APPENDIX 6-3

AQUATIC BASELINE REPORT

Aquatic baseline report for the proposed Cahermurphy West wind farm, Co. Clare

Prepared by Triturus Environmental Ltd. for MKO

September 2025

Please cite as:

Triturus (2025). Aquatic baseline report for the proposed Cahermurphy West wind farm, Co. Clare. Report prepared by Triturus Environmental Ltd. for MKO. September 2025

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by MKO to conduct baseline aquatic surveys to inform EIAR preparation for the proposed Cahermurphy West wind farm development located near Doonbeg, Co. Clare (**Figure 2.1**).

Undertaken on a catchment-wide scale, this report provides a baseline assessment of the aquatic ecology including fisheries and biological water quality, as well as protected species and habitats in the vicinity of the proposed development, inclusive of the proposed grid connection route (GCR). Aquatic surveys were undertaken in August 2025 (single GCR crossing) and July 2024 (all other sites).

1.2 Development description

A full description of the proposed development is provided in the Environmental Impact Assessment Report (EIAR) used to support consenting applications.

2. Methodology

2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed development and associated infrastructure were considered as part of the current assessment. This included sites in vicinity of the site boundary and watercourses crossed by the proposed grid cable route (GCR). Thus, a total of *n*=24 sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1** below). The courses and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

Survey sites were present on the Knocknahila More River (EPA code: 28K15), Clooneenagh Stream (28C08), Creegh River (28C02), Lissyneillan River (28L10), Carrownagry South Stream (28C38), Annageeragh River (28A02), Cloonwhite North Stream (28C30), Kilmihill River (28K44), Doonbeg River (28D02), Tullagower Trib West (28T16), Tullagower River (28T01), Moyasta River (28M04), Wood River (28W01), Garraunnatooha Stream 28G18), Kilcarroll Stream (28K06), Knockerry East Stream (28K49), Moylougha River (28M19) and the Burrane Lower Stream (27B87) (**Table 2.1**). The aquatic survey sites were located within the Annageeragh_SC_010, KiltumperStream_SC_010, Doonbeg_SC_010, Wood_SC_010 and Cloon[Clare]_SC_010 river sub-catchments. Although none of the survey sites were located within a European site, there was downstream hydrological connectivity (via various watercourses) with the Carrowmore Point to Spanish Points and Islands SAC (001021), Mid-Clare Coast SPA (004182), Carrowmore Dunes SAC (002250), River Shannon and River Fergus Estuaries SPA (004077) and the Lower River Shannon SAC (002165). The survey area overlapped with the Annageeragh, Creegh and Doonbeg *Margaritifera* sensitive areas (pearl mussel not assessed in the current survey).

Please note this aquatic report should be read in conjunction with the final Environmental Impact Assessment Report (EIAR) prepared for the proposed development. More specific aquatic methodology is outlined below and in the appendices of this report.

2.2 Aquatic site surveys

Aquatic surveys were conducted on the 16th, 17th, 18th and 19th July 2024, with a single GCR crossing of the Burrane Lower Stream surveyed on 1st August 2025. Survey effort focused on both instream and riparian habitats at each aquatic sampling location and included a fisheries assessment (electro-fishing and or fisheries habitat appraisal), white-clawed crayfish survey, macrophyte and aquatic bryophyte survey and biological water quality sampling (Q-sampling) (**Figure 2.1**). This holistic approach informed the overall aquatic ecological evaluation of each site/watercourse in context of the proposed development 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*=24 aquatic survey sites in the vicinity of the proposed Cahermurphy 2B wind farm, Co. Clare

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Knocknahila More River	28K15	Knocknahila More	508321	668887
A2	Knocknahila More River	28K15	Cloghaun Beg	506961	668583
A3	Clooneenagh Stream	28C08	Cloonwhite North	507195	667935
A4	Creegh River	28C02	Drumellihy Bridge	501612	666476
B1	Lissyneillan River	28L10	Cloghaun More	506397	669873
B2	Lissyneillan River	28L10	R483 road crossing	503237	670529
B3	Carrownagry South Stream	28C38	Carrownaghy South	508463	670543
B4	Annageeragh River	28A02	Knocknahila Bridge	505609	671169
D1	Creegh River	28C02	Cloonwhite South	508779	666852
D2	Cloonwhite North Stream	28C30	Cloonwhite South	507987	666225
D3	Kilmihill River	28K44	Clooneeddan	506625	663683
D4	Kilmihill River	28K44	Kilmacduane East	506507	663395
D5	Kilmihill Stream	28K02	Clooncullin	507143	662361
D6	Doonbeg River	28D02	Clooncullin Bridge	506229	661791
D7	Tullagower Trib West	28T16	Brisla West	504878	659825
D8	Tullagower River	28T01	Gowerhass	504605	659141
D9	Moyasta River	27M04	Carraunnatooha	504569	658033
D10	Wood River	27W01	Knockerry West	504820	657779
D11	Garraunnatooha Stream	28G18	Knockerry West	505055	657469
D12	Kilcarroll Stream	28K06	Carrowfree	505669	656228
D13	Knockerry East Stream	28K49	Derrylough	505707	655912
D14	Moylougha River	27M19	Ballymacrinay	503311	653121
D15	Moylougha River	27M19	Carrowdotia North	502500	652325
D16	Burrane Lower Stream	27B87	Doonnaghurroge	505476	653169

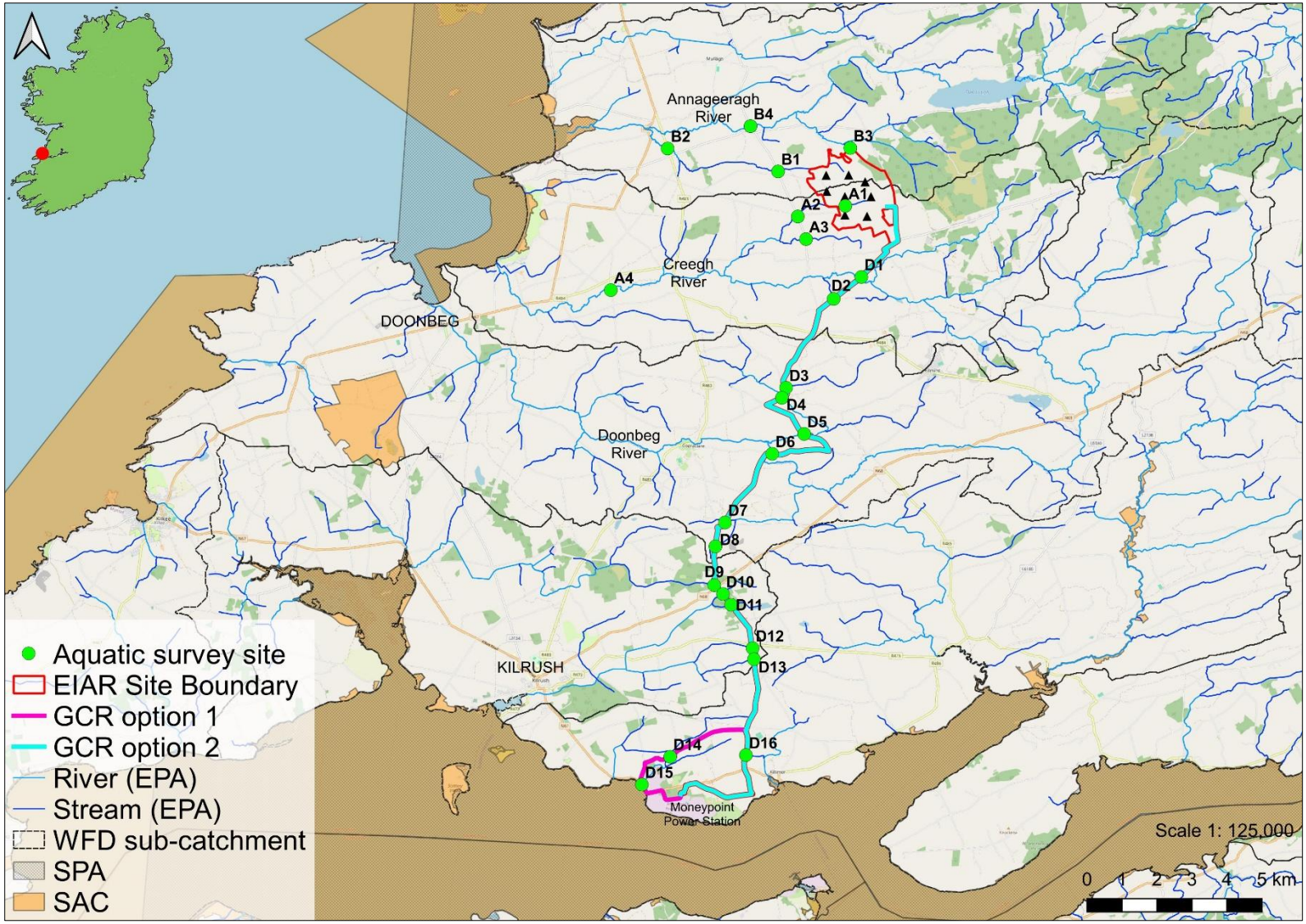

Figure 2.1 Overview of the aquatic survey sites in the vicinity of the proposed Cahermurphy 2B wind farm, Co. Clare

2.3 Fisheries assessment & habitat appraisal

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 development in July 2024 (**Table 2.1, Figure 2.1; Appendix A**), 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 (CFB, 2008; CEN, 2003) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of all aquatic survey sites (**Table 2.1**) was undertaken to establish their importance for salmonid, lamprey, European eel 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 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in August 2025 (site D16 only) and July 2024 (all other sites) under a National Parks and Wildlife (NPWS) open national licence (no. C20/2024), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2023), 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 wind farm 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 (Gammell et al., 2021; Peay, 2003), water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider survey area was completed.

2.5 Environmental DNA

In lieu of electro-fishing surveys at site D16 on the Burrane Lower Stream (a proposed GCR crossing) (**Figure 2.1; Table 2.1**), an environmental DNA (eDNA) sample was collected to further validate site surveys and to detect potentially cryptically low populations of high conservation value species. The sample was taken on the 1st August 2025 and analysed for brown trout (*Salmo trutta*), European eel (*Anguilla anguilla*), lamprey (*Lampetra* sp.) and white-clawed crayfish.

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 B** for full eDNA laboratory analysis methodology.

2.6 Biological water quality (Q-sampling)

The 24 no. riverine survey sites were assessed for biological water quality through Q-sampling in August 2025 (site D16 only) and July 2024 (all other sites) (**Table 2.1**). All samples were taken 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 Environmental Protection Authority (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**). 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)

Q 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

2.7 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 and or Irish Red list for vascular plants (Wyse-Jackson et al., 2016) 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').

2.8 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. 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 development is located in an upland area approximately 12km north-east of Doonbeg, Co. Clare (**Figure 2.1**). The proposed wind farm site is situated within the Shannon River Basin District and within hydrometric areas 27 (Shannon Estuary North) and 28 (Mal Bay) and the Annageeragh_SC_010, KiltumperStream_SC_010, Doonbeg_SC_010, Wood_SC_010 and Cloon[Clare]_SC_010 river sub-catchments.

The watercourses and aquatic surveys sites in the vicinity of the proposed development are typically small, upland eroding/spate channels (FW1; Fossitt, 2000) present in a landscape dominated by agricultural pasture with localised transitional woodland scrub and coniferous forests in the uplands. The survey area is underlain by Namurian shale, sandstone, siltstone and coal (Geological Survey of Ireland data).

3.2 Fisheries

The Annageeragh River supports antic salmon (*Salmo salar*), brown/sea trout (*Salmo trutta*), European eel (*Anguilla anguilla*) and lamprey (*Lampetra* sp.) (IFI, 2015).

The Creegh River supports Atlantic salmon, brown/sea trout, European eel and three-spined stickleback (*Gasterosteus aculeatus*) (Matson et al., 2018; Kelly et al., 2013, 2011). Freshwater pearl mussel are present within this watercourse (NPWS data).

The Clooneenagh Stream, a tributary of the Creegh, is also known to support brown trout (Matson et al., 2018)

The Doonbeg River supports Atlantic salmon, brown/sea trout, European eel and three-spined stickleback and flounder (*Platichthys flesus*) (IFI, 2015) in addition to significant numbers of freshwater pearl mussel (NPWS data).

The Moyasta River, a tributary of the Shannon Estuary, supports populations of brown/sea trout, European eel, lamprey (*Lampetra* sp.), three-spined stickleback and flounder (Triturus 2023 data).

Fisheries data for the other survey watercourses was not available.

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), Environmental Protection Agency (EPA) and Triturus databases for the 10km grid squares containing and adjoining the project (i.e. R05, R06, R07 & R16) identified a low number of records for rare and or protected aquatic species within the vicinity of the proposed development.

The Annageeragh, Creegh and Doonbeg rivers are known to support freshwater pearl mussel (*Margaritifera margaritifera*) (NPWS data). The Doonbeg River supports a particularly large

population, estimated to be ≥7000 individuals, although the Annageeragh and Creegh populations are rapidly declining and considered in threat of extinction due to water quality pressures (EirEco, 2016) (**Figure 3.1**). Please note that a freshwater pearl mussel survey did not form part of the current baseline survey.

A number of Annex II otter (*Lutra lutra*) records were available in the vicinity of the proposed development although most were historical only (i.e. 1980; data not shown). Contemporary records were available for the Ardcloony River at Ballycorney Bridge (survey site B2) and Ardcloony Bridge (survey site B3) as well as the Broadford River at Killaderry Bridge (site A16) and the River Backwater at site C2 (NPWS, NBDC & Triturus data; **Figure 3.1**).

Records for Annex II river lamprey (*Lampetra fluviatilis*) exist for the River Shannon at Castleconnell from 1994 and 1995, respectively (grid square R66). Historical records for Annex II sea lamprey (*Petromyzon marinus*) are also available for the lower River Shannon, with a single record for the lower reaches of the River Blackwater (unspecified date, period 1972-1995). Both river and sea lamprey are known from the lower reaches of the Owenogarney River, below Sixmilebridge (Ross, 2017; Igoe et al, 2004).

Records for the macrophyte species slender naiad (*Najas flexilis*), protected under the Flora (Protection) Order, 2022, were available for Knocka Lough (R16) in 2017 (**Figure 3.1**). This waterbody did not share any hydrological connectivity with the survey area. No other NPWS records for macrophytes or aquatic bryophytes protected under the Flora (Protection) Order, 2022 were available in the respective grid squares.

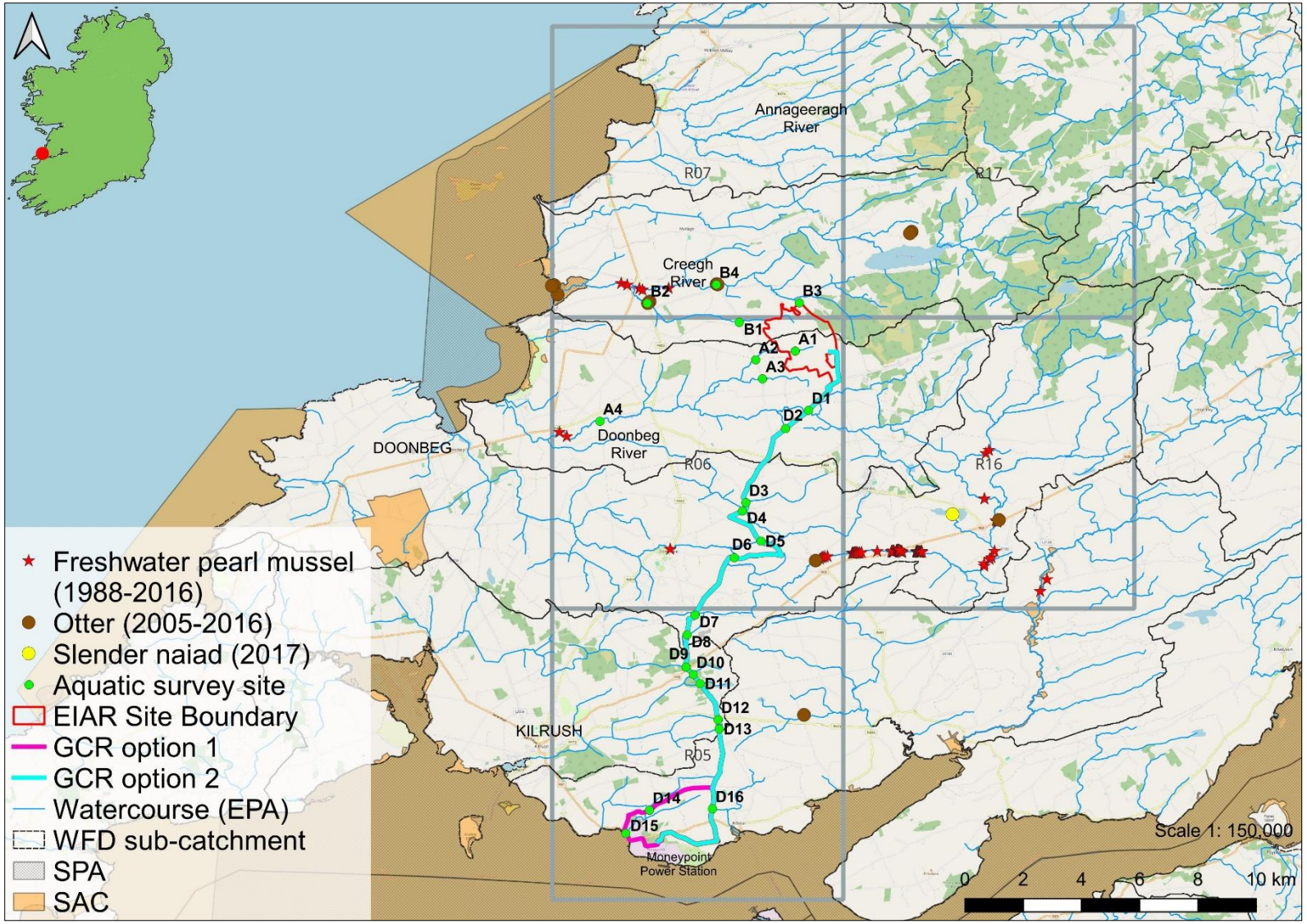

Figure 3.1 Selected protected aquatic species records in the vicinity of the proposed development (source: Triturus, NPWS & NBDC data)

4. Results of aquatic surveys

The following section summarises each of the 24 no. survey sites in terms of aquatic habitats, physical characteristics and overall value for fish and macrophyte/aquatic bryophyte communities. Please refer to **Appendix A** (fisheries assessment report) for more detailed fisheries results. Biological water quality (Q-sample) results are also summarised for each riverine sampling site and presented in full in **Appendix C**. 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**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in August 2025 (site D16 only) and July 2024 (all other sites).

4.1 Aquatic survey site results

4.1.1 Site A1 – Knocknahila More River, Knocknahila More

Site A1 was located on the uppermost reaches of the Knocknahila More River (EPA code: 28K15) at a forestry track crossing (pipe culvert). The narrow upland stream (FW1) had been extensively straightened and deepened in vicinity of coniferous plantations, resulting in a narrow, steep-sided channel flowing through peaty soils. The homogenous channel was 1m wide with banks of up to 2m and 0.2-0.5m deep. Bank scouring was widespread. The profile comprised very slow-flowing glide with pools and an absence of riffles. The substrata were dominated by deep silt (peat) deposits with scattered cobble and superficial gravels. Peat staining was very high at the time of survey. The narrow channel was very heavily shaded (tunnelled) and did not support macrophytes or aquatic bryophytes. The liverwort *Pellia epiphylla* was frequent on muddy/peaty banks. The riparian zones supported abundant and dense scrub comprising grey willow (*Salix cinerea*), heather (*Calluna vulgaris*), bramble (*Rubus fruticosus* agg.) gorse (*Ulex europaeus*), ferns and rushes (*Juncus* spp.). The site was bordered by immature coniferous plantations (WS2) and recolonising historical clear-fell (WS2).

No fish were recorded via electro-fishing at site A1 (**Appendix A**). The river at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to its location in the upper reaches of the catchment and poor fluvial connectivity with downstream habitats. There was no suitability for white-clawed crayfish (water chemistry). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). However, it should be noted that this was a tentative rating given poor flows and 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 species or habitats of higher conservation value, the aquatic ecological evaluation of site A1 was of **local importance (lower value) (Table 4.4).**

Plate 4.1 Representative image of site A1 on the Knocknahila More Stream, July 2024

4.1.2 Site A2 – Knocknahila More River, Cloghaun Beg

Site A2 was located on the upper reaches of the Knocknahila More River (28K15) at a forestry track crossing (pipe culvert) approximately 1.5m downstream of site A1. The small upland eroding channel (FW1) flowed over a moderate gradient and had been historically modified (deepened, bank clearance) between two road culverts. The river suffered from low summer flows at the time of survey with up to half of the bed exposed. The profile comprised slow-flowing glide and cascades with very limited shallow pool. The river was 2-2.5m wide and 0.05-0.15m deep. The substrata were dominated by boulder and cobble, with very localised mixed gravels. These were often mobile but very heavily silted, with abundant peat deposits on the bed in all but the fastest-flowing areas. Peat staining was very high. Macrophytes were limited to marginal watercress (*Nasturtium officinale*). Aquatic bryophyte coverage was very high (75%) with dominant *Fontinalis antipyretica*. The liverwort *Scapania undulata* was also present locally. The modified channel was largely open with low lying scrub and scattered trees along the riparian zones. The site was bordered by semi-improved pasture (reclaimed from GS4) and scrub (WS1).

