	n/a	Cloonkeenmore North	556926	730888
C3	Toorkeel Stream	29T06	Cloonkeenbeg	556151	730905
C4	Glennagloughaun Stream	29G17	Cloonkeenbeg	555618	730716
C5	Shoodaun River	29S03	Graigabbey Bridge	553061	730679

* indicates eDNA sampling for freshwater pearl mussel, white-clawed crayfish & crayfish plague

[1] Site B5 on the Attimon Beg River was dry at the time of the survey given the karstic nature of the channel at a swallow hole area

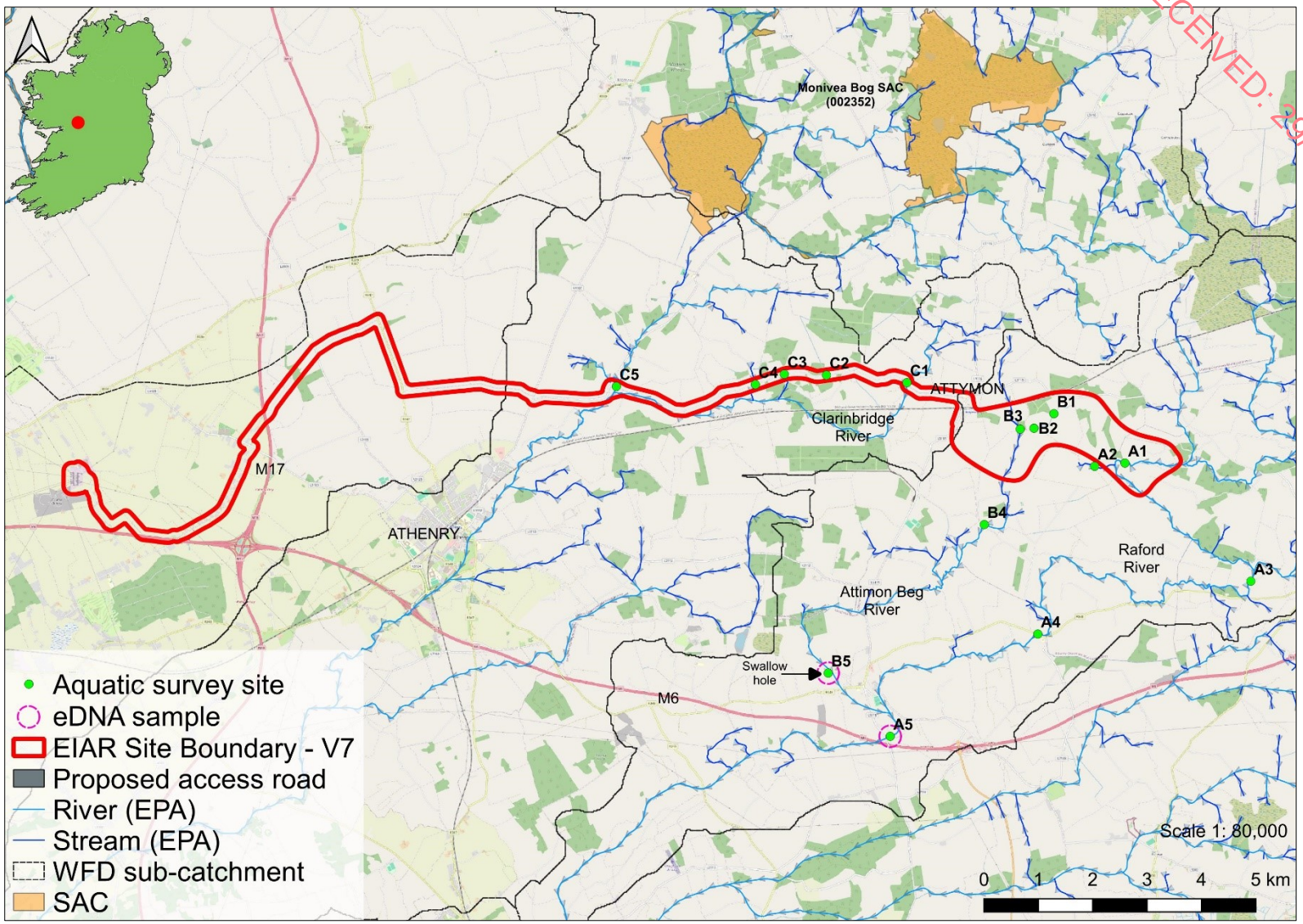

Figure 2.1 Overview of the aquatic survey sites in the vicinity of the Proposed Project site

2.3 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the Proposed Project site in August 2024 following notification to Inland Fisheries Ireland, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The survey was undertaken in accordance with best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of the aquatic survey sites was undertaken to establish their importance for salmonid, lamprey, European eel (*Anguilla anguilla*) and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites. For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix A.**

2.4 Biological water quality (Q-sampling)

Q-samples were collected from 14 of the 15 no. riverine survey sites (as site B5 was dry at the time of sampling). All samples were collected with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per EPA methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification to species level. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.2; Appendix B**). Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.2 Reference categories for EPA Q-ratings (Q1 to Q5) (Toner et al., 2005)

value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.5 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites during August 2024 under a National Parks and Wildlife (NPWS) open national licence (no. C20/2024), as prescribed by Sections 23 and 34 of the Wildlife Act (1976 to 2023), to capture and release crayfish to their site of capture. As per Inland Fisheries Ireland aquatic biosecurity recommendations, the crayfish sampling started at the uppermost site(s) of the Proposed Project site

catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical habitat attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider survey area was completed.

2.6 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the survey sites, with specimens collected (by hand or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species listed under the Flora (Protection) Order, 2022, Irish Red lists for vascular plants (Wyse-Jackson et al., 2016) and bryophytes (Lockhart et al., 2012) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

2.7 eDNA analysis

To validate site surveys and to detect potentially cryptically-low populations, composite water samples were collected from the Raford River (site A5 at Clogharevaun) in August 2024 and analysed for freshwater pearl mussel (*Margaritifera margaritifera*), white-clawed crayfish, crayfish plague (*Aphanomyces astaci*) (**Figure 2.1; Appendix C**).

In accordance with laboratory guidance, a composite (500ml) water sample was collected from the sampling point, maximising the geographic spread at the site (20 x 25ml samples at each site), thus increasing the chance of detecting the target species' DNA. 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 with 48 hours of collection. A total of *n*=12 qPCR replicates were analysed for the site. Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence (termed qPCR No Threshold, or qPCR NT). 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. Please refer to **Appendix C** for full eDNA laboratory analysis methodology.

2.8 Otter signs

The presence of otter (*Lutra lutra*) was determined through the recording of otter signs within 150m radius of each survey site. Notes on the age and location of signs (ITM coordinates) were made, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.).

2.9 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

2.10 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Care was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

3. Desktop review

3.1 Survey area description

The Proposed Project survey area is located in a lowland karstic area approximately 10km west of Athenry, Co. Galway within the Raford_SC_010 and Clarinbridge_SC_010 river sub-catchments (**Figure 2.1**). The watercourses and aquatic surveys sites in the vicinity of Proposed Project site are typically small, historically modified lowland depositing channels (FW2; Fossitt, 2000) which flow over areas of karstic Visean limestone and calcareous shale (Geological Survey of Ireland data). Land use practices in the wider survey area are dominated by pasture (CORINE 312) and peat bogs (412) with localised forestry (312 & 313).

3.2 Fisheries

The Clarinbridge (or Clarin) River is known to support Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), European eel (*Anguilla anguilla*) and lamprey (*Lampetra* sp.) with sea trout in the lower reaches (IFI data).

Approximately 1km east of Craughwell, the Raford River forms a confluence with the Dunkellin River (south of the Clarinbridge catchment). According to the fish counter data from 2024 (IFI, 2024), the Dunkellin River supports small runs of spring salmon (*n*=15), larger numbers of summer grilse (*n*=151) and small numbers of late summer salmon (*n*=12). The Dunkellin River also supports low densities of seatrout (*n*=46) based on the fish counter data. However, the Dunkellin River is not currently meeting the catchment wide electro-fishing (CWEF) mean minimum threshold of ≥17 salmon fry/ 5 min electro-fishing effort (mean 7.23 of salmon parr; TEGOS, 2023) indicating the numbers of salmon are below recommended conservation thresholds for open rivers for salmon angling. No other fisheries data was available for the remaining rivers in the study area.

3.3 Protected aquatic species

A comprehensive desktop review of available data from the National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC), Inland Fisheries Ireland (IFI), Botanical Society of Britain and Ireland (BSBI), National Crayfish Plague Surveillance Programme (NCPSP), EPA and Triturus databases for the 10km grid squares containing and adjoining the Proposed Project site (i.e. squares M52, M53, M62 & M63) identified records for a low number of rare and or protected aquatic species within the vicinity of the Proposed Project.

The Raford River, a tributary of the Dunkellin River, is known to support white-clawed crayfish (*Austropotamobius pallipes*) (EPA/NPWS/ NBDC data & pers. obs.) with records overlapping the survey area (e.g. site A3). White-clawed crayfish are also known from the Clarinbridge catchment to the north both upstream and downstream of the study area in 10km grid squares M52 and M63 (**Figure 3.1**).

Records for otter (*Lutra lutra*) were widespread in the Raford River catchment south of the M6 motorway with a paucity of records higher up in the catchment in the vicinity of the study area (**Figure 3.1**) (NPWS, NBDC & EPA data; **Figure 3.1**). A single record for otter was present in the Clarinbridge catchment south of the Proposed Grid Connection Route (**Figure 3.1**).

A review of the distribution of the NPWS Flora Protection Order Bryophytes database did not uncover any known records of protected bryophyte species in the study area. No Flora Protection Order macrophyte species such as narrow-fruited water-starwort (*Callitriche palustris*), short-leaved water-starwort (*Callitriche truncata*), red-listed stoneworts or other species of high conservation value were present within the study area on review of the BSBI Online Plant Atlas 2020.

3.4 EPA water quality data (existing data)

The following section outlines the available water quality data for the watercourses in context of the Proposed Project. Only recent water quality is summarised below. Contemporary EPA biological monitoring data was only available for the Raford River and Clarinbridge catchments. Please note that biological water quality analysis (Q-sampling) was also undertaken as part of this survey, with the results presented in the **section 4** and **Appendix B** of this report.

3.4.1 Raford River

There was 3 no. contemporary EPA biological monitoring stations located on the Raford (29R01) river catchment. In its upper reaches, the Attimon Beg River tributary achieved **Q4 (good status)** at station RS29R010100 on the Attimon Beg River. Station RS29R010300 downstream on the Raford River downstream also achieved **Q4 (good status)** during 2021. However, in the same year, at Raford Bridge (site A4 in the current survey) further downstream the river achieved **Q3-4 (moderate status)**. The Raford_030 and Raford_020 river waterbodies (upper reaches of the watercourse) overlapping the study area achieved good status in the 2016-2021 period.

3.4.2 Clarinbridge River

There was only a single contemporary EPA biological monitoring station on the upper Clarinbridge River (29C02) in vicinity of the Proposed Project survey area. The river achieved **Q4 (good status)** at station (RS29C020040) at a bridge site north of Ballyboggan (west of Cloonkeen) in 2021. The Clarinbridge_010 and Clarinbridge_020 river waterbodies (upstream of Athenry) achieved good status in the 2016-2021 period.

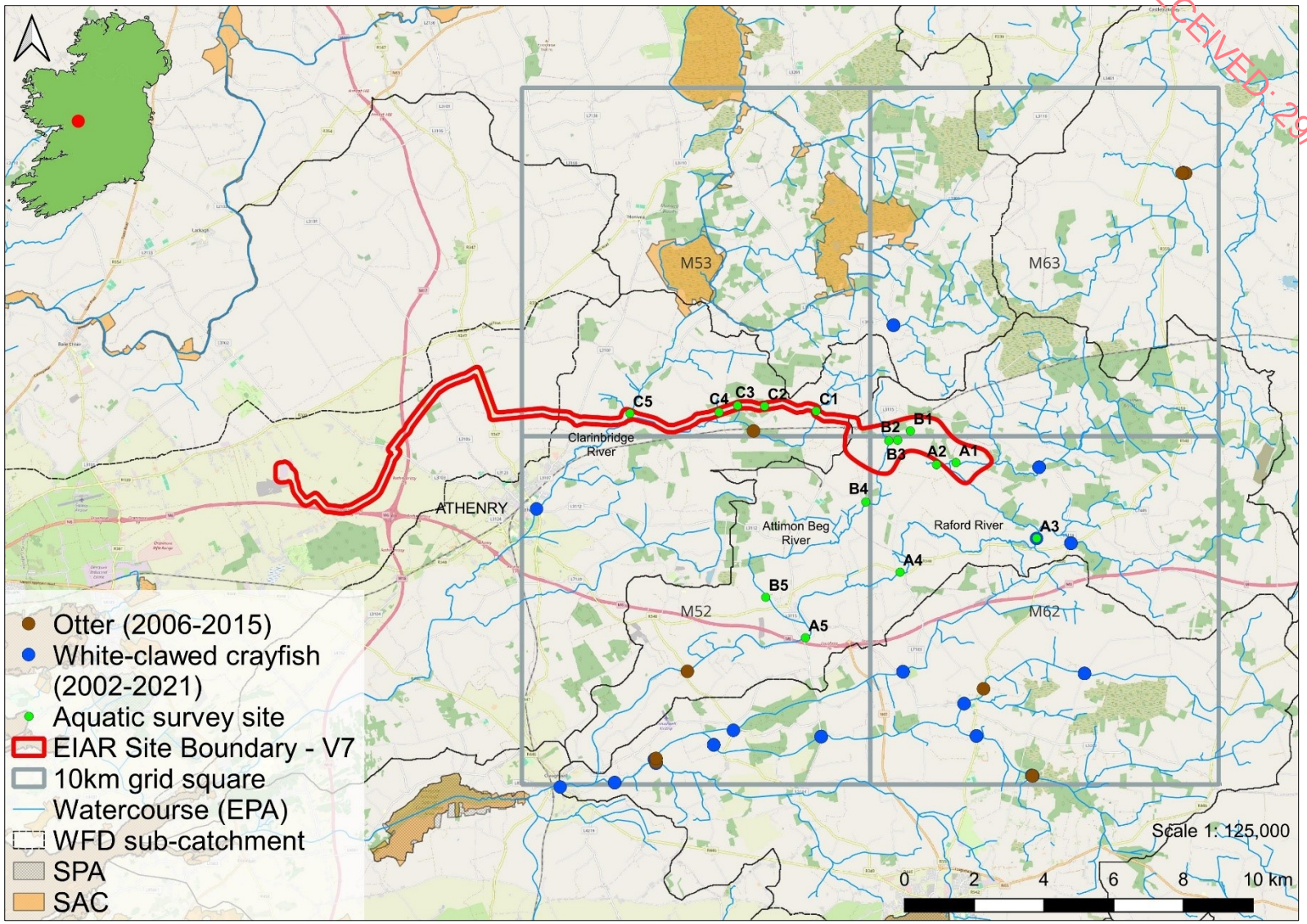

Figure 3.1 Selected protected aquatic species records in the vicinity of the Proposed Project (source: NPWS, NBDC, EPA & Triturus data)

4. Results of aquatic surveys

The following section summarises each of the *n*=15 survey sites in terms of physical characteristics, fisheries value, white-clawed crayfish, macrophyte/aquatic bryophyte communities and Annex I habitat associations. Biological water quality (Q-sample) results are also summarised for each riverine sampling site and in **Appendix B**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in August 2024. Please refer to **Appendix A** (fisheries assessment report) for more detailed fisheries results. A summary of the fish species recorded at each survey site is provided in **Table 4.2**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.3**. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.4**.

