



Cush Wind Farm
Phase II

Environmental Impact Assessment Report

Annex 5.3: Aquatic & Fisheries Report

Cush Wind Limited

Aquatic baseline report for the proposed Cush wind farm, Co. Offaly (2025)



Prepared by Triturus Environmental Ltd. for SLR Consulting Ireland

January 2026

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by SSLR Consulting Ireland to conduct baseline aquatic surveys to inform EIAR preparation for the proposed Cush wind farm development located c. 6km north of Birr, Co. Offaly (**Figure 2.1**). The baseline surveys would update and expand upon those previously completed in August 2022 (Triturus, 2022).

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 site boundary and internal cable route. Aquatic surveys were undertaken in August 2025.

1.2 Development description

A full description of the proposed development will be 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 wind farm development and associated infrastructure were considered as part of the current assessment. This included sites in vicinity of the site boundary and the proposed internal cable route. Thus, a total of 14 no. sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1**). The courses and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

Aquatic survey sites were present on the Rapemills River (EPA code: 25R01), Eglis Stream (25E18), West Galros Stream (25W44) and Whigsborough Stream (25W43) in addition to several lake/wetland and pond features (**Table 2.1**). The survey sites were located within within the Brosna_SC_080 and the Shannon (Lower)_SC_040 river sub-catchments. The proposed wind farm and associated infrastructure was not located within a European site although all riverine sites shared downstream hydrological connectivity with the River Shannon Callows SAC (000216) and the Middle Shannon Callows SPA (004096).

Please note this aquatic report should be read in conjunction with the final Environmental Impact Assessment Report (EIAR) prepared for the proposed development.

2.2 Aquatic site surveys

Aquatic surveys were conducted on the 14th, 15th and 16th August 2025. Survey effort focused on both instream and riparian habitats at each aquatic sampling location included a fisheries assessment (electro-fishing and or fisheries habitat appraisal), white-clawed crayfish survey, otter sign survey (within 150m radius), macrophyte and aquatic bryophyte survey and biological water quality (Q-sampling) or macro-invertebrate sweep sampling (**Figure 2.1**). Environmental DNA samples were also collected from 3 no. riverine sites. This holistic approach informed the overall aquatic ecological evaluation of each site 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 14 no. aquatic survey sites in the vicinity of the proposed Cush wind farm, Co. Offaly

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Rapemills River	25R01	Eglish	608544	709345
A2	Eglish Stream	25E18	Eglish	608194	709857
A3	Eglish Stream	25E18	Eglish	607766	709311
A4*	Rapemills River	25R01	Boolinarig Bridge	607478	709372
A5	West Galros Stream	25W44	Eglish	608084	710542
A6*	West Galros Stream	25W44	N62 road crossing	607627	710485
A7	Rapemills River	25R01	R439 road crossing	604773	710211
A8*	Rapemills River	25R01	Lusmagh Bridge	600128	714644
B1	Drainage channel	n/a	Clooneen	607887	712615
C1	Whigsborough Stream	25W43	Clooneen	608671	712865
L1	Lake/wetland	n/a	Eglish	608291	710532
L2	Lake/wetland	n/a	Clooneen	607832	713182
P1	Pond	n/a	Galros East	607783	710585
P2	Pond	n/a	Galros East	607982	710624

*eDNA sampling for Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel and or white-clawed crayfish

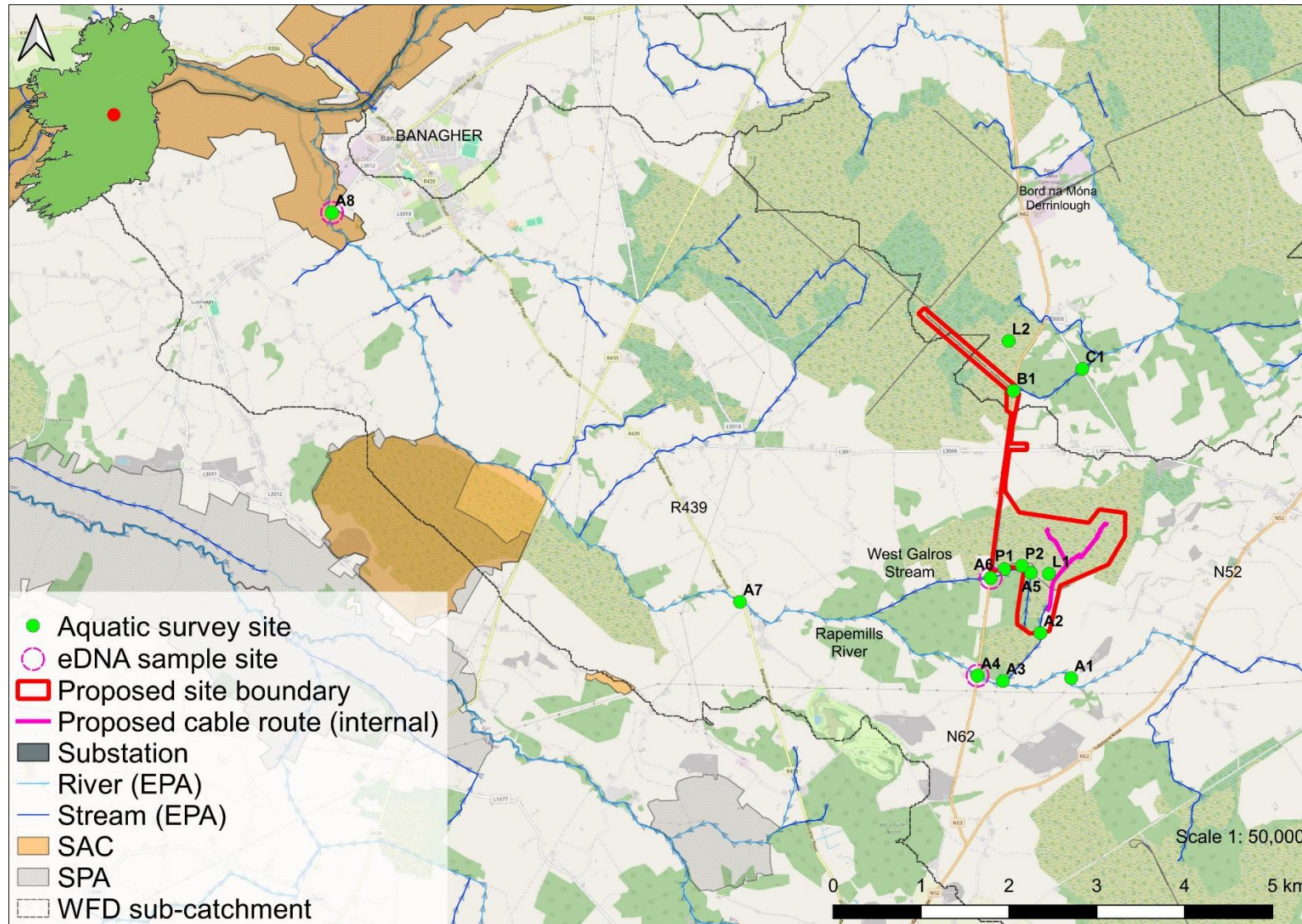


Figure 2.1 Overview of the aquatic survey sites, August 2025

2.3 Fisheries assessment (electro-fishing)

To collate a more accurate baseline, a catchment-wide approach was adopted and the electro-fishing survey was undertaken across 10 no. riverine sites (**Table 2.1, Figure 2.1**). A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish riverine sites on Thursday 14th, Friday 15th and Saturday 16th August 2025 following notification to Inland Fisheries Ireland and under the conditions of a Department of Climate, Energy and the Environment (DCEE) 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 (*Anguilla anguilla*) and other fish species. The baseline assessment also considered the quality of fisheries habitats 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 under a National Parks and Wildlife (NPWS) open national licence (C164/2025) 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 each catchment or sub-catchment 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 eDNA analysis

To further validate site surveys and to detect potentially cryptically low populations of high conservation value aquatic species within the survey area, composite water samples were collected from the Rapemills River (sites A4, A8) and the West Galros Stream (A6) on the 14th August 2025 (**Figure 2.1; Table 2.1**). This was analysed for Atlantic salmon (*Salmo salar*) or brown trout (*Salmo trutta*), European eel, lamprey (*Lampetra* sp.) and white-clawed crayfish eDNA, with the sites strategically chosen to maximise longitudinal (instream) coverage within the catchment (i.e. facilitating a greater likelihood of species detection).

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 A** for full eDNA laboratory analysis methodology.

2.6 Biological water quality (Q-sampling)

The 10 no. riverine survey sites were assessed for biological water quality through Q-sampling in August 2025 (**Figure 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 class	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 Lacustrine macro-invertebrate communities

Lacustrine sites L1, L2, P1 and P2 were sampled for macro-invertebrates via sweep netting in August 2025. A standard pond net (250mm width, mesh size 500µm) was used to sweep macrophytes and submerged vegetation to capture macro-invertebrates. The net was also moved along the lake bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was employed. To ensure appropriate habitat coverage, the sampling period was also divided amongst the range of meso-habitats present at the survey sites to get a representative sample for sub-habitats.

2.8 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the survey sites, with specimens collected (by hand or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species listed under the Flora (Protection) Order, 2022, Irish Red list for vascular plants (Wyse-Jackson et al.,

2016) and or aquatic bryophytes (Lockhart et al., 2012), or habitats corresponding to Annex I habitats, such as floating river vegetation (3260) or hydrophilous tall herb (6430).

2.9 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.).

2.10 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. Particular cognisance was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). 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 Cush wind farm is located c. 6km north of Birr, Co. Offaly within the Shannon River Basin District and hydrometric area 25 (Lower Shannon) (**Figure 2.1**). The survey watercourses are typically lowland depositing rivers (FW2; Fossitt; 2000) which have been historically modified (drained) and drainage channels (FW4) present in a landscape dominated by cutover bog adjoining agricultural pasture (CORINE landcover). The survey area is underlain by Tournaisian limestone and Visean limestone & calcareous shale (Geological Survey of Ireland data).

3.2 Fisheries

Previous surveys for the development recorded a low diversity of fish species. The Rapemills River, a tributary of the River Shannon, is known to support brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.), pike (*Esox lucius*), minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and three-spined stickleback (*Gasterosteus aculeatus*) (Triturus 2022 data).

The West Galros Stream, a heavily modified tributary of the Rapemills River, was found to support three-spined stickleback only (Triturus 2022 data). No fish were recorded from the heavily modified Eglish Stream at proposed survey site A2 or the heavily modified Whigsborough Stream at survey site C1 in 2022 (Triturus data).

3.3 Protected & rare 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 development (i.e. N00 & N01) identified a low number of records for rare and or protected aquatic species within the vicinity of the proposed wind farm.

A low 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). More contemporary records (2005-2022) were available for the Rapemills River and Grand Canal (Triturus, NPWS & NBDC data; **Figure 3.1**).

A low number of records for Annex II white-clawed crayfish (*Austropotamobius pallipes*) were available for several watercourses within the respective grid squares, including the West Galros Stream (**Figure 3.1**). White-clawed crayfish remains were recorded in otter spraint on both the Rapemills River and West Galros Stream during the previous survey (Triturus, 2022).

No contemporary NPWS records for macrophytes or aquatic bryophytes protected under the Flora (Protection) Order, 2022 or Red listed (Wyse-Jackson et al., 2016; Lockhart et al., 2012) were available for the respective grid squares.

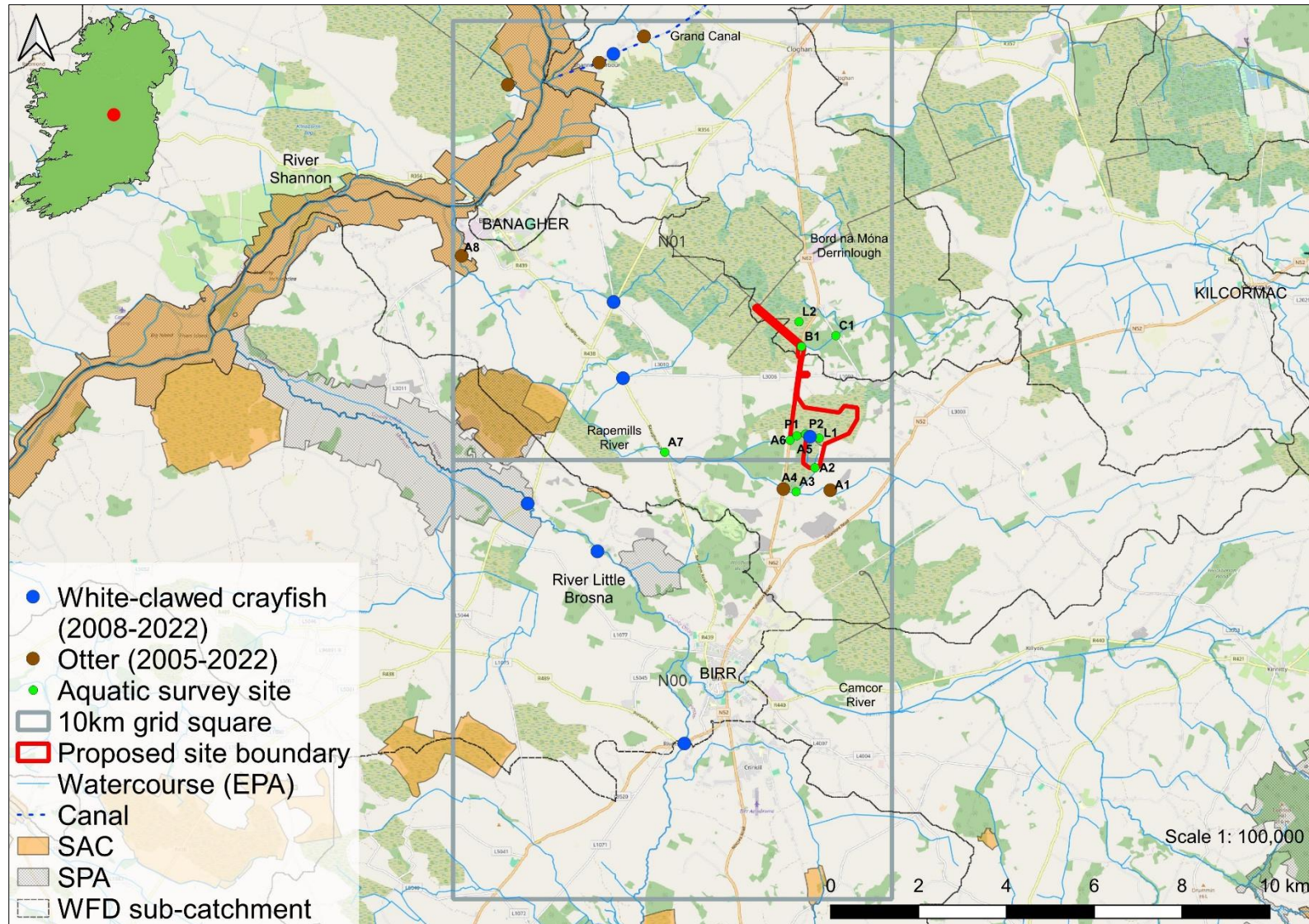


Figure 3.1 Selected protected aquatic species records in the vicinity of the proposed development (source: NPWS, NBDC, EPA, NCPSP & Triturus data)