Brown trout (*Salmo trutta*) and European eel (*Anguilla anguilla*) were the only fish species recorded via electro-fishing at site A2 (**Appendix A**). The small spate channel suffered from low water levels, with significant siltation (peat) which reduced the fisheries value considerably. However, a low density of fish were still present. The quality of salmonid spawning, nursery and holding habitat was poor given evident water quality pressures. Suitability for European eel was also poor although the proximity to marine habitats increased the usage of the habitat, in addition to a lack of significant instream barriers to downstream habitats. There was no suitability for white-clawed crayfish (water chemistry). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor 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 salmonids and Red-listed European eel, the aquatic ecological evaluation of site A2 was of **local importance (higher value) (Table 4.4).**

Plate 4.2 Representative image of site A2 on the Knocknahila More River, July 2024

4.1.3 Site A3 – Clooneenagh Stream, Cloonwhite North

Site A3 was located on the Clooneenagh Stream (28C08) at a local road crossing (pipe culvert). The small upland eroding stream had been extensively straightened and deepened downstream of the road crossing, resulting in a narrow, steep sided channel with frequent scouring of the peaty banks. The stream suffered from low summer flows at the time of survey and was 1-1.5m wide and <0.2m deep. Peat staining was very high at the time of survey. The profile comprised shallow, slow-flowing glide and riffle with only small localised pool. The substrata were dominated by bedded cobble and mixed gravels, with abundant silt accumulations (derived from peat). Macrophyte cover was locally high with branched bur-reed (*Sparganium erectum*) instream. Aquatic bryophyte coverage was low with some occasional *Chiloscyphus polyanthos* and *Nardia compressa* (indicative of acidic conditions). Cover of floc[1] was very high. The narrow stream was heavily shaded along the south bank by dense bramble and gorse scrub with open meadow (GS2) and wet grassland (GS4) on the north. Tunnelling by scrub vegetation and grey willow was high locally, especially upstream. The site was bordered by scrub (WS1) and wet grassland (GS4).

Brown trout and European eel were the only fish species recorded via electro-fishing at site A3 (**Appendix A**). Despite historical modifications and heavy siltation the site was of moderate value was

[1] floc is defined as an aggregation of (mostly dead) organic material, mainly from algae and diatoms, but also with potential origins from decaying macrophytes and associated decomposers (bacteria and fungi) (Moorkens & Killeen, 2020)

a salmonid nursery supporting low numbers of young-of-the-year trout. Spawning habitat quality was poor given siltation however the value would improve under higher flows. The site was not of value as a holding habitat given the paucity of deeper areas. There was low suitability for European eel with only a low density recorded. There was no suitability for white-clawed crayfish given unsuitable geology. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor 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 salmonids and Red-listed European eel, the aquatic ecological evaluation of site A3 was of **local importance (higher value) (Table 4.4).**

Plate 4.3 Representative image of site A3 on the Clooneenagh Stream, July 2024

4.1.4 Site A4 – Creegh River, Drumellihy Bridge

Site A4 was located on the Creegh River (28C02) at Drumellihy Bridge. The large upland spate river (FW1) was largely natural in character, with localised historical bank works in vicinity of the bridge (but good recovery was evident). The profile comprised a series of riffle, glide and pool over a bed dominated by boulder and siliceous bedrock. Cobble zones were present locally with frequent small areas of fine to medium gravels. Soft sediment accumulations of sands with silt were occasional along depositing littorals. Macrophyte cover was low although water crowfoot (*Ranunculus* sp.) stands were present locally. Variable-leaved pondweed (*Potamogeton gramineus*) was present but rare. Hemlock water dropwort (*Oenanthe crocata*) was frequent along channel margins with occasional small stands of water starwort (*Callitriche* sp.). Redshank (*Persicaria maculata*) also grew on exposed cobble and sand bars. Aquatic bryophyte coverage was moderate with localised Fontinalis squamosa, *Fontinalis antipyretica*, *Rhynchostegium riparioides*, *Chiloscyphus polyanthos* and *Leptodictyum riparium*. Cover of filamentous algae was c.5% indicating enrichment pressures. The river was lined by intermittent

mature treeline buffers of sycamore (*Acer psuedoplatanus*), ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*) and grey willow with abundant scrub. The site was bordered by a residential property and improved pasture (GA1).

Atlantic salmon (*Salmo salar*), brown trout, sea trout (*Salmo trutta*), European eel and flounder (*Platichthys flesus*) were recorded via electro-fishing at site A4 (**Appendix A**). This was the highest species diversity recorded during the survey. The site was of high value for salmonids, supporting moderate densities of mixed cohort salmon and trout, in addition to low numbers of anadromous sea trout. Cobble and boulder areas provided high quality instream nursery habitat, with occasional deeper glide and pool (especially those with riparian tree cover) offering valuable holding areas for adult salmonids. Given an abundance of instream refugia (e.g. boulder) and no significant downstream barriers to marine habitats, the site was also of high value for European eel. Relatively high densities of mixed size classes were recorded (including elvers). Despite the presence of soft sediment, the soft sediment areas were sand dominated and had limited suitability for lamprey ammocoetes (none recorded). There was no suitability for white-clawed crayfish given unsuitable water chemistry. A regular otter spraint site was recorded on a boulder under the bridge (ITM 501608, 666487).

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 presence of salmonids (including Atlantic salmon & sea trout) and Red-listed European eel, in addition to otter utilisation, the aquatic ecological evaluation of site A4 was of **local importance (higher value) (Table 4.4).**

Plate 4.4 Representative image of site A4 on the Creegh River at Drumellihy Bridge, July 2024

4.1.5 Site B1 – Lissyneillan River, Cloghaun More

Site B1 was located on the Lissyneillan Stream (28L10) at a local road crossing (single masonry arch, rendered apron). The small upland stream (FW1) had been historically straightened and deepened, resulting in a steep-sided trapezoidal channel with poor hydromorphology. The stream suffered from low summer flows at the time of survey and was 2m wide and <0.1m deep. The profile comprised shallow glide and riffle with a paucity of pool areas. The substrata were dominated by mixed gravels and sands with scattered cobble and small boulder. However, these were very heavily silted with a very high cover of iron-oxidising bacterial films. Silt accumulations (mostly from peat) were also widespread in depositing areas. Given high shading, macrophytes were limited to very occasional watercress. Aquatic bryophyte coverage was low with occasional *Chiloscyphus polyanthos* and *Pellia* sp. on the muddy banks. The steep (often vertical or undercut) banks were heavily scrub with dense bramble, hawthorn and ferns. The site was bordered by semi-improved pasture (GA1) and wet grassland (GS4).

Brown trout was the only fish species recorded via electro-fishing at site B1 (**Appendix A**). The small spate channel suffered from low water levels, with significant siltation (peat) and a very high coverage of iron-oxidising bacteria which reduced the fisheries value considerably. However, a single trout was recorded. The low density of trout recorded reflects the poor quality of the spawning, nursery and holding habitat. Suitability for European eel was also poor with none recorded. There was no suitability for lamprey and the species was not recorded. The water chemistry made the survey area unsuitable for white-clawed crayfish. Despite the low fisheries value, a recent otter spraint (with fish remains) was recorded on a boulder under the bridge (ITM 506394, 669879).

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 presence of salmonids and utilisation by otter, the aquatic ecological evaluation of site A5 was of **local importance (higher value) (Table 4.4).**

Plate 4.5 Representative image of site B1 on the Lissyneillan River, July 2024 (abundant iron oxidising bacterial deposits)

4.1.6 Site B2 – Lissyneillan River, R483 road crossing

Site B2 was located on the Lissyneillan River (28L10) at the R483 road crossing approximately 3.6km downstream of site B1. The upland eroding spate channel (FW1) had been historically modified with deepening and recent bank erosion evident. The river suffered from low summer flows at the time of survey with a profile comprised of very slow-flowing glide and localised riffle and pool. The substrata were dominated by compacted cobble and boulder with abundant silt deposits. Siltation was very high overall with widespread livestock poaching and bank works contributing to sedimentation (and visibly high water turbidity). Mixed gravels were present locally. Given high shading and siltation, macrophytes were limited to emergent brooklime (*Veronica beccabunga*), fool's watercress (*Helosciadium nodiflorum*) and branched bur-reed, with localised iris (*Iris psuedacorus*) along wetter areas of bank. Aquatic bryophyte coverage was low with some *Rhynchostegium riparioides* and *Leptodictyum riparium* (the latter an indicator of eutrophication). Filamentous algal cover was high locally, further indicating significant enrichment. The meandering river was typically heavily shaded by mature but narrow buffers of grey willow, alder, gorse and bramble (although clearance had occurred locally). The site was bordered by intensive pasture (GA1).

Brown trout, European eel and three-spined stickleback (*Gasterosteus aculeatus*) were recorded via electro-fishing at site B2 (**Appendix A**). Despite significant water quality pressures, the site was of moderate value to salmonids supporting a low density of mixed cohort trout. However, spawning, nursery and holding habitat were of poor quality primarily due to enrichment and siltation pressures. Abundant instream refugia (although mostly bedded) provided some localised habitat for European eel although this was sub-optimal. Despite abundant soft sediment deposits these were typically flocculent and unsuitable for ammocoetes. There was no suitability for white-clawed crayfish due to

unsuitable water chemistry. A regular otter spraint site (but all old) was recorded on a boulder under the (southern) dry bridge arch (ITM 503234, 670530).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor 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 salmonids and Red-listed European eel, in addition to otter utilisation, the aquatic ecological evaluation of site B2 was of **local importance (higher value) (Table 4.4).**

Plate 4.6 Representative image of site B2 on the Lissyneillan River, July 2024

4.1.7 Site B3 – Carrownagry South Stream, Carrownagry South

Site B3 was located on the upper reaches of the Carrownagry South Stream (28C38) adjoining the site boundary. The small upland stream (FW1) had been extensively straightened and deepened historically, resulting in a trapezoidal channel with poor hydromorphology. The stream suffered from low summer flows at the time of survey and was between 1-1.5m wide and <0.1m deep. The profile comprised shallow glide and riffle with very localised pools. The substrata were dominated by mixed gravels with occasional cobble and occasional boulder. Siltation (mostly from slumping of peaty banks) was moderate, with a high cover of floc. Iron-oxidising bacterial deposits were present locally on the bed. Given the narrow, heavily shaded channel, macrophytes were limited to rare watercress and brooklime in open areas (e.g. old livestock access point). Aquatic bryophyte coverage was very low with rare submerged *Pellia epiphylla*. The steep banks supported dense bramble-dominated scrub with frequent grey willow. The site was bordered by low intensity pasture (GA1) and dry meadows (GS2) with coniferous afforestation upstream and downstream (WD4).

Despite some physical suitability, no fish were recorded via electro-fishing at site B3 (**Appendix A**). The stream suffered from low summer flows and this likely precluded the absence of resident fish

during the survey. However, given the presence of abundant mixed gravel substrata (although silted), suitability for a small brown trout population existed under higher flows (seasonal migration from downstream areas). There was also some low suitability for European eel although the location of the site in the upper reaches of the catchment would reduce the inherent value. The peat-dominated soft sediment was unsuitable for lamprey ammocoetes. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

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

Plate 4.7 Representative image of site B3 on the Carrownagry South Stream, July 2024

4.1.8 Site B4 – Annageeragh River, Knocknahila Bridge

Site B4 was located on the Annageeragh River (28A02) at Knocknahila Bridge. The medium-sized upland spate river (FW1) was natural in character, 4-8m wide and between 0.2-0.5m deep. The profile comprised low-gradient riffle and swift glide with frequent pool to 1.3m. The substrata of the high energy site were dominated by bedrock, boulder and cobble. Fine to medium interstitial gravels were frequent but small in extent. Sands were also present locally. Siltation was low overall (given high flow rates) although cover of floc and flocculent peat was high (an issue at lower water levels only). The macrophyte community was dominated by hemlock water dropwort which was frequent along channel margins and on exposed cobble bars. Small stands of alternate leaved-milfoil (*Myriophyllum alterniflorum*) were present locally. The bryophyte-rich site supported abundant *Fontinalis squamosa* and *Rhynchostegium riparioides* with frequent *Chiloscyphus polyanthos*. *Riccardia chamedryfolia* was

also present but rare while the red algae, *Lemanea fluviatilis* was occasional. Boulder tops supported occasional *Sciuro-hypnum plumosum* and *Brachythecium rivulare*. The aquatic vegetation community was representative of the upland form of Annex I floating river vegetation habitat (3260). The mature riparian zones provided a good buffer from adjoining pasture and supported abundant grey willow with mature herbaceous communities. The site was bordered by semi-improved pasture (GA1) with mosaics of wet grassland (GS4).

Atlantic salmon, brown trout and European eel were recorded via electro-fishing at site B4 (**Appendix A**). The site was a good quality salmonid habitat with abundant cobble and boulder flow refugia supporting a relatively high density of juveniles. Salmonid spawning habitat was present locally although this was limited in extent and better represented downstream in larger riffle zones. Frequent pools under tree/macrophyte cover and bank scours offered high quality holding areas for adult salmonids (including pool under bridge). Such areas also provided high quality European eel habitat, which were present in good densities (inclusive of elvers). The high energy site was unsuitable for lamprey. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. An old otter spraint site was present on an exposed ledge under the road bridge (ITM 505608, 671173).

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 presence of Annex I floating river vegetation (3260) in addition to the high fisheries value (supporting salmon and eel), the aquatic ecological evaluation of site B4 was of **county importance** (as per NRA, 2009 criteria) **(Table 4.4).**

Plate 4.8 Representative image of site B4 on the Annageeragh River at Knocknahila Bridge, July 2024

4.1.9 Site D1 – Creegh River, Clonwhite South

Site D1 was located on the upper reaches of the Creegh River (28C02) at a local road and proposed GCR crossing. The upland spate river (FW1) had been deepened locally but not straightened, with frequent meanders retained. The river flowed over a low gradient in a steep-sided channel with frequent (peaty) bank scouring. The profile was dominated by slow-flowing deep glide and pool with localised riffle (good habitat heterogeneity). The substrata comprised abundant mixed gravels with localised areas of cobble and boulder (in faster areas). Siltation was high overall, with soft sediment accumulations (sand/silt) on depositing margins of meanders and in pools. Cover of floc was high. Macrophyte cover was high with frequent bog pondweed (*Potamogeton polygonifolius*) and localised water crowfoot (*Ranunculus* sp.), branched bur-reed and rare fool's watercress. Hemlock water dropwort was present along channel margins. Aquatic bryophyte coverage was locally high with abundant *Chiloscyphus polyanthos*, frequent *Rhynchostegium riparioides* and *Fontinalis antipyretica*. *Nardia compressa* and the filamentous rhodophyte *Torularia atrum* were present but rare. The aquatic vegetation community was representative of Annex I floating river vegetation habitat (3260). The foliose lichen *Xanthoparmelia conspersa* was occasional on the tops of instream boulders. The historically cleared banks supported scattered grey willow only (low shading) with dry meadow habitat (GS2).

Atlantic salmon, brown trout and European eel were recorded via electro-fishing at site D1 (**Appendix A**). The site was of high value for salmonids, supporting good quality nursery habitat with locally abundant instream refugia and good densities of juveniles. Widespread deep glide and pool were of high value as holding habitat for adult salmonids. The site was of relatively poor value as a spawning habitat with a paucity of suitable substrata and siltation pressures. Instream boulder/cobble and macrophyte beds were of high suitability for European eel (including boulder zone under bridge) which were recorded in moderate densities (mixed cohorts). Despite the presence of soft sediment, this was sand dominated and thus unsuitable for lamprey ammocoetes (but suitable for elvers). There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site, despite good foraging suitability.

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 presence of Annex I floating river vegetation (3260), the aquatic ecological evaluation of site D1 was of **county importance** (as per NRA, 2009 criteria) **(Table 4.4).**

Plate 4.9 Representative image of site D1 on the upper reaches of the Creegh River, July 2024

4.1.10 Site D2 – Cloonwhite North Stream, Cloonwhite South

Site D2 was located on the uppermost reaches of the Cloonwhite North Stream (28C30), a tributary of the Creegh River, at a local road and proposed GCR crossing. The upland eroding stream (FW1) had been straightened and deepened historically, resulting in a steep, trapezoidal channel with poor hydromorphology. The stream was 1.5-2m wide, 0.1-0.2m deep and suffered from low summer flows at the time of survey. The profile comprised near-stagnant glide and pool with an absence of riffles. Ponding of water was present between debris dams. The substrata were dominated by soft sediment with scattered angular boulder and cobble. Given high siltation and shading, macrophytes were absent. The moss *Rhynchostegium riparioides* was present on larger substrata with some *Pellia* sp. liverwort along the waterline. The steep banks support mature treelines of ash, grey willow, sycamore and horse chestnut (*Aesculus hippocastanum*). The site was bordered by semi-improved pasture (GA1) with areas of species-poor wet grassland (GS4).

No fish were recorded via electro-fishing at site D2 (**Appendix A**). The stream at this location was of poor fisheries value given low flows, significant historical modifications and heavy siltation pressures. However, given connectivity to the nearby Creegh River, there would be some low potential for migration of salmonids and European eel under higher flows. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). However, it should be noted that this was a tentative rating given poor flows and 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 species or habitats of higher conservation value, the aquatic ecological evaluation of site D2 was of **local importance (lower value) (Table 4.4).**

Plate 4.10 Representative image of site D2 on the Cloonwhite North Stream, July 2024

4.1.11 Site D3 – Kilmihill River, Clooneeddan

Site D3 was located on the Kilmihill River (28K02) at a local road and proposed GCR crossing. The upland river (FW1) had been straightened and deepened historically but retained some semi-natural characteristics. The river flowed under the road via a twin pipe culvert with a perched apron and was 3-4m wide and 0.1-0.3m deep. The profile comprised shallow glide and riffle with frequent small pool. The substrata were dominated by bedded angular boulder and cobble with localised interstitial gravels. Siltation was moderate although soft sediment accumulations were absent. Given very high riparian shading, macrophyte growth was sparse with localised watercress and hemlock water dropwort in open areas. Branched bur-reed was present upstream of the bridge. Aquatic bryophyte coverage was low with occasional *Rhynchostegium riparioides*, *Chiloscyphus polyanthos* and *Pellia* sp. The channel was heavily shaded and tunnelled by dense hedgerows of hawthorn, blackthorn, bramble and bracken with scattered sycamore. The site was bordered by improved pasture (GA1) with narrow borders.

Atlantic salmon, brown trout and three-spined stickleback were recorded via electro-fishing at site D3 (**Appendix A**). Despite significant instream modifications, the site was of value as a salmonid nursery, supporting a low density of juvenile salmon and trout. The site was of moderate spawning value despite siltation pressures. Holding habitat for adult salmonids was largely absent in the shallow river at this location. The perched apron was not considered a barrier to fish passage except at low flows. Suitability for European eel was moderate with ample instream refugia although none were recorded. There was no beds of soft sediment capable of supporting lamprey (superficial and or compacted in nature). There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor 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 salmonids (including Atlantic salmon) and Red-listed European eel, the aquatic ecological evaluation of site D3 was of **local importance (higher value) (Table 4.4).**

Plate 4.11 Representative image of site D3 on the Kilmihill River, July 2024

4.1.12 Site D4 – Kilmihill River, Kilmacduane East

Site D4 was located on the Kilmihill River (28K02) at a local road and proposed GCR crossing approximately 350m downstream of site D3. The upland eroding river (FW1) had been extensively straightened and over-deepened upstream of the pipe culvert crossing. A more natural meandering profile was present downstream. The profile comprised shallow glide and pool with only very localised riffle. Upstream, the bed was highly homogenous with very heavily silted mixed gravels and soft sediment accumulations. Downstream, a greater frequency of boulder and cobble created more heterogenous habitat (still heavy siltation). Peat staining was high at the time of survey. Macrophytes were limited to marginal watercress and water starwort (*Callitriche* sp.), with creeping bent grass (*Agrostis stolonifera*) along littorals of the step banks. Aquatic bryophyte coverage was low with some *Rhynchostegium riparioides* and *Dichodontium* sp. moss (on culvert). *Fissedens* sp. moss was occasional on the waterline of the steep banks. Iron oxidising bacterial deposits were present near the confluence. The narrow, steep channel was shaded by mature hedgerows of grey willow, bramble and ferns with scattered mature ash. The site was bordered (to the banktop) by improved pasture (GA1).