4.1 Aquatic survey sites

4.1.1 Site A1 – Raford River, Derrynamanagh

Site A1 was located on the upper reaches of the Raford River, a heavily modified lowland depositing river (FW2) that had been historically deepened. The river was 4-5m wide and between 0.2-0.8m deep with 1m high banks. The river anastomosed through dense beds of macrophytes and the substrata were dominated by compacted gravels, sand and silt. The bed suffered from high compaction and siltation. Filamentous green algae and floc cover was high c. 50% of the bed indicating high enrichment pressures. The river supported dense macrophyte cover including abundant common clubrush (*Schoenoplectus lacustris*) with occasional water mint (*Mentha aquatica*) and lesser water parsnip (*Berula erecta*). Broad-leaved pondweed (*Potamogeton natans*) and bright-leaved pondweed (*Potamogeton* x *nitens*) were occasional. The channel riparian areas supported occasional mature grey willow (*Salix cinerea* sp. *oleifolia*) with wet grassland characterised by yellow flag (*Iris pseudacorus*) , great willowherb (*Epilobium hirsutum*), meadowsweet (*Filipendula ulmaria*) and purple loosestrife (*Lythrum salicaria*). The channel was also bordered by wet pasture (GS4).

The Raford River at site A1 supported fair densities of minnow (*n*=14) with a low density of brown trout (*n*=2) and pike (*n*=2) (**Appendix A**). The river had been historically drained with poor spawning and nursery characteristics as the channel was dominated by slow moving glide with a heavily silted bed. The slow moving heavily vegetated channel was better suited to coarse fish than salmonid species. While some lower suitability for eel existed, no eel were recorded. The substrata were too compacted to support lamprey and the species was not recorded present. The channel had some good habitat for crayfish given soft banks and abundant macrophytes despite evident siltation pressures. A low density crayfish population was recorded (*n*=3). No otter signs were recorded but the channel likely supports commuting and foraging otter given evident prey resources and very limited disturbance.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (i.e. brown trout) and white-clawed crayfish and connectivity as an ecological corridor to other areas of the Raford River downstream, the aquatic ecological evaluation of site A1 on the Raford River was of **County Importance (Table 4.4).**

Plate 4.1 Representative image of the Raford River at site A1, Derrynamanagh, August 2024

4.1.2 Site A2 – Cappaghinanool Stream, Cappaghnanool

Site A2 was located on the upper reaches of the Capaghinanool Stream (29C60), a heavily modified U-shaped peatland channel. The lowland depositing channel (FW2) had been extensively straightened and deepened throughout, resulting in a homogenous channel and very poor hydromorphology. The channel was 1.5m wide and between 0.05-0.1m deep with 1.5m high banks. The flow profile was of very shallow slow moving glide with dark peat-stained water. The bed comprised exclusively of deep flocculent peat. The channel supported no macrophytes due to heavy shading and peat stained water. The channel riparian zone comprised of bracken (*Pteridium aquilinum*), bramble (*Rubus fruticosus* agg.), gorse (*Ulex europaeus*) and grey willow scrub. The bordering land use was of lowland blanket bog (PB3).

The peatland channel was not of fisheries value given very shallow water and poor flows and did not support fish (**Appendix A**). No fish or white-clawed crayfish were recorded given the poor quality of the channel. Given an absence of fish and crayfish the channel was not of value to otter. No otter signs were recorded present.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the very low aquatic value of the Cappaghinanool Stream (i.e. no fish, crayfish or aquatic habitat of high ecological value), the aquatic ecological evaluation of site A2 was of **local importance (lower value) (Table 4.4).**

Plate 4.2 Representative image of site A2 on the Cappaghinanool Stream, August 2024

4.1.3 Site A3 – Raford River, Island

Site A3 was located on the Raford River, a heavily modified, U-shaped lowland depositing watercourse (FW2) that had been extensively deepened and straightened. The river was 8m wide and between 0.5-1.4m deep with 1.5m high banks. Given historical drainage, the channel flow profile was dominated by deep and slow moving glide with occasional pool. The substrata were dominated by compacted boulder, cobble and bedded gravels. These had high siltation and compaction including infiltration. Filamentous green algae cover (c. 20%) was high despite the peat stained water supporting enrichment pressures. The river supported high cover of macrophytes characteristic of a drained channel including abundant common clubrush and branched bur reed (*Sparganium erectum*). Various-leaved pondweed (*Potamogeton gramineus*) was also locally frequent with occasional lesser-water parsnip. The aquatic moss species *Rhynchostegium riparioides* and *Leptodictyum riparium* were occasional on large boulder and cobble. The riparian areas supported mature ash (*Fraxinus excelsior*) and grey willow with wet grassland pockets (GS4) supporting great willowherb, meadowsweet, purple loosestrife, yellow flag, reed canary grass and wild angelica (*Angelica sylvestris*).

The Raford River supported a typical assemblage of fish associated with an enriched and historically modified limestone river. The deeper slow moving water was more suited to a coarse fish species including pike and minnow. However, the electro-fishing survey recorded small populations of large brown trout and adult European eel (**Appendix A**). The site was considered of moderate value as a brown trout holding habitat for adults given deep glide and pool with high macrophyte cover. The absence of clean gravels and cobbles with broken water precluded nursery and spawning habitat for

juvenile salmonids that was supported by their absence. Suitability for European eel was also very good deep pool refugia including boulders. This was supported by the moderate density of large adults recorded (**Appendix A**). The riverbed was too compacted to support lamprey and the species was not recorded. There was also moderate suitability for white-clawed crayfish given the presence of coarse limestone substrata with high macrophyte and bryophyte cover. However, this was compromised by historical channel drainage. A low density population of adult crayfish was recorded present (*n*=2). No European otter signs were recorded. However, the site is likely to support commuting and foraging otter given the prey resources present.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix C**). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of brown trout, Red-listed European eel and Annex II white-clawed crayfish the aquatic ecological evaluation of site A3 was of **County Importance (Table 4.4).**

Plate 4.3 Representative image of site A3 on the Raford River, August 2024

4.1.4 Site A4 – Raford River, Raford Bridge

Site A4 was located on the Raford River at Raford Bridge. The river was characteristic of a semi-natural upland eroding river (FW1) of moderate gradient with a meandering profile. The river was 10-12m wide and between 0.2-1m deep with 1.5m high banks. The river had exposed limestone bedrock with local cascading areas. Lower gradient pockets of riffle, glide and deep pool existed between these gradient drops. The substrata were dominated by compacted cobble and gravels. The substrata had siltation and compaction including infiltration. Filamentous green algae cover was c. 40% of the bed indicating high enrichment pressures. The river supported a good diversity of macrophytes including frequent curly pondweed (*Potamogeton crispus*), fine-leaved water-dropwort (*Oenanthe aquatica*),

common clubrush (*Schoenoplectus lacustris*), lesser water parsnip and various-leaved pondweed *(Potamogeton gramineus*). The river also supported occasional lesser pondweed (*Potamogeton pusillus*) and spiked water-milfoil (*Myriophyllum spicatum*). The exposed bedrock supported *Cinclidotus fontinaloides* with *Rhynchostegium riparioides*, *Fontinalis antipyretica and Leptodictyum riparium* on instream boulder and cobble. The community of macrophytes recorded was representative of the Annex I Habitat, floating river vegetation. The channel riparian areas supported mosaics of mature ash with wet grassland supporting species such as greater willowherb, meadowsweet, purple loosestrife and wild angelica.

The Raford River at site A4 supported a typical assemblage of fish associated with an enriched limestone river. This included large (well-conditioned) brown trout, Atlantic salmon, stone loach, minnow, pike and eel (**Appendix A**). The site was of good value as a salmonid habitat, with abundant instream boulders and cobble that supported a moderate density of mixed cohort brown trout and salmon. In shallow riffle areas below glide and pool, localised areas of clean cobble/ gravels provided moderate quality salmonid spawning and nursery habitat. Deeper pool and glide with overhanging ash provided valuable flow refugia and holding habitat for large adult brown trout. Suitability for European eel was also very good with ample cover and deep pool refugia and the species was recorded at low densities. The riverbed was too compacted to support lamprey and the species was not recorded present. There was also very high suitability for white-clawed crayfish given the presence of coarse limestone substrata with high macrophyte and bryophyte cover inclusive of mixed flow refugia. A moderate density population was recorded included adults and hatchlings (*n*=12). Otter latrine areas with mixed age (spraint) was present upstream of the bridge structure on the north bank.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Annex I floating river vegetation and Annex II white-clawed crayfish, Atlantic salmon in addition to red-listed European eel, the aquatic ecological evaluation of site A4 was of **County Importance (Table 4.4).**

Plate 4.4 Representative image of site A4 on the Raford River, August 2024

4.1.5 Site A5 – Raford River, Clogharevaun

Site A5 was located on the Raford River upstream of the M6 road crossing. The river was a heavily modified lowland depositing river (FW2). The channel had been historically deepened and straightened as part of historical drainage works. The river was 10-15m wide and between 0.2-1m deep with 2-3m high banks. The river bed supported boulder, cobble and mixed gravels. The substrata had high siltation and compaction. Filamentous green algae cover was high c. 40% of the bed indicating high enrichment pressures as with upstream. The river supported occasional curly pondweed (*Potamogeton crispus*), water-crowfoot (Ranunculus sp.) and various-leaved pondweed *(Potamogeton gramineus*). Instream boulders supported occasional *Rhynchostegium riparioides*, *Fontinalis antipyretica and Leptodictyum riparium.* The macrophyte community was too fragmented to be representative of Annex I floating river vegetation. The riparian areas where mainly open with abundant reed canary grass (*Phalaris arundinacea*) grass grading into heavily improved pasture (GA1). Mature ash were present on the west bank downstream of the bridge.

The Raford River at site A5 supported a fish composition characteristic of an enriched limestone river. This included brown trout, Atlantic salmon, stone loach, minnow, pike and eel. The site was of good value as a salmonid habitat, with abundant instream boulders and cobble that supported a moderate density of mixed cohort brown trout and salmon. The survey area also supported the highest density of salmon recorded during the survey (*n*=16) (**Appendix A**). The shallow riffle and glide areas supported pockets of clean cobble/ gravels that provided both moderate quality salmonid spawning and nursery habitat. Locally deeper pool and glide provided flow refugia and holding habitat for larger trout albeit these areas of habitat were more localised as reflected by the dominance of 0+ and 1+ salmonids rather than older fish. Suitability for European eel was good with ample cover in the rocky bed refugia. However, despite good quality habitat (i.e. refugia and prey resources) the species was only recorded at low densities. The riverbed was too compacted to support lamprey and the species

was not recorded present. There was also good suitability for white-clawed crayfish given the presence of coarse limestone substrata with macrophyte and bryophyte cover inclusive of mixed flow refugia. A low density population was recorded (*n*=2). The site had good suitability for foraging otter with a regular spraint site recorded under the bridge apron on boulders.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Annex II white-clawed crayfish, Atlantic salmon in addition to red-listed European eel, the aquatic ecological evaluation of site A4 was of **County Importance (Table 4.4).**

Plate 4.5 Representative image of site A5 on the Raford River, Clogharevaun, August 2024

4.1.6 Site B1 – drainage channel, Cappanarushaun

Site B1 was located on the upper reaches of drainage channel (FW4). The stagnant U-shaped channel was 1m wide with 1-2m high banks. The channel bed supported soft silt and peat with occasional cobble and gravel. The channel had peat stained water with pockets of macrophyte plants including occasional watercress (*Nasturtium officinale*), water forget-me-not (*Myosotis scorpioides*), fool's watercress (*Apium nodiflorum*) and common duckweed (*Lemna minor*).

The channel was not of fisheries value apart from supporting a low density of three-spined stickleback (*Gasterosteus aculeatus*). The channel did not have suitability for white-clawed crayfish or otter and neither species was recorded present.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than

'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic habitats or species of high ecological value, the aquatic ecological evaluation of site B1 was of **local importance (lower value) (Table 4.4).**

Plate 4.6 Representative image of site B1 on an unnamed drainage channel, August 2024

4.1.7 Site B2 – drainage channel, Cappanarushaun

Site B2 was located on a drainage channel (FW4) downstream of site B1. The channel had been extensively deepened and straightened. The channel was 1m wide and 0.1-0.3m deep with 2m high banks. The flow profile comprised of stagnant peat-stained stagnant water at the time of the survey. The bed comprised of heavily bedded gravels in deep peat with very high siltation by eroded peat. The channel supported no macrophytes due to high shading. It was not of fisheries value given very shallow water and the absence of flowing water. The channel riparian zones comprised of wet scrub (WS1) with rushes (*Juncus* sp.), bramble, greater willowherb, meadowsweet, yellow flag, purple loosestrife and grey willow. The channel was bordered by degraded, historical cutover lowland blanket bog (PB3).

The channel had no fisheries value and no fish were recorded during the survey. No crayfish were recorded given the poor quality of the channel. Given an absence of fish and crayfish the channel was not of value to otter (no signs recorded).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic habitats or species of high ecological value, the aquatic ecological evaluation of site B2 was of **local importance (lower value) (Table 4.4).**

Plate 4.7 Representative image of site B2 on an unnamed drainage channel, Cappanasruhaun

4.1.8 Site B3 – Attimon Beg River, Cappanaruhaun

Site B3 was located on the upper reaches of the Attimon Beg River. The channel had been extensively deepened and straightened through peatland and coniferous afforested areas. The channel was 1m wide and 0.1-0.3m deep with 2.5m high banks. The flow profile comprised of very slow flowing glide dominated and peat-stained water at the time of the survey. The bed comprised of heavily bedded gravels in deep peat with very high siltation by eroded peat. The channel supported no macrophytes due to high shading. The Attimon Beg River was not of fisheries value given very shallow water, poor flows, high shading and historical drainage modifications that exacerbated siltation pressures (by peat erosion). The heavily overgrown channel riparian zones comprised of wet scrub (WS1) species including abundant rushes (*Juncus* sp.), greater willowherb, rosebay willowherb (*Chamaenerion angustifolium*), meadowsweet, yellow flag, purple loosestrife, wild angelica and bracken. The channel was bordered by mature Sitka spruce (*Picea sitchensis*) plantation areas (WD4).

The channel had no fisheries value and no fish were recorded during the survey (**Appendix A**). No crayfish were recorded given the poor quality of the channel. Given an absence of fish and crayfish the channel was not of value to otter (no signs recorded).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of habitats or species of high conservation value, the aquatic ecological evaluation of site B3 was of **local importance (lower value) (Table 4.4).**

Plate 4.8 Representative image of site B3 on the Attimon Beg River, August 2024

4.1.9 Site B4 – Attimon Beg River, Killimor

Site B4 was located on the Attimon Beg River (29A03), a heavily modified upland eroding river (FW1) flowing over a moderate gradient. The small river had been historically deepened but retained a semi-natural profile with riffle, glide and pool sequences. The river was 2-2.5m wide and between 0.1-0.5m deep with 1-1.5m high banks. The substrata were dominated by compacted small cobble, coarse gravels, sand and silt. Small boulders were present locally in deeper pool. The bed suffered from high compaction and siltation. Filamentous green algae cover was low <5% but floc cover was higher (c.20% of the bed) indicating enrichment pressures. The river supported no macrophytes due to heavy shading but did support the aquatic moss species *Cinclidotus fontinaloides* and *Rhynchostegium riparioides* on instream small boulder. The riparian areas supported mature alder with bramble and blackthorn (*Prunus spinosa*) scrub in the understories. The small river was bordered by improved pasture (GA1) and an amenity lawn (GA2) from an adjoining private residence.