4. Results of aquatic surveys

The following section summarises each of the 14 no. survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, white-clawed crayfish, otter and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) results are 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 4.3**. A summary of the aquatic species and habitats of high conservation value recorded during the surveys is provided 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.

4.1 Aquatic survey sites

4.1.1 Site A1 – Rapemills River, Eglish

Site A1 was located on the Rapemills River (EPA code: 25R01) at quarry access bridge upstream of the proposed development (i.e. an upstream control site). The small lowland alkaline river (FW2; Fossitt, 2000) had been deepened and locally straightened historically but demonstrated good instream recovery in many areas. The meandering river was 3-4m wide and 0.3-0.8m deep, with locally deeper areas to >1m. The profile comprised heavily vegetated glide and pool with occasional riffle areas only. The substrata were dominated by fine to medium gravels with scattered cobble and small boulder. These were often relatively clean with widespread calcification. However, siltation was evident with organic rich soft sediment deposits on meanders and in depositing areas. The site supported profuse growth of macrophytes with abundant fool's watercress (*Helosciadium nodiflorum*) and watercress (*Nasturtium officinale*) - stands of these often covered the full channel width. Iris (*Iris pseudacorus*) and branched bur-reed (*Sparganium erectum*) stands were frequent instream. Common water starwort (*Callitriche stagnalis*) was occasional with water mint (*Mentha aquatica*) and brooklime (*Veronica beccabunga*) along the littorals. Aquatic bryophyte coverage was low due to the paucity of larger substrata but some *Fontinalis antipyretica* and *Pellia endiviifolia* were present. The river meandered along a narrow but mature buffers of herb rich nitrophilous vegetation dominated by reed canary grass (*Phalaris arundinacea*), great willowherb (*Epilobium hirsutum*), hedge bindweed (*Calystegia sepium*) and meadowsweet (*Filipendula ulmaria*). Scattered grey willow (*Salix cinerea* sp. *oleifolia*), hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*) provided valuable shading to the narrow channel. Tunnelling due to steeper banks was present downstream of the survey reach. The site was bordered by improved pasture (GA1) with mature fenced buffers (GS2/GS4) with an active quarry (ED4) upstream.

Brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.) and three-spined stickleback (*Gasterosteus aculeatus*) were recorded via electro-fishing at site A1 (**Appendix A**). The site was of good value for salmonids although primarily suited adults rather than juveniles given the predominance of deep pool, glide and bank scours/undercuts with high vegetation cover. Nonetheless, a mixed cohort trout population was present. Spawning habitat was widespread for both salmonids and lamprey. Organic rich soft sediment accumulations were frequent throughout but *Lampetra* sp. ammocoetes were highly localised, with most being confined to accumulations under the bridge (as per 2022 survey). Despite good suitability for European eel and white-clawed crayfish, neither were recorded. A regular otter spraint site with prints and a slide were recorded under the bridge on a muddy ledge.

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.



Plate 4.1 Representative image of site A1 on the Rapemills River upstream of the proposed development, August 2025

4.1.2 Site A2 – Eglish Stream, Eglish

Site A2 was located on the upper reaches of the Eglish Stream (25E18), adjoining the proposed site boundary. The channel had been extensively straightened and deepened along field boundaries and was 1-2m wide with a mostly trapezoidal profile and soft pea banks. The stream was dry at this location at the time of survey with a damp muddy base and no standing water. The channel heavily shaded by dense scrub comprising bramble (*Rubus fruticosus* agg.), bracken (*Pteridium aquilinum*) and grey willow, with high levels of terrestrial encroachment in the channel further indicating its ephemeral nature. The site was bordered by scrubby woodland (WN7) dominated by willow and downy birch (*Betula pubescens*) to the west and intensive pasture (GA1) to the east.

Site A2 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

Given the dry nature of the site, it was not possible to collect a biological water quality sample at the time of survey.



Plate 4.2 Representative image of site A2 on the Eglish Stream, August 2025 (dry, ephemeral channel)

4.1.3 Site A3 – Eglish Stream, Eglish

Site A3 was located on the lower reaches of the Eglish Stream (25E18) c. 750m downstream of site A2. In contrast to upstream, the stream (FW2) at this location contained water at the time of survey although this was stagnant and likely originated from the downstream-connecting Rapemills River. The stream had been heavily modified historically with deepening throughout and local straightening along field boundaries. The channel had also been re-excavated in the recent past with spoil visible on the steep trapezoidal banks. The stream was 1.5-2m wide and 0.05-0.1m deep with no flows of water. The bed comprised argillaceous soft sediment with scattered boulder and gravels which had slumped from the steep banks. The lower reaches supported a diverse range of macrophytes with scattered stands of branched bur-reed, bulrush (*Typha latifolia*) and broad-leaved pondweed (*Potamogeton natans*). Small pondweed (*Potamogeton berchtoldii*), common water starwort, water plantain (*Alisma plantago-aquatica*) and water horsetail (*Equisetum fluviatile*) were also present locally. Encroachment of the narrow channel by terrestrial plants was common with purple loosestrife (*Lythrum salicaria*), great willowherb and meadowsweet (*Filipendula ulmaria*) often present instream. Aquatic bryophytes were not present. The east and south bank had been cleared recently but the north bank was well shaded with abundant gorse (*Ulex europaeus*), grey willow and scrub adjoining a coniferous plantation (WD4). The site was also bordered by improved pasture (GA1).

No fish were recorded via electro-fishing at site A3 (**Appendix A**). With the exception of low suitability for ubiquitous species such as three-spined stickleback (not recorded), the stream was not of fisheries value given its heavily modified, silted and shallow nature with an absence of flows. There was no suitability for white-clawed crayfish. No otter signs were recorded along the stream with very limited foraging opportunities present given an absence of fish. However, a spraint site was recorded on boulders at a livestock access point on the Rapemills River at the confluence, c. 60m downstream (ITM 607733, 709273).

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix B)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.



Plate 4.3 Representative image of site A3 on the lower reaches of the Eglish Stream, August 2025

4.1.4 Site A4 – Rapemills River, Boolinarig Bridge

Site A4 was located on the Rapemills River (25R01) at Boolinarig Bridge (N62 road crossing). The swift flowing lowland alkaline river (FW2) had been historically deepened and straightened although demonstrated some recovery locally. The river was 4-5m wide and 0.2-0.75m deep with locally deeper areas to >1.2m. The profile comprised glide and pool with riffle confined to the cobbled bridge apron. Near the bridge, the substrata were dominated by heavily calcified cobbles and gravels (the cyanobacteria *Phormidium incrustatum*) with scattered boulder. However, elsewhere deep soft sediment deposits dominated, some up to 0.5m in depth. Macrophyte growth was localised with scattered stands of unbranched bur-reed (*Sparganium emersum*) and fool's watercress in addition to common duckweed (*Lemna minor*) and ivy-leaved duckweed (*Lemna trisulca*). Hard substrata supported abundant calcicolous liverwort *Riccardia chamedryfolia* with some *Fontinalis antipyretica*, *Rhynchostegium riparioides* and *Leptodictyum riparium*. Filamentous algal cover was low. The channel was well shaded by mature broadleaved woodland (WD1) and treelines dominated by grey willow and ash with bramble scrub. The site was also bordered by improved pasture (GA1) and dry meadows habitat (GS2).

Brown trout and lamprey (*Lampetra* sp.) were the only fish species recorded via electro-fishing at site A4 (**Appendix A**). The site was of good value for salmonids despite evident siltation and hydromorphological pressures, with a mixed cohort population present (as per 2022). Spawning habitat for salmonids and lamprey was limited given the general paucity of gravels/cobbles in addition

to natural bed calcification (colmation). Nursery habitat was also limited due to the highly localised nature of riffle and faster flowing glide areas. Deep pool and glide with bank scours and occasional macrophyte stands were of value as holding areas for adult salmonids. Abundant soft sediment deposits supported only a low density of *Lampetra* sp. ammocoetes. Despite good suitability for European eel, none were recorded, primarily reflecting downstream barriers in the Shannon catchment – however, the species was detected via eDNA sampling, indicating their presence at and or upstream of the sampling location (**Table 4.1**). Suitability for white-clawed crayfish was good (despite bed calcification & historical modifications) although none were recorded via targeted surveys or eDNA sampling (**Table 4.1**). A single old otter spraint was recorded on a boulder under the road bridge - this did not contain crayfish remains.

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.



Plate 4.4 Representative image of site A4 on the Rapemills River at Boolinarig Bridge, August 2025

4.1.5 Site A5 – West Galros Stream, Eglish

Site A5 was located on the upper reaches of the West Galros Stream (25W44). The stream (FW2) had been extensively straightened and over-deepened historically (peat drainage) and represented a canalised habitat throughout with no perceptible flow. The heavily modified U-shaped channel had been historically realigned from its mapped course and flowed through a series of peat settlement ponds (sites P1 & P2). The stream was 4-5m wide and 1-1.8m deep with a bed composed entirely of clay and silt (often up to 0.3m in depth). The sloping banks were composed of clay and peat. Clay agglomerations (from bank slumping) were frequent instream. Due to riparian shading and depths, macrophyte cover was low with rare bladderwort (*Utricularia* sp.) and water horsetail. The steep banks were fringed by abundant common reed (*Phragmites australis*) with scattered water mint. The

liverwort *Pellia endiviifolia* was abundant on the sloping clay banks. The riparian zone supported abundant herbaceous vegetation including bramble, purple loosestrife, meadowsweet, hedge bindweed, common knapweed (*Centaurea nigra*) and abundant bracken. To the west, the channel was lined by very dense scrubby woodland of downy birch, guelder rose (*Viburnum opulus*), alder (*Alnus glutinosa*) and grey willow. Coniferous afforestation (WD4) was present upstream. Recolonising cutover bog (PB4) was present to the north.

Electro-fishing was not undertaken at site B5 given prohibitive depths of >1.5m and a deep silt base. With the exception of three-spined stickleback (recorded in sweep samples), site A5 was of poor fisheries value given poor hydromorphology, low flows and poor fluvial connectivity. However, there was some suitability for European eel (eDNA detected downstream at site A6). Soft clay banks provided ideal opportunities for white-clawed crayfish burrowing and indeed many burrows were observed along the banks (but activity status unknown). In light of this potential prey resource, otter suitability was good although no signs were recorded in the vicinity of the site with limited marking opportunities present.

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 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.



Plate 4.5 Representative image of site A5 on the West Galros Stream, August 2025

4.1.6 Site A6 – West Galros Stream, N62 road crossing

Site A6 was located on the West Galros Stream (25W44) at the N62 road crossing, c.0.5km downstream of site A5. Downstream of online peat settlement ponds (sites P1 & P2), the stream had been extensively straightened and over-deepened historically resulting in a canalised channel with a steep U-shaped profile (banks of 2m). The stagnant stream was a homogenous 5-7m wide and 1.2-2m

deep with a bed composed entirely of soft agaricaceous sediment. The sloping banks were composed of clay and peat. Clay agglomerations (from bank slumping) were frequent instream. Due to riparian shading and modifications, macrophyte cover was low with only scattered stands of broad-leaved pondweed, yellow lily (*Nuphar lutea*) and rare bladderwort (*Utricularia* sp.) along the upper littorals. Common water starwort was present but rare. The liverwort *Pellia endiviifolia* was frequent on the sloping clay banks. The steep banks were lined by abundant common reed. The north bank supported abundant herbaceous vegetation with a broadleaved plantation (WS2) and some bog woodland (WN7) along the channel. The site was bordered upstream by extensive areas of cutover bog (PB4).