Atlantic salmon, brown trout and three-spined stickleback were recorded via electro-fishing at site D4 (**Appendix A**). Despite significant instream modifications and poor hydromorphology, the site was of value as a salmonid nursery, supporting a moderate density of juvenile salmon and trout (despite lack of refugia etc.). The site was of poor spawning value given significant siltation pressures. The quality

of spawning habitat improved upstream (near site D3). Suitability for European eel was poor given a paucity of instream refugia and none were recorded. Soft sediment accumulations were typically flocculent and of poor suitability for lamprey ammocoetes (none recorded). There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor 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 salmonids (including Atlantic salmon) and Red-listed European eel, the aquatic ecological evaluation of site D4 was of **local importance (higher value) (Table 4.4).**

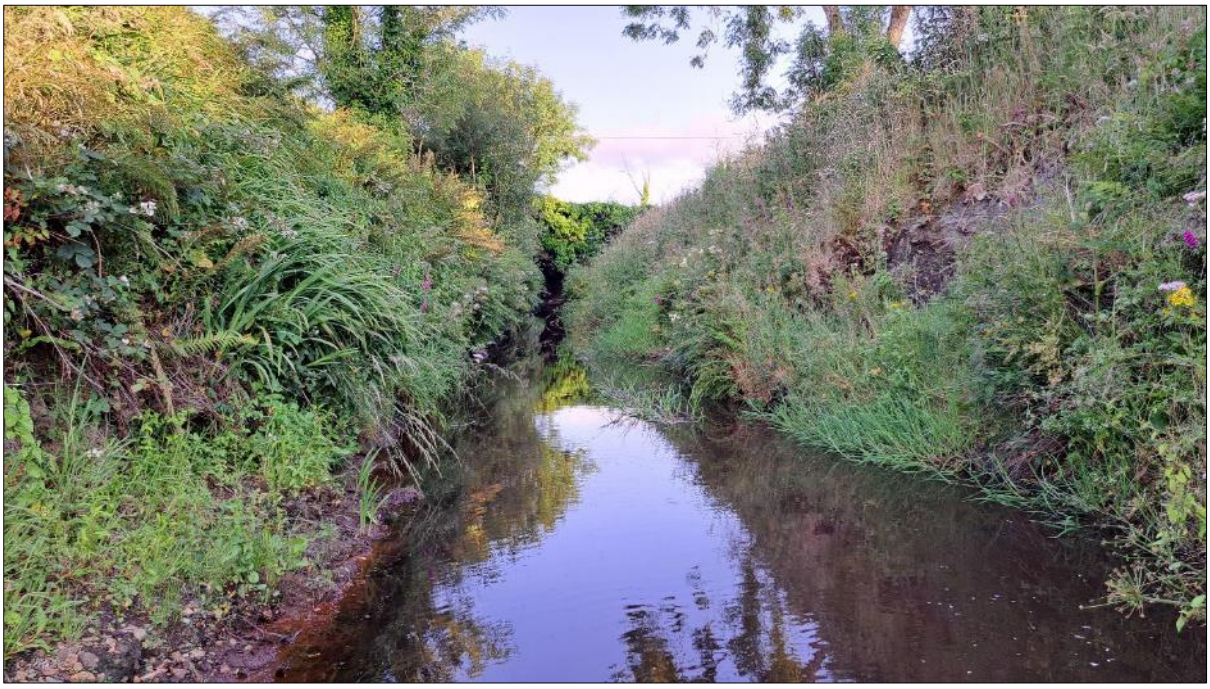

Plate 4.12 Representative image of site D4 on the Kilmihill River, July 2024

4.1.13 Site D5 – Kilmihill River, Clooncullin

Site D5 was located on the Kilmihil River (28K02) at a local road and proposed GCR crossing approximately 2.5km downstream of site D4. The upland river (FW1) had been straightened and deepened upstream of the bridge with a more natural profile retained downstream. The river suffered from low summer flows at the time of survey and was 2-4m wide and 0.1-0.2m deep. The profile was of very shallow glide and riffle with occasional small shallow pools, with deep (dredged) glide and pool (to 1m) dominating upstream. The substrata comprised compacted cobble with abundant boulder. Mixed gravels were present locally, with sand and flocculent silt accumulations along littoral areas. Deep glide upstream featured a heavily silted bed with superficial hard substrata only. Siltation was high overall. Peat staining was low at the time of survey. Macrophyte cover was high with abundant hemlock water dropwort instream. Water starwort (*Callitriche hamulata* & *C. stagnalis*) were frequent. Water crowfoot (*Ranunculus* sp.) and branched bur-reed were present but rare overall. Aquatic bryophyte coverage was high with locally abundant *Fontinalis antipyretica* in addition to

Leptodictyum riparium and *Chiloscyphus polyanthos*. The historically cleared riparian zones supported narrow buffers of herbaceous vegetation dominated by reed canary grass (*Phalaris arundinacea*) with a near total absence of trees. The site was bordered (to the banktop) by improved pasture (GA1) and dry meadow habitat (GS2).

Atlantic salmon, brown trout, lamprey (*Lampetra* sp.) and European eel were recorded via electro-fishing at site D5 (**Appendix A**). Despite historical modifications locally, the site was of good value for salmonids supporting a moderate density of mixed cohort trout with low numbers of salmon. Shallow riffle and glide provided good quality nursery habitat given an abundance of refugia. The deeper glide and pool habitat with undercut banks and overhanging vegetation also provided valuable flow refugia for adults. The quality of salmonid and lamprey spawning habitat was poor given siltation pressures. Boulder zones and deeper glide/scours were of high quality for European eel which were present in moderate densities, with juveniles present alongside lamprey ammocoetes buried in sediment. Shallow soft sediment accumulations under the bridge supported a high density of juvenile ammocoetes. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site despite good foraging habitat being present.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor 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 salmonids (including Atlantic salmon), lamprey (*Lampetra* sp.) and Red-listed European eel, the aquatic ecological evaluation of site D5 was of **local importance (higher value) (Table 4.4).**

Plate 4.13 Representative image of site D5 on the Kilmihill River, July 2024

4.1.14 Site D6 – Doonbeg River, Clooncullin Bridge

Site D6 was located on the Doonbeg River (28D02) at Clooncullin Bridge, a proposed GCR crossing. The large upland spate river (FW1) was largely natural in character although historical bank clearance (and local deepening) had occurred in vicinity of the bridge. However, good instream recovery was evident. The river was 6-8m wide and 0.1-0.4m deep with a profile of deep glide grading to riffle and shallow, boulder-strewn glide downstream of the bridge. Small pool areas were frequent. The substrata were dominated by boulder and cobble with only localised small interstitial areas of fine to medium gravels and sands. Siltation was low overall (no deposits), although flocculent peat was widespread. Deep glide supported frequent bog pondweed and localised alternate milfoil with rare branched bur-reed. Hemlock water dropwort was abundant along littoral areas with some instream. Aquatic bryophyte coverage was very high (75% cover) with abundant *Fontinalis antipyretica* and *Fontinalis squamosa*. The aquatic vegetation community was representative of the upland form of Annex I floating river vegetation habitat (3260). Filamentous algae cover (*Vaucheria* sp.) was low, indicating enrichment. The steep riparian zones supported mature grey willow treelines with abundant scrub dominated by reed canary grass, hedge bindweed (*Calystegia sepium*) and nettle (*Urtica dioica*). The site was bordered by lower intensity and wet, semi-improved pasture (GA1).

Atlantic salmon, brown trout, lamprey (*Lampetra* sp.) and European eel were recorded via electro-fishing at site D6 (**Appendix A**). The site was of very high value for salmonids, with particularly good nursery habitat present in boulder zones that supported high densities of juvenile salmon. Whilst spawning habitat was present downstream, the predominance of large substrata was better suited to Atlantic salmon rather than brown trout. Deeper glide and small pools with riparian tree cover provided valuable holing areas for adult salmonids. Areas of bryophyte-rich boulder were of very high value for European eel which were present at high densities (excellent quality habitat). Small areas of sand-dominated softer sediment between boulders supported low densities of lamprey ammocetes. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site, despite high suitability and marking opportunities.

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 presence of Annex I floating river vegetation (3260) and the presence of salmon, lamprey and eel, the aquatic ecological evaluation of site D6 was of **county importance (Table 4.4).**

Plate 4.14 Representative image of site D6 on the Doonbeg River, July 2024

4.1.15 Site D7 – Tullagower Trib West, Brisla West

Site D7 was located on the Tullagower Trib West Stream (28T16) at a local road and proposed GCR crossing. The small upland stream (FW1) had been extensively straightened and deepened historically resulting in a narrow channel with very poor flows and hydromorphology. The stream suffered from low summer flows at the time of survey (near imperceptible, with ponding) and was a homogenous 1m wide and less predominantly less than 0.05m deep. The substrata were dominated by soft silt deposits with only superficial fine and medium gravels locally. The steep sided channel was very heavily shaded and macrophyte growth was limited to rare fool's watercress. Aquatic bryophytes were not recorded. The trapezoidal channel was heavily encroached by terrestrial vegetation with abundant rushes (*Juncus* spp.), wild angelica (*Angelica sylvestris*), meadowsweet (*Filipendula ulmaria*), hedge bindweed, purple loosestrife (*Lythrum salicaria*) and rank grasses. The site was bordered by improved pasture (GA1) with narrow borders and wet grassland (GS4).

No fish were recorded via electro-fishing at site D7 (**Appendix A**). The channel at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). However, it should be noted that this was a tentative rating given poor flows and 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 species or habitats of higher conservation value, the aquatic ecological evaluation of site D7 was of **local importance (lower value) (Table 4.4).**

Plate 4.15 Representative image of site D7 on the Tullagower Trib West, July 2024

4.1.16 Site D8 – Tullagower River, Gowerhass

Site D8 was located on the Tullagower River (28T01) at a local road and proposed GCR crossing. The lowland river (FW2) had been extensively straightened and deepened in vicinity of historical coniferous plantations (now clear-fell). The heavily modified channel crossed under the local road via a masonry box culvert and suffered from low summer flows at the time of survey. The river was a homogenous 1.5m wide and 0.1-0.2m deep with a steep trapezoidal profile and slumping banks composed mostly of peat. The substrata were dominated by deep soft sediment (peat) with scattered bedded small boulder and superficial gravels only. The profile comprised near stagnant glide and pool. Given high shading and historical excavations, macrophytes were limited to rare water starwort (*Callitriche* sp.) and branched bur-reed. The liverwort *Pellia epiphylla* was occasional on steep banks and larger instream boulder. Floc was abundant with a very high cover of iron oxidising bacterial deposits present. The riparian zone supported scrub vegetation dominated by grey willow, bramble, ferns and rushes (*Juncus* spp.). The site was bordered by scrub (WS1), wet grassland (GS4) and recently felled woodland (WS5) with coniferous plantations (WD4) upstream.

No fish were recorded via electro-fishing at site D8 (**Appendix A**). The channel at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). However, it should be noted that this was a tentative rating given poor flows and 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 species or habitats of higher conservation value, the aquatic ecological evaluation of site D8 was of **local importance (lower value) (Table 4.4).**

Plate 4.16 Representative image of site D8 on the upper reaches of the Tullagower River, July 2024

4.1.17 Site D9 – Moyasta River, Carraunnatooha

Site D9 was located on the upper reaches of the Moyasta River (27M04) at a local road and proposed GCR crossing. The narrow river (FW2) had been extensively straightened, deepened and realigned along coniferous plantation boundaries, resulting in a trapezoidal channel with very poor hydromorphology. With the exception of localised ponding of stagnant rainwater, the river was dry at this location at the time of survey. The damp mud base, with high leaf litter cover, site did not support macrophytes or aquatic bryophytes. High encroachment from terrestrial species such as bracken (*Pteridium aquilinum*), bramble and grey willow indicated the channel rarely conveys water at this location. The site as bordered by dense bracken scrub (HD1), scrub (WS1) and mature coniferous plantations (WD4).

No fish were recorded via electro-fishing at site D9 (**Appendix A**). The channel at this location was not of fisheries value given its dry, ephemeral nature, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Given the dry nature of the watercourse at this location, it was not possible to collect a biological water quality sample.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site D9 was of **local importance (lower value) (Table 4.4).**

Plate 4.17 Representative image of site D9 on the upper reaches of the Moyasta River, July 2024 (dry channel)

4.1.18 Site D10 – Wood River, Knockerry West

Site D10 was located on the upper reaches of the Wood River (28W01) at a local road and proposed GCR crossing. The small upland stream (FW1) had been historically deepened and locally straightened in the vicinity of coniferous plantations upstream of the crossing The stream flowed under the local road via a perched, twin-bore box culvert and suffered from low summer flows at the time of survey. The narrow channel was 1.5-2m wide and <0.1m deep, with a profile comprising shallow glide and riffle. Pool was present but small and shallow. The substrata of the historically modified river were dominated by compacted boulder and cobble with interstitial gravels and sands. Siltation was high throughout with a high level of turbidity at the time of survey (likely from livestock poaching upstream). Given a compacted bed and high shading, macrophytes were limited to very occasional fool's watercress and water mint (*Mentha aquatica*) along margins. Aquatic bryophyte coverage was low with only some *Pellia* sp. on the banks and submerged on larger substrata. The narrow channel was heavily shaded by treelines of grey willow and dense scrub dominated by bramble and nettle. The site was bordered by improved pasture (GA1) and wet grassland (GS4) with coniferous afforestation (WD4) to the banktop upstream of the culvert.

Despite some low suitability for salmonids, no fish were recorded via electro-fishing at site D10 (**Appendix A**). The site was of poor fisheries value given significant water quality pressures and historical modifications and the location in the upper reaches of the watercourse. Furthermore, the road culvert was a significant barrier to fish migration, with very poor fisheries habitat present upstream. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor 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 species or habitats of higher conservation value, the aquatic ecological evaluation of site D10 was of **local importance (lower value) (Table 4.4).**

Plate 4.18 Representative image of site D10 on the Wood River, July 2024

4.1.19 Site D11 – Garraunnatooha Stream, Knockerry West

Site D11 was located on the Garraunnatooha Stream (28G18) at a local road and proposed GCR crossing. The small upland stream (FW1) had been extensively straightened and deepened in vicinity of conifer plantations, both upstream and downstream of the small box culvert. This resulted in a channel with poor hydromorphology and a trapezoidal profile supporting riffle, shallow glide and shallow pools locally. The stream suffered from very low summer flows at the time of survey with up to half of bed exposed. The stream was between 1.5-2m wide and <0.1m deep. There was widespread bank scouring of peaty banks creating an incised channel. The substrata were dominated by cobble and boulder with localised mixed gravels and sands. These were very heavily silted (peat). Slumping of the peat banks was frequent. Given high shading, macrophytes were absent. Aquatic bryophyte coverage was low with only rare *Pellia* sp. The stream flowed through a mature coniferous block (WD4) downstream of the road crossing and was adjoined by semi-improved pasture (GA1) with narrow scrubby buffers.

Brown trout were the only fish species recorded via electro-fishing at site D11 (**Appendix A**). The site was of poor fisheries value given historical modifications, low summer flows and evident water quality pressures. However, a low density of brown trout were recorded in isolated pools. Spawning, nursery and holding opportunities were poor. Furthermore, the collapsing road culvert was a significant barrier to fish migration, with reduced quality fisheries habitat present upstream. The fisheries value

would improve under higher (winter) flows. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). However, it should be noted that this was a tentative rating given poor flows and 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 salmonids, the aquatic ecological evaluation of site D11 was of **local importance (lower value) (Table 4.4).**

Plate 4.19 Representative image of site D11 on the Garraunnatooha Stream, July 2024

4.1.20 Site D12 – Kilcarroll Stream, Carrowfree

Site D12 was located on the Kilcarroll Stream (28K06) at a local road and proposed GCR crossing. The narrow upland stream (FW1) had been extensively straightened and deepened upstream and downstream of the road crossing (pipe culvert), resulting in a deep trapezoidal channel with very poor hydromorphology. The narrow 1-1.5m-wide stream was semi-dry at the time of with localised pools of stagnant water 0.1m deep. The substrata comprised heavily silted mixed gravels with scattered boulder and abundant soft sediment deposits (peat). Given very high riparian shading, macrophytes and aquatic bryophytes were absent. The historically cleared banks supported low lying scrub vegetation comprising bramble, grey willow, gorse, ferns and rushes (*Juncus* spp.). The site was bordered by partially reclaimed pasture (GA1) and wet grassland (GS4).

No fish were recorded via electro-fishing at site D12 (**Appendix A**). The channel at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats. There was no suitability

for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix C**). However, it should be noted that this was a tentative rating given poor flows and 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 species or habitats of high conservation value, the aquatic ecological evaluation of site D12 was of **local importance (lower value) (Table 4.4).**

Plate 4.20 Representative image of site D12 on the Kilcarroll River, July 2024

4.1.21 Site D13 – Knockerry East Stream, Derrylough

Site D13 was located on the Knockerry East Stream (28K49) at a local road and proposed GCR crossing. The stream had been extensively straightened, deepened and realigned along coniferous plantation boundaries, resulting in a narrow U-shaped channel with very poor hydromorphology. The stream was dry at this location at the time of survey. The damp mud base, with high leaf litter cover, site did not support macrophytes or aquatic bryophytes. High encroachment from terrestrial scrub species such as gorse, bracken, bramble and grey willow indicated the channel rarely conveys water at this location. The site as bordered by low diversity wet grassland (GS4), scrub (WS1) and mature coniferous plantations (WD4).

No fish were recorded via electro-fishing at site D13 (**Appendix A**). The channel at this location was not of fisheries value given its dry, ephemeral nature, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

In light of the dry nature of the watercourse at this location, it was not possible to collect a biological water quality sample. Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site D13 was of **local importance (lower value) (Table 4.4).**

Plate 4.21 Representative image of site D13 on the Knockerry East Stream, July 2024 (dry channel)

4.1.22 Site D14 – Moylougha River, Ballymacrinay

Site D14 was located on the Moylougha River (28M19) at a local road and proposed GCR crossing. The small upland stream (FW1) had been extensively straightened and deepened and realigned along the local road, both upstream and downstream of the road crossing (pipe culvert). The narrow trapezoidal channel flowed over a slight gradient alongside the road but suffered from low summer flows at the time of survey. The stream was 1m wide and <0.1m deep with minimal flows and banks of 1-2m in height. The profile comprised shallow glide and riffle with a near absence of pool. The substrata were dominated by bedded cobble and boulder with frequent mixed gravels and sands. These were very heavily silted with a high cover of filamentous algae and floc. Soft sediment accumulations were present locally but were shallow (<1cm & mostly flocculent). The river had been cleared in the recent past and supported frequent recolonising stands of water starwort (*Callitriche* sp.) and branched bur-reed. Margins also supported blue water speedwell (*Myosotis scorpioides*), lesser spearwort (*Ranunculus flammula*) and rare broad-leaved pondweed (*Potamogeton natans*) and round-leaved crowfoot (*Ranunculus omiophyllus*). Aquatic bryophyte coverage was relatively high with frequent *Leptodictyum riparium* and *Hygroamblystegium* sp. The filamentous rhodophyte *Torularia atrum* was also locally frequent. The open, heavily modified channel was lined by low-lying herbaceous vegetation with no riparian shading (but heavily tunnelled upstream). The site was bordered by intensive pasture (GA1).

European eel were the only fish species recorded via electro-fishing at site D14 (**Appendix A**). Despite low summer flows, downstream barriers and poor quality instream habitats, the site supported a moderate density of mixed cohort eels (including elvers). There was very poor suitability for salmonids, with an absence of resident fish at the time of survey likely due to low summer flows and water quality issues. There was no suitability for white-clawed crayfish due to unsuitable water chemistry. No otter signs were recorded in vicinity of the site.

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 presence of Red-listed European eel, the aquatic ecological evaluation of site D14 was of **local importance (higher value) (Table 4.4).**

Plate 4.22 Representative image of site D14 on the Moylougha River, July 2024

4.1.23 Site D15 – Moylougha River, Carrowdotia North

Site D15 was located on the lower reaches of the Moylougha River (28M19) at the N67 road and proposed GCR crossing, adjacent to Moneypoint Power Station. However, contrary to EPA mapping, the river had been culverted underground with no aquatic habitats present in vicinity of the road crossing. The river appeared to discharge to the Ballymacrinan Bay via a pipe culvert on a rocky shore which, based on the presence of European eel upstream, would appear fish passable (**Plate 4.24**).

Given the culverted (underground) nature of the watercourse at this location, it was not possible to undertake an electro-fishing survey or collect a biological water quality sample.

Given the inaccessibility to aquatic habitats (due to culverting), an aquatic ecological evaluation was not applicable to this site **(Table 4.4).**

Plate 4.23 Representative image of site D15 on the lowermost reaches of the Moylougha River, July 2024 (culverted underground)

Plate 4.24 Likely discharge point of the Moylougha River to Ballymacrinan Bay (via pipe culvert)

4.1.24 Site D16 – Burrane Lower Stream, Doonnaghurroge

Site D16 was located on the uppermost reaches of the Burrane Lower Stream (27B87) at a local road and proposed GCR crossing. Contrary to EPA mapping, the watercourse was present both upstream and downstream of the road culvert. The lowland stream (FW2) had been extensively straightened and deepened historically resulting in a homogenous channel with very poor hydromorphology (i.e. resembling a drainage channel). The stream supported minimal flows at the time of survey (August 2025) with the water source appearing to emanate from an adjoining 0.5m wide stream immediately upstream of the road crossing (north bank). The stream was 3m wide and 0.3-0.6m deep with a bed composed entirely of very deep soft/flocculent sediment of up to 1m in depth. The site was very heavily vegetated with near total cover of floating mats of floating sweet grass (*Glyceria fluitans*) in addition to watercress. Bulrush (*Typha latifolia*) and branched bur-reed was present locally in small stands. Aquatic bryophytes were not present with extremely high cover of floc and iron-oxidising bacterial deposits (*Leptothrix ochracea*). The narrow riparian zones had been cleared historically and supported common vegetation including purple loosestrife, wild angelica, hedge bindweed, nettle, meadowsweet, bramble and rank grasses. Shading of the channel was low with only isolated grey willow. The site was bordered by improved pasture (GA1) with wet grassland (GS4) upstream (south bank only).