The Attimon Beg River at site B4 supported abundant stone loach with only a single brown trout (**Appendix A**). The high abundance of stone loach with a low abundance of salmonids is a further indicator of enrichment (pers. obs.). While the river had some lower suitability for eel existed (i.e. coarse substrata and deeper pool) only a low density population was recorded. The substrata were too compacted to support lamprey and none were recorded. No crayfish population was present despite some localised suitability. The more limited cleaner coarse substrata including flow diversity reduced the quality of the habitat for the species. No otter signs were recorded but the channel likely supports commuting and feeding otter given the presence of fish prey resources.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of a low density of brown trout and red-listed European eel, the aquatic ecological evaluation of site B4 was of **local importance (higher value) (Table 4.4).**

Plate 4.9 Representative image of site B4 on the Attimon Beg River, Killimor, August 2024

4.1.10 Site B5 – Attimon Beg River (Swallow Hole), Kiltullagh North

Site B5 was located on the upper reaches of Attimon Beg River in a swallow hole depression containing no water at the time of the survey. The dry depression had a muddy base and very steep sided banks. The muddy base of the swallow hole supported abundant redshank (*Persicaria maculosa*). The channel was bordered by heavily improved pasture (GA1).

As the channel was dry there was no fisheries or aquatic value and it was not possible to collect biological water quality sample.

Given the absence of habitats or species of high conservation value, the aquatic ecological evaluation of site B5 was of **local importance (lower value) (Table 4.4).**

Plate 4.10 Representative image of site B5 at the swallow hole area on the Attimon Beg River, Kiltullagh North, August 2024

4.1.11 Site C1 – Clarinbridge River, Ballynaulty

Site C1 was located on the upper reaches of the Clarinbridge River (29C02) at a Proposed Grid Connection crossing. The watercourse was representative of a heavily modified lowland depositing river (FW2) that was extensively straightened and deepened. The river was 1.5m wide and between 0.2-0.5m deep with 1m high banks. The flow profile was dominated by deeper slow moving glide and pool with more localised riffle. The substrata were dominated by compacted cobble and gravels with high siltation including infiltration. There were localised areas of soft sediment adjoining macrophyte beds and in pool slacks. The channel supported high cover (c. 70%) cover of filamentous algae and floc. The channel supported occasional macrophytes comprising of fool's watercress, brooklime (*Veronica beccabunga*), watercress and water-starwort (*Callitriche* sp.). The channel margins were open and graded into bordering heavily improved pasture (GA1).

The Clarinbridge River at site C1 supported brown trout, minnow and three-spined stickleback. Despite very heavy modification the channel was a moderate quality brown trout nursery with a moderate-density mixed cohort population recorded (**Appendix A**). The deeper water with macrophyte refugia and a stoney bed (despite high enrichment and siltation pressures) supported cohorts of 0+ and 1+ brown trout. The localised shallow riffle areas below glide and pool also supported small pockets of cleaner cobble and gravels that provided localised spawning habitat. Deeper pool and glide supported some localised holding habitat for adult trout despite riparian clearance (evident tree removal) reducing the holding value (i.e. limited cover). Suitability for European eel was good with ample cover and deep pool refugia including fish prey food resources but the species was not recorded present. The riverbed was too compacted to supported lamprey and the species was not recorded. There was some suitability for white-clawed crayfish given the presence of

coarse substrata and macrophyte cover. However, the species was not recorded. No otter signs were recorded in vicinity of the site despite evident foraging value.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of brown trout populations in the Clarinbridge River the aquatic ecological evaluation of site C1 was of **local importance (higher value) (Table 4.4).**

Plate 4.11 Representative image of site C1 on the upper Clarinbridge River, Ballynaulty, August 2024

4.1.12 Site C2 – drainage channel, Cloonkeenmore North

Site C1 was located on a field drainage channel (FW4) at a Proposed Grid Connection crossing. The channel was 1.5m wide and between 0.05-0.1m deep with 1.5m high banks. The channel only supported stagnant pools of water with no flow between dense beds of macrophyte growth. The substrata were dominated by deep silt with scattered cobble and gravel. The channel supported occasional bulrush (*Typha latifolia*), water mint, great willowherb, yellow flag and meadowsweet. The riparian areas were open and graded into the adjoining wet pasture.

The watercourse did not have suitability for white-clawed crayfish and was not of fisheries value given it was an artificial channel supporting only pools of water.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic habitats or species of high conservation value, the aquatic ecological evaluation of site C2 was of **local importance (lower value) (Table 4.4).**

Plate 4.12 Representative image of site C2 on a drainage channel, Cloonkeenmore North

4.1.13 Site C3 – Toorkeel Stream, Cloonkeenbeg

Site C3 was located on the Toorkeel Stream (29T06) at a Proposed Grid Connection crossing. The survey area was representative of a modified lowland depositing stream (FW2) channel that was historically realigned and locally deepened. The stream was 1-1.5m wide and between 0.05-0.1m deep with 1m high banks. The flow profile was dominated by very shallow slow flowing riffle and glide. The substrata were dominated by compacted cobble and gravels with high siltation including infiltration. Filamentous algae cover was low c. 5% of the bed given peat stained water. The channel supported occasional emergent fool's watercress, brooklime, watercress and water mint. The riparian areas were open apart from scattered mature ash. They graded into the adjoining wet pasture (GA1).

The stream did not have suitability for crayfish and was not of fisheries value due to very poor summer flows with evident siltation pressures. No fish were recorded at site C3 apart from a low density three-spined stickleback population (**Appendix A**). No otter signs were recorded on the stream.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix C**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic habitats or species of high conservation value, the aquatic ecological evaluation of site C3 was of **local importance (lower value) (Table 4.4).**

Plate 4.13 Representative image of site C3 on the Toorkeel Stream, August 2024

4.1.14 Site C4 – Glennagloughaun Stream

Site C4 was located on the Glennagloughaun Stream (29G17) at a Proposed Grid Connection crossing. The stream was a heavily modified lowland depositing channel (FW2) that had been historically straightened and deepened. The stream was 1-1.5m wide and between 0.05-0.1m deep with 1m high banks. The flow profile was dominated by very shallow slow flowing riffle. The substrata were dominated by compacted cobble and gravels with high siltation including infiltration. Filamentous algae cover was high with c. 80% of the bed covered with algae and floc. The channel supported occasional emergent lesser water parsnip, water mint and water figwort on exposed cobble margins. The riparian areas supported scattered mature blackthorn, hawthorn and ash with bramble in the understories. The heavily modified stream was bordered by wet pasture (GA1).

No fish were recorded at site C4 (**Appendix A**). The small heavily modified stream had very poor summer flows with high siltation and enrichment pressures that created conditions inimical for fish. In light of the poor stream condition, no suitability for crayfish existed and the species was not recorded present. No otter signs were recorded.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic habitats or species of high conservation value, the aquatic ecological evaluation of site C4 was of **local importance (lower value) (Table 4.4).**

Plate 4.14 Representative image of site C4 on the Glennagloughaun Stream at Cloonkeenbeg, August 2024

4.1.15 Site C5 – Shoodaun River, Graigabbey Bridge

Site C5 was located on the Shoodaun River (29S03) at Graigabbey Bridge, a Proposed Grid Connection. The river was characteristic of a depositing river (FW2) channel that was historically straightened and deepened. The river was 4m wide and between 0.2-0.8m deep with 1.5m high banks. The flow profile was dominated by deeper slow moving glide and pool with more localised riffle. The substrata were dominated by compacted cobble and gravels with high siltation including infiltration. Filamentous algae (*Cladophora* sp.) was occasional in open areas of channel (<5%). There were localised areas of soft sediment adjoining macrophyte beds but these were either flocculent or compacted and superficial. The site featured a relatively high coverage of macrophytes characteristic of drained river channels including branched bur-reed and broad-leaved pondweed. The channel margins also supported occasional water-forget-me-not, water mint, water figwort (*Scrophularia auriculata*) and fool's watercress. Instream small boulder supported occasional *Rhynchostegium riparioides* and *Leptodictyum riparium* (the latter species being an indicator or enrichment). The liverwort *Pellia endiviifolia* was also occasional. The channel was too shaded and peat stained to support filamentous green algae. The riparian areas supported mature grey willow, sycamore and alder. The understories supported dense scrub comprising of scattered bramble, gorse, meadowsweet, purple loosestrife, wild angelica and yellow flag. The river was bordered wet pasture (GA1).

Brown trout were the only fish species recorded via electro-fishing at site C5. The site was of good value as a salmonid habitat, with abundant instream boulder and cobble supporting a low to moderate density of mixed cohort brown trout (**Appendix A**). In shallow riffle areas below glide and pool, localised areas of clean coarse substrata provided moderate quality salmonid spawning and nursery habitat. Deeper pool and glide with overhanging grey willow provided valuable flow refugia and holding habitat for adult brown trout. Suitability for European eel was good with ample cover and

deep pool refugia but the species was not recorded present. The riverbed was too compacted to supported lamprey and none were recorded. There was some suitability for white-clawed crayfish given the presence of coarse substrata and macrophyte cover. However, the species was not recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix C**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of a mixed cohort brown trout population the aquatic ecological evaluation of site C5 was of **local importance (higher value) (Table 4.4).**

Plate 4.14 Representative image of site C5 on the Shoodaun River at Graigabbey Bridge, August 2024

4.2 White-clawed crayfish

White-clawed crayfish were recorded at sites A1, A3, A4 and A5 on the Raford River. Low densities of crayfish were present at sites A1, A3 and A5 with moderate densities at site A4. No crayfish were recorded on the Attimon Beg (sites B1-B5) or Clarinbridge sub-catchments (sites C1-C5). However, despite an absence of records in the Clarinbridge survey areas (sites C1-C5), it is likely that crayfish are present downstream given the known historical distribution of the species in the lower Clarinbridge catchment including in the vicinity of Athenry (pers. obs.).

Plate 4.15 White-clawed crayfish captured at site A4 on the Raford River at Raford Bridge including adults and hatchlings

4.3 eDNA analysis

No freshwater pearl mussel eDNA was recorded at site A5 the lowermost aquatic survey site on the Raford River, in keeping with the known absence of the species in the catchment (**Appendix C**). However, 12 positive qPCR replicates out of 12 were recorded for white-clawed crayfish on the Raford River supporting the presence of the species. This was validated in the results of the physical site surveys for crayfish (i.e. the species was recorded at sites A1, A3, A4 & A5 on the Raford River). The invasive pathogen crayfish plague (*Aphanomyces astaci*) was not detected in the Raford River (**Table 4.1; Appendix C**).

Table 4.1 eDNA results for the Raford River, Co. Galway (positive qPCR replicates out of 12 in parentheses)

Site	Watercourse	Freshwater pearl mussel	White-clawed crayfish	Crayfish plague
A5	Raford River	Negative (0/12)	**Positive (12/12)**	Negative (0/12)

4.4 Invasive aquatic species

No aquatic invasive macrophyte plant species were recorded during the August 2024 surveys. However, two non-native invertebrate species were recorded during the survey. These were the New Zealand mud snail (*Potamopyrgus antipodarum*) and the North American amphipod *Crangonyx* sp.. The latter species was first detected in the Phoenix Park ponds in 1975 (Holmes, 1975) and is considered to be expanding its range in Ireland's inland waterways (Caffrey et al., 2008). This species was only present at site A4 on the Raford River at Raford Bridge.

The second non-native species, the New Zealand mud snail (*Potamopyrgus antipodarum*) is thought to have been introduced to Ireland in the early 19th century. It now has a ubiquitous distribution nationally (Anderson, 2016). This species was widespread in the Raford River, Clarinbridge and Attimon Beg sub-catchments (**Appendix B**).

4.5 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 14 no. riverine sites during August 2024 (**Appendix B**). Please note site B5 on the Attimon Beg River was situated in dry karstic channel connected to a swallow hole and therefore it was not possible to collect a biological water quality sample.

Two survey areas (site B4 on the Attimon Beg River) and site C5 on the Shoodaun River achieved **Q4 (good status)** (**Figure 4.1**). This was given the presence of the EPA group A (most pollution sensitive) flattened mayflies *Ecdyonurus dispar*, *Heptagenia sulphurea, Rhithrogena semicolorata* in fair numbers (5-10% of total abundance) (**Appendix B**).

Two survey sites on the Raford River sites (A3 & A4) and site C3 on the Toorkeel Stream achieved **Q3-4 (moderate status)** given the presence of low numbers of EPA group A mayflies and fair numbers of EPA group B mayflies (e.g. *Alainites muticus*) and stoneflies (i.e. *Leuctra fusca*) (**Appendix B**).

The remaining sites however (i.e. A1, A2, A5, B1, B2, B3 C1, C2 & C4) achieved **Q2-3 or Q3 (poor status)** based on a dominance of EPA group C species, including the mayflies *Baetis rhodani* and *Serratella ignita*. These sites also supported freshwater shrimp (*Gammarus duebeni*), chironomids (non-*Chironomus* sp.), New Zealand mud snail (*Potamopyrgus antipodarum*) and blackfly larvae (*Simulium* sp.) (**Appendix B**). These sites did not support any group A species and only low numbers or an absence of group B species.

The Q-ratings for sites A2, B1, B2, B3 and C2 were tentative only given the absence of riffle areas for sampling and poor flows (as per Toner et al., 2005).

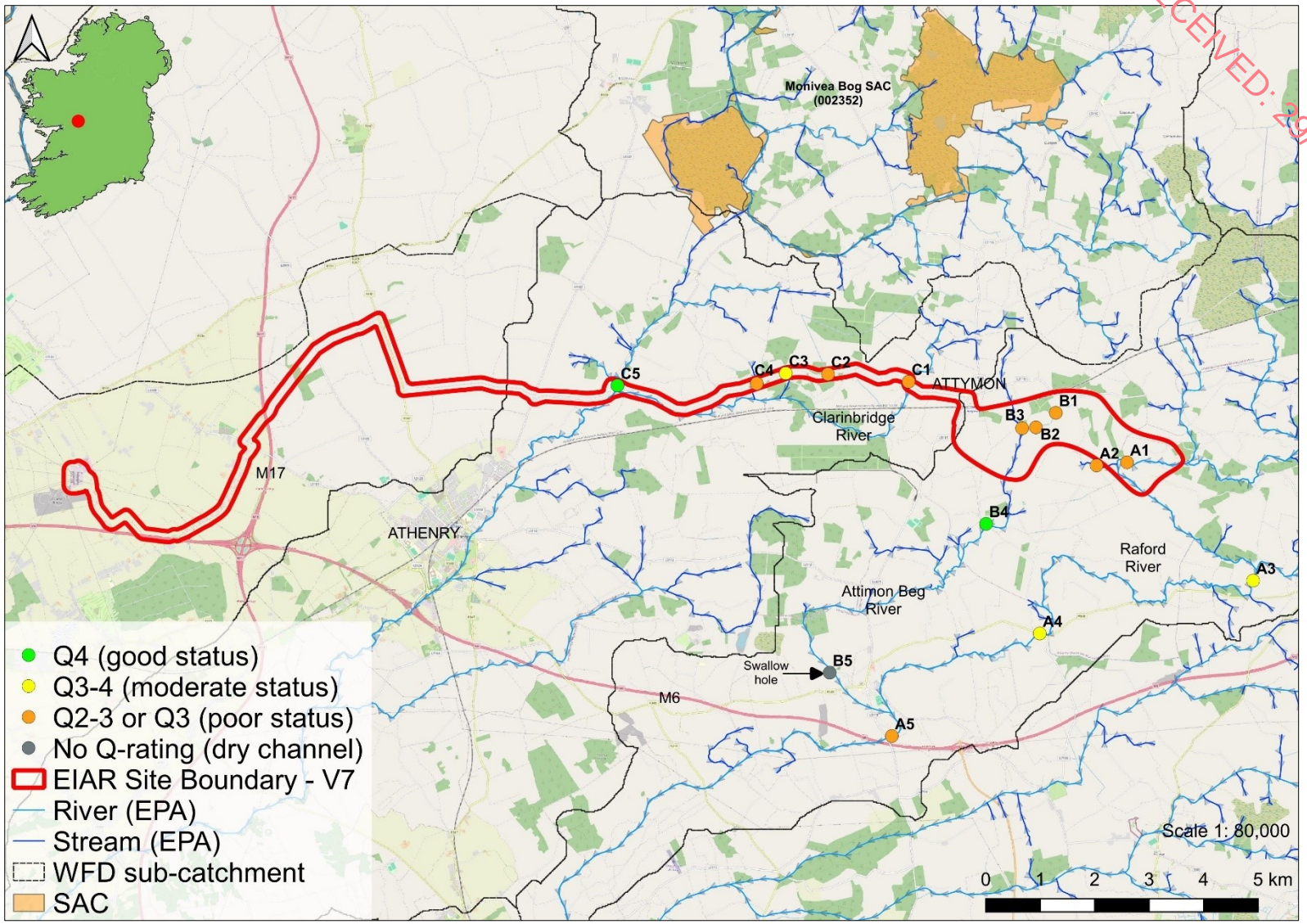

Figure 4.1 Overview of the biological water quality status in the vicinity of the Proposed Project site, August 2024

4.6 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of desktop review (i.e., presence of fish of conservation value), fisheries habitat assessments, the presence of protected or rare invertebrates (e.g. white-clawed crayfish), rare macrophytes and associated representations of Annex I habitats. Furthermore, biological water quality status also informed the aquatic evaluation should good or high status biological water quality be present (**Table 4.4**).