Electro-fishing was not undertaken at site A6 given prohibitive depths of >1.5-2m. With the exception of three-spined stickleback (recorded via sweep sampling), site A6 was of poor fisheries value given poor hydromorphology, low/absent flows and heavy siltation. However, whilst salmonid spawning and nursery habitat was absent, the site had some low value as a holding habitat for adult trout given the high average depth. Argillaceous sediment deposits were unsuitable for lamprey ammocoete burial (no lamprey eDNA detected). Suitability for European eel was high and indeed the species was detected via eDNA sampling, alongside brown trout (**Table 4.1**). Whilst no white-clawed crayfish were recorded by sweep netting, burrows in the soft clay banks were abundant (as per upstream site A5). However, the species was not detected through eDNA sampling at the site (**Table 4.1**). In light of this potential prey resource, otter suitability was good although no signs were recorded in the vicinity of the site (poor marking opportunities).

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 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.



Plate 4.6 Representative image of site A6 on the West Galros Stream, August 2025

4.1.7 Site A7 – Rapemills River, R439 road crossing

Site A7 was located on the Rapemills River (25R01) at the R439 road c.3km downstream of site A4 and at the confluence with a small unmapped stream. With the exception of some local bank modifications in vicinity of the pipe culvert and along the roadside, the alkaline river retained a largely natural profile. The high energy lowland river (FW2) was 3-5m wide and 0.2-0.75m deep with a profile comprised on swift glide and riffle with frequent small pool. The substrata were dominated by abundant cobble and boulder with occasional areas of mixed gravels. However, bed calcification by the cyanobacteria *Phormidium incrustatum* was widespread (**Plate 4.8**). This had also caused some riverine tufa formations instream (but not representative of the submerged from of Annex I petrifying springs 7220 habitat). Soft sediment accumulations were shallow and superficial where present (in stark contrast to upstream sites). Livestock poaching was present downstream of the survey site (at a ford crossing). Given high flow rates and high shading, macrophytes were limited to occasional fool's watercress, water mint and heterophyllus lesser water parsnip (*Berula erecta*). The bed was dominated by aquatic bryophytes with very abundant *Riccardia chamedryfolia* in addition to *Pellia endiviifolia*, *Leptodictyum riparium* and occasional *Rhynchostegium riparioides*. A mature treeline of ash, sycamore (*Acer pseudoplatanus*), elder (*Sambucus nigra*) and hawthorn provided valuable shading from the west bank. Upstream of the culvert, the channel was heavily shaded (also with mature trees). The site was bordered by the R498 road and improved pasture (GA1).

Brown trout was the only species recorded via electro-fishing at site A7 (**Appendix A**). The site was of high value for salmonids, supporting a moderate density of mixed-cohort brown trout. Whilst bed calcification reduced the spawning capacity of the site (colmation of gravels), some limited spawning habitat for both salmonids and lamprey was present in pool tailings. Abundant bryophyte rich boulder and cobble provided some good quality salmonid nursery refugia with frequent small shaded pools of value as holding areas for adults. Lamprey ammocoete habitat was absent. Despite some good suitability for both European eel and white-clawed crayfish, neither were recorded, with bed calcification reducing the availability of instream refugia. A regular otter spraint site (containing fish & diving beetle remains) was recorded on marginal bedrock along the roadside (ITM 604794, 710200).

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.



Plate 4.7 Representative image of site A7 on the Rapemills River, August 2025



Plate 4.8 Cyanobacterial crusts (*Phormidium incrustatum*) and the calcicolous liverwort *Riccardia chamedryfolia* on the riverbed at site A7 on the Rapemills River, August 2025

4.1.8 Site A8 – Rapemills River, Lusmagh Bridge

Site A8 was located on the lower reaches of the Rapemills River (25R01) at Lusmagh Bridge, c.4.5km downstream of site A7 and 1.2km upstream of the River Shannon confluence. The lowland depositing river (FW2) had been straightened and deepened historically but retained some good semi-natural features. The river was 6-8m wide and 0.5-1.8m deep with a profile of deep glide and pool (no riffle).

Shallower water (ranging from 0.2-1m) was present in the vicinity of the bridge. The substrata comprised cobble and boulder with occasional coarse gravels that were heavily silted. Elsewhere, in deeper depositional habitat, the bed was dominated by silt with occasional bedded boulder. Siltation was high overall. Calcification of hard substrata was also evident. The site supported a range of macrophytes with frequent common clubrush (*Schoenoplectus lacustris*), branched bur-reed, unbranched bur-reed and yellow lily. Beds of fool's watercress, water starwort (*Callitriche* sp.), lesser water parsnip, blue water speedwell (*Veronica anagallis-aquatica*), water forget-me-not (*Myosotis scorpioides*) and invasive Canadian pondweed (*Elodea canadensis*) were occasional. Mare's-tail (*Hippuris vulgaris*) and arrowhead (*Sagittaria sagittifolia*) were rare. The littorals were dominated by reed canary grass with frequent water mint and scattered iris, blue water speedwell and water plantain. Larger substrata supported the aquatic moss *Leptodictyum riparium* with rare *Fontinalis antipyretica*. Filamentous algae and floc were abundant, indicating significant enrichment. The banks were typically open and grazed with occasional patches of bramble scrub with scattered hawthorn. The site was bordered by improved pasture (GA1) with frequent livestock poaching.

Brown trout, pike (*Esox lucius*), gudgeon (*Gobio gobio*), minnow (*Phoxinus phoxinus*), stone loach and three-spined stickleback were recorded via electro-fishing at site A8 (**Appendix A**). A short section near the bridge was shallow enough to undertake backpack electro-fishing (too deep elsewhere). The site was of relatively poor value for salmonids given a paucity of suitable spawning and nursery habitat although deep glide and pool were valuable holding areas for adult salmonids (albeit none recorded). These areas were also of high value for a range of coarse fish species. Soft sediment accumulations did not support lamprey ammocoetes and the site was not of value for spawning lamprey given siltation pressures. Despite some good physical suitability, no European eel or white-clawed crayfish were recorded. Atlantic salmon, *Lampetra* sp. and European eel but not crayfish were detected via eDNA sampling, indicating their presence at and or upstream of the sampling location (**Table 4.1**). No otter signs were recorded in vicinity of the site despite the presence of good quality foraging habitat.

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 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.



Plate 4.9 Representative image of site A8 on the Rapemills River at Lusmagh Bridge, August 2025

4.1.9 Site B1 – Drainage channel, Clooneen

Site B1 was located on a drainage channel perpendicular to a dry roadside drain within the proposed site boundary. The small drainage channel was intermittent in nature being impounded between peat dams in extensive cutover bog. The channel was 1-1.5m wide and 0.1-0.2m deep with a bed of deep humic soft sediment (peat, up to 1m in depth). The series of impounded sections supported frequent bog pondweed (*Potamogeton polygonifolius*) and bladderwort (*Utricularia* sp.). Filamentous algae and floc was abundant throughout given nutrient escapement from the surrounding cutover bog. The channel was cut through cutover bog (PB4) with low lying open banks supporting abundant heather (*Calluna vulgaris*), bog asphodel (*Narthecium ossifragum*), sedges (*Carex* spp.), purple moor grass (*Molinia caerulea*) and occasional downy birch saplings.

No fish were recorded via electro-fishing at site B1 (**Appendix A**). The intermittent drainage channel was unsuitable for fish given its shallow heavily silted nature and isolation from other habitats. However, there was some good suitability for amphibians (none recorded) and invertebrates. There was no suitability for white-clawed crayfish. 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 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.



Plate 4.10 Representative image of site B1 on an impounded peat drainage channel, August 2025

4.1.10 Site C1 – Whigsborough Stream, Clooneen

Site C1 was located on the Whigsborough Stream (25W43) at a local road crossing downstream (east) of the proposed site boundary. The lowland stream (FW2) had been extensively straightened and deepened historically as part of peatland drainage, resulting in a homogenous channel with very poor hydromorphology that was 1-1.5m wide and <0.1m deep with no flows at the time of survey (stagnant pools only). The bed was comprised entirely of deep soft flocculent peat (up to 1m in depth). Peat dams, impeding water flow and restricting fluvial connectivity. Given very high shading, macrophytes were limited to occasional water mint, fool's watercress and common duckweed in more open areas of channel. Aquatic bryophytes were not recorded. Encroachment of the channel by terrestrial vegetation was high with abundant bramble along channel margins. The site was located in an area of heavily-scrubbed, wet mixed broad-leaved woodland (WD1/WN7) supporting abundant sycamore with ash, hawthorn, alder, hazel (*Corylus avellana*), elder and grey willow. Coniferous plantations (WD4) were present upstream.

No fish were recorded via electro-fishing at site C1 (**Appendix A**). The site was not of fisheries value given gross siltation, poor hydromorphology and absent flows, in addition to poor connectivity with downstream habitats (frequent peat blockages instream). No white-clawed crayfish were recorded by sweep netting and there was no suitability. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per 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.



Plate 4.11 Representative image of site C1 on the Whigsborough Stream, August 2025

4.1.11 Site L1 – Lake/wetland, Eglish

Site L1 was located at a small wetland within the proposed site boundary. The small irregular shaped wetland featured a main basin of water of c.0.2ha with several smaller satellite ponds which would be interconnected at higher water levels. Where present, the water was shallow and often <0.2m. The bed was composed entirely of peat (humic sediment). The shallow sloping open banks of exposed peat supported abundant sharp-flowered rush (*Juncus acutiflorus*), marsh arrow-grass (*Triglochin palustre*), water horsetail and bottle sedge (*Carex rostrata*) which extended into the littorals. Submerged macrophytes were limited to very scattered delicate stonewort (*Chara virgata*), bladderwort (*Utricularia* sp.) and bog pondweed. The wetland/marsh surrounding the basin supported common species such as marsh pennywort (*Hydrocotyle vulgaris*), sedges, bog cotton (*Eriophorum* sp.) and purple loosestrife. The site was bordered by extensive areas of cutover bog (PB4), some of which was recolonising.

Electro-fishing was not undertaken at site L1 given the lacustrine conditions and deep silt bed. The wetland was of poor fisheries value given very shallow depths, siltation and isolation from other habitats. However, the site was of good suitability for amphibians (none recorded). There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep sampling (**Appendix C**).



Plate 4.12 Representative image of site L1, August 2025

4.1.12 Site L2 – Lake/wetland, Clooneen

Site L2 was located at a large lake/wetland complex adjacent to Derrinlough wind farm and the proposed site boundary. The large surface water feature covered approximately 20ha with a highly complex margin featuring abundant bays, back-channels and small islands. The lake was shallow, being mostly <1m depth, with a bed composed entirely of sift silt (peat). The margins were gently sloping and supported extensive stands of bottle sedge and more localised bog pondweed and bulrush. Small stunted willow and downy birch were abundant in the littorals and also scattered throughout open water on plateaux of peat. The banks were dominated by exposed peat with scattered scrub (WS1) of heather, downy birch, lodgepole pine (*Pinus contorta*), gorse, cotton grass (*Eriophorum* sp.), deergrass (*Trichophorum cespitosum*) and purple moor grass.

Electro-fishing was not undertaken at site L2 given the lacustrine conditions and deep silt bed. The wetland was of some fisheries value despite its generally shallow depths, siltation and isolation from other habitats. Three-spined stickleback were visibly plentiful and recorded in sweep samples. The site was of high biodiversity value, including for aquatic species, including amphibians (none recorded). There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site although utilisation is likely.

No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via sweep sampling (**Appendix C**).



Plate 4.13 Representative image of site L2, August 2025

4.1.13 Site P1 – Pond, Galros East

Site P1 was located at a former peat settlement pond adjacent to the West Galros Stream. The small 0.2ha clear water linear pond had a canal-like profile being 175m long and just 12m wide. The pond was connected to the adjacent stream via a pipe culvert (western end) and a cut channel (eastern end). Given its artificial nature, the banks were steep and dropped into >0.5m of water at the base of the slope. The pond was a homogenous 1.6-2m deep with a bed comprised entirely of argillaceous soft sediment. The bank slopes were also composed of clay. The shallow pond was heavily vegetated with abundant broad-leaved pondweed and more localised yellow lily and bottle sedge. Small pondweed, unbranched bur-reed and bladderwort (*Utricularia* sp.) were rare. Common reed dominated the steep banks and deep littorals. The semi-aquatic liverwort *Pellia endiviifolia* was present locally on exposed muddy bank sections. The pond was bordered by recolonising historical cutover bog (PB4), much of which had recolonised with abundant grey willow, downy birch and gorse scrub (WS1) and wetland vegetation including purple loosestrife, meadowsweet, tormentil (*Potentilla erecta*), hedge bindweed and purple moor grass.

Electro-fishing was not undertaken at site P1 given the deep lacustrine conditions. However, three-spined stickleback were recorded via sweep sampling and were present in high numbers. The alkaline pond was of good suitability for European eel and had some suitability for brown trout although the absence of suitable spawning habitat likely precluded the species. The alkaline pond was also of high suitability for white-clawed crayfish. Whilst none were recorded via sweep sampling, the steep clay banks featured many crayfish burrows. No otter signs were recorded in vicinity of the site although there was good foraging suitability.

No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via sweep sampling (**Appendix C**).