Electro-fishing was not undertaken at site D16. However, an eDNA sample was collected (August 2025) and analysed for high conservation value fish and aquatic species. The site was of very poor fisheries value given highly significant siltation, water quality and hydromorphological pressures. However, three-spined stickleback were observed and also captured in invertebrate sweep samples. Despite the proximity to coastal habitats, there was very poor suitability for European eel and salmonids. Nonetheless, both brown trout and European eel were detected via eDNA sampling (**Table 4.1**). There was no suitability for lamprey or white-clawed crayfish (neither detected via eDNA). No otter signs were recorded in vicinity of the site and suitability was very low.

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 poor flows and 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 salmonids and European eel (detected via eDNA), the aquatic ecological evaluation of site D16 was of **local importance (higher value) (Table 4.4).**

Plate 4.25 Representative image of site D16 on the uppermost reaches of the Burrane Lower Stream, August 2025

4.2 White-clawed crayfish survey

No white-clawed crayfish were recorded via hand-searching or sweep netting of instream refugia and no crayfish remains were identified in otter spraint sites recorded during the survey. Environmental DNA sampling at site D16 on the Burrane Lower Stream did not detect the species. This species is not known to be present in the wider survey area given unsuitable water chemistry and geographical isolation (Demers et al., 2005; Lucy & McGarrigle, 1987).

4.3 Otter signs

A low number of otter signs were recorded during the current survey. Spraint sites were identified at sites on the Creegh River (A4), Lissyneillan River (B1 & B2) and the Annageeragh River (B4). No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in July 2024.

4.4 eDNA sampling

An environmental DNA sample was collected at site D16 on the Burrane Lower Stream on the 1st August 2025. Brown trout and European eel eDNA was detected in the sample (2 and 11 positive replicates out of 12, respectively; **Table 4.1**). However, no lamprey of white-clawed crayfish DNA was detected (0 positive replicates out of 12).

Table 4.1 eDNA results in the vicinity of the proposed projects, July 2025 (positive qPCR replicates out of 12 in parentheses)

Site	Watercourse	Brown trout	European eel	Lamprey (*Lampetra* sp.)	White-clawed crayfish
D16	Burrane Lower Stream	**Positive (2/12)**	**Positive (11/12)**	Negative (0/12)	Negative (0/12)

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 a total of 21 no. wetted riverine sites in July 2024 and 1 no. site (D16) in August 2025 (**Appendix C**).

None of the survey sites achieved greater than **Q3-4 (moderate status)** and thus all 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**).

A total of 7 no. sites on the Creegh River (A4 & D1), Lissyneillan River (B1), Carrownagry South Stream (B3), Annageeragh River (B4), Doonbeg River (D6), Moylougha River (D14) and Burrane Lower Stream (D16) achieved **Q3-4 (moderate status)** water quality (**Figure 4.1**). Despite the presence of EPA group A mayfly species *Ecdyonurus dispar, Heptagenia sulphurea* and or the stonefly *Nemurella pictetii*, these were only recorded in low numbers (<5% of total sample) and thus did not meet the qualifying criteria for good status as set out by Toner et al. (2005).

The remaining 14 no. sites (i.e. A1, A2, A3, B2, D2, D3, D4, D5, D7, D8, D9, D10, D11, D12 & D13) achieved **Q3 (poor status)** based on an absence of group A species, low numbers of group B species and a dominance of group C species, particularly the mayflies *Baetis rhodani* and *Seratella ignita*, freshwater shrimp (*Gammarus duebeni*), New Zealand mud snail (*Potamopyrgus antipodarum*) and Simuliidae larvae (**Appendix C**).

Sites D9 on the Moyasta River and D13 on the Knockerry East Stream were dry at the time of survey and thus it was not possible to collect a biological water quality sample. Site D15 on the Moylougha River was culverted underground and thus not accessible for biological water quality sampling.

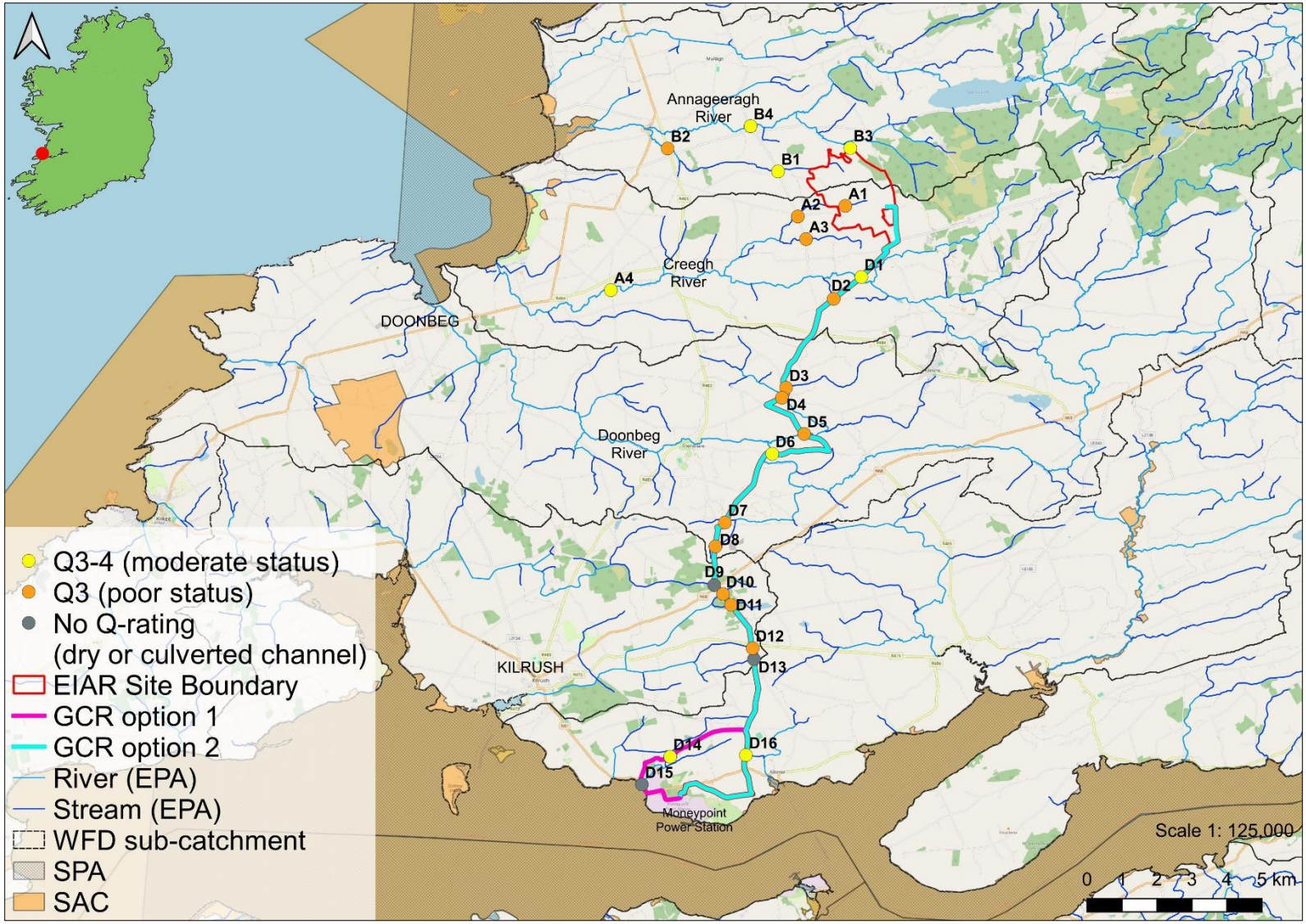

Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed development, August 2025 (D16 only) & July 2024 (all other sites)

Table 4.2 Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the vicinity of the proposed development, July 2024

Site	Watercourse	Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	Other species
A1	Knocknahila More River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
A2	Knocknahila More River	Not recorded	Low	Not recorded	Low	Not recorded
A3	Clooneenagh Stream	Not recorded	Medium	Not recorded	Low	Not recorded
A4	Creegh River	Medium	Medium	Not recorded	High	Sea trout
B1	Lissyneillan River	Not recorded	Low	Not recorded	Not recorded	Not recorded
B2	Lissyneillan River	Not recorded	Medium	Not recorded	Low	Three-spined stickleback
B3	Carrownagry South Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
B4	Annageeragh River	Medium	Medium	Not recorded	Medium	Not recorded
D1	Creegh River	Medium	Medium	Not recorded	Medium	Not recorded
D2	Cloonwhite North Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D3	Kilmihill River	Low	Medium	Not recorded	Not recorded	Three-spined stickleback
D4	Kilmihill River	Medium	Medium	Not recorded	Not recorded	Three-spined stickleback
D5	Kilmihill Stream	Low	Medium	High	Medium	Not recorded
D6	Doonbeg River	Very high	Low	Low	Very high	Not recorded
D7	Tullagower Trib West	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D8	Tullagower River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D9	Moyasta River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded – dry channel
D10	Wood River	Not recorded	Not recorded	Not recorded	Not recorded	No fish recorded
D11	Garraunnatooha Stream	Not recorded	Low	Not recorded	Not recorded	Not recorded
D12	Kilcarroll Stream	Not recorded	Not recorded	Not recorded	Not recorded	No fish recorded
D13	Knockerry East Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded – dry channel
D14	Moylougha River	Not recorded	Not recorded	Not recorded	Medium	Not recorded
D15	Moylougha River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded – culverted channel
D16	Burrane Lower Stream	Negative eDNA	Positive eDNA	Negative eDNA	Positive eDNA	

Conservation value: Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*) and river lamprey (*Lampetra fluviatilis*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. 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 and sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations 2023. With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

Table 4.3 Summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the proposed development, July 2024

Site	Watercourse	White-clawed crayfish	Otter signs[3]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
A1	Knocknahila More River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
A2	Knocknahila More River	None recorded	No signs recorded	None recorded	None recorded	None recorded	**European eel**
A3	Clooneenagh Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	**European eel**
A4	Creegh River	None recorded	**Regular spraint site**	None recorded	None recorded	None recorded	**Atlantic salmon, sea trout, European eel**
B1	Lissyneillan River	None recorded	**Fresh spraint**	None recorded	None recorded	None recorded	None recorded
B2	Lissyneillan River	None recorded	**Regular spraint site**	None recorded	None recorded	None recorded	**European eel**
B3	Carrownagry South Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
B4	Annageeragh River	None recorded	**Regular spraint site**	**Floating river vegetation (3260)**	None recorded	None recorded	**Atlantic salmon, European eel**
D1	Creegh River	None recorded	No signs recorded	**Floating river vegetation (3260)**	None recorded	None recorded	**Atlantic salmon, European eel**
D2	Cloonwhite North Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D3	Kilmihill River	None recorded	No signs recorded	None recorded	None recorded	None recorded	**Atlantic salmon**
D4	Kilmihill River	None recorded	No signs recorded	None recorded	None recorded	None recorded	**Atlantic salmon**
D5	Kilmihill Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	**Atlantic salmon, lamprey (*Lampetra* sp.), European eel**
D6	Doonbeg River	None recorded	No signs recorded	**Floating river vegetation (3260)**	None recorded	None recorded	**Atlantic salmon, lamprey (*Lampetra* sp.), European eel**
D7	Tullagower Trib West	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D8	Tullagower River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D9	Moyasta River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D10	Wood River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded

Site	Watercourse	White-clawed crayfish	Otter signs[3]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
D11	Garraunnatooha Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D12	Kilcarroll Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D13	Knockerry East Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	**European eel**
D14	Moylougha River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D15	Moylougha River	None recorded	No signs recorded	None recorded	None recorded	None recorded	None recorded
D16	Burrane Lower Stream	None recorded	No signs recorded	None recorded	None recorded	None recorded	**European eel (eDNA only)**

Conservation value: Eurasian otter (*Lutra lutra*), Atlantic salmon (*Salmo salar*) & lamprey (*Lampetra* spp.) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). Atlantic salmon and sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations 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).

[3] Otter signs within 150m of the survey site

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

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
A1	Knocknahila More River	28K15	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
A2	Knocknahila More River	28K15	**Local importance (higher value)**	Brown trout & European eel recorded
A3	Clooneenagh Stream	28C08	**Local importance (higher value)**	Brown trout & European eel recorded
A4	Creegh River	28C02	**Local importance (higher value)**	Atlantic salmon, sea trout & European eel recorded, otter utilisation
B1	Lissyneillan River	28L10	**Local importance (higher value)**	Brown trout recorded & otter utilisation
B2	Lissyneillan River	28L10	**Local importance (higher value)**	Brown trout & Red-listed European eel recorded, otter utilisation
B3	Carrownagry South Stream	28C38	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3-4 (moderate status) water quality
B4	Annageeragh River	28A02	**County importance**	Annex I floating river vegetation (3260) present, Atlantic salmon & European eel
D1	Creegh River	28C02	**County importance**	Annex I floating river vegetation (3260) present, Atlantic salmon & European eel
D2	Cloonwhite North Stream	28C30	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D3	Kilmihill River	28K44	**Local importance (higher value)**	Salmonids & European eel recorded
D4	Kilmihill River	28K44	**Local importance (higher value)**	Salmonids & European eel recorded
D5	Kilmihill Stream	28K02	**Local importance (higher value)**	Salmonids, lamprey (*Lampetra* sp.) & European eel recorded
D6	Doonbeg River	28D02	**County importance**	Annex I floating river vegetation (3260) present, Atlantic salmon, eel & lamprey
D7	Tullagower Trib West	28T16	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D8	Tullagower River	28T01	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D9	Moyasta River	27M04	Local importance (lower value)	No aquatic species or habitats of high conservation value; no biological water quality sample possible (dry, ephemeral channel)
D10	Wood River	27W01	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
D11	Garraunnatooha Stream	28G18	**Local importance (higher value)**	Brown trout recorded
D12	Kilcarroll Stream	28K06	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative rating)
D13	Knockerry East Stream	28K49	Local importance (lower value)	No aquatic species or habitats of high conservation value; no biological water quality sample possible (dry, ephemeral channel)
D14	Moylougha River	27M19	**Local importance (higher value)**	Red-listed European eel recorded
D15	Moylougha River	27M19	n/a	Channel culverted underground
D16	Burrane Lower Stream	27B87	**Local importance (higher value)**	Brown trout & Red-listed European eel detected via eDNA

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 have no legal protection in Ireland.

5. Discussion

The majority of the surveyed watercourses in vicinity of the proposed wind farm site were natural or semi-natural in character with good summer flows and supported species of high conservation value. This included Atlantic salmon, lamprey in addition to European eel, resulting in an evaluation of **local importance (higher value)**. By contrast, many of the watercourses crossed by the GCR were smaller in nature, historically modified and of naturally lower aquatic value.

Sites on the Creegh (A4), Annageeragh (B4) and Doonbeg (D6) rivers were the highest quality aquatic habitats in the study area. These were considered of **county importance** given the presence of the Annex I floating river vegetation habitat [3260] while they also supported eel and salmon populations (as per criteria of NRA, 2009). These rivers also support freshwater pearl mussel (*Margaritifera margaritifera*) although targeted surveys for this species were beyond the scope of the current study.

No protected macro-invertebrates (including white-clawed crayfish), macrophytes or aquatic bryophytes were recorded, and none of the sampling sites achieved greater than Q3-4 (moderate status) biological water quality.

5.1 Fisheries

A typical diversity of fish species for hydrometric areas 27 (Shannon Estuary North) and 28 (Mal Bay) was recorded during the electro-fishing survey, with Atlantic salmon, brown trout, sea trout, lamprey (*Lampetra* sp.), European eel, three-spined stickleback and flounder captured (**Table 4.2**). A total of 9 no. sites[2] (A1, B3, D2, D7, D8, D9, D10, D12 & D13) did not support fish at the time of survey. These were primarily located along the proposed grid cable route with exception of sites A1 and B3.

Salmonid populations were widespread in vicinity of the proposed development. Brown trout were recorded from a total of 12 no. sites with Atlantic salmon present at 7 no. sites on the Creegh River (A4 & D1), Annageeragh River (B4), Kilmihill River (D3, D4 & D5) and Doonbeg River (D6). These four watercourses provided the most important salmonid habitats in the survey area (**Appendix A**). Anadromous sea trout were only recorded from site A4 on the Creegh River. Despite poor quality habitats, brown trout were detected via eDNA sampling on the Burrane Lower Stream at site D16 (proposed GCR crossing).

Lamprey (*Lampetra* sp.) ammocoetes were only recorded from only two sites in the study area, D5 and D6 on the Kilmihill River. This restricted distribution reflected the upland, higher-energy, spate nature of the survey watercourses which created conditions unsuitable for lamprey. European eel were relatively widespread in the survey area and were recorded from a total of 9 no. sites (**Table 4.2; Appendix A**), in addition to site D16 on the Burrane Lower Stream (eDNA only). Particularly high numbers were recorded on the Creegh River at Drumellihy Bridge (site A4) and the Doonbeg River at Clooncullin Bridge (site D6).

5.2 Otter

Despite suitability elsewhere, otter signs (spraints) were only recorded at sites on the Creegh River (A4), Lissyneillan River (B1 & B2) and the Annageeragh River (B4). The paucity of signs was considered

[2] Site D15 on the Moylougha River was culverted underground and thus not accessible for survey

to mainly reflect the higher-energy and or small, shallow nature of many survey watercourses which generally provide more restricted, stochastic prey resources and reduced foraging opportunities for otter compared with lower-gradient, larger watercourses with larger prey resources (Triturus data; Hong et al., 2020; Sittenthaler et al., 2019; Scorpio et al., 2016; Reid et al., 2013; Remonti et al., 2009). Furthermore, the timing of surveys (July 2024 and August 2025) falls outside the optimal period for the detection of otter signs (the number of signs in summer is often low, despite otter presence; Triturus pers. obs.). No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in July 2024 or August 2025 (site D16 only).

5.3 Biological water quality & pressures

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from a total of 21 no. wetted riverine sites in July 2024 and 1 no. site (D16) in August 2025 (**Appendix C**) and none of the survey sites achieved greater than **Q3-4 (moderate status)** water quality (**Figure 4.1**). Impacts to water quality from agriculture and forestry (siltation) and instream modifications (hydromorphology) were observed during the site surveys and these threats, along with urban run-off, were in keeping with EPA data for the sub-catchments in question.

5.4 Annex I floating river vegetation (3260)

Annex I floating river vegetation 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) was recorded at a total of 3 no. sites on the Annageeragh River (B4), Creegh River (D1) and Doonbeg River (D6). Sites B4 and D6 featured high flow rates and were thus dominated by aquatic bryophytes (e.g. *Fontinalis* spp.[3]) with indicator macrophytes such as bog pondweed (*Potamogeton polygonifolius*) and alternate milfoil (*Myriophyllum alterniflorum*) (EC, 2013) also present. Although water crowfoot (*Ranunculus* spp.) may be an important and often dominant component of this vegetation type, the heavy emphasis on this genus is not necessarily representative of the habitat as a whole (Hatton-Ellis & Grieve, 2003) and higher energy, upland representations are often dominated by aquatic mosses. The aquatic vegetation community at site D1 on the lower energy Creegh River was a more typical example of the Annex I habitat with water crowfoot (*Ranunculus* sp.) and pondweed (*Potamogeton* sp.) species in addition to several aquatic mosses.

[3] While *Fontinalis antipyretica* is the only bryophyte species specifically listed as an indicator species (EC, 2013), all aquatic mosses are considered important components of the Annex I FRV habitat

6. 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.

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.

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.

EirEco (2016). Freshwater Pearl Mussel Survey of the Doonbeg, Annageeragh and Creegh Rivers, Co. Clare. October 2016.

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.

Gammell, M., McFarlane, A., Brady, D., O'Brien, J., Mirimin, L., Graham, C., Lally, H., Minto, C. & O'Connor, I. (2021). White-clawed Crayfish *Austropotamobius pallipes* survey in designated SACs in 2017. Irish Wildlife Manuals, No. 131. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

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.

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.

Hatton-Ellis, T.W. & Grieve, N. (2003). Ecology of Watercourses Characterised by *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation. Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.

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.

Hong, S., Di Febbraro, M., Loy, A., Cowan, P., & Joo, G. J. (2020). Large scale faecal (spraint) counts indicate the population status of endangered Eurasian otters (*Lutra lutra*). Ecological Indicators, 109, 105844.

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

IFI (2015). Report on Salmon Monitoring Programme – 2014. Report on projects to assess attainment of Conservation Limit for Atlantic Salmon in Irish Rivers. Inland Fisheries Ireland. IFI 2016/1-4236. December 2015.

Kelly, F.L., Harrison, A., Connor, L., Wightman, G., Matson, R., Hanna, G., Feeney, R., Morrissey, E., O'Callaghan, R., Wogerbauer, C., Rocks, K., Hayden, B., & Stafford, T. (2011). Sampling fish for the Water Framework Directive – Rivers 2009: Shannon International River Basin District Rivers. Central and Regional Fisheries Boards, Dublin.