The Raford River at sites A1, A3, A4 & A5 was evaluated as **county importance** in terms of its aquatic ecology given the presence of Annex II white-clawed crayfish, Annex II Atlantic salmon, Red-listed European eel and locally (e.g. site A4) Annex I floating river vegetation habitat [3260].

Sites B4 (Attimon Beg River), C1 (Clarinbridge River) and C5 (Shoodaun River) were evaluated as of **local importance (higher value)** in terms of their aquatic ecology. This evaluation was due to the presence of brown trout population, European eel and or supporting good status (Q4) biological water quality.

The remaining sites 8 no. sites on drainage channels (B1, B2 & C2), Cappaghinanool Stream (A2), Attimon Beg River (sites B3 & B5), Toorkeel Stream (C3) and Glennagloughaun Stream (C4) were evaluated as **local importance (lower value)** given an absence of aquatic species or habitats of high conservation value and less than good status water quality.

Table 4.2 Relative abundance of fish species of higher conservation value recorded per survey site in the vicinity of the Proposed Project, August 2024

Site	Watercourse	Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	Other species
A1	Raford River	Not recorded	Low	Not recorded	Not recorded	Not recorded
A2	Cappaghnanool Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
A3	Raford River	Not recorded	Low	Not recorded	Moderate	Pike
A4	Raford River	Low	Medium	Not recorded	Low	Pike, stone loach, minnow
A5	Raford River	Medium	Medium	Not recorded	Low	Pike, stone loach, minnow
B1	Drainage channel	Not recorded	Not recorded	Not recorded	Not recorded	Three-spined stickleback
B2	Drainage channel	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
B3	Attimon Beg River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
B4	Attimon Beg River	Not recorded	Low	Not recorded	Low	Stone loach, three-spined stickleback
B5	Attimon Beg River (dry channel)	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
C1	Clarinbridge River	Not recorded	Medium	Not recorded	Not recorded	Minnow, three-spined stickleback
C2	Drainage channel	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
C3	Toorkeel Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
C4	Glennagloughaun Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
C5	Shoodaun River	Not recorded	Low	Not recorded	Not recorded	Not recorded

Table 4.3 Summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the Proposed Project, August 2024

Site	Watercourse	Freshwater pearl mussel	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
A1	Raford River	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	**White-clawed crayfish (low density)**	None recorded
A2	Cappaghnanool Stream	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
A3	Raford River	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	**White-clawed crayfish (low density)**	**European eel**
A4	Raford River	Not recorded, no suitability or records for species in catchment	**Spraint site**	**Floating river vegetation [3260]**	None recorded	**White-clawed crayfish (moderate density)**	**Atlantic salmon & European eel**
A5	Raford River	Not recorded, no suitability or records for species in catchment	**Spraint site**	Not present	None recorded	**White-clawed crayfish (low density)**	**Atlantic salmon & European eel**
B1	Drainage channel	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
B2	Drainage channel	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
B3	Attimon Beg River	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
B4	Attimon Beg River	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	**European eel**
B5	Attimon Beg River	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded (dry channel)
C1	Clarinbridge River	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
C2	Drainage channel	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
C3	Toorkeel Stream	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
C4	Glennagloughaun Stream	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded
C5	Shoodaun River	Not recorded, no suitability or records for species in catchment	No signs	Not present	None recorded	None recorded	None recorded

Conservation value: Eurasian otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive') and are protected under the Irish Wildlife Acts 1976-2023. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Atlantic salmon are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. Apart from the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout and coarse fish species have no legal protection in Ireland. [4] Otter signs within 150m of the survey site

Table 4.4 Aquatic ecological evaluation summary of the Gannow wind farm survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
A1	Raford River	**29R01**	**County importance**	Brown trout & crayfish recorded, connectivity as an ecological corridor with other high ecological value areas of the downstream connecting Raford River (i.e. sites A3, A4 & A5)
A2	Cappaghnanool Stream	29C60	Local importance (lower value)	No aquatic species or habitats of high conservation value
A3	Raford River	**29R01**	**County importance**	Red-listed European eel , brown trout & white-clawed crayfish recorded
A4	Raford River	**29R01**	**County importance**	Annex I floating river vegetation, Atlantic salmon, brown trout & Red-listed European eel recorded; utilisation by otter
A5	Raford River	**29R01**	**County Importance**	Atlantic salmon, brown trout & Red-listed European eel recorded; utilisation by otter
B1	Unnamed drainage channel	N/A	Local importance (lower value)	No aquatic species or habitats of high conservation value
B2	Unnamed drainage channel	N/A	Local importance (lower value)	No aquatic species or habitats of high conservation value
B3	Attimon Beg River	29A03	Local importance (lower value)	No aquatic species or habitats of high conservation value
B4	Attimon Beg River	29A03	**Local importance (higher value)**	Brown trout & Red-listed European eel recorded
B5	Attimon Beg River	29A03	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry channel)
C1	Clarinbridge River	29C02	**Local importance (higher value)**	Brown trout recorded
C2	Unnamed drainage channel	N/A	Local importance (lower value)	No aquatic species or habitats of high conservation value
C3	Toorkeel Stream	29T06	Local importance (lower value)	No aquatic species or habitats of high conservation value
C4	Glennagloughaun Stream	29G17	Local importance (lower value)	No aquatic species or habitats of high conservation value
C5	Shoodaun River	29S03	**Local importance (higher value)**	Brown trout recorded

Conservation value: Eurasian otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive') and are protected under the Irish Wildlife Acts 1976-2023. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Atlantic salmon are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations. Apart from the Inland Fisheries Acts 1959 to 2017, non-anadromous brown trout and coarse fish species have no legal protection in Ireland.

5. Discussion

The watercourses in the vicinity of the Proposed Project were typically lowland depositing channels and tributaries that had been historically modified. The hydromorphology of the Raford River, despite historical drainage, exhibited good flow heterogeneity and mixed rocky substrata. The moderate to good quality hydromorphology of the river overall (despite historical drainage, enrichment and siltation pressures) helped support moderate to good quality salmonid habitat, crayfish populations and localised Annex I, floating river vegetation. This was the highest quality aquatic habitat in the study area (**Tables 4.3 & 4.4**).

The upper Attimon Beg catchment (sites B1, B2 & B3) was heavily impacted by drainage works, including peat erosion (siltation) and enrichment pressures and was consequently of low ecological value. While site B4 on the Attimon Beg River supported a low density population of brown trout and European eel it was also evidently impacted by historical drainage, siltation and enrichment pressures. The Clarinbridge catchment also exhibited poor hydromorphology with the majority of the channels being of local importance (lower value) given the absence of any aquatic habitats or species of high conservation value, with exception of the Clarinbridge River (C1) and Shoodaun River (C5) that supported brown trout populations. The main aquatic habitats and species of ecological interest are described individually below, inclusive of the fisheries asset.

5.1 Fisheries

The Raford River was the best fisheries habitat in the study area supporting Atlantic salmon, European eel and brown trout populations (**Table 4.2**). The lower sites on the Raford River (i.e. sites A4 & A5) were the only sites in the study area to support Atlantic salmon.

Site A5 supported the highest density of salmon (*n*=16) (**Appendix A**). Apart from the Rafford River at sites A3, A4 and A5 that supported European eel, site B4 on the Attimon Beg River also supported the species. The highest density eel population was recorded at site A3 on the Raford River (*n*=5).

Brown trout populations were recorded at all sites on the Raford River (sites A1, A3, A4 & A5) but not on the Cappaghnanool Stream tributary (A2). Brown trout populations were also recorded on the Attimon Beg River (B4), Clarinbridge River (C1) and Shoodaun River (C5). The highest density brown trout population was recorded on the Shoodaun River (*n*=22).

Lamprey species were not recorded in the study area given sub-optimal habitat (limited spawning and suitable ammocoete burial habitat) due to historical drainage pressures and or watercourses of too high an energy. However, lamprey are known from the lower reaches of the Raford River and Clarinbridge River outside of the study area (pers. obs.).

5.2 Annex I floating river vegetation

The Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (commonly referred to as floating river vegetation) was recorded at site A4 on the Raford River. The aquatic vegetation community at this site supported several indicator species (EC, 2013) including *Potamogeton crispus*, *Potamogeton gramineus*, *Potamogeton pusillus* and

Myriophyllum spicatum. The Raford River at site A3 also supported the aquatic moss species *Cinclidotus fontinaloides, Rhynchostegium riparioides, Fontinalis antipyretica* and *Leptodictyum riparium*. The limited historical drainage near Raford Bridge resulted in improved hydromorphology that helped improve supporting conditions for the Annex I habitat.

5.3 Macro-invertebrates

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the samples taken from 14 no. riverine sites (1 no. site; B5 on the Attimon Beg River was dry) (**Appendix B**). With the exception of sites B4 (Attimon Beg River) and C5 (Shoodaun River) which achieved **Q4 (good status)**, all sites failed to meet the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). The remaining 12 no. sites achieved **Q3-4 (moderate status)** or **Q3/Q2-3 (poor status)** water quality. Significant siltation of the watercourses (primarily from peat drainage and agriculture) was noted during the surveys and, along with eutrophication and hydromorphological alterations (channelisation). These are known to be significant threats to water quality in the wider survey area (EPA, 2021).

5.4 White-clawed crayfish

White-clawed crayfish were recorded at all sites on the Raford River (i.e. sites A1, A3, A4 & A5). This was supported by the eDNA results that detected 12 positive replicates out of 12 for the species in the river. Furthermore, the river tested negative for crayfish plague indicating the importance of the river for the species. Crayfish plague is listed at one of the world's 100 worst invasive species (GISD, 2022; Lowe et al., 2000) and is becoming highly prevalent across Ireland. In modern times catchments free of plague are becoming increasingly rare and thus their importance cannot be underestimated.

Crayfish were not detected in the Cappaghinanool Stream (site A2), the Attimon Beg River catchment (sites B1-B5) and the Clarinbridge River catchment (sites C1-C5). While alkalinities were suitable to support the species (i.e. limestone) extensive historical drainage including of enrichment, siltation and other pressures may account for the species absence during the surveys.

5.5 Freshwater pearl mussel

Freshwater pearl mussel were not recorded from the survey area via eDNA sampling (**Appendix C**), in keeping with the absence of records for the Raford_SC_010 and Clarinbridge_SC_010 sub-catchments (NPWS data). The extensive historical drainage, enrichment and siltation pressures created conditions inimical for freshwater pearl mussel.

5.6 Otter

An otter latrine site (with fresh spraint) was identified at site A4 upstream of Raford Bridge supporting regular use (ITM 560817, 726146). Otter signs were also recorded on the Raford River on boulders under the R348 bridge crossing at site A5 on boulders (ITM 558096, 724246). At these locations superior fisheries habitats and higher fish densities provided greater foraging opportunities compared with many other survey sites. No breeding (holt) or couch (resting) areas were identified in the vicinity

of the survey sites during August 2024. Otter signs were not recorded in the vicinity of the remaining aquatic survey areas.

6. References

Byrne, A. W., Moorkens, E. A., Anderson, R., Killeen, I. J., & Regan, E. (2009). Ireland Red List no. 2: Non-marine molluscs. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government.

Caffrey, J.M., Coyne, J. & Gallagher, T. (2008). Ponds of the Phoenix Park: Current ecological status and future management. Report prepared by the Central Fisheries Board for the Office of Public Works. February 2008.

CEN (2003). Water Quality - Sampling of Fish with Electricity. Document CEN EN 14011:2000.

CFB (2008). Methods for the Water Framework Directive. Electric Fishing in Wadeable Reaches. Central Fisheries Board. Unpublished report.

Demers, A., Lucey, J., McGarrigle, M. L., & Reynolds, J. D. (2005). The distribution of the white-clawed crayfish, *Austropotamobius pallipes*, in Ireland. In Biology and Environment: Proceedings of the Royal Irish Academy (pp. 65-69). Royal Irish Academy.

EA (2003). River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003. Environment Agency, UK.

EPA (2021) WFD 3rd Cycle Draft Galway Bay South East Catchment Report (HA 29).

Feeley, H. B., Baars, J. R., Kelly-Quinn, M., & Nelson, B. (2020). Ireland Red List No. 13: Stoneflies (Plecoptera). National Parks and Wildlife Service.

Fossitt, J. (2000) A Guide to Habitats in Ireland. The Heritage Council, Ireland.

Foster, G. N., Nelson, B. H. & O Connor, Á. (2009). Ireland Red List No. 1 – Water beetles. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

GISD (2022). Global Invasive Species Database downloaded from http://www.iucngisd.org/gisd/100_worst.php on 06-10-2022.

Holmes, J.M.C. (1975) *Crangonyx pseudogracilis* Bousfield a freshwater amphipod new to Ireland. Irish Naturalists' Journal 18, 225-6.

IFI (2024) Inland Fisheries Ireland Summary Fish Counter Report 2023.

IFI (2010). Biosecurity Protocol for Field Survey Work. Available at http://www.fisheriesireland.ie/Invasive-Species/biosecurity-protocol-for-field-survey-work.html

Igoe, F. (2004). Introduction: Threatened Irish Freshwater Fishes. In Biology and Environment: Proceedings of the Royal Irish Academy (Vol. 104, No. 3, pp. 1-3). Royal Irish Academy.

Kelly-Quinn, M. & Regan, E.C. (2012). Ireland Red List No. 7: Mayflies (Ephemeroptera). National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

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

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012). Ireland Red List No.8: Bryophytes. National Parks and Wildlife

Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Lowe, S., Browne, M., Boudjelas, S., & De Poorter, M. (2000). 100 of the world's worst invasive alien species: a selection from the global invasive species database (Vol. 12). Auckland: Invasive Species Specialist Group.

Lucey, J., & McGarrigle, M. L. (1987). The distribution of the crayfish *Austropotamobius pallipes* (Lereboullet) in Ireland.

Marsh, J. E., Lauridsen, R. B., Gregory, S. D., Beaumont, W. R., Scott, L. J., Kratina, P., & Jones, J. I. (2020). Above parr: Lowland river habitat characteristics associated with higher juvenile Atlantic salmon (*Salmo salar*) and brown trout (*S. trutta*) densities. Ecology of Freshwater Fish, 29(4), 542-556.