Plate 4.14 Representative image of site P1, August 2025

4.1.14 Site P2 – Pond, Galros East

Site P2 was located at a former peat settlement pond adjacent to site P1 and the West Galros Stream. The small 0.3ha linear pond had a canal-like profile being 200m long and 15m wide. The pond was connected to the adjacent stream via cut channels (both ends). The banks were steep and dropped into >0.5-1m of water at the base of the slope. The pond was 1.5-2.5m deep with a bed comprised of clay and silt. The bank slopes were also composed of clay with areas of exposed peat. In contrast to site P1, the water was quite turbid (diatom or algal bloom) resulting in significantly less macrophyte growth. Whilst the margins were fringed with abundant common reed and occasional water horsetail, the open water supported only scattered stands of small pondweed and rare bladderwort (*Utricularia* sp.) and broad-leaved pondweed. The semi-aquatic liverwort *Pellia endiviifolia* was present locally on exposed muddy bank sections with *Conocephalum conicum* rare. The pond was bordered by historical cutover bog (PB4), much of which had recolonised with abundant grey willow, downy birch and gorse scrub (WS1) and wetland vegetation including bracken, purple loosestrife, meadowsweet, tormentil, hedge bindweed and purple moor grass.

Electro-fishing was not undertaken at site P2 given the deep lacustrine conditions. However, three-spined stickleback were recorded via sweep sampling and were present in moderate numbers. The alkaline pond was of good suitability for European eel and had some suitability for brown trout although the absence of suitable spawning habitat likely precluded the species. The alkaline pond was of high suitability for white-clawed crayfish. Whilst none were recorded via sweep sampling, the steep clay banks featured many crayfish burrows. No otter signs were recorded in vicinity of the site although there was good foraging suitability.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep sampling (**Appendix C**).



Plate 4.15 Representative image of site P2, August 2025

Table 4.1 2025 eDNA results in the vicinity of the proposed Cush wind farm, Co. Offaly (positive qPCR replicates out of 12 in parentheses)

Site	Watercourse	Atlantic salmon	Brown trout	Lamprey (<i>Lampetra</i> sp.)	European eel	White-clawed crayfish
A4	Rapemills River	Negative (0/12)	n/a	Positive (2/12)	Positive (12/12)	Negative (0/12)
A6	West Galros Stream	n/a	Positive (12/12)	Negative (0/12)	Positive (10/12)	Negative (0/12)
A8	Rapemills River	Positive (1/12)	n/a	Positive (2/12)	Positive (11/12)	Negative (0/12)

4.2 White-clawed crayfish

No live white-clawed crayfish were recorded via hand-searching or sweep netting of instream refugia during the survey of 14 no. survey sites. Furthermore, field inspection of otter spraint at 4 no. sites on the Rapemills River did not reveal the presence of white-clawed crayfish remains. Crayfish burrows were visibly widespread at sites A5 and A6 on the West Galros Stream and the adjacent settlement pond sites P1 and P2, although no live crayfish were recorded.

Environmental DNA sampling failed to detect the presence of crayfish from the West Galros Stream or Rapemills River (see section 4.3 below).

4.3 eDNA sampling

In support of previous and current targeted surveys, no white-clawed crayfish eDNA was detected at sites A4 and A8 on the Rapemills River nor site A6 on the West Galros Stream (0 positive qPCR replicates out of 12, respectively) (**Table 4.1; Appendix B**).

A weak signature (1 positive qPCR replicate out of 12) of Atlantic salmon was detected at site A8 on the lower reaches of the Rapemills River. Lamprey (*Lampetra* sp.) were also detected at both sites A4 and A8 on the Rapemills River, despite an absence during the electro-fishing survey.

Although none were recorded during the electro-fishing survey, European eel was detected at all three sampling locations on the Rapemills River and West Galros Stream (**Table 4.1; Appendix B**). Brown trout were also detected at site A6 on the West Galros Stream.

4.4 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 10 no. riverine sites or sweep samples collected at 4 no. lacustrine sites in August 2025 (**Appendix C**).

All 10 no. riverine sites achieved **Q2-3 or Q3 (poor status)** based on a dominance of pollution tolerant EPA group C and D species such as the mayfly *Baetis rhodani*, freshwater shrimp (*Gammarus duebeni*), freshwater hoglouse (*Asellus aquaticus*) and common molluscs such as the margined ramshorn (*Planorbis planorbis*), wandering snail (*Ampullacaena balthica*) and New Zealand mud snail (*Potamopyrgus antipodarum*) (**Appendix C**). None of the sampling sites supported group A (most pollution sensitive) species with only low numbers of group B taxa present including the mayfly *Alainites muticus*, cased caddis species such as *Sericostoma personatum* and Coenagrionidae species damselflies.

The backswimmer *Notonecta obliqua* was recorded from the impounded peat channel at site B1. Whilst not protected, this is an uncommon species with a restricted distribution in Ireland (Nelson, 2022).

It should be noted that the rating for sites A3, A5, A6, A8, B1 and C1 were tentative due to poor flows and or an absence of riffle areas for sampling at the time of survey (as per Toner et al., 2005).

Table 4.2 Comparison of 2022 and 2025 biological water quality (Q-ratings) at riverine sites in vicinity of the proposed Cush wind farm

Site no.	Watercourse	EPA code	August 2022		August 2025	
			Q-rating	WFD status	Q-rating	WFD status
A1	Rapemills River	25R01	Q3-4	Moderate	Q3	Poor
A2	Eglish Stream	25 E18	n/a – dry channel		n/a – dry channel	
A3	Eglish Stream	25 E18	Not surveyed		Q2-3*	Poor
A4	Rapemills River	25R01	Q3-4	Moderate	Q3	Poor
A5	West Galros Stream	25W44	Q3*	Poor	Q3*	Poor
A6	West Galros Stream	25W44	Q3*	Poor	Q3*	Poor
A7	Rapemills River	25R01	Q3	Poor	Q3	Poor
A8	Rapemills River	25R01	Q3*	Poor	Q3*	Poor
B1	Drainage channel	n/a	Not surveyed		Q3*	Poor
C1	Whigsborough Stream	25W43	Q2-3*	Poor	Q2-3*	Poor

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

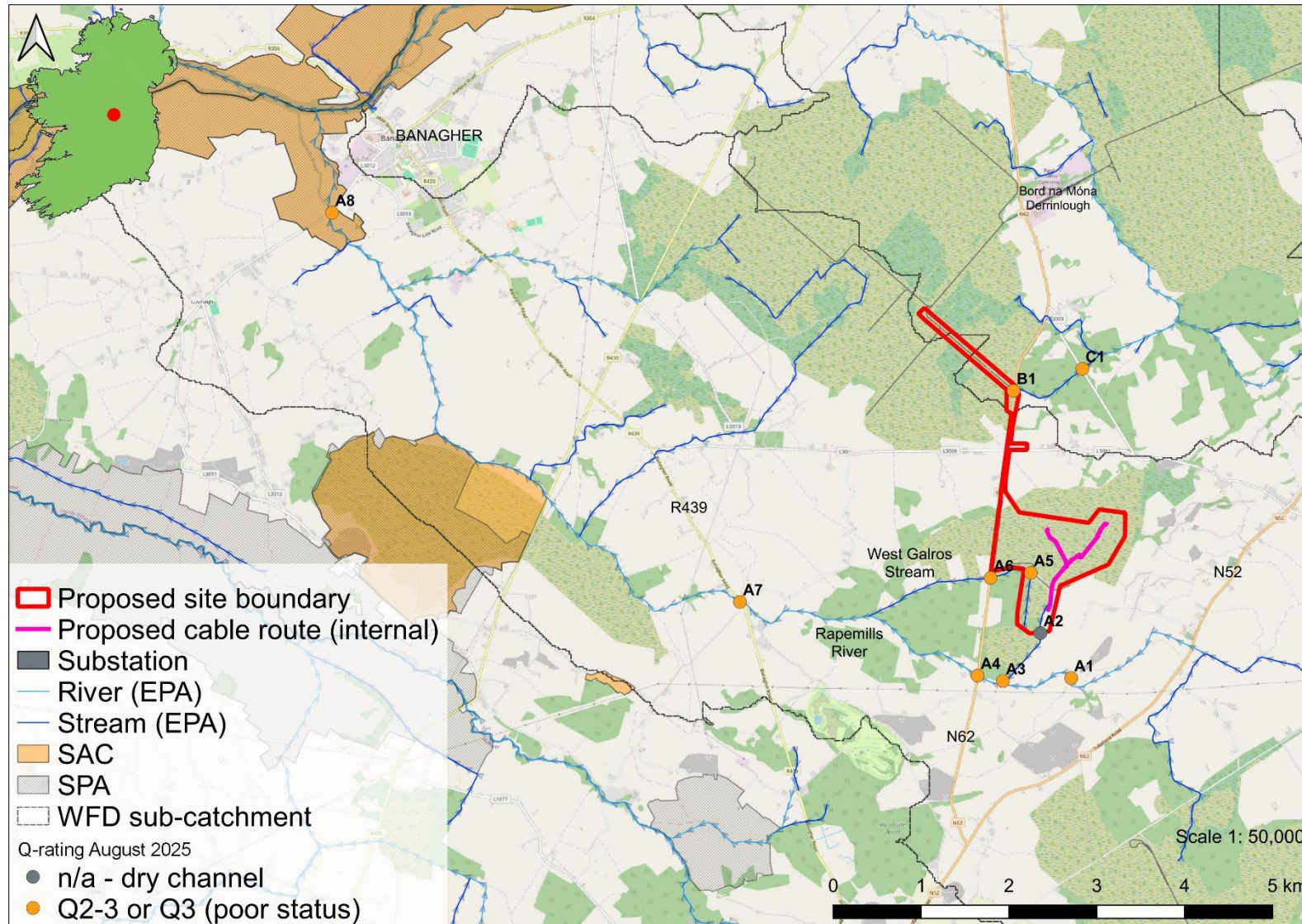


Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed development, August 2025

4.5 Lacustrine macro-invertebrate communities

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the composite sweep samples collected from the 4 no. lacustrine sites in August 2025.

The peatland wetland/lake site L1 was dominated by Coenagrionidae damselflies, lake olive mayfly (*Cloeon simile*) and Dipteran larvae with a modest species diversity (13) (**Appendix C**). The larger site L2 supported a much lower diversity of macroinvertebrates, again dominated by Coenagrionidae damselflies, lake olive mayfly (*Cloeon simile*). The non-native shrimp species *Crangonyx* sp. was recorded from site L2 (the only site it was recorded from in the current survey).

The highly alkaline and deeper pond sites P1 and P2 supported a higher species diversity relative to the wetland/lake sites (22 & 17, respectively; **Appendix C**). The communities were broadly similar with Coenagrionidae damselflies, lake olive mayfly, freshwater hoglouse and gastropod molluscs such as great pond snail (*Lymnaea stagnalis*) and pea mussels (Sphaeriidae) dominating.

4.6 Otter signs

Whilst a full otter survey was beyond the scope of this survey, signs were recorded within a 150m radius of the survey sites in August 2025.

Otter signs (typically spraints) were identified at a total of 4 no. sites on the Rapemills River at sites A1, A4, A7 and near site A3.

No breeding (holts) or resting (couch) areas were identified in the vicinity of the survey sites in August 2025 or August 2022.



Plate 4.16 Old, disintegrating otter spraint located under a quarry access bridge on the Rapemills River at site A1, August 2025 (spraint also recorded here in August 2022)

Table 4.3 Relative abundance of fish species of higher conservation value recorded via **electro-fishing** in the vicinity of the proposed development, August 2025 (blank cell = not recorded)

Site	Watercourse	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Other species
A1	Rapemills River		Medium	Low		Three-spined stickleback
A2	Eglish Stream	No fish recorded – dry, ephemeral channel				
A3	Eglish Stream	No fish recorded				
A4	Rapemills River	Negative eDNA	Medium	Low	Positive eDNA	
A5	West Galros Stream	Fisheries appraisal only				
A6	West Galros Stream	Fisheries appraisal only – negative brown trout & <i>Lampetra</i> sp. but positive European eel eDNA				
A7	Rapemills River		High			
A8	Rapemills River	Positive eDNA	Low	Positive eDNA	Positive eDNA	Minnow, stone loach, pike, three-spined stickleback, gudgeon
B1	Drainage channel	No fish recorded				
C1	Whigsborough Stream	No fish recorded				
L1	Lake/wetland	Fisheries appraisal only				
L2	Lake wetland	Fisheries appraisal only – three-spined stickleback recorded during sweep sampling				
P1	Pond	Fisheries appraisal only – three-spined stickleback recorded during sweep sampling				
P2	Pond	Fisheries appraisal only – three-spined stickleback recorded during sweep sampling				

Table 4.4 Summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the proposed Cush wind farm, August 2025

Site	Watercourse	White-clawed crayfish	Otter signs within 150m	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
A1	Rapemills River	None recorded	Regular spraint site with prints & slide	Not present	None recorded	None recorded	Lamprey (<i>Lampetra</i> sp.)
A2	Eglish Stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A3	Eglish Stream	None recorded	Spraint site on boulders c.60m downstream	Not present	None recorded	None recorded	None recorded
A4	Rapemills River	None recorded; negative eDNA result at site	Old spraint	Not present	None recorded	None recorded	Lamprey (<i>Lampetra</i> sp.); European eel (eDNA only)
A5	West Galros Stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A6	West Galros Stream	None recorded; negative eDNA result at site	No signs	Not present	None recorded	None recorded	None recorded
A7	Rapemills River	None recorded	Regular spraint site	Not present	None recorded	None recorded	None recorded
A8	Rapemills River	None recorded; negative eDNA result at site	No signs	Not present	None recorded	None recorded	Atlantic salmon, lamprey (<i>Lampetra</i> sp.) & European eel (all eDNA only)
B1	Drainage channel	None recorded	No signs	Not present	None recorded	None recorded	None recorded
C1	Whigsborough Stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L1	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L2	Lake wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
P1	Pond	None recorded	No signs	Not present	None recorded	None recorded	None recorded
P2	Pond	None recorded	No signs	Not present	None recorded	None recorded	None recorded

Conservation value: Brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), otter (*Lutra lutra*) and white-clawed crayfish (*Austropotamobius pallipes*) 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'). Otters and white-clawed crayfish are also protected under the Irish Wildlife Acts 1976-2023. White-clawed crayfish (Füreder et al., 2010) are listed as 'Endangered' according to the IUCN Red List. 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., 20

5. Discussion

The watercourses in the vicinity of the proposed Cush wind farm were lowland and peatland channels which had typically been extensively straightened and deepened historically (land drainage) and suffered from evident water quality pressures (primarily siltation). Over half of the survey sites were of low aquatic value and did not support aquatic species or habitats of high conservation value during the survey period.