Kelly, F.L., Matson, R., Connor, L., Feeney, R., Morrissey, E., Wogerbauer, C. & Rocks, K. (2013). Water Framework Directive Fish Stock Survey of Rivers in the Shannon International River Basin District. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. Dublin, Ireland.

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.

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

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., Gordon, P., O'Briain, R., Garland, D., Cierpal, D., Connor, L., Corcoran, W., Coyne, J., McLoone, P., Morrisey-McCaffrey, E., Brett, T., Ní Dhonnabhain, L. & Kelly, F.L., (2018). Sampling Fish in Rivers 2017 – Creegh, Factsheet No. 23. National Research Survey Programme. Inland Fisheries 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.

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

NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes. National Roads Authority, Dublin.

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.

Peay, S. (2003). Monitoring the white-clawed crayfish Austropotamobius pallipes. Conserving Natura 2000 Rivers Monitoring Series No. 1, English Nature, Peterborough.

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.

Reid, N., Thompson, D., Hayden, B., Marnell, F., & Montgomery, W. I. (2013). Review and quantitative meta-analysis of diet suggests the Eurasian otter (*Lutra lutra*) is likely to be a poor bioindicator. Ecological indicators, 26, 5-13.

Remonti, L., Balestrieri, A., & Prigioni, C. (2009). Altitudinal gradient of Eurasian otter (Lutra lutra) food niche in Mediterranean habitats. Canadian Journal of Zoology, 87(4), 285-291.

Scorpio, V., Loy, A., Di Febbraro, M., Rizzo, A., Aucelli, P. (2016). Hydromorphology meets mammal ecology: river morphological quality, recent channel adjustments and otter resilience. River Res. Appl. 32, 267–279.

Sittenthaler, M., Koskoff, L., Pinter, K., Nopp-Mayr, U., Parz-Gollner, R., & Hackländer, K. (2019). Fish size selection and diet composition of Eurasian otters (*Lutra lutra*) in salmonid streams: Picky gourmets rather than opportunists? Knowledge & Management of Aquatic Ecosystems, (420), 29.

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

Fisheries assessment for the proposed Cahermurphy 2B wind farm, Co. Clare

Prepared by Triturus Environmental Ltd. for MKO

September 2025

Please cite as:

Triturus (2025). Fisheries assessment for the proposed Cahermurphy 2B wind farm, Co. Clare. Report prepared by Triturus Environmental Ltd. for MKO. September 2025.

Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by MKO to undertake a baseline fisheries assessment of watercourses in the vicinity of the proposed Cahermurphy 2B wind farm, located near Doonbeg, Co. Clare.

The catchment wide survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed development. In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the vicinity of the proposed development, inclusive of the grid cable route (GCR), a catchment-wide electro-fishing survey across *n*=23 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, lamprey (*Lampetra* sp.) and European eel (*Anguilla anguilla*). Other species of lower conservation value were also recorded. The presence and or absence of fish populations and or associated supporting habitat would help inform the impact assessment and any associated mitigation for the proposed development.

1.2 Fisheries (desktop review)

The Annageeragh River supports antic salmon (*Salmo salar*), brown/sea trout (*Salmo trutta*), European eel (*Anguilla anguilla*) and lamprey (*Lampetra* sp.) (IFI, 2015).

The Creegh River supports Atlantic salmon, brown/sea trout, European eel and three-spined stickleback (*Gasterosteus aculeatus*) (Matson et al., 2018a; Kelly et al., 2013, 2011). Freshwater pearl mussel are present within this watercourse (NPWS data).

The Clooneenagh Stream, a tributary of the Creegh, is also known to support brown trout (Matson et al., 2018a).

The Doonbeg River supports Atlantic salmon, brown/sea trout, European eel and three-spined stickleback and flounder (*Platichthys flesus*) (IFI, 2015) in addition to significant numbers of freshwater pearl mussel (NPWS data).

The Moyasta River, a tributary of the Shannon Estuary, supports populations of brown/sea trout, European eel, lamprey (*Lampetra* sp.), three-spined stickleback and flounder (Triturus 2023 data).

Fisheries data for the other survey watercourses was not available.

2. Methodology

2.1 Fisheries assessment (electro-fishing)

Triturus Environmental Ltd. made an application to the Department of the Environment, Climate and Communications (DECC) 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 of watercourses in the vicinity of the proposed development. The surveys were undertaken following the conditions of the licence on the 16th, 17th, 18th and 19th July 2024, following notification to Inland Fisheries Ireland. The electro-fishing survey was undertaken across 23 no. riverine sites (see **Table 2.1, Figure 2.1**).

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to conduct the electro-fishing survey. 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).

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.

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., 2018b). A total of approximately 30-75m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages.

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 moderate conductivity waters of the sites a voltage of 240-275v, frequency of 35-40Hz 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, approximately 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

A fisheries habitat appraisal of 23 no. sites (July 2024) and 1 no. site (D16, August 2025) was undertaken. The appraisal 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 (EA, 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. 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 *n*=24 electro-fishing and fisheries appraisal survey sites in the vicinity of Cahermurphy 2B wind farm, Co. Clare

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Knocknahila More River	28K15	Knocknahila More	508321	668887
A2	Knocknahila More River	28K15	Cloghaun Beg	506961	668583
A3	Clooneenagh Stream	28C08	Cloonwhite North	507195	667935
A4	Creegh River	28C02	Drumellihy Bridge	501612	666476
B1	Lissyneillan River	28L10	Cloghaun More	506397	669873
B2	Lissyneillan River	28L10	R483 road crossing	503237	670529
B3	Carrownagry South Stream	28C38	Carrownaghy South	508463	670543
B4	Annageeragh River	28A02	Knocknahila Bridge	505609	671169
D1	Creegh River	28C02	Cloonwhite South	508779	666852
D2	Cloonwhite North Stream	28C30	Cloonwhite South	507987	666225
D3	Kilmihill River	28K44	Clooneeddan	506625	663683
D4	Kilmihill River	28K44	Kilmacduane East	506507	663395
D5	Kilmihill Stream	28K02	Clooncullin	507143	662361
D6	Doonbeg River	28D02	Clooncullin Bridge	506229	661791
D7	Tullagower Trib West	28T16	Brisla West	504878	659825
D8	Tullagower River	28T01	Gowerhass	504605	659141
D9	Moyasta River	27M04	Carraunnatooha	504569	658033
D10	Wood River	27W01	Knockerry West	504820	657779
D11	Garraunnatooha Stream	28G18	Knockerry West	505055	657469
D12	Kilcarroll Stream	28K06	Carrowfree	505669	656228
D13	Knockerry East Stream	28K49	Derrylough	505707	655912
D14	Moylougha River	27M19	Ballymacrinay	503311	653121
D15	Moylougha River	27M19	Carrowdotia North	502500	652325
D16*	Burrane Lower Stream	27B87	Doonnaghurroge	505476	653169

* Fisheries appraisal and environmental DNA survey only, August 2025

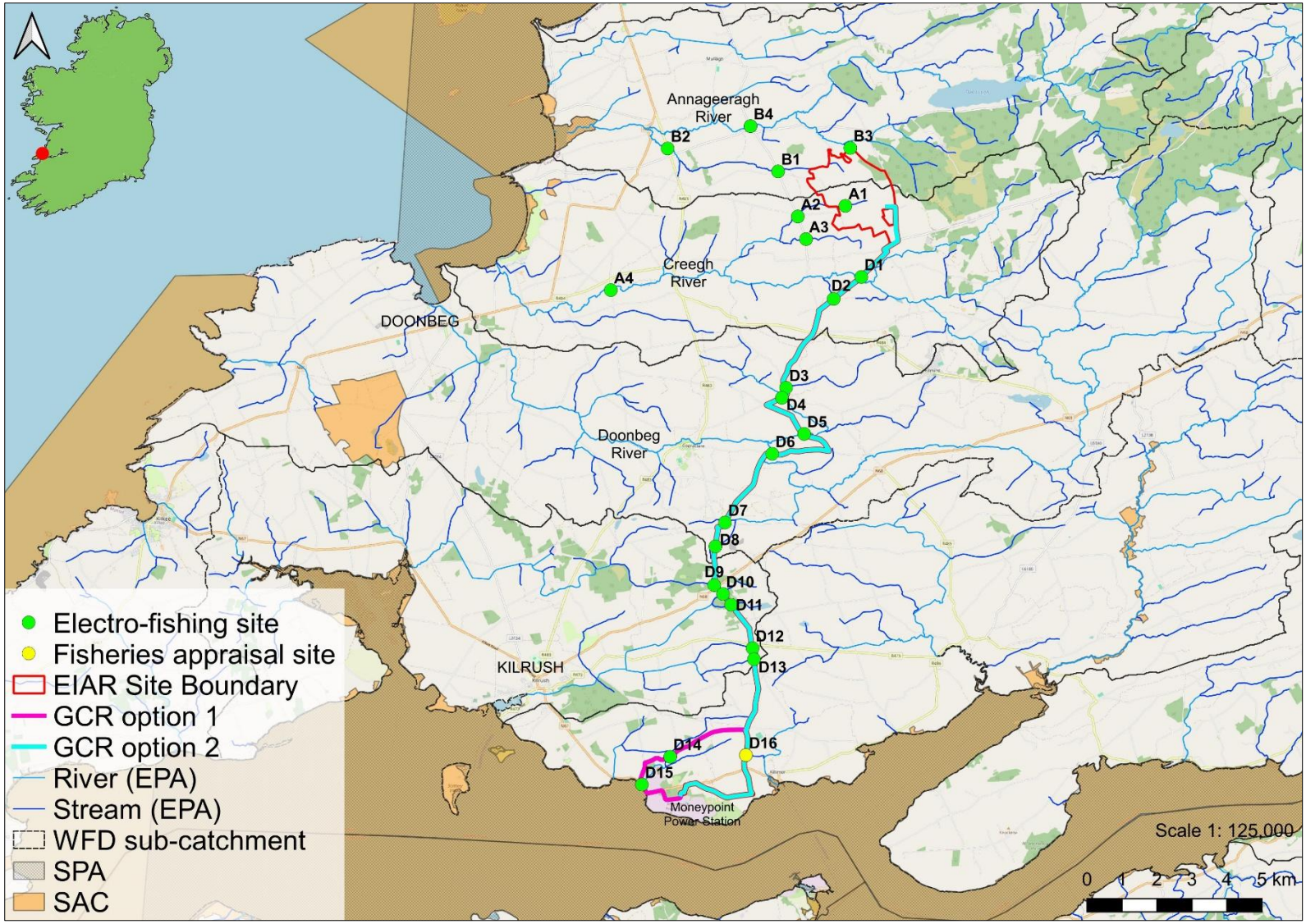

Figure 2.1 Overview of the *n*=24 electro-fishing and fisheries appraisal survey site locations for the proposed Cahermurphy 2B wind farm, Co. Clare

3. Results

A catchment-wide electro-fishing survey of 23 no. riverine sites in the vicinity of the proposed development was conducted on the 16th, 17th, 18th and 19th July 2024 following notification to Inland Fisheries Ireland. A fisheries appraisal survey (inclusive of environmental DNA sampling) was undertaken at site D16 in August 2025.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 and spawning habitat for salmonids, European eel and lamprey species. Scientific names are provided at first mention only.

3.1 Fisheries assessment & appraisal

3.1.1 Site A1 – Knocknahila More River, Knocknahila More

No fish were recorded via electro-fishing at site A1 on the uppermost reaches of the Knocknahila More River (EPA code: 28K15) at a forestry track crossing (pipe culvert). The river at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to its location in the upper reaches of the catchment and poor fluvial connectivity with downstream habitats.

Plate 3.1 Representative image of site A1 on the Knocknahila More Stream, July 2024

3.1.2 Site A2 – Knocknahila More River, Cloghaun Beg

Brown trout (*Salmo trutta*) (*n*=3) and European eel (*Anguilla anguilla*) (*n*=2) were the only fish species recorded via electro-fishing at site A2 on the upper reaches of the Knocknahila More River (28K15) at a forestry track crossing (pipe culvert) (**Figure 3.1**).

The small spate channel suffered from low water levels, with significant siltation (peat) which reduced

the fisheries value considerably. However, a low density of fish were still present. The quality of salmonid spawning, nursery and holding habitat was poor given evident water quality pressures. Suitability for European eel was also poor although the proximity to marine habitats increased the usage of the habitat, in addition to a lack of significant instream barriers to downstream habitats. There was poor suitability for lamprey.

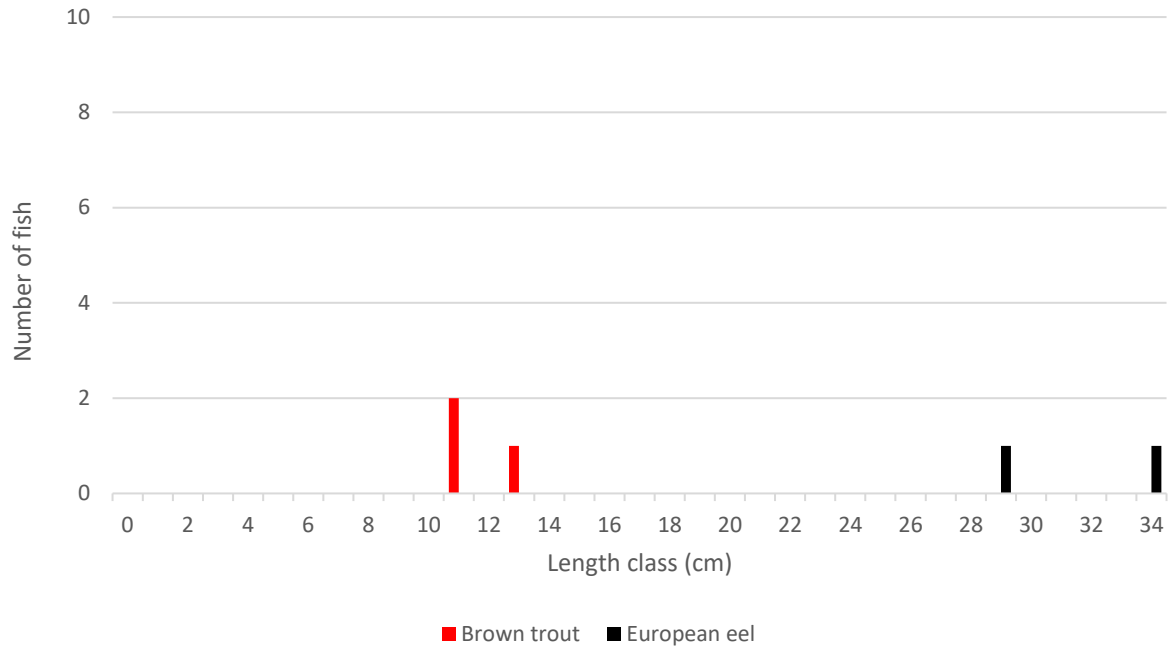

Figure 3.1 Length frequency distribution recorded via electro-fishing at A2 on the Knocknahila More River, July 2024

Plate 3.2 Brown trout and European eel recorded at site A2 on the Knocknahila More River, July 2024

3.1.3 Site A3 – Clooneenagh Stream, Cloonwhite North

Brown trout (*n*=14) and European eel (*n*=1) were the only fish species recorded via electro-fishing at site A3 on the Clooneenagh Stream (28C08) at a local road crossing (pipe culvert) (**Figure 3.2**).

Despite historical modifications and heavy siltation the site was of moderate value was a salmonid nursery supporting low numbers of young-of-the-year trout. Spawning habitat quality was poor given siltation however the value would improve under higher flows. The site was not of value as a holding habitat given the paucity of deeper areas. There was low suitability for European eel with only a low density recorded. There was poor suitability for lamprey with no suitable soft sediment nursery areas.

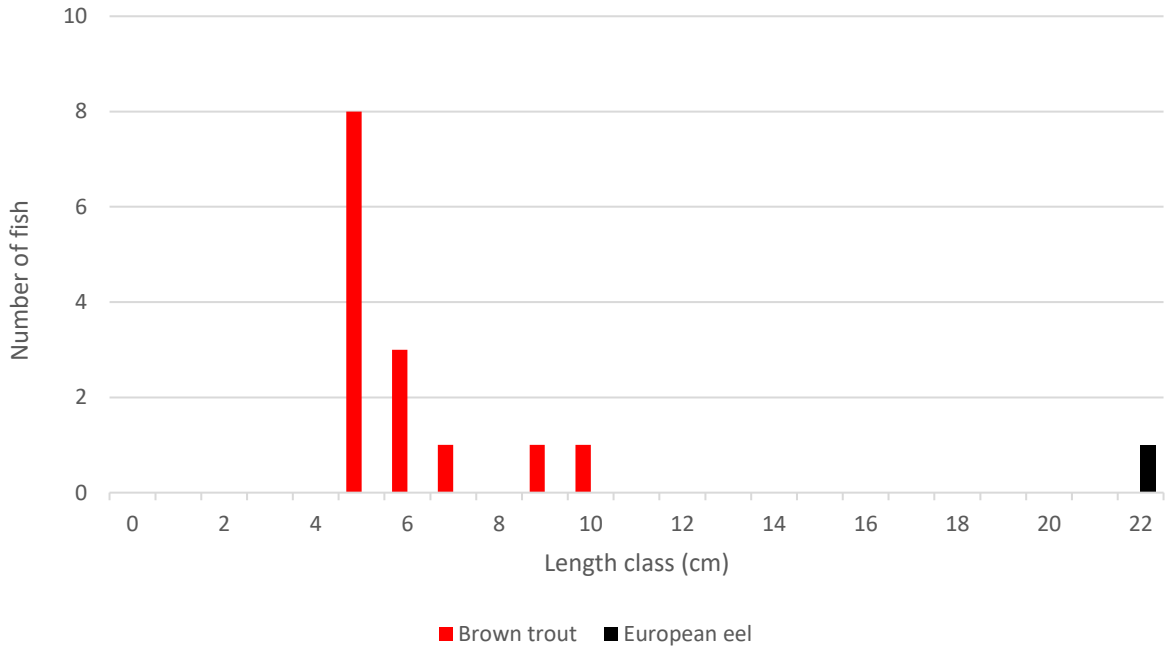

Figure 3.2 Length frequency distribution recorded via electro-fishing at A3 on the Clooneenagh Stream, July 2024

Plate 3.3 Representative image of site A3 on the Clooneenagh Stream, July 2024

3.1.4 Site A4 – Creegh River, Drumellihy Bridge

Atlantic salmon (*Salmo salar*) (*n*=28), brown trout (*n*=16), sea trout (*Salmo trutta*) (*n*=1), European eel (*n*=15) and flounder (*Platichthys flesus*) (*n*=1) were recorded via electro-fishing at site A4 on the Creegh River (28C02) at Drumellihy Bridge (**Figure 3.3**). This was the highest species diversity recorded during the survey.

The site was of high value for salmonids, supporting moderate densities of mixed cohort salmon and trout, in addition to low numbers of anadromous sea trout. Cobble and boulder areas provided high quality instream nursery habitat, with occasional deeper glide and pool (especially those with riparian tree cover) offering valuable holding areas for adult salmonids. Given an abundance of instream refugia (e.g. boulder) and unobstructed pathway to marine habitats, the site was also of high value for European eel, with relatively high densities of mixed size classes recorded (including elvers). Despite the presence of soft sediment, this was sand dominated and thus unsuitable for lamprey ammocoetes (but suitable for elvers).

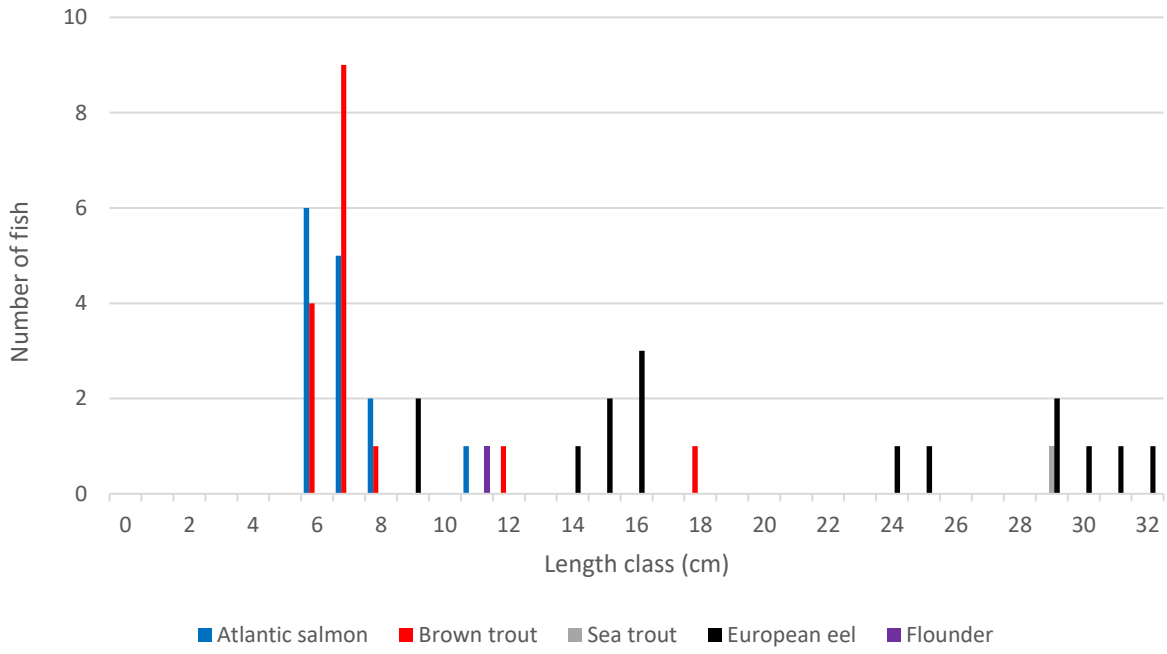

Figure 3.3 Length frequency distribution recorded via electro-fishing at A4 on the Creegh River, July 2024

Plate 3.4 Anadromous sea trout recorded at site A4 on the Creegh River at Drumellihy Bridge, July 2024

3.1.5 Site B1 – Lissyneillan River, Cloghaun More

Brown trout (*n*=1) was the only fish species recorded via electro-fishing at site B1 on the Lissyneillan Stream (28L10) at a local road crossing (**Figure 3.4**).