McGinnity, P., Gargan, P., Roche, W., Mills, P. & McGarrigle, M. (2003). Quantification of the Freshwater Salmon Habitat Asset in Ireland using data interpreted in a GIS platform. Irish Freshwater Fisheries, Ecology and Management Series: Number 3, Central Fisheries Board, Dublin, Ireland.

Moorkens, E.A. & Killeen, I.J. (2020). Monitoring Populations of the Freshwater Pearl Mussel, *Margaritifera margaritifera*, Stage 3 and Stage 4 Survey. Irish Wildlife Manuals, No. 122. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.

Nelson, B., Ronayne, C. & Thompson, R. (2011). Ireland Red List No.6: Damselflies & Dragonflies (Odonata). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes. Revision 2, 1st June 2009. National Roads Authority, Dublin.

O'Reilly, P. (2009). Rivers of Ireland: A Flyfishers Guide (7th edition). Merlin Unwin Books. 416pp.

Pike, C., Crook, V. & Gollock, M. (2020). *Anguilla anguilla*. The IUCN Red List of Threatened Species 2020: e.T60344A152845178. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T60344A152845178.en.

Reynolds, J.D., Lynn, D., O' Keeffe, C. (2010). Methodology for Monitoring Irish Lake Populations of White-clawed Crayfish Austropotamobius pallipes (Lereboullet). Freshwater Crayfish 17:195–200.

TEGOS (2023). The Status of Irish Salmon Stocks in 2023 with Catch Advice for 2024. Report of the Technical Expert Group on Salmon (TEGOS) to the North-South Standing Scientific Committee for Inland Fisheries. 60 pp

Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., ... & MacGarthaigh, M. (2005). Water quality in Ireland. Environmental Protection Agency, Co. Galway, Ireland.

Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M., & Wright, M. (2016). Ireland red list no. 10: Vascular plants. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.

7. Appendix A – fisheries assessment report

Please see accompanying fisheries assessment report

Fisheries assessment of the proposed Gannow Renewable Energy Development, Co. Galway

Prepared by Triturus Environmental Ltd. for MKO

October 2024

Please cite as: Triturus (2024). Fisheries assessment of the proposed Gannow Renewable Energy Development, Co. Galway. Report prepared by Triturus Environmental Ltd. for MKO. October 2024.

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by MKO to undertake a baseline fisheries assessment of riverine watercourses in the vicinity of the proposed Gannow Renewable Energy Development (hereafter referred to as the Proposed Project), inclusive of the Proposed Wind Farm and Proposed Grid Connection. The Proposed Project is located approximately 9.5km east of Athenry, Co. Galway (**Figure 2.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the Proposed Project. In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the vicinity of the Proposed Project site, a catchment-wide electro-fishing survey and or fisheries appraisal across 15 no. riverine sites was undertaken (**Table 2.1; Figure 2.1**). Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, European eel (*Anguilla anguilla*) and lamprey (*Lampetra* sp.). The fisheries survey also documented other fish species of lower conservation value and helped to further inform impact assessment and any subsequent mitigation for the project.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the Proposed Wind Farm and Proposed Grid Connection options. The surveys were undertaken on the 20th and 21st August 2024.

1.2 Fisheries asset of the survey area

The Clarinbridge (or Clarin) River is known to support Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), European eel (*Anguilla anguilla*) and lamprey (*Lampetra* sp.) with sea trout in the lower reaches (IFI data).

Approximately 1km east of Craughwell, the Raford River forms a confluence with the Dunkellin River (south of the Clarinbridge catchment). According to the fish counter data from 2024 (IFI, 2024), the Dunkellin River supported small runs of spring salmon (*n*= 15), larger numbers of summer grilse (*n*=151) and small numbers of late summer salmon (*n*=12). The Dunkellin River also supported low densities of seatrout (*n*=46) based on the fish counter data. However, the Dunkellin River is not currently meeting the catchment wide electro-fishing (CWEF) mean minimum threshold of ≥17 salmon fry/ 5 min electro-fishing effort (mean 7.23 of salmon parr; TEGOS, 2023) indicating the numbers of salmon are below recommended conservation thresholds for open rivers for salmon angling. No other fisheries data is available for the remaining rivers in the study area.

2. Methodology

2.1 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on riverine watercourses in the vicinity of the Proposed Project in August 2024 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The catchment-wide electro-fishing (CWEF) survey was undertaken across 15 no. riverine sites (see **Table 2.1, Figure 2.1**). Please note one of these sites, B5 on the Attimon Beg River was dry at the time of the survey given the karstic nature of the channel and thus electro-fishing was not possible.

Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank. Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel was surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 40-75m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages. At certain sites with limited access (e.g. high average depths), it was more feasible to undertake electro-fishing for a 5-minute CPUE. Discrepancies in fishing effort (CPUE) between sites are provided in the results section (**Table 3.1**).

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the low to moderate conductivity waters of the sites (igneous geologies) a voltage of 250-300v, frequency of 35-45Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey

take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, 10-15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

2.2 Fisheries habitat appraisal

A fisheries habitat appraisal of all 15 no. aquatic survey sites was undertaken to establish their fisheries value. The surveys focused on evaluating the spawning, nursery and or holding habitat for salmonids and lamprey species but also considered European eel and other fish species. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.).

2.3 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Care was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

Table 2.1 Location of the *n*=15 electro-fishing and fisheries appraisal survey sites in the vicinity of the Proposed Wind Farm and Proposed Grid Connection.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Raford River	29R01	Derrynamanagh	562418	729269
A2	Cappaghinanool Stream	29C60	Cappaghnanool	561859	729211
A3	Raford River	29R01	Island	564734	727097
A4	Raford River	29R01	Raford Bridge	560815	726125
A5	Raford River	29R01	Clogharevaun	558099	724243
B1	Drainage channel	n/a	Cappanasruhaun	561111	730178
B2	Drainage channel	n/a	Cappanasruhaun	560745	729911
B3	Attimon Beg River	29A03	Cappanasruhaun	560491	729895
B4	Attimon Beg River	29A03	Killimor	559830	728139
B5	Attimon Beg River[1]	29A03	Kiltullagh North	556958	725406
C1	Clarinbridge River	29C02	Ballynanulty	558407	730750
C2	Drainage channel	n/a	Cloonkeenmore North	556926	730888
C3	Toorkeel Stream	29T06	Cloonkeenbeg	556151	730905
C4	Glennagloughaun Stream	29G17	Cloonkeenbeg	555618	730716
C5	Shoodaun River	29S03	Graigabbey Bridge	553061	730679

[1] Site B5 on the Attimon Beg River was dry at the time of the survey given the karstic nature of the channel at a swallow hole area

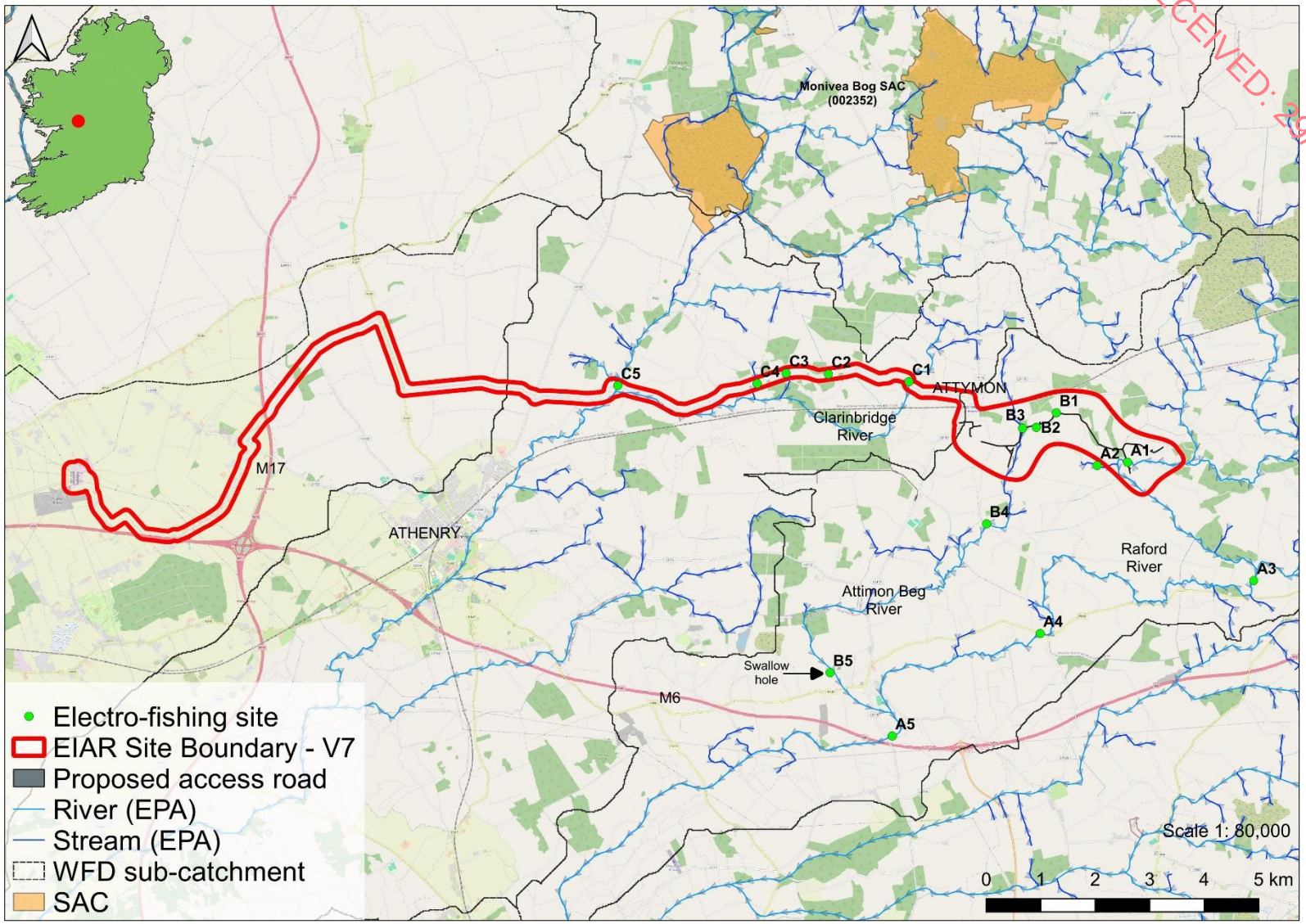

Figure 2.1 Overview of the *n*=15 electro-fishing & fisheries appraisal survey site locations for the Proposed Project, Co. Galway

3. Results

A catchment-wide fisheries survey of 15 no. sites in the vicinity of the Proposed Project was conducted between the 20th and 21st of August 2024 following notification to Inland Fisheries Ireland. The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery, spawning and or holding habitat for salmonids, European eel, lamprey and other fish species. Scientific names are provided at first mention only.

3.1 Fisheries assessment & appraisal

3.1.1 Site A1 – Raford River, Derrynamanagh

Site A1 was located on the upper reaches of the Raford River at Derrynamanagh, a heavily modified lowland depositing river (FW2) that had been historically deepened. The river anastomosed through dense beds of macrophytes. The river had been historically drained with poor spawning and nursery characteristics as the channel was dominated by slow moving glide with a heavily silted bed. Only a low density (*n*=2) adult brown trout were recorded present. The channel supported fair densities of minnow (*n*=14) and low density of pike (*n*=2) (**Figure 3.1**). The slow moving heavily vegetated channel was better suited to these species. While some lower suitability for eel existed no eel were recorded. The substrata were too compacted to support lamprey and none were recorded. The Raford River improved in character downstream i.e. sites A4 and A5 where the river became larger with improved flow diversity and bed condition (i.e. being a significantly better salmonid habitat).

Plate 3.1 Representative image of the Raford River at site A1, August 2024 (historically drained)

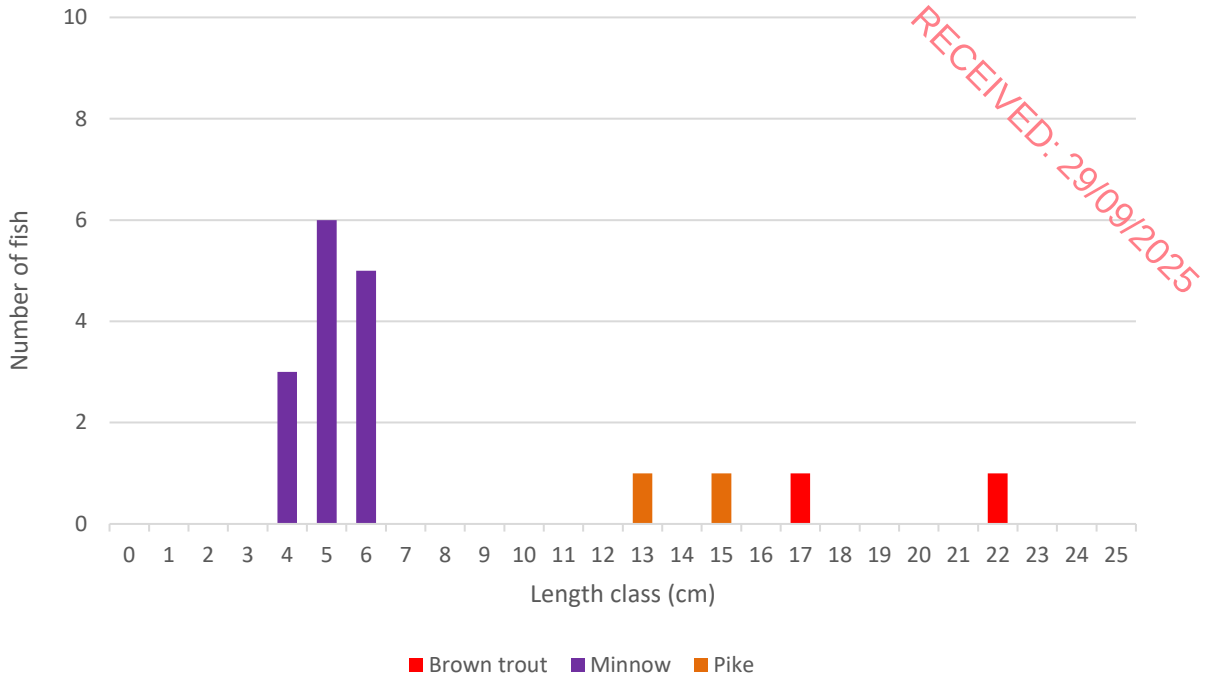

Figure 3.1 Length frequency distribution recorded via electro-fishing at site A1 on the Raford River, August 2024

3.1.2 Site A2 – Cappaghinanool Stream, Cappaghnanool

Site A2 was situated on a very heavily modified deep U-shaped lowland peatland stream channel (FW2). The channel had been extensively deepened and straightened adjoining peatland. It was 1.5m wide and between 0.05-0.1m deep with 1.5m high banks. The flow profile was of very shallow slow moving glide that stagnated in places. The bed comprised exclusively of deep peat with high peat staining and peat mobility observed. The channel supported no macrophytes due to heavy shading and peat stained water. No fish were recorded during the survey as the channel had very poor fisheries value overall.