However, in keeping with the previous 2022 surveys (Triturus, 2022), a number of high conservation value aquatic species were recorded. Annex II otter signs were identified at several locations on the Rapemills River, with Annex II lamprey (*Lampetra* sp.) again recorded from the Rapemills River (as per previous surveys). Annex II Atlantic salmon were detected through eDNA sampling of the Rapemills River at site A8, with Red-listed European eel eDNA detected from the Rapemills River and West Galros Stream. Whilst none of these species were recorded at lake site L2 - a large wetland/lake complex situated in cutover bog adjacent to the proposed site boundary - the site was considered of high overall biodiversity and aquatic value in a local context.

In support of previous surveys no rare or protected macrophytes/aquatic bryophytes, rare or protected macro-invertebrates, Annex I aquatic habitats or otter breeding/resting areas were recorded during the current survey. The only aquatic invasive species recorded was the macrophyte Canadian pondweed (*Elodea canadensis*)¹ at site A8 on the Rapemills River. Whilst no white-clawed crayfish were recorded in the current survey, the species is known from the survey area and the presence of a small population is considered likely (see **section 5.3** below).

5.1 Fisheries

A typical diversity of fish species for the surveyed sub-catchments were recorded via electro-fishing during the current survey, with brown trout, lamprey (*Lampetra* sp.), gudgeon, minnow, stone loach, pike and three-spined stickleback captured in August 2025 (**Table 3.1, 3.2**). Atlantic salmon and European eel were detected through eDNA sampling only (**Table 4.1; Appendix B**). With the exception of Atlantic salmon (eDNA only), the same species assemblage was recorded during the previous survey in August 2022 (Triturus, 2022). Four of the riverine sites did not support resident fish at the time of survey.

Salmonid populations were restricted in vicinity of the proposed development, with brown trout being recorded throughout the Rapemills River at sites A1, A4, A7 and A8 and via eDNA sampling of the West Galros Stream (A6). Atlantic salmon were also detected through eDNA sampling at site A8 (Lusmagh Bridge). Lamprey ammocoetes (*Lampetra* sp.) were recorded in low densities from sites A1 and A4 on the Rapemills River, with eDNA sampling detecting the species at site A8. Suitability for the species was typically poor or absent in the survey area. Hydromorphological modifications, siltation and bed calcification significantly reduced the quality and availability of salmonid and lamprey spawning and nursery habitats in the survey area (**Appendix A**). Although no Red-listed European eel were recorded

¹ listed on the on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011) but a very widespread, established species in Ireland now considered as a low risk (Torsney et al., 2025)

via electro-fishing, eDNA sampling did detect the species in the Rapemills River (A4, A8) and West Galros Stream (A6) in August 2025, indicating low numbers of eel are present in the survey area.

5.2 Otter

Otter signs (typically spraints) were identified at a total of 4 no. sites on the Rapemills River (A1, A4, A7 and near site A3). Several signs were identified at the same locations as the previous 2022 surveys (i.e. inter-annual marking sites, **Plate 4.16**). Although many smaller watercourses and waterbodies were of low value for otter (poor prey resources etc.), the low number of otter signs identified was mostly due to a paucity of suitable instream/riparian marking features such as boulders and large woody debris - features typically removed through historical drainage. This can result in sign detection difficulties (Wang et al., 2021; Reuther et al., 2000) even when areas are utilised by foraging and commuting otter (e.g. West Galros Stream and connected peat settlement ponds).

No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in August 2025 or August 2022.

5.3 White-clawed crayfish (likely presence)

No live white-clawed crayfish were recorded during the current targeted surveys and environmental DNA sampling of the Rapemills River (2 sites) and West Galros Stream failed to detect the species. However, white-clawed crayfish remains were recorded in otter spraint on both these watercourses during the previous survey (Triturus, 2022). Crayfish burrows were frequent in the steep clay banks of the West Galros Stream (sites A5 & A6) as well as connected former peat settlement ponds (sites P1 & P2) and suitability was high overall.

The failure to detect eDNA signatures of crayfish in these watercourses may be an artefact of hydrological conditions at the time of sampling, especially in the West Galros Stream which did not support flowing water in August 2025. Whilst highly sensitive and often detectable over long distances instream (including in crayfish; Chucholl et al., 2021), the detection of eDNA from an upstream (riverine) population depends on downstream transport of genetic material, and mixing of same in lacustrine habitats. The low summer flows present on the West Galros Stream and connected ponds (very suitable crayfish habitat) at the time of survey may have limited the flow/mixing of eDNA and thus influenced detection rates of crayfish (i.e. DNA may have temporarily settled out of suspension; Buxton et al., 2018). The patchy distribution and often low abundances of white-clawed crayfish in a given river system may also strongly influence eDNA detection probability (Sint et al., 2022). Whilst further survey effort would be required to confirm, it is considered likely that a small fragmented crayfish population still exists in the Rapemills River/West Galros Stream system.

5.4 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 10 no. riverine or composite sweep samples collected at 2 no. lake sites (**Appendix C**). However, whilst not protected, the nationally uncommon backswimmer *Notonecta obliqua* was recorded from the impounded peat channel at site B1. This species occupies a restricted and mostly coastal distribution in Ireland but is known to inhabit small pools in heathland and peatlands (Nelson, 2022).

The non-native amphipod crustacean *Crangonyx* sp. was recorded in low numbers from lake site L2 (**Appendix B**). Whilst *Crangonyx pseudogracilis* has been known in Ireland since 1969, its Irish range has expanded in recent years (Minchin et al., 2013) and it is now well established (Baars et al., 2021). Furthermore, *Crangonyx floridanus* has recently been confirmed in the Liffey and Barrow catchments (Baars et al., 2021). Speciation within the *Crangonyx* genus has proven difficult (Mauvisseau et al. 2018) and could not be determined in the current survey. Although the ecological impacts of either *Crangonyx* species in Ireland remains uncertain (Baars et al., 2021) the species has been shown to be an important dietary component in brown trout in the River Liffey (Delanty et al., 2022).

As per previous surveys (**Table 4.2**), all sampling sites failed to meet the target good status ($\geq$ Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). Whilst Rapemills River at site A1 and A4 was of Q3-4 (moderate status) in August 2022 (EPA group A *Rhithrogena semicolorata* or *Ephemera danica* present), this had decreased to Q3 (poor status) in August 2025. All other sampling sites ranged from Q2-3 to Q3 (poor status) with several ratings tentative due to poor flows and an absence of suitable riffle areas for sampling. Alongside eutrophication, hydromorphological modifications (land/peatland drainage) and peat harvesting (leading to siltation) have been identified as the major pressures impacting water quality in the Brosna_SC_080 and the Shannon (Lower)_SC_040 river sub-catchments (EPA data) and this was supported by observations made during the current and previous surveys.

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7. Appendix A – fisheries report

Please see accompanying fisheries assessment report

8. Appendix B – eDNA lab report

Folio No: 4087-2025
Purchase Order: eDNA_Cush
Contact: Triturus Environmental Ltd
Issue Date: 23.09.2025
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eDNA Report

Technical Report



Folio No: 4087-2025
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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
FK2898.	A4 - Rapemills River		White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
			Atlantic salmon (Salmo salar)	Pass	Negative	0
			European eel (Anguilla anguilla)	Pass	Positive	12
			Brook/River lamprey (Lampetra planeri/ Lampetra fluviatilis)	Pass	Positive	2
FK2901.	A6 - West Galros Stream		White-clawed crayfish (Austropotamobius pallipes)	Pass	Negative	0
			Brown (sea) trout (Salmo trutta)	Pass	Positive	12

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



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		European eel (<i>Anguilla anguilla</i>)	Pass	Positive	10
		Brook/River lamprey (<i>Lampetra planeri</i> / <i>Lampetra fluviatilis</i>)	Pass	Negative	0
FK3496	A8 - Rapemills River	White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Pass	Negative	0
		Atlantic salmon (<i>Salmo salar</i>)	Pass	Positive	1
		European eel (<i>Anguilla anguilla</i>)	Pass	Positive	11
		Brook/River lamprey (<i>Lampetra planeri</i> / <i>Lampetra fluviatilis</i>)	Pass	Positive	2

Matters affecting result: none

Reported by: Vanessa Hind

Approved by: Consuela Sopronyi



Folio No: 4087-2025
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Methodology

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

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

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

Interpretation of Results

Sample Integrity Check: Laboratory Arrival:

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

Degradation and Inhibition check:

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

Result:

Presence of eDNA (Positive/Negative/Inconclusive)

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

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

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

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



9. Appendix C – biological water quality & lacustrine macro-invertebrate communities

Table 9.1 Macro-invertebrate Q-sampling results for riverine sites, August 2025

Group	Family	Species	A1	A3	A4	A5	A6	A7	A8	B1	C1	EPA group
Ephemeroptera	Baetidae	<i>Alainites muticus</i>	2	5	6			4				B
Plecoptera	Leuctridae	<i>Leuctra fusca</i>			3							B
Trichoptera	Glossosomatidae	<i>Agapetus fuscipes</i>										B
Trichoptera	Hydroptilidae	<i>Hydroptila</i> sp.							1			B
Trichoptera	Limnephilidae	<i>Limnephilus lunatus</i>				11						B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>						23				B
Trichoptera	Phryganeidae	<i>Agrypnia obsoleta</i>							1			B
Trichoptera	Sericostomatidae	<i>Sericostoma personatum</i>	11		6							B
Odonata	Aeshnidae	sp. indet.								1		B
Odonata	Coenagrionidae	sp. indet.				7	4			15		B
Odonata	Libellulidae	<i>Sympetrum</i> sp.								12		B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	5	3	8			45	13			C
Ephemeroptera	Ephemerellidae	<i>Serratella ignita</i>	36		6			3	2			C
Trichoptera	Hydropsychidae	<i>Hydropsyche instabilis</i>			10							C
Trichoptera	Hydropsychidae	<i>Hydropsyche siltalai</i>			26			1				C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>								6		C
Trichoptera	Polycentropodidae	<i>Polycentropus kingi</i>							1			C
Arachnida	Hydrachnidae	sp. indet.					6		1		1	C
Coleoptera	Dytiscidae	<i>Graptodytes pictus</i>				4						C
Coleoptera	Dytiscidae	<i>Nebrioporus depressus</i>							2			C
Coleoptera	Dytiscidae	<i>Oreodytes sanmarkii</i>	1		1							C
Coleoptera	Elmidae	<i>Elmis aenea</i>	6		29			25	4			C
Coleoptera	Elmidae	<i>Limnius volckmari</i>	42		3							C
Coleoptera	Gyrinidae	Gyrinidae larva							1			C
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>				6					4	C

Group	Family	Species	A1	A3	A4	A5	A6	A7	A8	B1	C1	EPA group
Coleoptera	Haliphiidae	<i>Brychius elevatus</i>	1		8			1				C
Coleoptera	Haliphiidae	<i>Haliphus ruficollis</i> group				3						C
Coleoptera	Notonectidae	<i>Notonecta obliqua</i>								6		C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	55	11	38			5	4		3	C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	21							3	7	C
Diptera	Simuliidae	sp. indet.	3	4	22			6				C
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>		1		2	12		2		3	C
Gastropoda	Planorbidae	<i>Bathymphalus contortus</i>		1								C
Gastropoda	Planorbidae	<i>Gyraulus albus</i>					1					C
Gastropoda	Planorbidae	<i>Planorbis planorbis</i>	1	15								C
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>			11	1	8	12				C
Hirudinea	Piscicolidae	<i>Piscicola</i> sp.				2						C
Hemiptera	Corixidae	Corixidae nymph							1	2	2	C
Hemiptera	Corixidae	<i>Hesperocorixa castanea</i>								9		C
Hemiptera	Corixidae	<i>Hesperocorixa linnaei</i>							1			C
Hemiptera	Corixidae	<i>Hesperocorixa sahlbergi</i>				12						C
Hemiptera	Gerridae	<i>Gerris</i> sp.				22	18					C
Crustacea	Asellidae	<i>Asellus aquaticus</i>	4			26			1		4	D
Gastropoda	Lymnaeidae	<i>Ampullacaena balthica</i>	1	21		6	1					D
Gastropoda	Physidae	<i>Physa fontinalis</i>							1			D
Megaloptera	Sialidae	<i>Sialis lutaria</i>					1		1		1	D
Diptera	Chironomidae	<i>Chironomus</i> spp.		10					3	1	3	E
Oligochaeta		sp. indet.			5						6	n/a
Abundance			189	71	182	102	51	125	40	55	34	
Q-rating			Q3	Q2-3*	Q3	Q3*	Q3*	Q3	Q3*	Q3	Q2-3	
WFD class			Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	