The small spate channel suffered from low water levels, with significant siltation (peat) and a very high coverage of iron-oxidising bacteria which reduced the fisheries value considerably. However, a single trout was recorded. The quality of salmonid spawning, nursery and holding habitat was poor given evident water quality pressures. Suitability for European eel was also poor with none recorded. There was no suitability for lamprey and the species was not recorded.

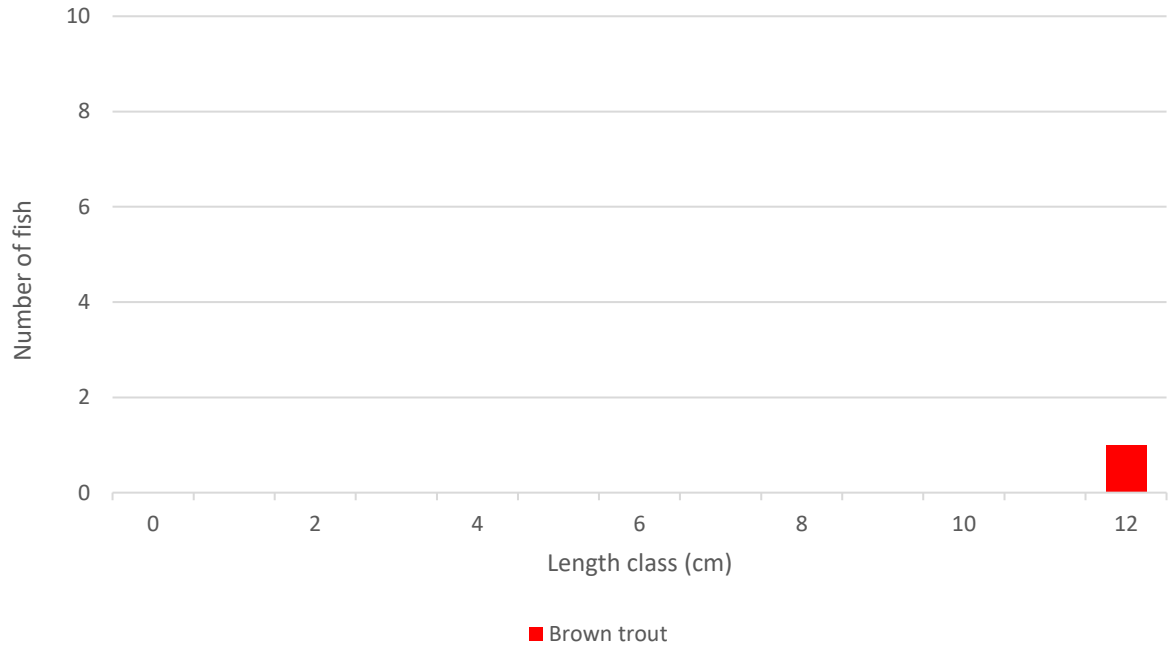

Figure 3.4 Length frequency distribution recorded via electro-fishing at B1 on the Lissyneillan River, July 2024

Plate 3.5 Representative image of site B1 on the Lissyneillan River, July 2024 (abundant iron oxidising bacterial deposits)

3.1.6 Site B2 – Lissyneillan River, R483 road crossing

Brown trout (*n*=15), European eel (*n*=1) and three-spined stickleback (*Gasterosteus aculeatus*) (*n*=10) were recorded via electro-fishing at site B2 on the Lissyneillan River (28L10) approximately 3.6km downstream of site B1 (**Figure 3.5**).

Despite significant water quality pressures, the site was of moderate value to salmonids supporting a low density of mixed cohort trout. However, spawning, nursery and holding habitat were of poor quality (but would all improve at higher water levels). Abundant instream refugia (although mostly bedded) provided some localised habitat for European eel although this was sub-optimal and supported only a low density of fish. Despite abundant soft sediment deposits these were typically flocculent and unsuitable for lamprey ammocoetes (none recorded during the survey).

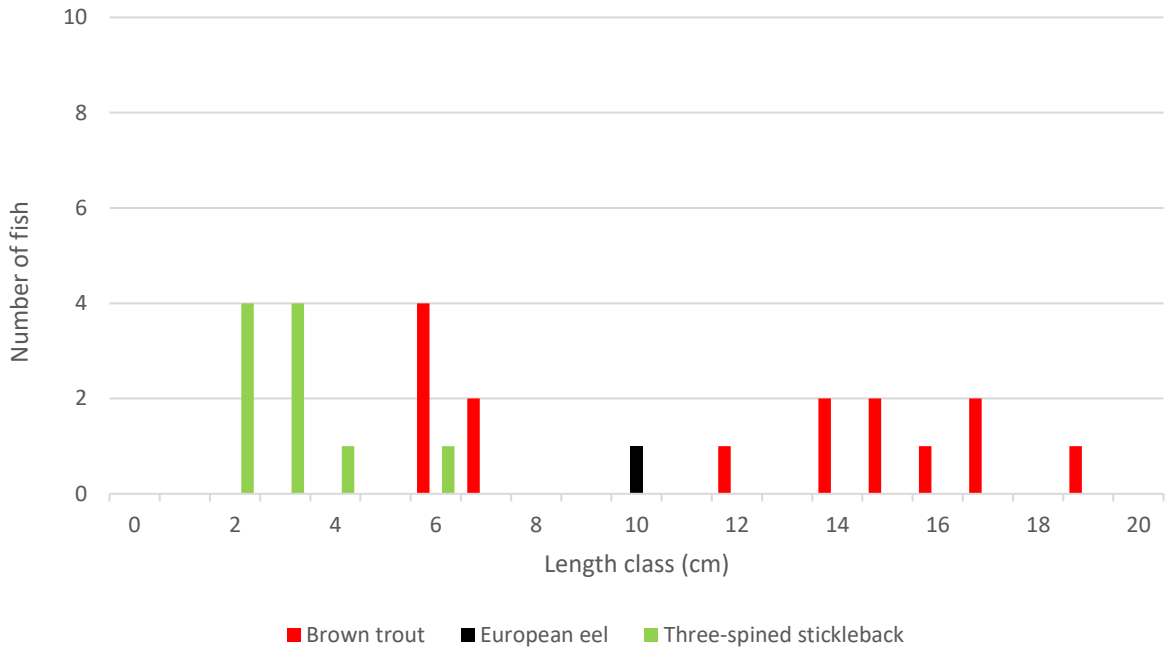

Figure 3.5 Length frequency distribution recorded via electro-fishing at B2 on the Lissyneillan River, July 2024

Plate 3.6 Mixed cohort brown trout recorded at site B2 on the Lissyneillan River, July 2024

3.1.7 Site B3 – Carrownagry South Stream, Carrownagry South

Despite some physical suitability, no fish were recorded via electro-fishing at site B3 on the upper reaches of the Carrownagry South Stream (28C38) adjoining the proposed site boundary. The stream suffered from low summer flows and this likely precluded the absence of resident fish during the survey. However, given the presence of abundant mixed gravel substrata (although silted), suitability

for a small salmonid (trout) population existed under higher flows (seasonal migration from downstream areas). There was also some low suitability for European eel although the location of the site in the upper reaches of the catchment would reduce the inherent value. The peat-dominated soft sediment was unsuitable for lamprey ammocoetes.

Plate 3.7 Representative image of site B3 on the Carrownagry South Stream, July 2024

3.1.8 Site B4 – Annageeragh River, Knocknahila Bridge

Atlantic salmon (*n*=27), brown trout (*n*=30) and European eel (*n*=9) were recorded via electro-fishing at site B4 on the Annageeragh River (28A02) at Knocknahila Bridge (**Figure 3.6**).

The site was a good quality salmonid habitat with abundant cobble and boulder flow refugia supporting a relatively high density of juveniles. Salmonid spawning habitat was present locally although this was limited in extent and better represented downstream in larger riffle zones. Frequent pools under tree/macrophyte cover and bank scours offered high quality holding areas for adult salmonids (including pool under bridge). Such areas also provided high quality European eel habitat, which were present in good densities (inclusive of elvers). The high energy site was unsuitable for lamprey.

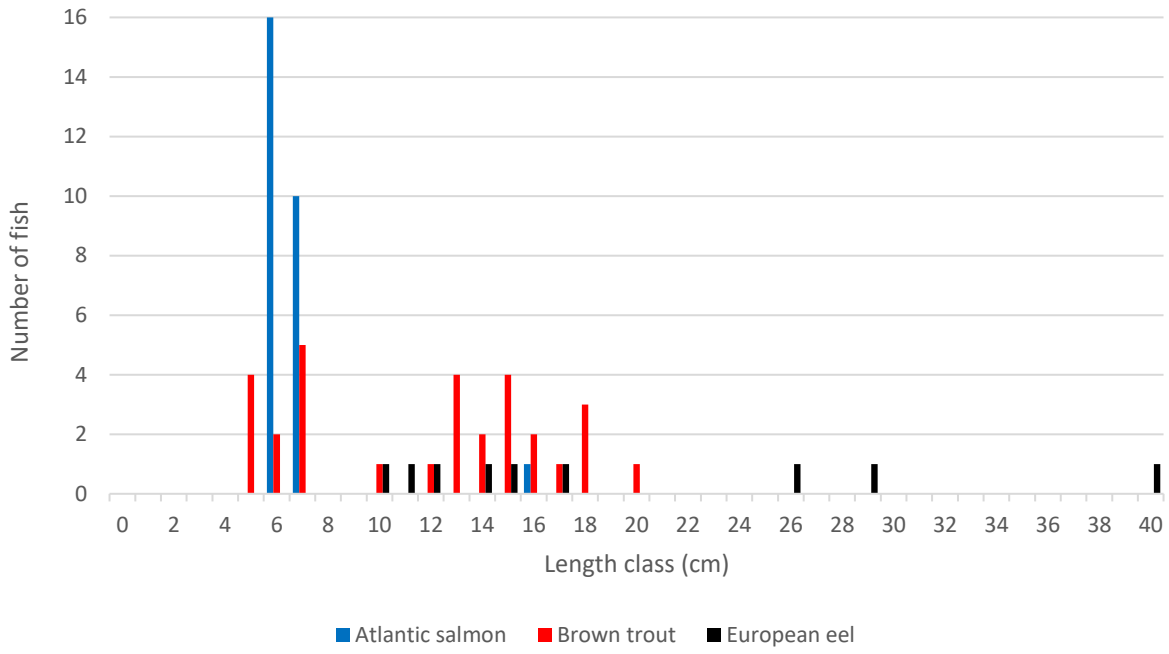

Figure 3.6 Length frequency distribution recorded via electro-fishing at site B4 on the Annageeragh River at Knocknahila Bridge

Plate 3.8 Browen trout (top) and Atlantic salmon (bottom) recorded at site B4 on the Annageeragh River, July 2024

3.1.9 Site D1 – Creegh River, Clonwhite South

Atlantic salmon (*n*=24), brown trout (*n*=27) and European eel (*n*=11) were recorded via electro-fishing at site D1 on the upper reaches of the Creegh River (28C02) (**Figure 3.7**).

The site was of high value for salmonids, supporting good quality nursery habitat with locally abundant instream refugia and good densities of juveniles. Widespread deep glide and pool were of high value as holding habitat for adult salmonids. The site was of relatively poor value as a spawning habitat with a paucity of suitable substrata and siltation pressures. Instream coarse substrata inclusive of macrophyte beds provided high suitability refugia for European eel which were recorded in moderate densities (mixed cohorts). Despite the presence of soft sediment, it was sand dominated with limited organic material making it unsuitable for lamprey ammocoetes.

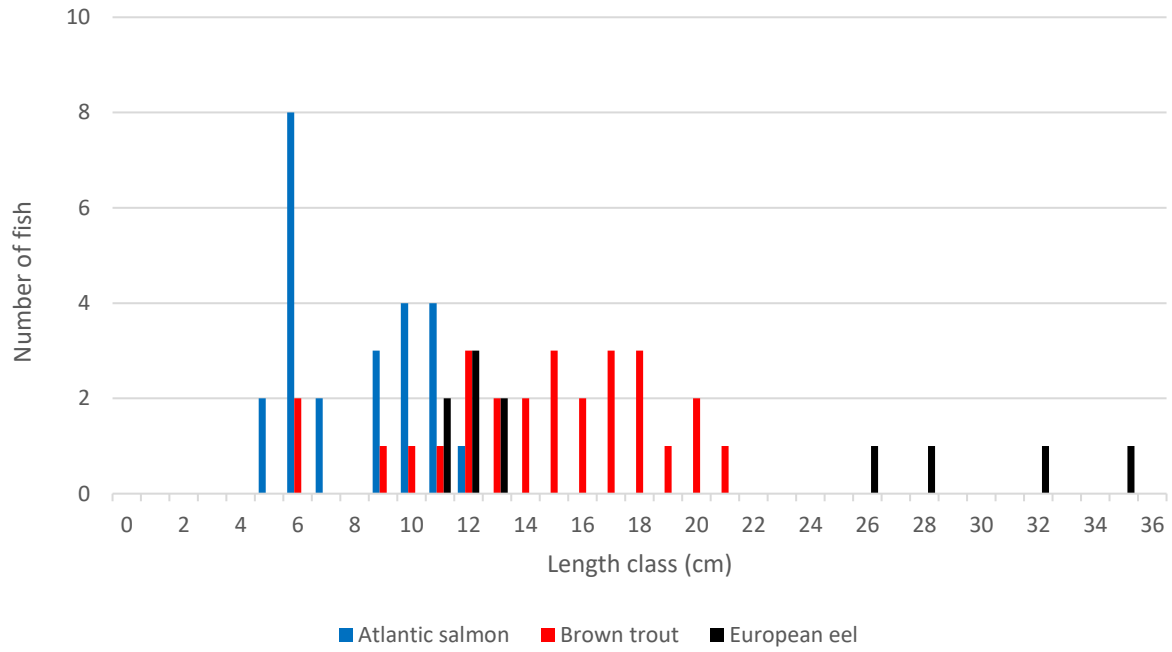

Figure 3.7 Length frequency distribution recorded via electro-fishing at site D1 on the Creegh River, July 2024

Plate 3.9 Mixed cohort European eel recorded at site D1 on the Creegh River, July 2024

3.1.10 Site D2 – Cloonwhite North Stream, Cloonwhite South

No fish were recorded via electro-fishing at site D2 on the uppermost reaches of the Cloonwhite North Stream (28C30), a tributary of the Creegh River. The stream at this location was of poor fisheries value given low flows, significant historical modifications and heavy siltation pressures. However, given connectivity to the nearby Creegh River, there would be some low potential for migration of salmonids and European eel under higher flows.

Plate 3.10 Representative image of site D2 on the Cloonwhite North Stream, July 2024

3.1.11 Site D3 – Kilmihill River, Clooneeddan

Atlantic salmon (*n*=3), brown trout (*n*=11) and three-spined stickleback (*n*=2) were recorded via electro-fishing at site D3 on the Kilmihill River (28K02) at a local road and proposed GCR crossing (**Figure 3.8**).

Despite significant instream modifications, the site was of value as a salmonid nursery, supporting a low density of juvenile salmon and trout. The site was of moderate spawning value despite siltation pressures. Holding habitat for adult salmonids was largely absent in the shallow river at this location. The perched apron was not considered a barrier to fish passage except at low flows. Suitability for European eel was moderate with ample instream refugia although none were recorded. Suitability for lamprey was low with no suitable nursery habitat present.

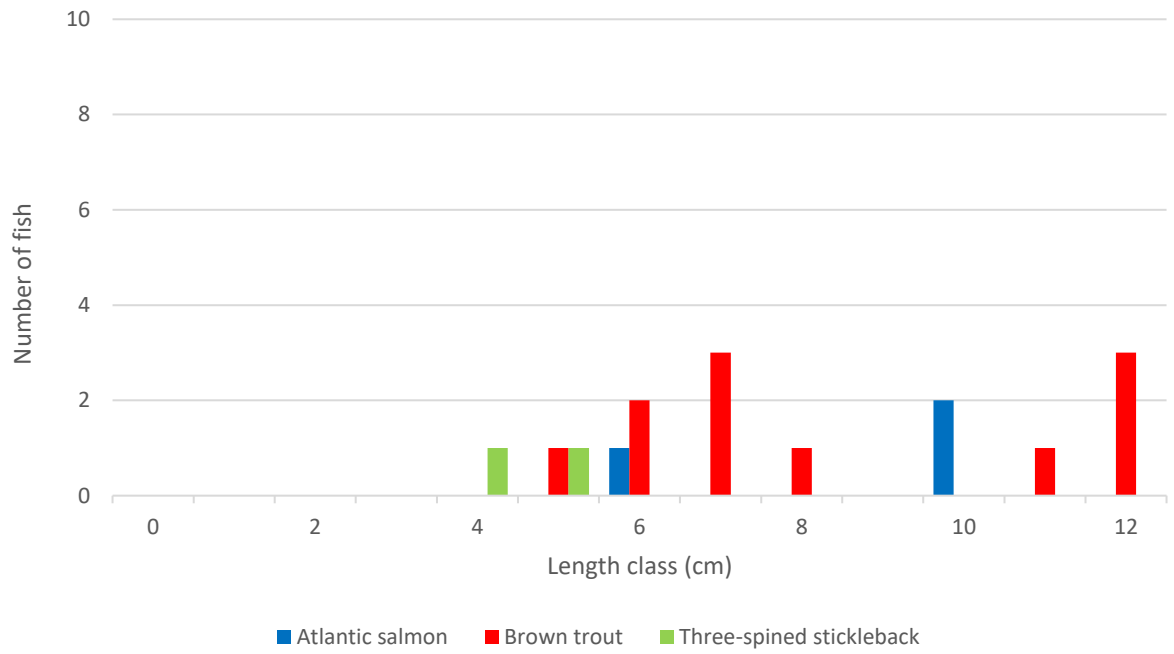

Figure 3.8 Length frequency distribution recorded via electro-fishing at D3 on the Kilmihill River, July 2024

Plate 3.11 Representative image of site D3 on the Kilmihill River, July 2024

3.1.12 Site D4 – Kilmihill River, Kilmacduane East

Atlantic salmon (*n*=11), brown trout (*n*=19) and three-spined stickleback (*n*=8) were recorded via electro-fishing at site D4 on the Kilmihill River (28K02) at a local road and proposed GCR crossing approximately 350m downstream of site D3 (**Figure 3.9**).

Despite significant instream modifications and poor hydromorphology, the site was of value as a salmonid nursery, supporting a moderate density of juvenile salmon and trout (despite lack of refugia etc.). The site was of poor spawning value given significant siltation pressures. The quality of spawning habitat improved upstream (near site D3). Suitability for European eel was poor given a paucity of instream refugia and none were recorded. Soft sediment accumulations were typically flocculent and of poor suitability for lamprey ammocoetes (none recorded).