Plate 3.2 Representative image of site A2 on the Cappaghinanool Stream, August 2024

3.1.3 Site A3 – Raford River, Island

Site A3 was located on the Raford River, at the townland of Island. The river was a heavily modified, U-shaped lowland depositing watercourse (FW2) that was extensively deepened and straightened. The Raford River supported a typical assemblage of fish associated with an enriched and historically drained limestone river. The deeper slow moving water was more suited to a coarse fish assemblage such as pike. However, the river also supported a low density of very large brown trout (*n*=4) and large adult European eel (*n*=5). The site was of moderate value as a brown trout holding habitat for adult fish given deep glide and pool with high macrophyte cover. The absence of clean gravels and cobbles with broken water precluded nursery and spawning habitat for juvenile salmonids that was supported by their absence (**Figure 3.2**). Suitability for European eel was also very good deep pool refugia including boulders. This was supported by the moderate density of large adults recorded. The riverbed was too compacted to support lamprey and the species was not recorded present. The presence of large eel and brown trout supports (**Plates 3.3 & 3.4**) the importance of the Raford River at site A3 as a holding habitat for adults. It also has good coarse fisheries value given the presence of pike. While not recorded during the current survey the deeper water likely also supports other coarse fish species such as roach (*Rutilus rutilus*) and perch (*Perca fluviatilis*).

Plate 3.3 Representative image of large adult European eel at site A3 on the Raford River, August 2024

Plate 3.4 Representative images of very large and well-conditioned brown trout from the Raford River, August 2024

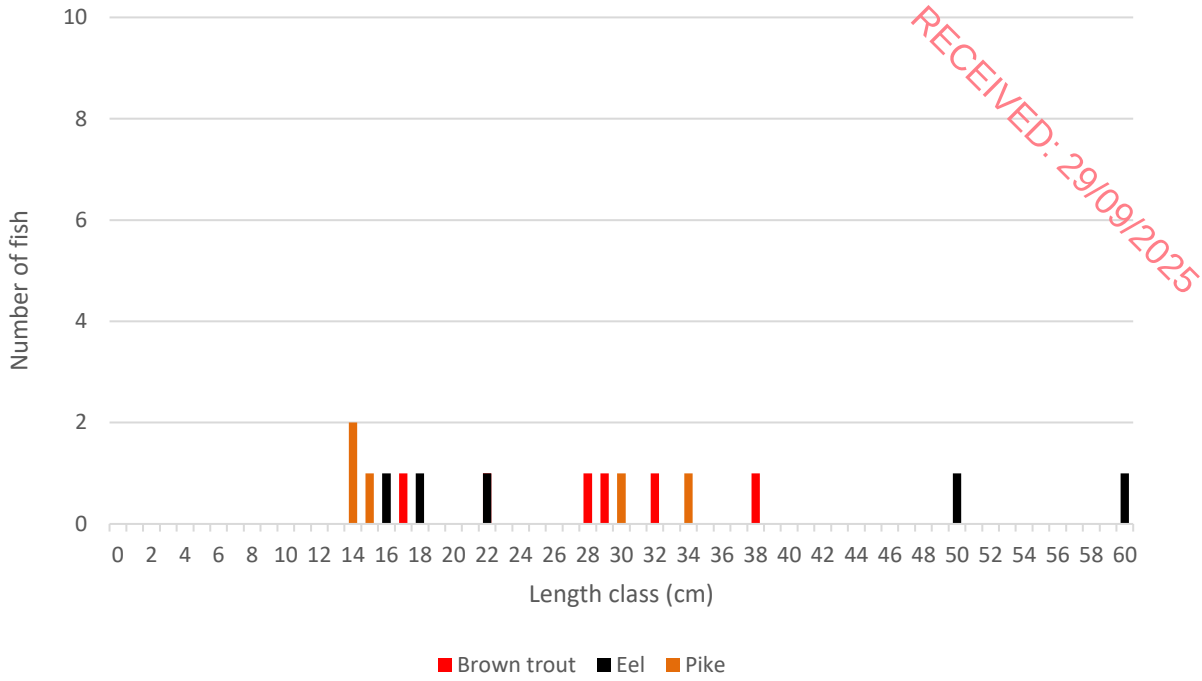

Figure 3.2 Length frequency distribution recorded via electro-fishing at site A3 on the Raford River, August 2024

3.1.4 Site A4 – Raford River, Raford Bridge

Site A4 was located on the Raford River, a semi-natural upland eroding river (FW1) of moderate gradient with a meandering profile over pockets of exposed limestone bedrock. The Raford River at site A4, supported a typical assemblage of fish associated with an enriched limestone river. The moderate densities of brown trout (*n*=19) included large (well-conditioned) fish (**Plate 3.5**) with low densities of Atlantic salmon (*n*=8). The site also supported low densities of stone loach (*n*=2), pike (n=2) and eel (*n*=2). Given evident enrichment the site supported high densities of minnow (*n*=28) (**Figure 3.3**).

Overall the site was of good value as a salmonid nursery habitat, with abundant instream boulders and cobble that supported shallow riffle areas below glide and pool with localised areas of clean cobble/ gravels. These provided moderate quality salmonid spawning and nursery habitat. Deeper pool and glide with overhanging ash provided valuable flow refugia and holding habitat for large adult brown trout. Suitability for European eel was also very good with ample cover and deep pool refugia. The riverbed was too compacted to support lamprey and the species was not recorded present. Overall, improved the good hydromorphology at site A4 at Raford Bridge over the other survey areas in the catchment provided the highest quality fisheries habitat within the study area.

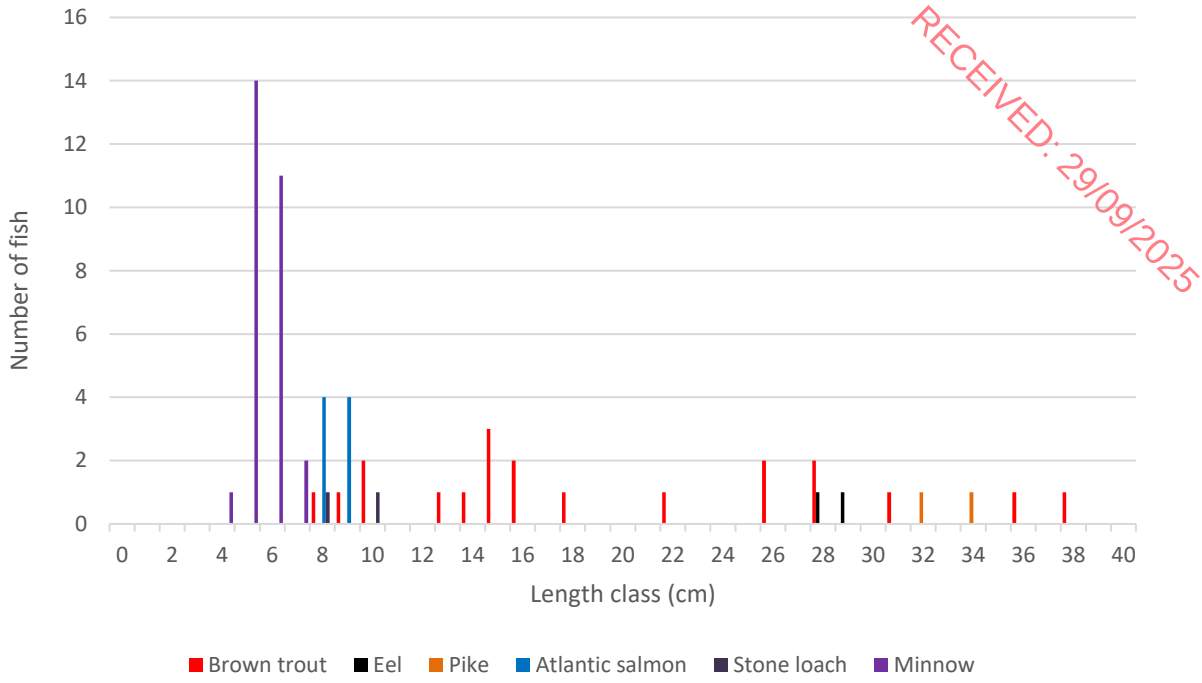

Figure 3.3 Length frequency distribution recorded via electro-fishing at site A4 on the Raford River, August 2024

Plate 3.5 Large trout and pike recorded from site A4 on the Raford River, August 2024

3.1.5 Site A5 – Raford River, Clogharevaun

The Raford River at site A5 was a heavily modified lowland depositing river (FW2) that had been historically deepened and straightened. Despite historical drainage the river retained a semi-natural profile and supported a fish composition characteristic of an enriched limestone river. This included brown trout, Atlantic salmon, stone loach, minnow, pike and eel. The site was of good value as a salmonid habitat, with abundant instream boulders and cobble that supported a moderate density of mixed cohort salmon parr (*n*=16) and lower densities of trout (*n*=4). The survey area supported the highest density of salmon recorded in the wider survey area (**Appendix A**). The shallow riffle and glide areas supported pockets of clean cobble/ gravels that provided both moderate quality salmonid spawning and nursery habitat. Locally deeper pool and glide provided flow refugia and holding habitat for larger trout albeit these areas of habitat were more localised as reflected by the dominance of 0+ and 1+ salmonids rather than older fish. Suitability for European eel was good with ample cover in rocky refugia . However, despite good quality habitat (i.e. refugia and prey resources) the species was recorded at low densities. The riverbed was too compacted to support lamprey and the species was not recorded present. Good densities of minnow (*n*=17) with lower densities of stone loach (*n*=2) and pike (*n*=1) were also recorded at the study area.

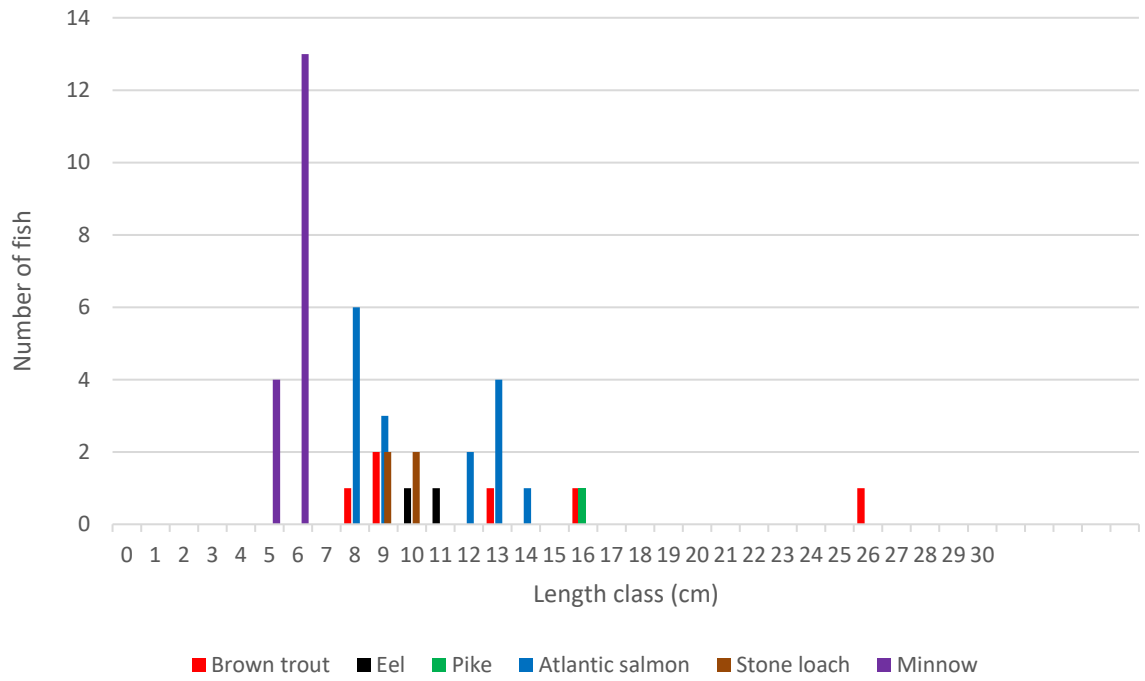

Figure 3.4 Length frequency distribution recorded via electro-fishing at A5 on the Raford River, August 2024

Plate 3.6 Mixed cohorts of Atlantic salmon 0+ and 1+ on the Raford River at site A5

3.1.6 Site B1 – Unnamed Drainage Channel, Cappanarushaun

Site B2 was located on an unnamed drainage channel (FW4) at Cappanarushaun, downstream of site B1. The channel had been extensively deepened and straightened. The channel was 1m wide and 0.1-0.3m deep with 2m high banks. The flow profile comprised of stagnant peat-stained stagnant water at the time of the survey. Given the poor quality fisheries habitat of the watercourse only low densities of three-spined stickleback (*n*=9) were recorded present (**Figure 3.3 & Plate 3.7**).

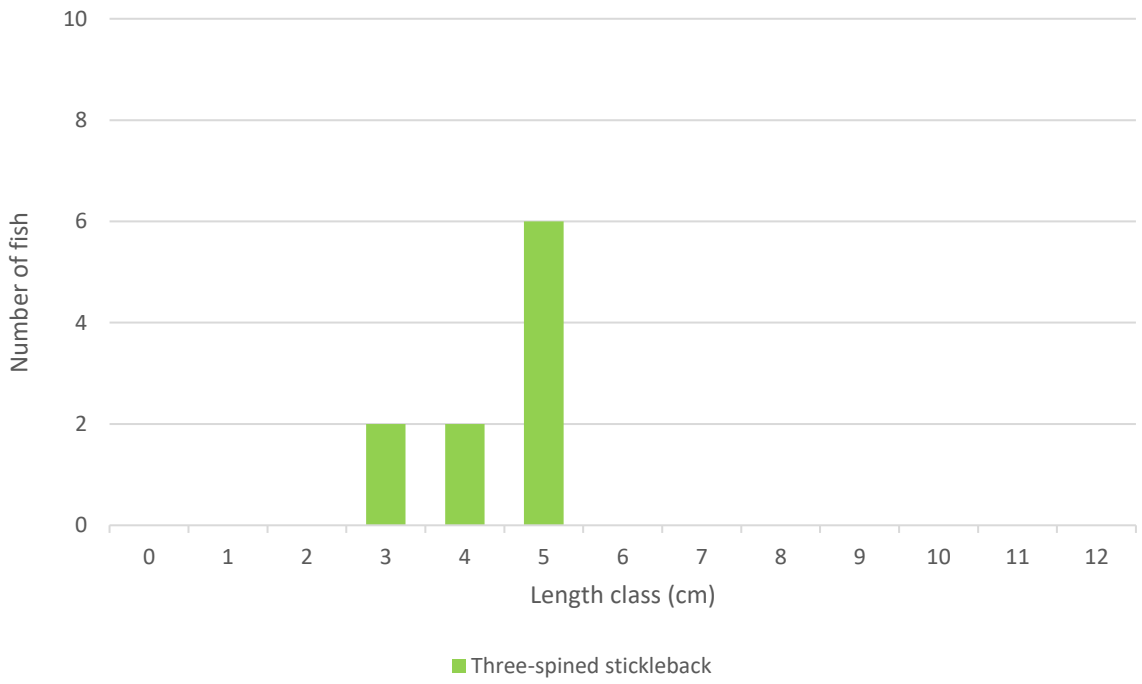

Figure 3.3 Length frequency distribution recorded via electro-fishing at site B1, August 2024

Plate 3.7 Three-spined stickleback recorded at site B1 on the unnamed drainage channel at Cappanarushaun, August 2024

3.1.7 Site B2 – Unnamed Drainage Channel, Cappanarushaun

Site B2 was located on an unnamed drainage channel (FW4) at Cappanarushaun, downstream of site B1. The channel had been extensively deepened and straightened. The channel was 1m wide and 0.1-0.3m deep with 2m high banks. The flow profile comprised of stagnant peat-stained water at the time of the survey. No fish were recorded during targeted electro-fishing. The poor channel hydromorphology, poor water quality, flows and small size of the channel precluded any fisheries value.

Plate 3.7 Representative image of site B2 on an unnamed drainage channel, Cappanarushaun, August 2024

3.1.8 Site B3 – Attimon Beg River, Cappanasruhaun

Site B3 was located on the upper reaches of the Attimon Beg River. The channel had been extensively deepened and straightened through peatland and coniferous afforested areas. The flow profile comprised of slow moving glide dominated peat-stained water at the time of the survey. No fish were recorded during targeted electro-fishing. The poor channel hydromorphology, poor water quality, flows and small size of the channel precluded any fisheries value.