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

Table 9.2 Macro-invertebrate communities recorded at lacustrine sites, August 2025

Group	Family	Species	L1	L2	P1	P2
Mollusca	Sphaeriidae	sp. indet.				86
Odonata	Coenagrionidae	sp. indet.	13	33	28	2
Ephemeroptera	Baetidae	<i>Cloeon simile</i>	17	11	21	10
Crustacea	Asellidae	<i>Asellus aquaticus</i>			36	16
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>			44	1
Diptera	Chironomidae	<i>Chironomus</i> spp.	4		12	21
Trichoptera	Limnephilidae	<i>Halesus radiatus</i>			10	21
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	12		1	
Hemiptera	Corixidae	Corixidae nymph		11		2
Trichoptera	Phryganeidae	<i>Agrypnia obsoleta</i>			5	6
Crustacea	Ostracoda	sp. indet.				11
Odonata	Aeshnidae	sp. indet.	6		1	
Coleoptera	Gyrinidae	<i>Gyrinus substriatus</i>	7			
Megaloptera	Sialidae	<i>Sialis lutaria</i>			1	5
Crustacea	Crangonyctidae	<i>Crangonyx</i> sp.		6		
Coleoptera	Noteridae	<i>Noterus crassicornis</i>	5			
Diptera	Culicidae	sp. indet.		5		
Coleoptera	Dytiscidae	<i>Graptodytes pictus</i>			4	
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>			4	
Coleoptera	Hydrophilidae	<i>Helophorus brevipalpis</i>	4			
Gastropoda	Lymnaeidae	<i>Ampullacaena balthica</i>	1		2	
Trichoptera	Leptoceridae	<i>Mystacides longicornis</i>				3
Coleoptera	Halpliidae	<i>Haliphus ruficollis</i> group			2	
Crustacea	Gammaridae	<i>Gammarus duebeni</i>			2	
Arachnida	Hydrachnidae	sp. indet.			1	1
Coleoptera	Dytiscidae	<i>Nebrioporus depressus</i>			1	1
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	1		1	
Diptera	Tabanidae	sp. indet.	1			1
Ephemeroptera	Caenidae	<i>Caenis luctuosa</i>				2
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>		2		
Coleoptera	Dytiscidae	<i>Hyphydrus ovatus</i>			1	
Ephemeroptera	Heptageniidae	<i>Heptagenia sulphurea</i>			1	
Gastropoda	Planorbidae	<i>Gyraulus albus</i>			1	
Hemiptera	Corixidae	<i>Hesperocorixa linnaei</i>			1	
Annelidae	Oligochaeta	sp. indet.				1
Coleoptera	Halpliidae	<i>Haliphus ruficollis</i>	1			
Coleoptera	Halpliidae	<i>Haliphus</i> sp.	1			
Abundance			73	68	180	190
Taxon richness			13	6	22	17



Triturus Environmental Ltd.,
Unit 5 Anchor Business Park,
Little Island,
Co. Cork,
T45 XN59.

Fisheries assessment for the proposed Cush wind farm, Co. Offaly (2025)



Prepared by Triturus Environmental Ltd. for SLR Consulting Ireland

January 2026

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by SLR Consulting Ireland to undertake a baseline fisheries assessment of numerous watercourses in the vicinity of the proposed Cush wind farm development located near Birr, Co. Offaly.

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed development, inclusive of the proposed internal cable route. In order to gain an accurate overview of the existing and potential fisheries value of the watercourses within the vicinity of the proposed development a catchment-wide electro-fishing survey across 10 no. riverine sites was undertaken (**Table 2.1; Figure 2.1**). A fisheries appraisal of 4 no. lacustrine sites was also undertaken. 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 impact assessment and any subsequent mitigation for the development.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the proposed Cush wind farm. The current surveys were undertaken in August 2025 and would update those previously completed by Triturus in August 2022.

1.2 Fisheries (desktop review)

Previous surveys for the development recorded a low diversity of fish species. The Rapemills River, a tributary of the River Shannon, is known to support brown trout (*Salmo trutta*), lamprey (*Lampetra* sp.), pike (*Esox lucius*), minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and three-spined stickleback (*Gasterosteus aculeatus*) (Triturus 2022 data).

The West Galros Stream, a heavily modified tributary of the Rapemills River, was found to support three-spined stickleback only in the August 2022 survey (Triturus 2022 data). No fish were recorded from the heavily modified Eglish Stream at proposed survey site A2 or the heavily modified Whigsborough Stream at survey site C1 in August 2022 (Triturus data).

2. Methodology

2.1 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish riverine sites on Thursday 14th, Friday 15th and Saturday 16th August 2025 following notification to Inland Fisheries Ireland and under the conditions of a Department of Climate, Energy and the Environment (DCEE) licence. To collate a more accurate baseline of the proposed receiving watercourses, the electro-fishing survey was undertaken across 10 no. riverine sites (see **Table 2.1**, **Figure 2.1**).

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

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

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of 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 relatively high conductivity waters of the sites a voltage of 200-220v, 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 14 no. riverine and lacustrine sites was undertaken to establish their importance for salmonid, lamprey, 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 profile, 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. Particular cognisance was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). 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 14 no. electro-fishing & fisheries appraisal survey sites in the vicinity of the proposed Cush wind farm, Co. Offaly

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Rapemills River	25R01	Eglish	608544	709345
A2	Eglish Stream	25E18	Eglish	608194	709857
A3	Eglish Stream	25E18	Eglish	607766	709311
A4	Rapemills River	25R01	Boolinarig Bridge	607478	709372
A5	West Galros Stream	25W44	Eglish	608084	710542
A6	West Galros Stream	25W44	N62 road crossing	607627	710485
A7	Rapemills River	25R01	R439 road crossing	604773	710211
A8	Rapemills River	25R01	Lusmagh Bridge	600128	714644
B1	Drainage channel	n/a	Clooneen	607887	712615
C1	Whigsborough Stream	25W43	Clooneen	608671	712865
L1*	Lake/wetland	n/a	Eglish	608291	710532
L2*	Lake/wetland	n/a	Clooneen	607832	713182
P1*	Pond	n/a	Galros East	607783	710585
P2*	Pond	n/a	Galros East	607982	710624

* fisheries appraisal only

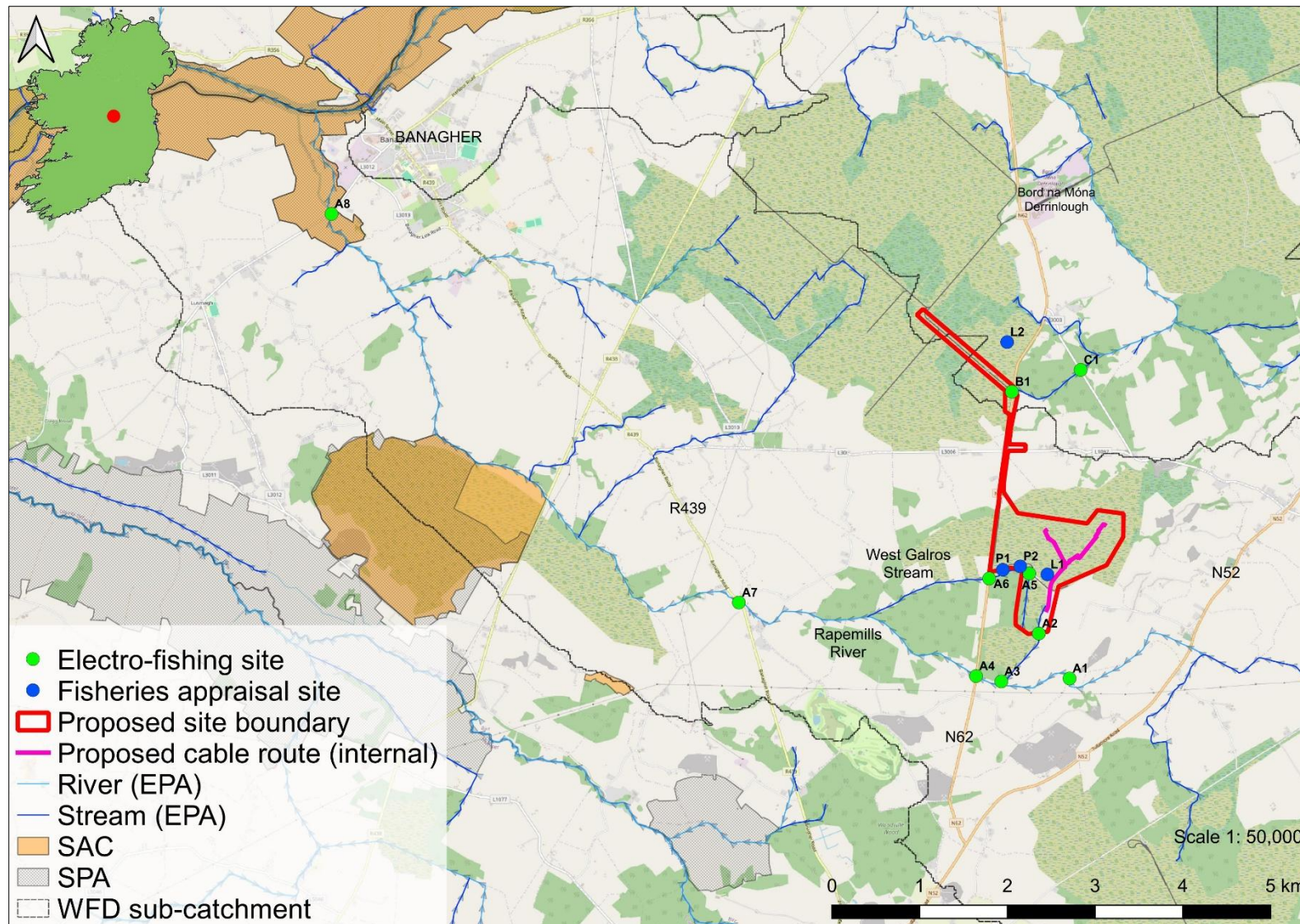


Figure 2.1 Overview of the electro-fishing & fisheries appraisal survey site locations, August 2025

3. Results

A catchment-wide fisheries survey of 10 no. riverine and 4 no. lacustrine sites in the vicinity of the proposed Cush wind farm was conducted on Thursday 14th, Friday 15th and Saturday 16th August 2025 following notification to Inland Fisheries Ireland. The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery 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 – Rapemills River, Eglish

Brown trout (*Salmo trutta*) ($n=16$), lamprey (*Lampetra* sp.) ($n=14$) and three-spined stickleback (*Gasterosteus aculeatus*) ($n=6$) were recorded via electro-fishing at site A1 on the Rapemills River (EPA code: 25R01) at quarry access bridge upstream of the proposed development (i.e. an upstream control site). (**Figure 3.1**).

The site was of good value for salmonids although primarily suited adults rather than juveniles given the predominance of deep pool, glide and bank scours/undercuts with high vegetation cover. Nonetheless, a mixed cohort trout population was present. Spawning habitat was widespread for both salmonids and lamprey. Organic rich soft sediment accumulations were frequent throughout but *Lampetra* sp. ammocoetes were highly localised, with most being confined to accumulations under the bridge (as per 2022 survey). Despite good suitability for European eel none were recorded.

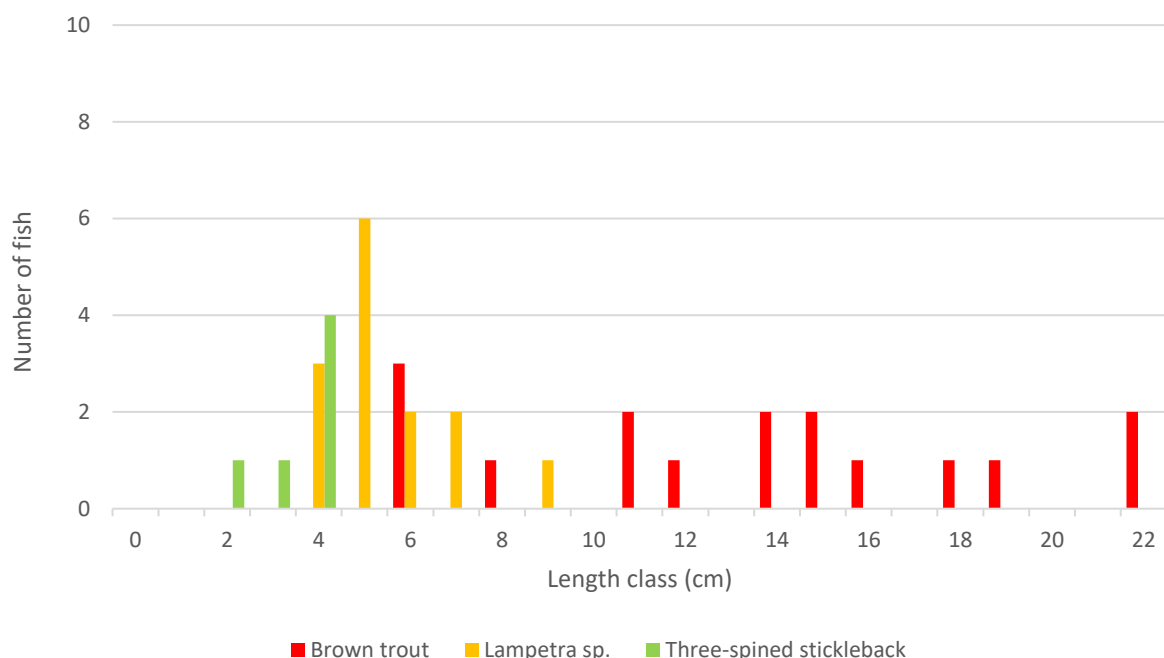


Figure 3.1 Length frequency distribution recorded via electro-fishing at site A1, August 2025



Plate 3.1 Mixed cohort brown trout recorded at site A1 on the Rapemills River upstream of the proposed development, August 2025



Plate 3.2 *Lampetra* sp. ammocoetes recorded at site A1 on the Rapemills River, August 2025

3.1.2 Site A2 – Eglish Stream, Eglish

Site A2 on the upper reaches of the Eglish Stream (25E18) was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats at the time of survey. The stream was also dry at this location during the previous August 2022 survey.