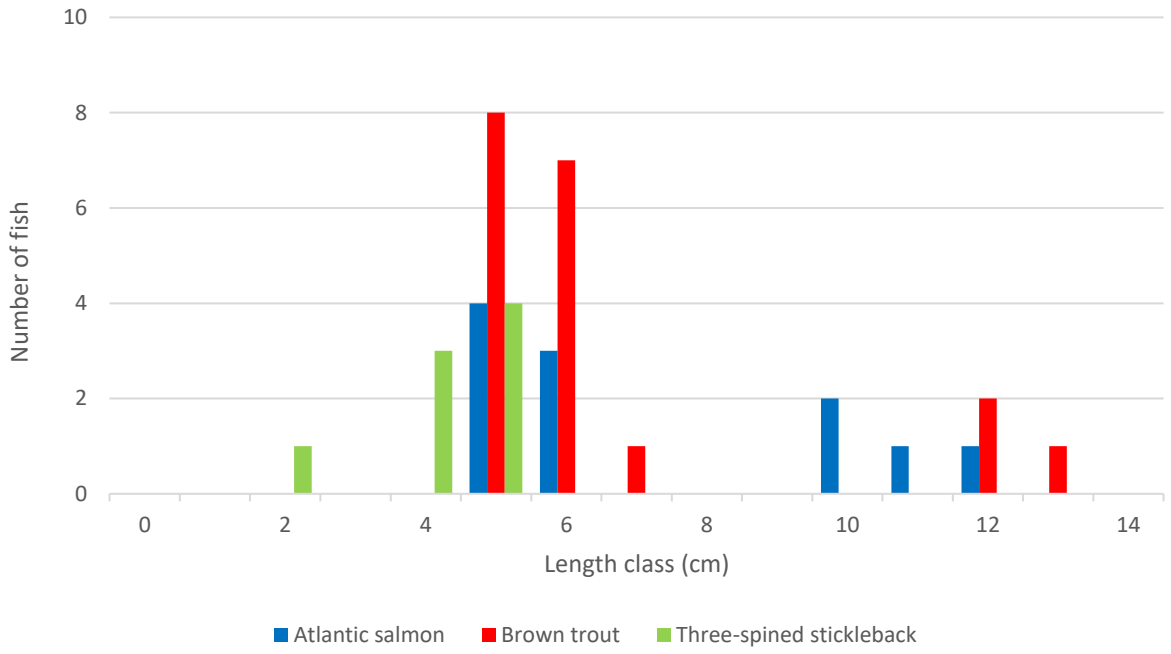

Figure 3.9 Length frequency distribution recorded via electro-fishing at D4, July 2024

Plate 3.12 Brown trout and three-spined stickleback recorded at site D4 on the Kilmihill River, July 2024

3.1.13 Site D5 – Kilmihill River, Clooncullin

Atlantic salmon (*n*=8), brown trout (*n*=17), lamprey (*Lampetra* sp.) (*n*=18) and European eel (*n*=7) were recorded via electro-fishing at site D5 on the Kilmihill River (28K02) approximately 2.5km downstream of site D4 (**Figure 3.10**).

Despite historical modifications locally, the site was of good value for salmonids supporting a moderate density of mixed cohort trout with low numbers of salmon. Shallow riffle and glide provided good quality nursery habitat given an abundance of refugia, with deeper glide and pool with undercut banks and overhanging vegetation providing valuable flow refugia for adults. The quality of salmonid and lamprey spawning habitat, however, was poor given siltation pressures. Boulder zones and deeper glide were of high quality for European eel which were present in moderate densities, with juveniles present alongside lamprey ammocoetes buried in soft sediment. Shallow soft sediment accumulations under the bridge supported a high density of juvenile ammocoetes (12 per m^2).

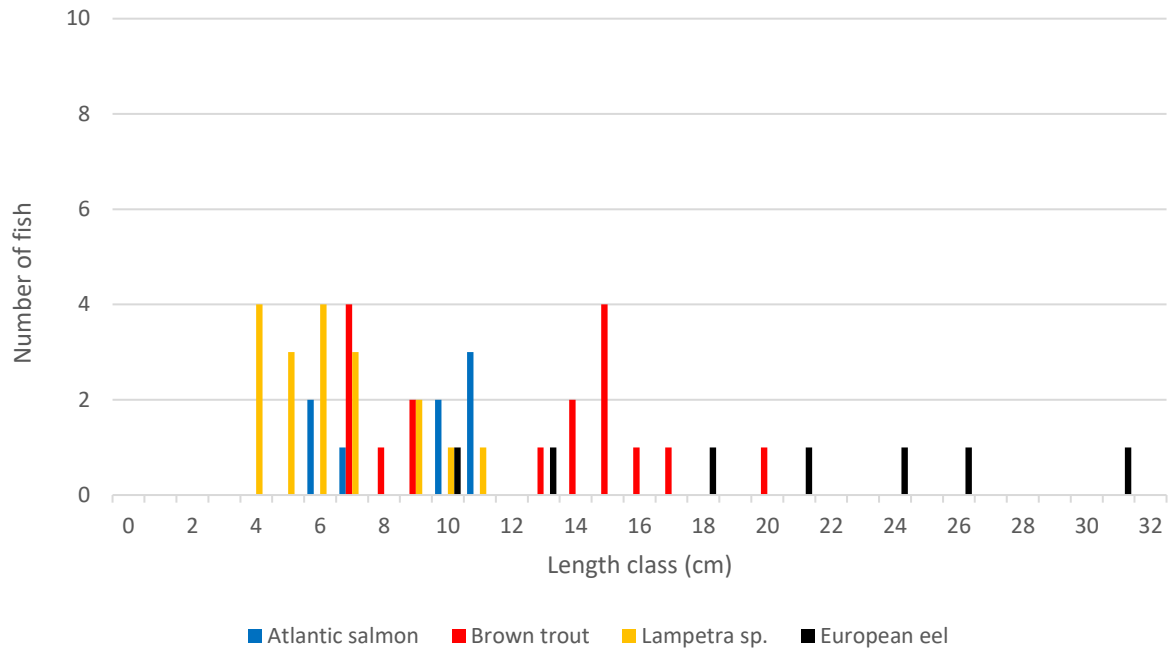

Figure 3.10 Length frequency distribution recorded via electro-fishing at site D5, July 2024

Plate 3.13 *Lampetra* sp. ammocoete and juvenile European eel recorded at site D5 on the Kilmihill River, July 2024

3.1.14 Site D6 – Doonbeg River, Clooncullin Bridge

Atlantic salmon (*n*=86), brown trout (*n*=9), lamprey (*Lampetra* sp.) (*n*=3) and European eel (*n*=24) were recorded via electro-fishing at site D6 on the Doonbeg River (28D02) at Clooncullin Bridge (**Figure 3.11**).

The site was of very high value for salmonids, with particularly good nursery habitat present in boulder refugia. The supported high densities of juvenile salmon. Whilst spawning habitat was present downstream, the predominance of large substrata was better suited to Atlantic salmon rather than brown trout. Deeper glide and small pools with riparian tree cover provided valuable holing areas for adult salmonids. Areas of bryophyte-rich boulder were of very high value for European eel which were present at high densities (excellent quality habitat). Small areas of sand-dominated softer sediment between boulders supported low densities of lamprey ammocetes (1.5 per m^2).

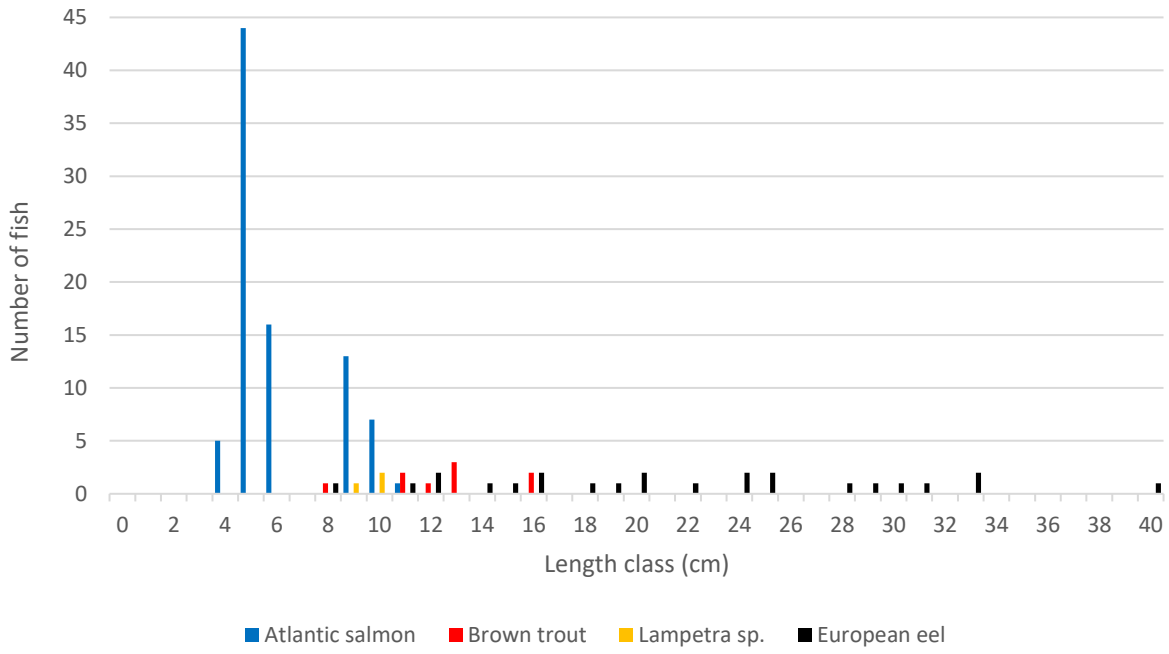

Figure 3.11 Length frequency distribution recorded via electro-fishing at site D6 on the Doonbeg River, July 2024

Plate 3.14 Mixed cohort Atlantic salmon and brown trout recorded at site D6 on the Doonbeg River, July 2024

3.1.15 Site D7 – Tullagower Trib West, Brisla West

No fish were recorded via electro-fishing at site D7 on the Tullagower Trib West Stream (28T16). The channel at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats.

Plate 3.15 Representative image of site D7 on the Tullagower Trib West, July 2024

3.1.16 Site D8 – Tullagower River, Gowerhass

No fish were recorded via electro-fishing at site D8 on the Tullagower River (28T01) at a local road and proposed GCR crossing. The channel at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats.

Plate 3.16 Representative image of site D8 on the upper reaches of the Tullagower River, July 2024

3.1.17 Site D9 – Moyasta River, Carraunnatooha

No fish were recorded via electro-fishing at site D9 on the upper reaches of the Moyasta River (27M04) at a local road and proposed GCR crossing. The channel at this location was not of fisheries value given its dry, ephemeral nature, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats. Populations of brown trout, sea trout, European eel, lamprey (*Lampetra* sp.), three-spined stickleback and flounder are known in the lower reaches of this watercourse (Triturus 2023 data).

Plate 3.17 Representative image of site D9 on the upper reaches of the Moyasta River, July 2024 (dry channel)

3.1.18 Site D10 – Wood River, Knockerry West

Despite some low suitability for salmonids, no fish were recorded via electro-fishing at site D10 on the upper reaches of the Wood River (28W01). The site was of poor fisheries value given significant water quality pressures and historical modifications and the location in the upper reaches of the watercourse. Furthermore, the road culvert was a significant barrier to fish migration, with very poor fisheries habitat present upstream.

Plate 3.18 Representative image of site D10 on the Wood River, July 2024

3.1.19 Site D11 – Garraunnatooha Stream, Knockerry West

Brown trout (*n*=2) were the only fish species recorded via electro-fishing at site D11 on the Garraunnatooha Stream (28G18) at a local road and proposed GCR crossing (**Figure 3.12**).

The site was of poor fisheries value given historical modifications, low summer flows and evident water quality pressures. However, a low density of brown trout were recorded in isolated pools. Spawning, nursery and holding opportunities were poor. Furthermore, the collapsing road culvert was a significant barrier to fish migration, with reduced quality fisheries habitat present upstream. The fisheries value would improve under higher (winter) flows.

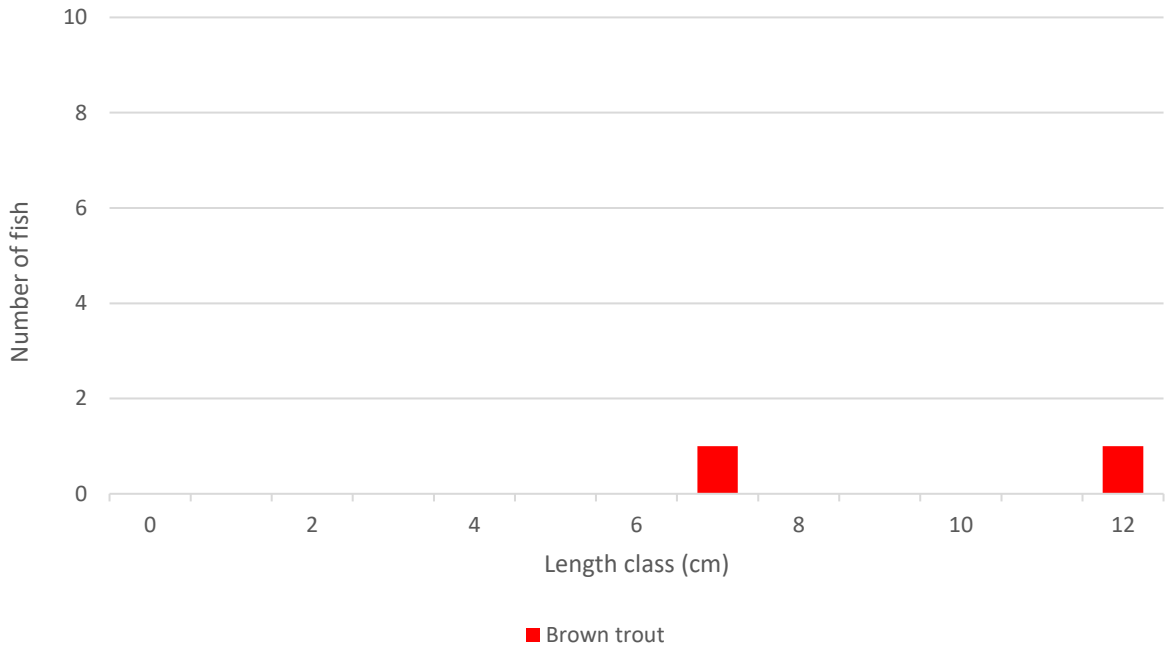

Figure 3.12 Length frequency distribution recorded via electro-fishing at site D11 on the Garraunnatooha Stream, July 2024

Plate 3.19 Representative image of site D11 on the Garraunnatooha Stream, July 2024

3.1.20 Site D12 – Kilcarroll Stream, Carrowfree

No fish were recorded via electro-fishing at site D12 on the Kilcarroll Stream (28K06) at a local road and proposed GCR crossing. The channel at this location was not of fisheries value given poor flows, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats.

Plate 3.20 Representative image of site D12 on the Kilcarroll River, July 2024

3.1.21 Site D13 – Knockerry East Stream, Derrylough

No fish were recorded via electro-fishing at site D13 on the Knockerry East Stream (28K49) at a local road and proposed GCR crossing. The channel at this location was not of fisheries value given its dry, ephemeral nature, significant historical modifications and heavy siltation pressures, in addition to poor fluvial connectivity with downstream habitats.

Plate 3.21 Representative image of site D13 on the Knockerry East Stream, July 2024 (dry channel)

3.1.22 Site D14 – Moylougha River, Ballymacrinay

European eel (*n*=7) were the only fish species recorded via electro-fishing at site D14 on the Moylougha River (28M19) at a local road and proposed GCR crossing (**Figure 3.13**).

Despite low summer flows, downstream barriers and poor quality instream habitats, the site supported a moderate density of mixed cohort eels (including elvers). There was very poor suitability for salmonids, with an absence of resident fish at the time of survey likely due to low summer flows and water quality issues.

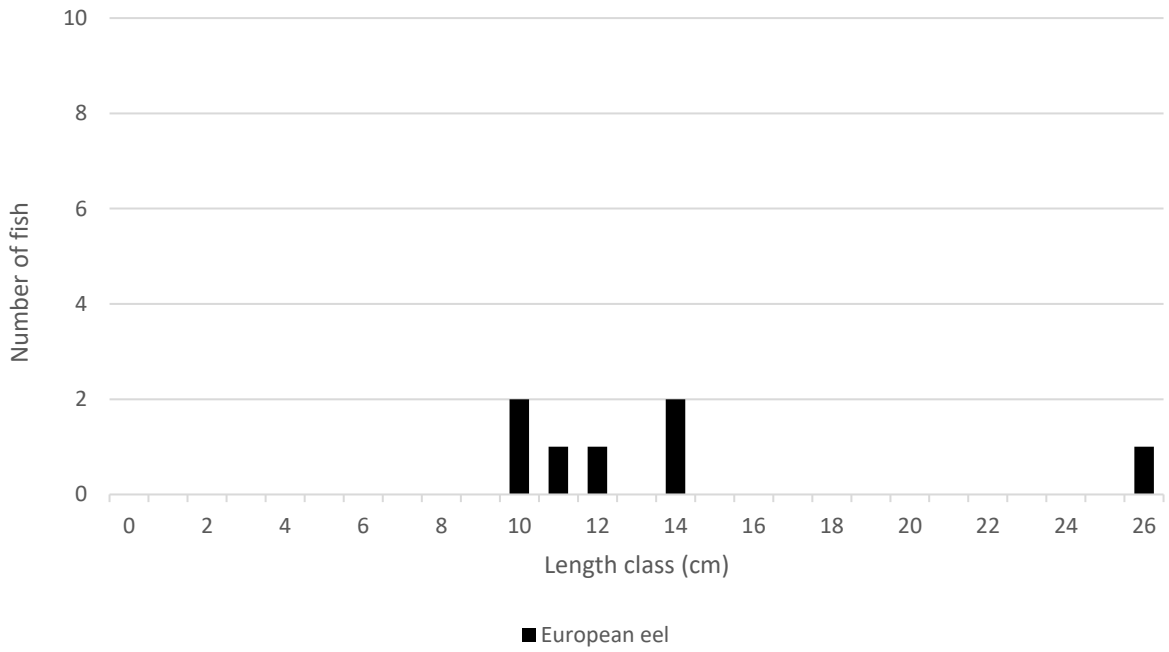

Figure 3.13 Length frequency distribution recorded via electro-fishing at site D14 on the Moylougha River, July 2024

Plate 3.22 European eel recorded at site D14 on the Moylougha River, July 2024

3.1.23 Site D15 – Moylougha River, Carrowdotia North

Site D15 was located on the lower reaches of the Moylougha River (28M19) at the N67 road and proposed GCR crossing, adjacent to Moneypoint Power Station. However, contrary to EPA mapping, the river had been culverted underground with no aquatic habitats present in vicinity of the road crossing. Given the culverted (underground) nature of the watercourse at this location, it was not possible to undertake an electro-fishing survey.

Plate 3.23 Representative image of site D15, July 2024 (culverted underground)

3.1.24 Site D15 – Moylougha River, Carrowdotia North

Site D15 was located on the lower reaches of the Moylougha River (28M19) at the N67 road and proposed GCR crossing, adjacent to Moneypoint Power Station. However, contrary to EPA mapping, the river had been culverted underground with no aquatic habitats present in vicinity of the road crossing. Given the culverted (underground) nature of the watercourse at this location, it was not possible to undertake an electro-fishing survey.