Plate 3.8 Representative image of site B3 on Attimon Beg River, Cappanarushaun, August 2024

3.1.9 Site B4 – Attimon Beg River, Killimor

Site B4 was located on the Attimon Beg River (29A03) at Killimor, a heavily modified upland eroding river (FW1) flowing over a moderate gradient. The Attimon Beg River at site B4 supported abundant stone loach (*n*=11) with only a single juvenile brown trout recorded. The river had been historically deepened and the bed was compromised by heavy siltation and enrichment pressures. While lower suitability for eel existed (i.e. coarse substrata and deeper pool) only a low density population was recorded (*n*=2). Overall the stream had moderate fisheries value given it supported a low density brown trout population and red-listed European eel (**Figure 3.4 & Plate 3.9**).

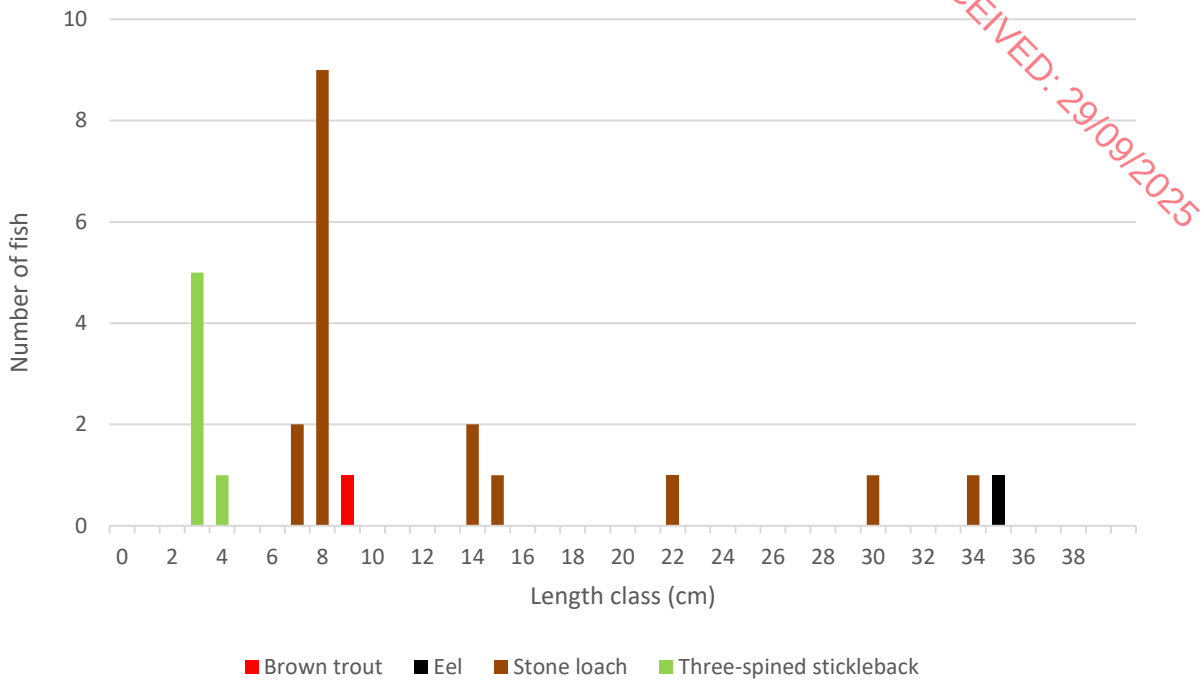

Figure 3.4 Length frequency distribution of fish recorded via electro-fishing at B4, August 2024

Plate 3.9 European eel recorded at site B4 on the Attimon Beg River, Killimor, August 2024

3.1.10 Site B5 – Attimon Beg River, Kiltullagh North

The Attimon Beg River at site B5 was situated in a seasonal (karstic channel) adjoining a swallow hole depression. Given the absence of water at the time of the survey the channel was not considered of fisheries value (**Plate 3.10**).

Plate 3.10 Site B5 on the Attimon Beg River was situated in a karstic channel near a swallow hole depression and was not of fisheries value

3.1.11 Site C1 – Clarinbridge River, Ballynanulty

Site C1 was located on the upper reaches of the Clarinbridge River (29C02) was representative of a heavily modified lowland depositing river (FW2) that was extensively straightened and deepened. Despite very heavy modification the channel was a moderate quality brown trout nursery with a moderate-density mixed cohort population recorded (**Appendix A**). The deeper water with macrophyte refugia and a stoney bed (despite high enrichment and siltation pressures) supported cohorts of 0+ and 1+ brown trout (*n*=15) (**Figure 3.5**). The localised shallow riffle areas below glide and pool also supported small pockets of cleaner cobble and gravels that provided localised spawning habitat. Deeper pool and glide supported some localised holding habitat for adult trout despite riparian clearance (evident tree removal) reducing the holding value (i.e. limited cover). The Clarinbridge River also supported moderate numbers of minnow (*n*=11) and low densities of three-spined stickleback (*n*=2). Suitability for European eel was good with ample cover and deep pool refugia including fish prey food resources but the species was not recorded present. The riverbed was too compacted to support lamprey and the species was not recorded.

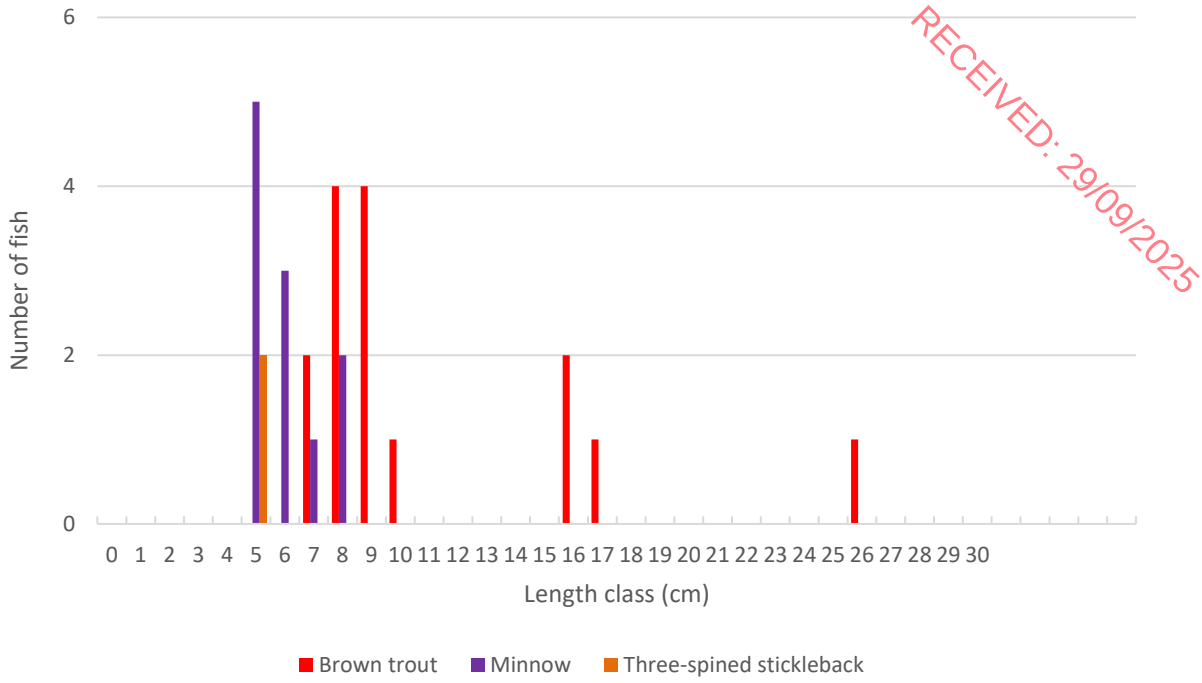

Figure 3.5 Length frequency distribution recorded via electro-fishing at site C1, August 2024

Plate 3.11 Minnow and brown trout recorded at site C1 on the Clarinbridge River

3.1.12 Site C2 – Unnamed Drainage Channel, Cloonkeenmore North

The unnamed drainage channel (FW4) at Cloonkeenmore North, only supported stagnant pools of water with no flow between dense beds of macrophyte growth. It was not of fisheries value with no fish were recorded during the survey.

Plate 3.12 Site C2 on an unnamed drainage channel at Cloonkeenmore North had no fisheries value

3.1.13 Site C3 – Toorkeel Stream, Cloonkeenbeg

Site C3 was located on the Toorkeel Stream (29T06) at Cloonkeenbeg, a heavily modified lowland depositing stream (FW2) channel that was historically realigned and locally deepened. The flow profile was dominated by very shallow slow flowing riffle and glide. No fish were recorded in the Toorkeel Stream apart from a low density three-spined stickleback population (*n*=10; **Figure 3.9**).

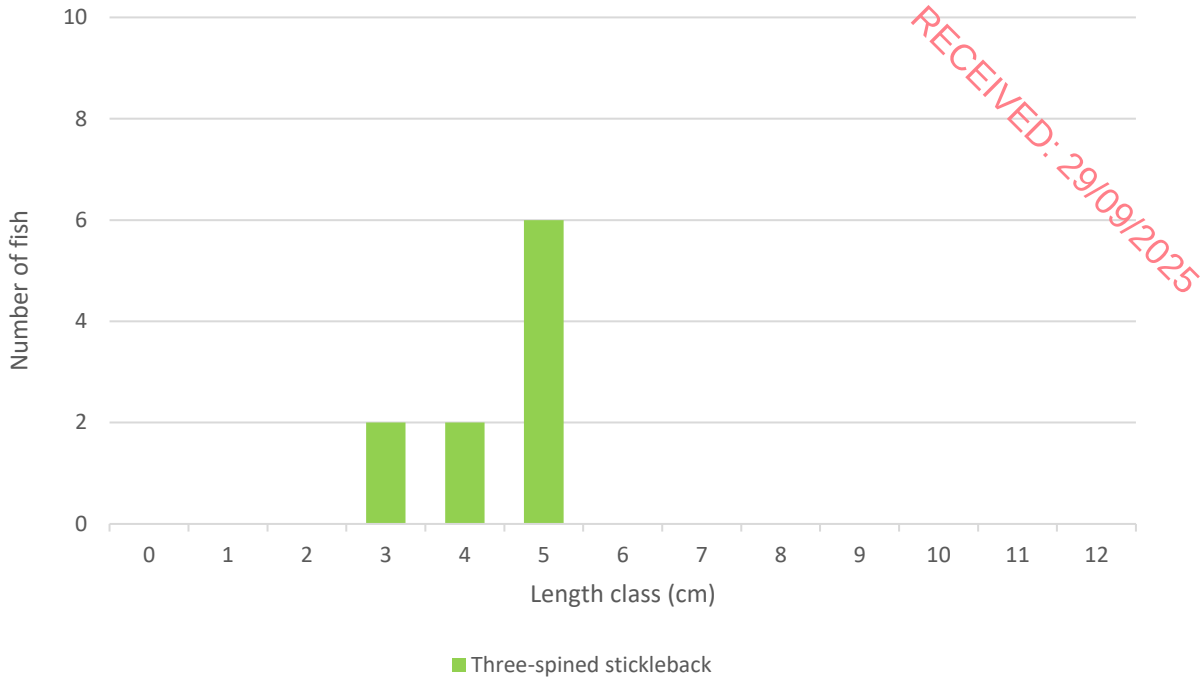

Figure 3.9 Length frequency distribution of fish recorded via electro-fishing at C3, August 2024

3.1.14 Site C4 – Glennagloughaun Stream, Cloonkeenbeg

Site C4 was located on the Gleannagloughaun Stream (29G17) at Cloonkeenbeg. The stream was representative of a heavily modified lowland depositing stream (FW2) channel was historically straightened and deepened. The stream was 1-1.5m wide and between 0.05-0.1m deep with 1m high banks. The flow profile was dominated by very shallow slow flowing riffle. No fish were recorded during the survey likely because of very poor flows and the small size of the watercourse.

Plate 3.14 Representative image of the Glennagloughaun Stream at site C4

3.1.15 Site C5 – Shoodaun River, Graigabbey Bridge

Site C5 was located on the Shoodaun River (29S03), a lowland depositing river (FW2) that was historically straightened and deepened. The river was 4m wide and between 0.2-0.8m deep with 1.5m high banks. The flow profile was dominated by deeper slow moving glide and pool with more localised riffle. Brown trout were the only fish species recorded via electro-fishing at site C5. The site was of good value as a salmonid habitat, with abundant instream boulder and cobble supporting a good density of mixed cohort brown trout (*n*=22), the highest recorded in the survey area. In shallow riffle areas below glide and pool, localised areas of clean coarse substrata provided moderate quality salmonid spawning and nursery habitat. Deeper pool and glide with overhanging grey willow provided valuable flow refugia and holding habitat for adult brown trout (**Figure 3.10**). Suitability for European eel was good with ample cover but the species was not recorded present.

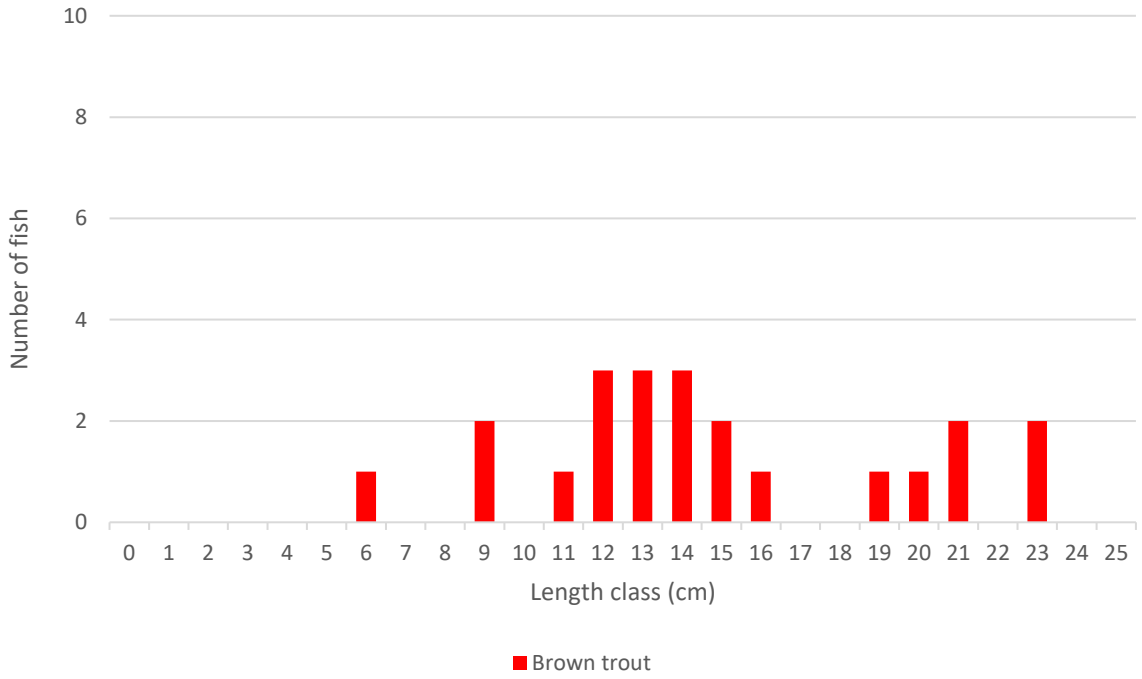

Figure 3.10 Length frequency distribution recorded via electro-fishing at site C5, August 2024

Plate 3.15 Large brown trout recorded at site C5 on the Shoodaun River

Table 3.1 Fish species densities per m^2 recorded at sites in the vicinity of the Proposed Project via electro-fishing in August 2024 (abundances in parenthesis, **bold** indicates highest density recorded per species)

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	Stone loach	Minnow	Pike	Three-spined stickleback
A1	Raford River	5	250	0.000	0.008	0.000	0.000	0.000	0.056	0.008	0.000
A2	Cappaghinanool Stream	10	200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A3	Raford River	10	220	0.000	0.018	0.000	**0.023**	0.000	0.000	**0.023**	0.000
A4	Raford River	10	300	0.027	0.063	0.000	0.007	0.007	**0.093**	0.007	0.000
A5	Raford River	10	300	**0.053**	0.020	0.000	0.007	0.013	0.056	0.003	0.000
B1	Drainage channel	5	100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
B2	Drainage channel	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B3	Attimon Beg River	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B4	Attimon Beg River	10	250	0.000	0.004	0.000	0.004	**0.044**	0.000	0.000	0.024
B5	Attimon Beg River	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C1	Clarinbridge River	10	250	0.000	0.070	0.000	0.000	0.000	0.055	0.000	0.010
C2	Drainage channel	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	Toorkeel Stream	10	180	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.056**
C4	Glennagloughaun Stream	10	220	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C5	Shoodaun Stream	10	200	0.000	**0.110**	0.000	0.000	0.000	0.000	0.000	0.000

4. Discussion

The watercourses in the vicinity of the Proposed Project were typically lowland depositing channels and tributaries which had been straightened and or deepened historically, resulting in watercourses with compromised hydromorphology. This results in poorer inherent fisheries value, primarily due to impacts on nursery and spawning habitat (O'Grady et al., 2017; O'Grady, 2006). The Attimon Beg River catchment for example (sites B1, B2 & B3) were particularly poor in this respect.