Plate 3.3 Representative image of site A2 on the Eglish Stream, August 2025 (dry, ephemeral channel)

3.1.3 Site A3 – Eglish Stream, Eglish

No fish were recorded via electro-fishing at site A3 on the lower reaches of the Eglish Stream (25E18). With the exception of low suitability for ubiquitous species such as three-spined stickleback (not recorded), the stream was not of fisheries value given its heavily modified, silted and shallow nature with an absence of flows.



Plate 3.4 Representative image of site A3 on the lower reaches of the Eglish Stream, August 2025

3.1.4 Site A4 – Rapemills River, Boolinarig Bridge

Brown trout ($n=15$) and lamprey (*Lampetra* sp.) ($n=7$) were the only fish species recorded via electro-fishing at site A4 on the Rapemills River (25R01) at Boolinarig Bridge (N62 road crossing) (**Figure 3.2**).

The site was of good value for salmonids despite evident siltation and hydromorphological pressures, with a mixed cohort population present (as per 2022). Spawning habitat for salmonids and lamprey was limited given the general paucity of gravels/cobbles in addition to natural bed calcification (colmation). Nursery habitat was also limited due to the highly localised nature of riffle and faster flowing glide areas. Deep pool and glide with bank scours and occasional macrophyte stands were of value as holding areas for adult salmonids. Abundant soft sediment deposits supported only a low density (3.5 per m²) of *Lampetra* sp. ammocoetes. Despite good suitability for European eel, none were recorded, primarily reflecting downstream barriers in the Shannon catchment – however, the species was detected via eDNA sampling, indicating their presence at and or upstream of the sampling location (**Appendix B**).

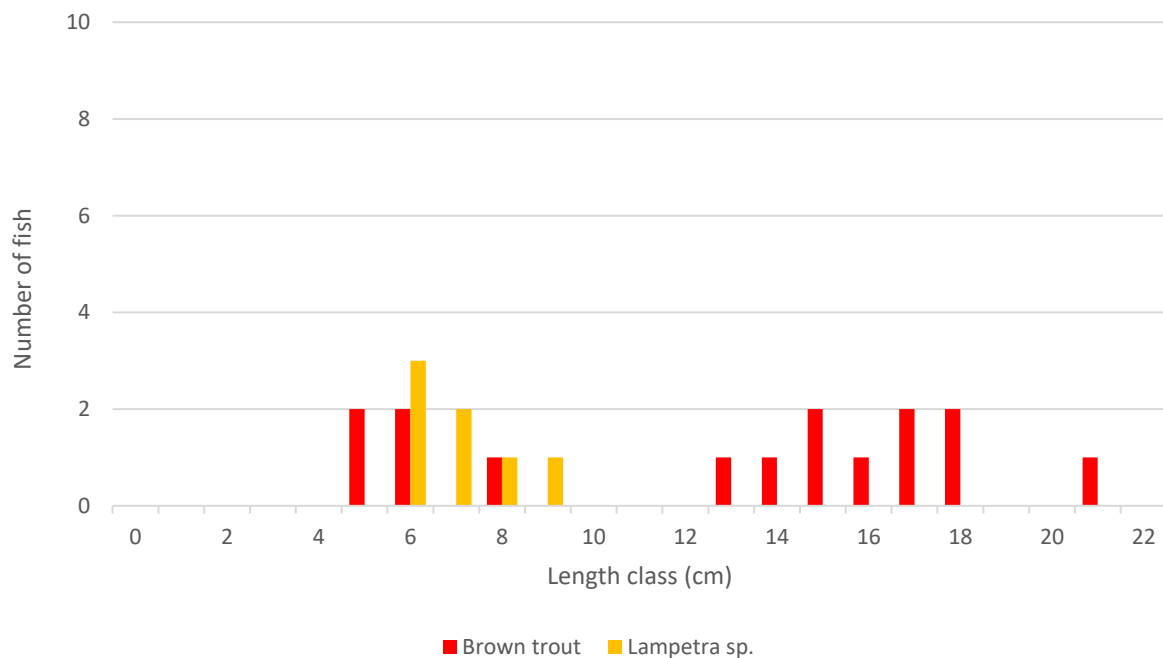


Figure 3.2 Length frequency distribution recorded via electro-fishing at site A4, August 2025



Plate 3.5 Mixed cohort brown trout recorded at site A4 on the Rapemills River at Boolinarig Bridge, August 2025

3.1.5 Site A5 – West Galros Stream, Eglish

Electro-fishing was not undertaken at site B5 on the upper reaches of the West Galros Stream (25W44) given prohibitive depths of >1.5m and a deep silt base. With the exception of three-spined stickleback (recorded in sweep samples), site A5 was of poor fisheries value given poor hydromorphology, low flows and poor fluvial connectivity. However, there was some suitability for European eel (eDNA detected downstream at site A6).



Plate 3.6 Representative image of site A5 on the West Galros Stream, August 2025

3.1.6 Site A6 – West Galros Stream, N62 road crossing

Electro-fishing was not undertaken at site A6 on the West Galros Stream (25W44) at the N62 road crossing given prohibitive depths of >1.5-2m. With the exception of three-spined stickleback (recorded via sweep sampling), site A6 was of poor fisheries value given poor hydromorphology, low/absent flows and heavy siltation. However, whilst salmonid spawning and nursery habitat was absent, the site had some low value as a holding habitat for adult trout given the high average depth. Argillaceous sediment deposits were unsuitable for lamprey ammocoete burial (no lamprey eDNA detected). Suitability for European eel was high and indeed the species was detected via eDNA sampling (**Table 4.1**).



Plate 3.7 Representative image of site A6 on the West Galros Stream, August 2025

3.1.7 Site A7 – Rapemills River, R439 road crossing

Brown trout ($n=28$) was the only species recorded via electro-fishing at site A7 on the Rapemills River (25R01) at the R439 road c.3km downstream of site A4 (**Figure 3.3**).

The site was of high value for salmonids, supporting a moderate density of mixed-cohort brown trout. Whilst bed calcification reduced the spawning capacity of the site (colmation of gravels), some limited spawning habitat for both salmonids and lamprey was present in pool tailings. Abundant bryophyte rich boulder and cobble provided some good quality salmonid nursery refugia with frequent small shaded pools of value as holding areas for adults. Lamprey ammocoete habitat was absent. Despite some good suitability for European eel, none were recorded, with bed calcification reducing the availability of instream refugia.

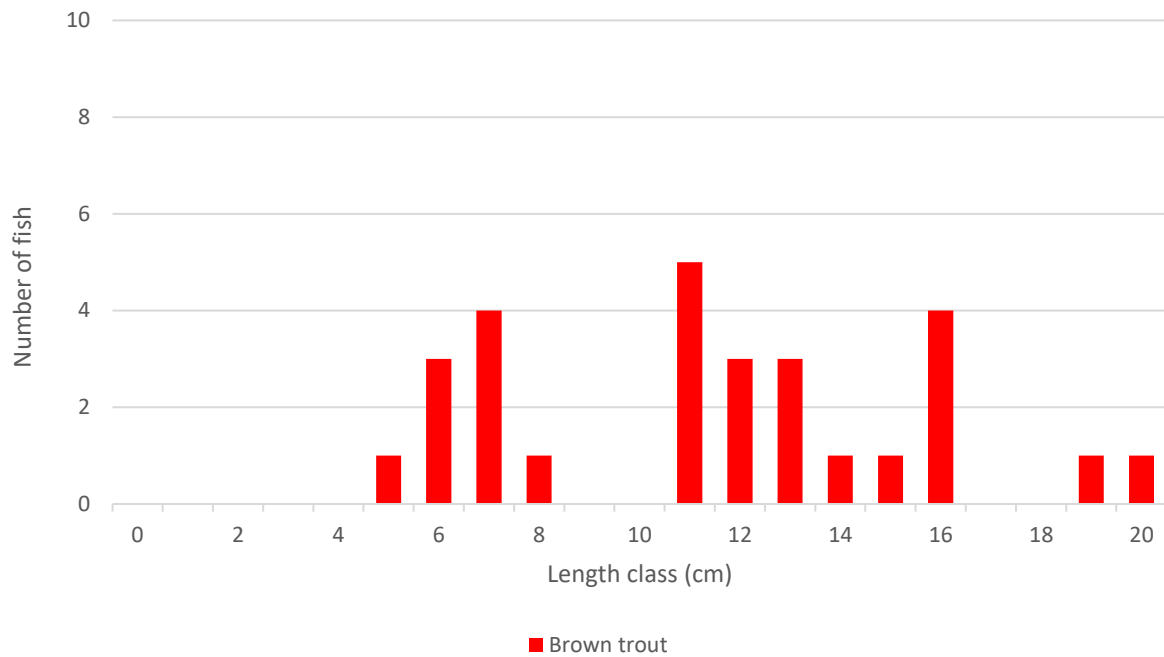


Figure 3.3 Length frequency distribution recorded via electro-fishing at site A7, August 2025



Plate 3.8 Brown trout recorded at site A7 on the Rapemills River, August 2025

3.1.8 Site A8 – Rapemills River, Lusmagh Bridge

minnow (*Phoxinus phoxinus*) ($n=35$), three-spined stickleback ($n=11$), gudgeon (*Gobio gobio*) ($n=10$), stone loach ($n=6$), brown trout ($n=2$) and pike (*Esox lucius*) ($n=1$) were recorded via electro-fishing at site A8 on the lower reaches of the Rapemills River (25R01) at Lusmagh Bridge (**Figure 3.4**).

A short section near the bridge was shallow enough to undertake backpack electro-fishing (too deep elsewhere). The site was of relatively poor value for salmonids given a paucity of suitable spawning and nursery habitat although deep glide and pool were valuable holding areas for adult salmonids (albeit none recorded). These areas were also of high value for a range of coarse fish species. Soft sediment accumulations did not support lamprey ammocoetes and the site was not of value for spawning lamprey given siltation pressures. Despite some good physical suitability, no European eel were recorded. However, European eel, Atlantic salmon and *Lampetra* sp. were detected via eDNA sampling, indicating their presence at and or upstream of the sampling location (**Appendix B**).

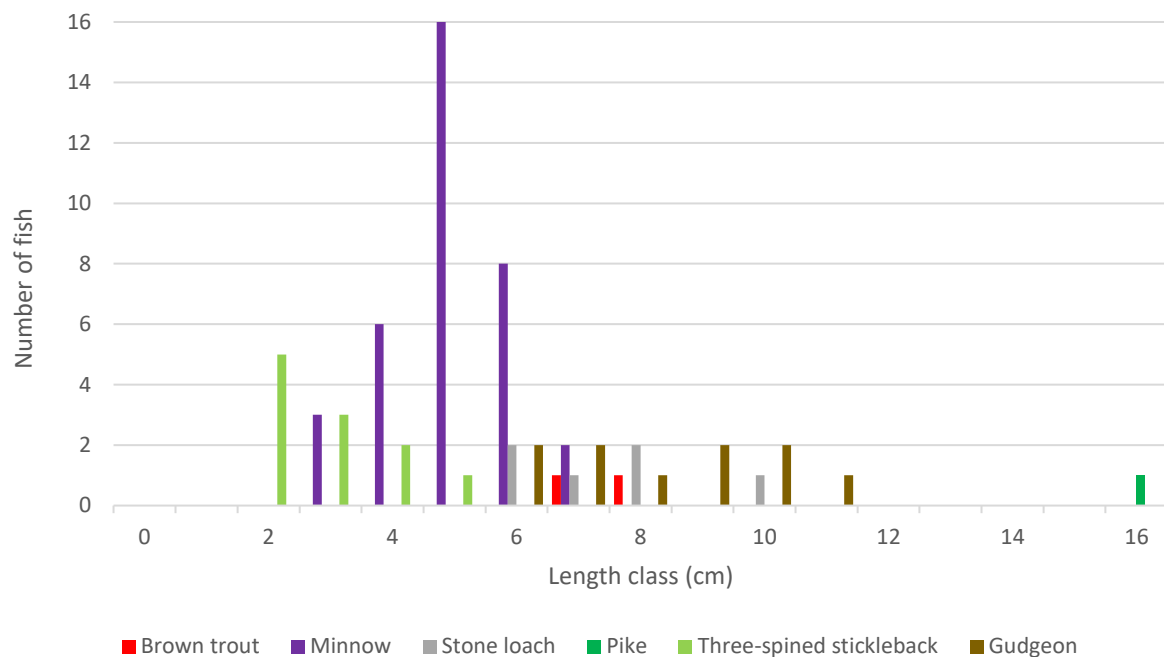


Figure 3.4 Length frequency distribution recorded via electro-fishing at site A8, August 2025



Plate 3.9 Juvenile pike recorded at site A8 on the Rapemills River at Lusmagh Bridge, August 2025



Plate 3.10 Gudgeon recorded at site A8 on the Rapemills River at Lusmagh Bridge, August 2025

3.1.9 Site B1 – Drainage channel, Clooneen

No fish were recorded via electro-fishing at site B1 on a drainage channel perpendicular to a dry roadside drain within the proposed site boundary. The intermittent drainage channel was unsuitable for fish given its shallow heavily silted nature and isolation from other habitats.