Plate 3.24 Representative image of site D15 on the Burrane Lower Stream, August 2025

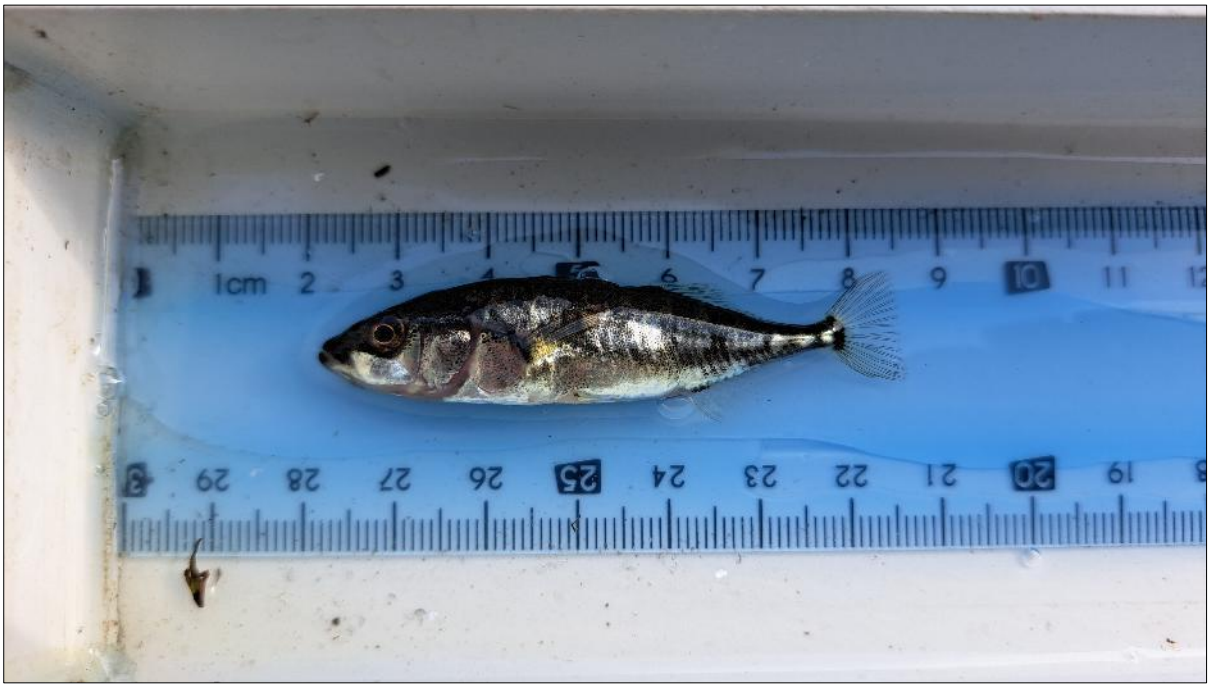

Plate 3.25 Three-spined stickleback recorded via sweep sampling site D15 in August 2025

Table 3.1 Fish species densities per m^2 recorded at sites in the vicinity of the proposed Cahermurphy 2B wind farm via electro-fishing in July 2024 (values in **bold** represent the highest densities recorded for each species, respectively)

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Atlantic salmon	Brown trout	Sea trout	*Lampetra* sp.	European eel	Three-spined stickleback	Flounder
A1	Knocknahila More River	5	45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A2	Knocknahila More River	10	125	0.000	0.024	0.000	0.000	0.016	0.000	0.000
A3	Clooneenagh Stream	10	120	0.000	0.117	0.000	0.000	0.008	0.000	0.000
A4	Creegh River	10	360	0.078	0.044	**0.003**	0.000	0.042	0.000	**0.003**
B1	Lissyneillan River	5	80	0.000	0.013	0.000	0.000	0.000	0.000	0.000
B2	Lissyneillan River	10	150	0.000	0.100	0.000	0.000	0.007	**0.067**	0.000
B3	Carrownagry South Stream	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B4	Annageeragh River	10	315	0.086	0.095	0.000	0.000	0.029	0.000	0.000
D1	Creegh River	10	225	0.107	**0.120**	0.000	0.000	0.049	0.000	0.000
D2	Cloonwhite North Stream	5	75	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D3	Kilmihill River	5	100	0.030	0.110	0.000	0.000	0.000	0.020	0.000
D4	Kilmihill River	10	240	0.046	0.079	0.000	0.000	0.000	0.033	0.000
D5	Kilmihill Stream	10	210	0.038	0.081	0.000	**12 per m2**	0.033	0.000	0.000
D6	Doonbeg River	10	280	**0.307**	0.032	0.000	1.5 per m2	**0.086**	0.000	0.000
D7	Tullagower Trib West	5	25	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D8	Tullagower River	5	45	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Atlantic salmon	Brown trout	Sea trout	*Lampetra* sp.	European eel	Three-spined stickleback	Flounder
D9	Moyasta River	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D10	Wood River	10	240	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D11	Garraunnatooha Stream	10	150	0.000	0.013	0.000	0.000	0.000	0.000	0.000
D12	Kilcarroll Stream	5	30	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D13	Knockerry East Stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D14	Moylougha River	5	90	0.000	0.000	0.000	0.000	0.078	0.000	0.000
D15	Moylougha River	n/a	Culverted channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a
D16	Burrane Lower Stream	Fisheries appraisal only		n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 3.2 Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the vicinity of the proposed development, July 2024

Site	Watercourse	Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	Other species
A1	Knocknahila More River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
A2	Knocknahila More River	Not recorded	Low	Not recorded	Low	Not recorded
A3	Clooneenagh Stream	Not recorded	Medium	Not recorded	Low	Not recorded
A4	Creegh River	Medium	Medium	Not recorded	High	Sea trout
B1	Lissyneillan River	Not recorded	Low	Not recorded		Not recorded
B2	Lissyneillan River	Not recorded	Medium	Not recorded	Low	Three-spined stickleback
B3	Carrownagry South Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
B4	Annageeragh River	Medium	Medium	Not recorded	Medium	Not recorded
D1	Creegh River	Medium	Medium	Not recorded	Medium	Not recorded
D2	Cloonwhite North Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D3	Kilmihill River	Low	Medium	Not recorded	Not recorded	Three-spined stickleback
D4	Kilmihill River	Medium	Medium	Not recorded	Not recorded	Three-spined stickleback
D5	Kilmihill Stream	Low	Medium	High	Medium	Not recorded
D6	Doonbeg River	Very high	Low	Low	Very high	Not recorded
D7	Tullagower Trib West	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D8	Tullagower River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D9	Moyasta River	Not recorded	Not recorded	Not recorded	Not recorded	No fish recorded – dry channel
D10	Wood River	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D11	Garraunnatooha Stream	Not recorded	Low	Not recorded	Not recorded	Not recorded
D12	Kilcarroll Stream	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded
D13	Knockerry East Stream	Not recorded	Not recorded	Not recorded	Not recorded	No fish recorded – dry channel
D14	Moylougha River	Not recorded	Not recorded	Not recorded	Medium	Not recorded
D15	Moylougha River	Not recorded	Not recorded	Not recorded	Not recorded	No fish recorded – culverted channel
D16	Burrane Lower Stream	Negative eDNA	Positive eDNA	Negative eDNA	Positive eDNA	

Conservation value: Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*) and river lamprey (*Lampetra fluviatilis*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. 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 and sea trout are also protected under the Wild Salmon and Sea Trout Tagging Scheme (Amendment) Regulations 2023. With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

4. Discussion

Most of surveyed watercourses in vicinity of the proposed project were upland eroding, natural or semi-natural in character, maintained good summer flows and were of value for salmonids and European eel. A typical diversity of fish species for hydrometric areas 27 (Shannon Estuary North) and 28 (Mal Bay) was recorded during the electro-fishing survey, with Atlantic salmon, brown trout, sea trout, lamprey (*Lampetra* sp.), European eel, three-spined stickleback and flounder captured (**Table 3.1, 3.2**). A total of 9 no. sites[1] (A1, B3, D2, D7, D8, D9, D10, D12 & D13) had no fish recorded during the survey. These were primarily located along the proposed GCR or in the upper reaches of watercourses where fisheries habitats are often of inherently poor quality.

Salmonid populations were widespread in vicinity of the proposed wind farm but less so along the proposed grid cable route where smaller, often heavily modified channels provided lower quality fisheries habitats. Brown trout were recorded from a total of 12 no. sites with Annex II Atlantic salmon present at 7 no. sites on the Creegh River (A4 & D1), Annageeragh River (B4), Kilmihill River (D3, D4 & D5) and Doonbeg River (D6), typically in low to medium numbers (**Table 3.2**). The highest salmonid densities were recorded on the Doonbeg River (**Table 3.1**), reflecting the high quality nursery habitat present. Anadromous sea trout were recorded from site A4 on the Creegh River, a site known to support the species (Matson et al., 2018a; Kelly et al., 2013, 2011). Despite poor quality habitats, brown trout were detected via eDNA sampling on the Burrane Lower Stream at site D16 (proposed GCR crossing). Siltation pressures were widespread in the survey area and impacted the quality of salmonid spawning habitat, in addition to historical hydromorphological modifications.

Lamprey (*Lampetra* sp.) ammocoetes were only recorded from sites D5 and D6 on the Kilmihill River, with site D5 providing good quality albeit localised nursery habitat given a predominance of soft sediment accumulations in the historically modified channel. This restricted distribution reflected the upland, higher-energy, spate nature of the survey watercourses which reduces the extent of fine gravels required for spawning (Dawson et al., 2015; Rooney et al., 2013; Lasne et al., 2010) and discourages the deposition of fine, organic-rich sediment ≥5cm in depth generally required by larval *Lampetra* spp. (Aronsuu & Virkkala, 2014; Goodwin et al., 2008; Gardiner, 2003). Although located in close proximity to the sea, none of the survey watercourses are known to support anadromous sea lamprey (*Petromyzon marinus*) or river lamprey (*Lampetra fluviatilis*) (NPWS & IFI data), primarily due to instream barriers and natural gradients which prohibit catchment ingress.

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). European eel were relatively widespread in the survey area and were recorded from a total of 9 no. sites on the Knocknahila More River (A2), Clooneenagh Stream (A3), Creegh River (A4, D1), Lissyneillan River (B2), Annageeragh River (B4), Kilmihill Stream (D6), Doonbeg River (D6) and the Moylougha River (D14) (**Table 3.2**). Eel were also detected via eDNA sampling on the Burrane Lower Stream at site D16 (August 2025). Particularly high numbers were recorded on the Creegh River at Drumellihy Bridge (site A4) and the Doonbeg River at Clooncullin Bridge (site D6) where high quality adult and juvenile habitats were present on watercourses where no significant instream barriers impact fish passage. Despite significant culverting, eel were evidently able to access the Moylougha River from marine habitats (i.e. present at site D14). Soft sediment accumulations at site

[1] Site D15 on the Moylougha River was culverted underground and thus not accessible for survey

D5 on the Kilmihill River supported both lamprey ammocoetes and elvers, behaviour often observed at sites with higher eel densities (Harwood et al., 2022; Steendam et al., 2020; Christoffersen et al., 2018; Triturus pers. obs.). Eel abundance naturally decreases with gradient and distance from marine habitats (Matondo et al., 2021; Degerman et al., 2019), with a greater frequency of eel typically found in the lower reaches of watercourses (Moriarty, 2003), as observed in the current survey.

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.

Christoffersen, M., Svendsen, J. C., Kuhn, J. A., Nielsen, A., Martjanova, A., & Støttrup, J. G. (2018). Benthic habitat selection in juvenile European eel *Anguilla anguilla*: implications for coastal habitat management and restoration. Journal of Fish Biology, 93(5), 996-999.

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.

Degerman, E., Tamario, C., Watz, J., Nilsson, P. A., & Calles, O. (2019). Occurrence and habitat use of European eel (*Anguilla anguilla*) in running waters: lessons for improved monitoring, habitat restoration and stocking. Aquatic ecology, 53(4), 639-650.

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.

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.

Harwood, A. J., Perrow, M. R., Sayer, C. D., Piper, A. T., Berridge, R. J., Patmore, I. R., ... & Cooper, G. (2022). Catchment-scale distribution, abundance, habitat use, and movements of European eel (*Anguilla anguilla* L.) in a small UK river: Implications for conservation management. Aquatic Conservation: Marine and Freshwater Ecosystems, 32(5), 797-816.

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.

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

IFI (2015). Report on Salmon Monitoring Programme – 2014. Report on projects to assess attainment of Conservation Limit for Atlantic Salmon in Irish Rivers. Inland Fisheries Ireland. IFI 2016/1-4236. December 2015.

Kelly, F.L., Harrison, A., Connor, L., Wightman, G., Matson, R., Hanna, G., Feeney, R., Morrissey, E., O'Callaghan, R., Wogerbauer, C., Rocks, K., Hayden, B., & Stafford, T. (2011). Sampling fish for the Water Framework Directive – Rivers 2009: Shannon International River Basin District Rivers. Central and Regional Fisheries Boards, Dublin.

Kelly, F.L., Matson, R., Connor, L., Feeney, R., Morrissey, E., Wogerbauer, C. & Rocks, K. (2013). Water Framework Directive Fish Stock Survey of Rivers in the Shannon International River Basin District. Inland Fisheries Ireland, Swords Business Campus, Swords, Co. 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,.

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.

Matondo, B. N., Benitez, J. P., Dierckx, A., Renardy, S., Rollin, X., Colson, D., ... & Ovidio, M. (2021). What are the best upland river characteristics for glass eel restocking practice?. Science of the Total Environment, 784, 147042.

Matson, R., Delanty, K., Gordon, P., O'Briain, R., Garland, D., Cierpal, D., Connor, L., Corcoran, W., Coyne, J., McLoone, P., Morrisey-McCaffrey, E., Brett, T., Ní Dhonnabhain, L. & Kelly, F.L., (2018a). Sampling Fish in Rivers 2017 – Creegh, Factsheet No. 23. National Research Survey Programme. Inland Fisheries Ireland.

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

Moriarty, C. (2003). The yellow eel. In Eel Biology, pp. 89-105). Springer, Tokyo.

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.

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

Steendam, C., Verhelst, P., Van Wassenbergh, S., & De Meyer, J. (2020). Burrowing behaviour of the European eel (*Anguilla anguilla*): Effects of life stage. Journal of Fish Biology, 97(5), 1332-1342.

Triturus Environmental Ltd.,

Unit 5 Anchor Business Park,

Little Island,

Co. Cork,

T45 XN59.

8. Appendix B – eDNA lab report

Folio No:	3985-2025
Purchase Order:	eDNA_Cahermurphy
Contact:	Triturus Environmental Ltd
Issue Date:	27.08.2025
Received Date:	14.08.2025

eDNA Report

Technical Report

SureScreen Scientifics

Triturus

Folio No: 3985-2025
Purchase Order: eDNA_Cahermurphy
Contact: Triturus Environmental Ltd
Issue Date: 27.08.2025
Received Date: 14.08.2025

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
FK2925	D16 - Byrrane Lower Stream Cahermurphy Wind Farm		White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
			Brown (sea) trout (Salmo trutta)	Pass	Positive	2
			European eel (Anguilla anguilla)	Pass	Positive	11
			Brook/River lamprey (Lampetra planeri/ Lampetra fluviatilis)	Pass	Negative	0

Matters affecting result: none

Reported by:Consuela Sopronyi

Approved by: Lauryn Jewkes

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

Folio No:	3985-2025
Purchase Order:	eDNA_Cahermurphy
Contact:	Triturus Environmental Ltd
Issue Date:	27.08.2025
Received Date:	14.08.2025

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

9. Appendix C – Macro-invertebrates (biological water quality)

Table 9.1 Macro-invertebrate Q-sampling results for sites A1-A4 and B1-B4, July 2024

Group	Family	Species	A1	A2	A3	A4	B1	B2	B3	B4	EPA group
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*				3				2	**A**
Plecoptera	Nemouridae	*Nemurella pictetii*					4		1		**A**
Ephemeroptera	Baetidae	*Alainites muticus*				1		1			**B**
Plecoptera	Leuctridae	*Leuctra fusca*			1	8		12		18	**B**
Plecoptera	Leuctridae	*Leuctra hippopus*						4	3		**B**
Trichoptera	Cased caddis pupa	sp. indet.			13		1				**B**
Trichoptera	Leptoceridae	*Athripsodes aterrimus*								1	**B**
Trichoptera	Limnephilidae	*Halesus radiatus*								1	**B**
Trichoptera	Limnephilidae	*Micropterna* sp.							11	1	**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*		2			6	3			**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*						1		6	**B**
Odonata	Calopterygidae	*Calopteryx splendens*									**B**
Ephemeroptera	Baetidae	*Baetis rhodani*		46		44		64	6	17	**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*				21		81		32	**C**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*				8					**C**
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*				25		3		36	**C**
Trichoptera	Philopotamidae	*Wormaldia occipitalis*								1	**C**
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*							2		**C**
Trichoptera	Polycentropodidae	*Polycentropus kingi*						1			**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*		5	2	7		9		18	**C**
Trichoptera	Rhyacophilidae	*Rhyacophila munda*								3	**C**
Crustacea	Gammaridae	*Gammarus duebeni*			14		1	152	26	9	**C**
Coleoptera	Dytiscidae	Dytiscidae larva						2			**C**
Coleoptera	Dytiscidae	*Hydroporus tessellatus*							2		**C**
Coleoptera	Dytiscidae	*Hygrotus inaequalis*						4			**C**

Group	Family	Species	A1	A2	A3	A4	B1	B2	B3	B4	EPA group
Coleoptera	Dytiscidae	*Nebrioporus depressus*						1			**C**
Coleoptera	Elmidae	*Elmis aenea*				17				1	**C**
Coleoptera	Elmidae	*Limnius volckmari*						18		9	**C**
Coleoptera	Elmidae	*Oulimnius tuberculatus*							7		**C**
Coleoptera	Gyrinidae	*Orectochilus villosus*						1			**C**
Coleoptera	Hydrophilidae	*Anacaena limbata*						1			**C**
Coleoptera	Hydrophilidae	*Helophorus brevipalpis*		1				2			**C**
Coleoptera	Hydrophilidae	*Helophorus minutus*						2			**C**
Diptera	Chironomidae	Non-*Chironomus* spp.	11	4	2	2	2	2		3	**C**
Diptera	Dixidae	sp. indet.			11						**C**
Diptera	Tipulidae	*Tipula* sp.			1						**C**
Diptera	Pediciidae	*Dicranota* sp.		1							**C**
Diptera	Simuliidae	sp. indet.		26	4	45	134	26		12	**C**
Hemiptera	Gerridae	*Gerris* sp.	6								**C**
Gastropoda	Planorbidae	*Ancylus fluviatilis*								9	**C**
Gastropoda	Tateidae	*Potamopyrgus antipodarum*				61	1	14			**C**
Crustacea	Crangonyctidae	*Crangonyx* sp.					2				**D**
Hirudinidae	Glossiphoniidae	sp. indet.						1		1	**D**
Diptera	Chironomidae	*Chironomus* spp.	4		5					2	**E**
Annelidae	Oligochaeta	sp. indet.	7	8	7					4	**n/a**
Abundance			**28**	**93**	**60**	**242**	**151**	**405**	**58**	**186**	
Q-rating			Q3*	Q3	Q3	Q3-4	Q3-4	Q3	Q3-4	Q3-4	
WFD status			Poor	Poor	Poor	Mod	Mod	Poor	Mod	Mod	

* tentative Q-rating given lack of suitable riffle areas for sampling and or poor flows (Toner et al., 2005)

Table 9.1 Macro-invertebrate Q-sampling results for sites D1-D14 (July 2024) and D16 (August 2025)

Group	Family	Species	D1	D2	D3	D4	D5	D6	D7	D8	D10	D11	D12	D14	D16	EPA group
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*						1								**A**
Ephemeroptera	Heptageniidae	*Heptagenia sulphurea*	3													**A**
Plecoptera	Nemouridae	*Nemurella pictetii*												3	4	**A**
Ephemeroptera	Baetidae	*Alainites muticus*			3	1	4	2								**B**
Plecoptera	Leuctridae	*Leuctra fusca*	32		5	7	6	11								**B**
Plecoptera	Leuctridae	*Leuctra hippopus*									3					**B**
Trichoptera	Cased caddis pupa	sp. indet.		2												**B**
Trichoptera	Leptoceridae	*Athripsodes aterrimus*	1													**B**
Trichoptera	Limnephilidae	*Halesus radiatus*						5	1	2	1					**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*		2			2				11					**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*					6	7	3		2					**B**
Odonata	Calopterygidae	*Calopteryx splendens*						2								**B**
Ephemeroptera	Baetidae	*Baetis rhodani*	28	5	45	58	82	31	5	1	15	4		37		**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*	49	1	34	21	17	16				1				**C**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*	3				5	1								**C**
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*			4	1	7	6								**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*	11			6	3	6								**C**
Trichoptera	Rhyacophilidae	*Rhyacophila munda*					3	2								**C**
Crustacea	Gammaridae	*Gammarus duebeni*		43	55	39	33	12	18	2	12	16	4	15	74	**C**
Coleoptera	Dytiscidae	Dytiscidae larva							1							**C**
Coleoptera	Dytiscidae	*Hydroporus tessellatus*											1			**C**
Coleoptera	Dytiscidae	*Hygrotus inaequalis*				3				1						**C**
Coleoptera	Elmidae	*Elmis aenea*	3				5		1		1				3	**C**
Coleoptera	Elmidae	*Limnius volckmari*	2		9	5	5	8			1	1				**C**
Coleoptera	Gyrinidae	*Orectochilus villosus*		1												**C**

Group	Family	Species	D1	D2	D3	D4	D5	D6	D7	D8	D10	D11	D12	D14	D16	EPA group
Coleoptera	Halipliidae	*Brychius elevatus*					2									C
Coleoptera	Hydraenidae	*Hydraena gracilis*	1				1									C
Coleoptera	Hydrophilidae	*Helophorus brevipalpis*					1							4		C
Coleoptera	Hydrophilidae	*Helophorus minutus*							1	3				2		C
Diptera	Ceratopogonidae	sp. indet.		2			1			2		1				C
Diptera	Chironomidae	Non-*Chironomus* spp.	1	2	3		2	4	1				8	11	8	C
Diptera	Dixidae	sp. indet.		4					1			2				C
Diptera	Tipulidae	*Tipula* sp.			1				3				3			C
Diptera	Pediciidae	*Dicranota* sp.				3	2		1	1			3			C
Diptera	Simuliidae	sp. indet.	1		15	31	53	1						4		C
Hemiptera	Gerridae	*Gerris* sp.		3	1				1			3		2	4	C
Hemiptera	Hydrometridae	*Hydrometra stagnorum*												3		C
Hemiptera	Veliidae	Veliidae nymph					4			1		3		1	10	C
Gastropoda	Planorbidae	*Ancylus fluviatilis*	3					3								C
Gastropoda	Tateidae	*Potamopyrgus antipodarum*	42	11	28	13	36	23	4	2			3	10	525	C
Platyhelminthes	Planaridae	sp. indet.		4			12		3		4		1			C
Arachnida	Hydrachnidiae	sp. indet.				1		5								C
Crustacea	Asellidae	*Asellus aquaticus*					8		3							D
Mollusca	Sphaeriidae	sp. indet.													6	D
Gastropoda	Lymnaeidae	*Ampullacaena balthica*												15		D
Gastropoda	Physidae	*Physella acuta*													31	D
Hirudinidae	Glossiphoniidae	sp. indet.							1	3			1	3		D
Diptera	Chironomidae	*Chironomus* spp.							1	2			3	8	21	E
Annelidae	Oligochaeta	sp. indet.		5	2	1			2	8	2		5			n/a
Abundance			**180**	**85**	**205**	**190**	**300**	**146**	**51**	**28**	**52**	**31**	**32**	**118**	**686**	
Q-rating			Q3-4	Q3*	Q3	Q3	Q3	Q3-4	Q3*	Q3*	Q3	Q3*	Q3*	Q3-4*	Q3-4*	
WFD status			Mod	Poor	Poor	Poor	Poor	Mod	Poor	Poor	Poor	Poor	Poor	Mod	Mod	

* tentative Q-rating given lack of suitable riffle areas for sampling and or poor flows (Toner et al., 2005)

Triturus Environmental Ltd.,

Unit 5 Anchor Business Park,

Little Island,

Co. Cork,

T45 XN59.