The Raford River was the best fisheries habitat in the study area given larger size, improved flow heterogeneity and rocky bed substrata with sites A4 and A5 having the best fisheries value. The Raford River supported Atlantic salmon, European eel and brown trout populations (**Table 3.1**). The lower sites on the Raford River (i.e. sites A4 & A5) were the only sites in the study area to support Atlantic salmon. Site A5 on the Raford River supported the highest density of salmon (*n*=16) in the study area. Apart from the Raford River at sites A3, A4 and A5 that supported European eel, site B4 on the Attimon Beg River also supported the species. The highest density eel population was recorded at site A3 on the Raford River (*n*=5). European eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020).

Brown trout populations were recorded at all sites on the Raford River (sites A1, A3, A4 & A5) but not on the Cappaghnanool Stream tributary (A2). Brown trout populations were also recorded on the Attimon Beg River (B4), Clarinbridge River (C1) and Shoodaun River (C5). The highest density brown trout population was recorded on the Shoodaun River (*n*=22).

Lamprey species were not recorded in the study area given sub-optimal habitat (limited spawning and suitable ammocoete burial habitat). This was a primarily a consequence of historical drainage pressures (e.g. bed compaction, poor flows) as well as siltation pressures which have resulted in a paucity of suitable nursery and spawning habitat (as per characteristics provided in Dawson et al., 2015; Aronsuu & Virkkala, 2014; Rooney et al., 2013; Lasne et al., 2010; Goodwin et al., 2008; Gardiner, 2003). However, lamprey are known from the lower reaches of the Raford River and Clarinbridge River outside of the study area (pers. obs.).

5. References

APEM (2004). Assessment of sea lamprey distribution and abundance in the River Spey: Phase II. Scottish Natural Heritage Commissioned Report No. 027 (ROAME No. F01AC608).

Armstrong, J. D., Kemp, P. S., Kennedy, G. J. A., Ladle, M., & Milner, N. J. (2003). Habitat requirements of Atlantic salmon and brown trout in rivers and streams. Fisheries research, 62(2), 143-170.

Aronsuu, K. & Virkkala, P. (2014). Substrate selection by subyearling European river lampreys (*Lampetra fluviatilis*) and older larvae (*Lampetra* spp.). Ecology of Freshwater Fish, 23: 644–655

CEN (2003). Water Quality - Sampling of Fish with Electricity. Document CEN EN 14011:2000.

CFB (2008). Methods for the Water Framework Directive. Electric Fishing in Wadeable Reaches. Central Fisheries Board. Unpublished report.

Dawson, H. A., Quintella, B. R., Almeida, P. R., Treble, A. J., & Jolley, J. C. (2015). The ecology of larval and metamorphosing lampreys. In Lampreys: biology, conservation and control (pp. 75-137). Springer, Dordrecht.

EA (2003). River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual: 2003 Version. Forest Research. Environment Agency, UK.

Gardiner, R. (2003). Identifying lamprey. A field key for sea, river and brook lamprey. Conserving Natura 2000 Rivers, Conservation techniques No. 4. Peterborough. English Nature.

Goodwin, C.E., Dick, J.T.A. & Elwood, R.W. (2008). A preliminary assessment of the distribution of the sea lamprey (*Petromyzon marinus* L), river lamprey (*Lampetra fluviatilis* (L.)) and brook lamprey (*Lampetra planeri* (Bloch)) in Northern Ireland. Biology and Environment: Proceedings of the Royal Irish Academy 109B, 47-52.

Hendry, K., & Cragg-Hine, D. (1997). Restoration of Riverine Salmon Habitats: A Guidance Manual. Environment Agency.

Hendry, K., Cragg-Hine, D., O'Grady, M., Sambrook, H., & Stephen, A. (2003). Management of habitat for rehabilitation and enhancement of salmonid stocks. Fisheries Research, 62(2), 171-192.

Harvey, J. & Cowx, I. (2003). Monitoring the River, Sea and Brook Lamprey, *Lampetra fluviatilis, L. planer*i and *Petromyzon marinus*. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

IFI (2024) Inland Fisheries Ireland Summary Fish Counter Report 2023.

IFI (2010). Biosecurity Protocol for Field Survey Work. Available at http://www.fisheriesireland.ie/Invasive-Species/biosecurity-protocol-for-field-survey-work.html

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

Lasne. E., Sabatie, M-R. & Evanno, G. (2010). Communal spawning of brook and river lampreys (*Lampetra planeri* and *L. fluviatilis*) is common in the Oir River (France). Ecology of Freshwater Fish 2010: 19: 323–325.

Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Matson, R., Delanty, K., Shephard, S., Coghlan, B., & Kelly, F. (2018). Moving from multiple pass depletion to single pass timed electrofishing for fish community assessment in wadeable streams. Fisheries Research, 198, 99-108.

McGinnity, P., Gargan, P., Roche, W., Mills, P. & McGarrigle, M. (2003). Quantification of the Freshwater Salmon Habitat Asset in Ireland using data interpreted in a GIS platform. Irish Freshwater Fisheries, Ecology and Management Series: Number 3, Central Fisheries Board, Dublin, Ireland.

Niven, A.J. & McCauley, M. (2013). Lamprey Baseline Survey No2: River Faughan and Tributaries SAC. Loughs Agency, 22, Victoria Road, Derry.

O'Grady, M.F. (2006). Channels and challenges: enhancing Salmonid rivers. Irish Fresh- water Fisheries Ecology and Management Series: Number 4. Central Fisheries Board, Dublin.

O'Grady, M., Delanty, K., Coghlan, B., O'Briain, R. & Gilligan, N. (2017). River Enhancement Programmes in Ireland. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

O'Reilly, P. (2009). Rivers of Ireland: A Flyfishers Guide (seventh edition). Merlin Unwin Books. 416pp.

Pike, C., Crook, V. & Gollock, M. (2020). *Anguilla anguilla*. The IUCN Red List of Threatened Species 2020: e.T60344A152845178. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T60344A152845178.en.

Potter, I. C., & Osborne, T.S. (1975). The systematics of British larval lampreys. Journal of Zoology, 176(3), 311-329.

Rooney, S.M., O'Gorman, N. & King, J.J. (2013). Aspects of brook lamprey (*Lampetra planeri*) spawning in Irish waters. Biology and Environment: Proceedings of the Royal Irish Academy 113B: 1-13.

TEGOS (2023). The Status of Irish Salmon Stocks in 2023 with Catch Advice for 2024. Report of the Technical Expert Group on Salmon (TEGOS) to the North-South Standing Scientific Committee for Inland Fisheries. 60 pp

Triturus Environmental Ltd.

42 Norwood Court,

Rochestown,

Co. Cork,

T12 ECF3.

8. Appendix B – Macro-invertebrates (biological water quality)

Table 8.1 Macro-invertebrate Q-sampling results, August 2024 (* tentative rating due to poor flows and or absence of riffle areas, as per Toner et al., 2005)

Taxon	Family	Binomial name	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	EPA Group
Ephemeroptera	Ephemeridae	*Ephemera danica*				1											**A**
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*									17					1	**A**
Ephemeroptera	Heptageniidae	*Ecdyonurus insignis*			1												**A**
Ephemeroptera	Heptageniidae	*Heptagenia sulphurea*														3	**A**
Ephemeroptera	Heptageniidae	*Rhithrogena semicolorata*														1	**A**
Ephemeroptera	Heptageniidae	sp. indet.												1			**A**
Plecoptera	Nemouridae	*Protonemura meyeri*									1						**A**
Ephemeroptera	Baetidae	*Alainites muticus*			1	11								6		2	**B**
Plecoptera	Leuctridae	*Leuctra fusca*			1	6	2				2			3			**B**
Trichoptera	Beraeodes	*Beraeodes minutus*								1							**B**
Trichoptera	Cased caddis pupa	sp. indet.								1							**B**
Trichoptera	Glossosomatidae	*Agapetus fuscipes*											1	1			**B**
Trichoptera	Goeridae	*Silo pallipes*					1										**B**
Trichoptera	Lepidostomatidae	*Lepidostoma hirtum*				1	1				11						**B**
Trichoptera	Limnephilidae	*Halesus radiatus*												1			**B**
Trichoptera	Limnephilidae	*Limnephilus lunatus*		1								1					**B**
Trichoptera	Limnephilidae	*Limnephilus marmoratus*											1				**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*						3									**B**
Trichoptera	Limnephilidae	sp. indet.								1				3			**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*														1	**B**
Odonata	Calopterygidae	*Calopteryx splendens*									1						**B**
Odonata	Coenagrionidae	sp. indet.											3				**B**
Ephemeroptera	Baetidae	*Baetis rhodani*	19		16	7	9	2						10		1	**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*			1	2	16	2			8			1		3	**C**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*				15	6	3			27					2	**C**
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*				1											**C**
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*												10			**C**
Trichoptera	Polycentropodidae	*Polycentropus kingi*					1									1	**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*						1				1				4	**C**
Crustacea	Gammaridae	*Gammarus duebeni*	16	2	10	13	4	20	19	2	13	7	3	20	51	24	**C**
Coleoptera	Dytiscidae	Dytiscidae larva			3	1						2	1	1			**C**
Coleoptera	Dytiscidae	*Ilybius fuliginosus*	1							1							**C**

Taxon	Family	Binomial name	A1	A2	A3	A4	A5	B1	B2	B3	B4	C1	C2	C3	C4	C5	EPA Group
Coleoptera	Dytiscidae	*Stictotarsus duodecimpustulatus*					1										C
Coleoptera	Elmidae	*Elmis aenea*				1		1			5	11		2		47	C
Coleoptera	Elmidae	*Limnius volckmari*								1	7	1		2		2	C
Coleoptera	Gyrinidae	*Gyrinus substriatus*											2				C
Coleoptera	Halipliidae	*Brychius elevatus*					5					11					C
Coleoptera	Hydraenidae	*Hydraena gracilis*														4	C
Coleoptera	Sericostomatidae	*Sericostoma personatum*					3				2						C
Diptera	Chironomidae	Non-*Chironomus* spp.				3		3	1		1	1	8				C
Diptera	Pediciidae	*Dicranota* sp.						8			1			1		1	C
Diptera	Simuliidae	sp. indet.	3				2					5				1	C
Hemiptera	Corixidae	Corixidae nymph			1												C
Hemiptera	Gerridae	*Gerris* sp.	2			1					3				2	1	C
Hemiptera	Gerridae	Gerridae nymph			2												C
Hemiptera	Hydrometridae	*Hydrometra stagnorum*								1				1			C
Hemiptera	Veliidae	Veliidae nymph							2								C
Gastropoda	Bithnyiidae	*Bithynia tentaculata*					3									2	C
Gastropoda	Lymnaeidae	*Lymnaea stagnalis*	1														C
Gastropoda	Neritidae	*Theodoxus fluviatilis*	2			1	2										C
Gastropoda	Planorbidae	*Ancylus fluviatilis*				1											C
Gastropoda	Planorbidae	*Bathyomphalus contortus*					1										C
Gastropoda	Planorbidae	*Planorbis planorbis*					2					1					C
Gastropoda	Tateidae	*Potamopyrgus antipodarum*	8		1	6		9					2			11	C
Arachnida	Hydrachnidiae	sp. indet.								1						2	C
Crustacea	Asellidae	*Asellus aquaticus*		7	27	7	2	3		5	7	19	1	7	38	1	D
Crustacea	Crangonyctidae	*Crangonyx* sp.			4												D
Hirudinidae	Glossiphoniidae	*Glossiphonia complanata*														1	D
Gastropoda	Lymnaeidae	*Ampullacaena balthica*					5			2			3				D
Megaloptera	Sialidae	*Sialis lutaria*								2			1				D
Diptera	Chironomidae	*Chironomus* spp.	2	4			1	1	4	2		2	3		6		E
Abundance			**54**	**14**	**68**	**78**	**67**	**56**	**26**	**20**	**106**	**62**	**29**	**70**	**97**	**116**	
Q-rating			Q3	Q3*	Q3-4	Q3-4	Q3	Q3*	Q3*	Q3*	**Q4**	Q3	Q3*	Q3-4	Q2-3	**Q4**	
WFD status			Poor	Poor	Mod	Mod	Poor	Poor	Poor	Poor	**Good**	Poor	Poor	Mod	Poor	**Good**	

9. Appendix C – eDNA analysis lab report

Triturus

Folio No:	3542-2024
Purchase Order:	eDNA Gannow 24
Contact:	Triturus Environmental Ltd
Issue Date:	10.10.2024
Received Date:	27.09.2024

eDNA Report

Technical Report

SureScreen Scientifics

Triturus

Folio No:	3542-2024
Purchase Order:	eDNA Gannow 24
Contact:	Triturus Environmental Ltd
Issue Date:	10.10.2024
Received Date:	27.09.2024

SureScreen Scientifics

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
FK2429	Gannow - A5		Crayfish plague	Pass	Negative	0
			Freshwater pearl mussel	Pass	Negative	0
			White-clawed crayfish	Pass	Positive	12

Matters affecting result: none

Reported by:Lauryn Jewkes

Approved by: Chelsea Warner

SureScreen Scientifics Ltd, Morley Retreat, Church Lane, Morley, Derbyshire, DE7 6DE, UK
+44 (0)1332 292003 | scientifics@surescreen.com | surescreenscientifics.com

Triturus

Folio No:	3542-2024
Purchase Order:	eDNA Gannow 24
Contact:	Triturus Environmental Ltd
Issue Date:	10.10.2024
Received Date:	27.09.2024

SureScreen Scientifics

RECEIVED: 29/09/2025

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.

SureScreen Scientifics Ltd, Morley Retreat, Church Lane, Morley, Derbyshire, DE7 6DE, UK
+44 (0)1332 292003 | scientifics@surescreen.com | surescreenscientifics.com

Triturus Environmental Ltd.

42 Norwood Court,

Rochestown,

Co. Cork,

T12 ECF3.