Plate 3.11 Representative image of site B1 on an impounded peat drainage channel, August 2025

3.1.10 Site C1 – Whigsborough Stream, Clooneen

No fish were recorded via electro-fishing at site C1 on the Whigsborough Stream (25W43) at a local road crossing downstream (east) of the proposed site boundary. The site was not of fisheries value given gross siltation, poor hydromorphology and absent flows, in addition to poor connectivity with downstream habitats (frequent peat blockages instream).



Plate 3.12 Representative image of site C1 on the Whigsborough Stream, August 2025

3.1.11 Site L1 – Lake/wetland, Eglish

Site L1 was located at a small wetland within the proposed site boundary. Electro-fishing was not undertaken at site L1 given the lacustrine conditions and deep silt bed. The wetland was of poor fisheries value given very shallow depths, siltation and isolation from other habitats.



Plate 3.13 Representative image of site L1, August 2025

3.1.12 Site L2 – Lake/wetland, Clooneen

Site L2 was located at a large 20ha lake/wetland complex adjacent to Derrinlough wind farm and the proposed site boundary. Electro-fishing was not undertaken at site L2 given the lacustrine conditions and deep silt bed. The wetland was of some fisheries value despite its generally shallow depths, siltation and isolation from other habitats. Three-spined stickleback were visibly plentiful and recorded in sweep samples.



Plate 3.14 Three-spined stickleback recorded via sweep netting at site L2, August 2025



Plate 3.15 Representative image of site L2, August 2025

3.1.13 Site P1 – Pond, Galros East

Site P1 was located at a former peat settlement pond of 0.2ha adjacent to the West Galros Stream. Electro-fishing was not undertaken at site P1 given the deep lacustrine conditions. However, three-spined stickleback were recorded via sweep sampling and were present in high numbers. The alkaline pond was of good suitability for European eel and had some suitability for brown trout although the absence of suitable spawning habitat likely precluded the species.



Plate 3.16 Three-spined stickleback were abundant in sweep samples taken at site P1, August 2025



Plate 3.17 Representative image of site P1, August 2025

3.1.14 Site P2 – Pond, Galros East

Site P2 was located at a former peat settlement pond of 0.3ha adjacent to site P1 and the West Galros Stream. Electro-fishing was not undertaken at site P2 given the deep lacustrine conditions. However, three-spined stickleback were recorded via sweep sampling and were present in moderate numbers. The alkaline pond was of good suitability for European eel and had some suitability for brown trout although the absence of suitable spawning habitat likely precluded the species.



Plate 3.18 Representative image of site P2, August 2025

Table 3.1 Fish species densities per m² recorded at sites in the vicinity of the proposed development via electro-fishing in August 2025 (values in **bold** represent the highest densities recorded for each species, respectively)

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m ²)	Fish density per m ²						
				Brown trout	<i>Lampetra</i> sp.	Minnow	Stone loach	Gudgeon	Pike	Three-spined stickleback
A1	Rapemills River	10	200	0.080	3.5 per m²	0.000	0.000	0.000	0.000	0.030
A2	Eglish Stream	n/a	Dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a
A3	Eglish Stream	5	105	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A4	Rapemills River	10	280	0.054	2.3 per m ²	0.000	0.000	0.000	0.000	0.000
A5	West Galros Stream	n/a	Fisheries appraisal only	n/a	n/a	n/a	n/a	n/a	n/a	n/a
A6	West Galros Stream	n/a	Fisheries appraisal only	n/a	n/a	n/a	n/a	n/a	n/a	n/a
A7	Rapemills River	10	250	0.112	0.000	0.000	0.000	0.000	0.000	0.000
A8	Rapemills River	10	225	0.009	0.000	0.156	0.027	0.044	0.004	0.049
B1	Drainage channel	5	90	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C1	Whigsborough Stream	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
L1	Lake/wetland	n/a	Fisheries appraisal only	n/a	n/a	n/a	n/a	n/a	n/a	n/a
L2	Lake/wetland	n/a	Fisheries appraisal only	n/a	n/a	n/a	n/a	n/a	n/a	n/a
P1	Pond	n/a	Fisheries appraisal only	n/a	n/a	n/a	n/a	n/a	n/a	n/a
P2	Pond	n/a	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, August 2025

Site	Watercourse	Atlantic salmon	Brown trout	<i>Lampetra</i> sp.	European eel	Other species
A1	Rapemills River		Medium	Low		Three-spined stickleback
A2	Eglish Stream	No fish recorded – dry, ephemeral channel				
A3	Eglish Stream	No fish recorded				
A4	Rapemills River	Negative eDNA	Medium	Low	Positive eDNA	
A5	West Galros Stream	Fisheries appraisal only				
A6	West Galros Stream	Fisheries appraisal only – negative brown trout, <i>Lampetra</i> sp. eDNA but positive European eel eDNA				
A7	Rapemills River		High			
A8	Rapemills River	Positive eDNA	Low	Positive eDNA	Positive eDNA	Minnow, stone loach, pike, three-spined stickleback, gudgeon
B1	Drainage channel	No fish recorded				
C1	Whigsborough Stream	No fish recorded				
L1	Lake/wetland	Fisheries appraisal only				
L2	Lake/wetland	Fisheries appraisal only – three-spined stickleback recorded during sweep sampling				
P1	Pond	Fisheries appraisal only – three-spined stickleback recorded during sweep sampling				
P2	Pond	Fisheries appraisal only – three-spined stickleback recorded during sweep sampling				

Table 3.3 Comparison of fish recorded via electro-fishing in 2022 and 2025 at sites in vicinity of the proposed Cush wind farm

Site no.	Watercourse	EPA code	Fish species recorded	
			August 2022	August 2025
A1	Rapemills River	25R01	Brown trout, <i>Lampetra</i> sp., three-spined stickleback	Brown trout, <i>Lampetra</i> sp., three-spined stickleback
A2	Eglish Stream	25E18	No fish recorded – dry channel	No fish recorded – dry channel
A3	Eglish Stream	25E18	Not surveyed	No fish recorded
A4	Rapemills River	25R01	Brown trout, <i>Lampetra</i> sp.	Brown trout, <i>Lampetra</i> sp.; European eel (eDNA only)
A5	West Galros Stream	25W44	Fisheries appraisal only	Fisheries appraisal only
A6	West Galros Stream	25W44	Fisheries appraisal only	Fisheries appraisal only
A7	Rapemills River	25R01	Brown trout	Brown trout
A8	Rapemills River	25R01	Brown trout, European eel, pike, minnow, stone loach, three-spined stickleback	Brown trout, minnow, stone loach, pike, three-spined stickleback, gudgeon; Atlantic salmon, <i>Lampetra</i> sp. & European eel (eDNA only)
B1	Drainage channel	n/a	Not surveyed	No fish recorded
C1	Whigsborough Stream	25W43	No fish recorded	No fish recorded
L1	Lake/wetland	n/a	Not surveyed	Fisheries appraisal only
L2	Lake/wetland	n/a	Not surveyed	Fisheries appraisal only – three-spined stickleback recorded
P1	Pond	n/a	Not surveyed	Fisheries appraisal only – three-spined stickleback recorded
P2	Pond	n/a	Not surveyed	Fisheries appraisal only – three-spined stickleback recorded

4. Discussion

The surveyed watercourses in the vicinity of the proposed Cush wind farm development were typically small lowland channels draining areas of peatland that had been extensively straightened and deepened historically. In addition to hydromorphological impacts, siltation, eutrophication and low summer flows had significantly impacted fisheries habitat. Historical straightening and deepening of watercourses damages habitat and hydromorphological heterogeneity, encourages sediment deposition and invariably results in an irreparable reduction in fisheries potential, particularly for salmonids and lamprey (O’Grady et al., 2017; Blann et al., 2009; O’Grady, 2006) but also European eel. Four of the riverine sites did not support resident fish at the time of survey, with a further 6 no. sites unsuitable for electro-fishing (fisheries appraisals undertaken).

Nevertheless, several fish species of high conservation value were recorded. A typical diversity of fish species for the surveyed sub-catchments were recorded via electro-fishing during the current survey, with brown trout, lamprey (*Lampetra* sp.), gudgeon, minnow, stone loach, pike and three-spined stickleback captured in August 2025 (**Table 3.1, 3.2**). Atlantic salmon and European eel were detected through eDNA sampling only (**Appendix B**). With the exception of Atlantic salmon (detected via eDNA sampling at site A8 on the Rapemills River), the same species assemblage was recorded during the previous survey in August 2022 (**Table 3.3**). Fish abundances and distributions were also broadly similar to 2022.

Salmonids were restricted in the survey area, primarily given poor habitat suitability. Brown trout were recorded throughout the Rapemills River at sites A1, A4, A7 and A8, with site A7 offering particularly valuable spawning and nursery habitat. Much of the river had been heavily modified and suffered from considerable siltation pressures, reducing the quality of salmonid habitat. Bed calcification (colmation) in this alkaline river further limited the availability of salmonid spawning habitat but it was still the most valuable salmonid watercourse in the survey area. Salmonid suitability elsewhere was low, although brown trout eDNA was detected in the West Galros Stream (site A6). Notably, Atlantic salmon was detected at site A8 on the Rapemills River (Lusmagh Bridge), indicating their presence at or (likely) upstream of the sampling point. Given significant downstream barriers in the Shannon catchment (e.g. Ardnacrusha hydro-electric dam)¹ the occurrence of salmon this far up the Shannon catchment is very limited and highly sporadic.

Lamprey (*Lampetra* sp.) also occupied a limited distribution in the survey area, with organic rich soft sediment accumulations at sites A1 and A4 on the Rapemills River supporting low densities of ammocoetes, respectively (3.5 & 2.3 per m²). These sites were also found to support low numbers of ammocoetes during the previous 2022 survey (Triturus, 2022). Environmental DNA sampling also detected *Lampetra* sp. at site A8 in the lower reaches and the species is likely distributed throughout the watercourse. Nevertheless, the quality of lamprey habitat was generally poor across the survey area. Owing to their relatively small morphologies, *Lampetra* species such as brook lamprey require clean, fine gravels in which to dig their redds (Dawson et al., 2015; Rooney et al., 2013; Lasne et al., 2010) although areas may also include fractions of sand, larger gravels, and cobble (Kelly & King, 2011; Nika & Virbickas, 2010). Spawning habitat in the vicinity of the proposed development was sparse and

¹ Due to downstream migration barriers (such as hydroelectric dams and weirs), Atlantic salmon distribution is highly restricted in the upper Shannon catchment and the river is only achieving 5% of its conservation limit above Parteen weir in recent years (e.g. TEGOS, 2025a)

of poor quality due to significant siltation, bed calcification and hydromorphological pressures (as outlined above for salmonids). Furthermore, lamprey ammocoetes require the deposition of fine, organic-rich sediment $\geq 5\text{cm}$ in depth in which to burrow and mature (Aronsoo & Virkkala, 2014; Goodwin et al., 2008; Gardiner, 2003) – many accumulations observed were either dominated by peat or argillaceous particles, both of which are sub-optimal for larval burial.

European eel are ‘critically endangered’ in Ireland (King et al., 2011) and on a global scale (Pike et al., 2020). Despite habitat suitability across much of the survey area, no European eel were recorded in the electro-fishing survey. As with salmonids, European eel habitat is also degraded by river drainage by virtue of a reduction or removal of instream refugia required by the species (Laffaille et al., 2003) and more optimal, heterogeneous areas of channel (e.g. boulder zones) were highly localised in vicinity of the proposed development. As eel occurrence decreases significantly with increasing distance from the sea (Harwood et al., 2022; Degerman et al., 2019), the paucity of eel observed can be further explained by the large distances between the survey area and marine habitats (Matondo et al., 2021; Chadwick et al., 2007) in addition to significant instream barriers in the Shannon catchment. Nevertheless, European eel were detected through eDNA sampling on the Rapemills River (sites A4, A8) and the West Galros Stream (A6) in August 2025 signifying there is at least a low number of eels within the survey area. This is supported by the capture of low numbers of eel (electro-fishing) from the Rapemills River at Lusmagh Bridge in August 2022 (Triturus, 2022).

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Triturus Environmental Ltd.,

Unit 5 Anchor Business Park,

Little Island,

Co. Cork,

T45 XN59.