

Ballyfeeny Green Energy Limited

Ballyfeeny Green Energy Project

Appendix 6.8: Aquatic Ecology Baseline Technical Appendix

July 2025

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TABLE OF Contents

1. Introduction	1
1.1. Background	1
1.2. Statement of Authority	1
1.3. Project description	2
2. Methodology	4
2.1. Selection of watercourses for assessment	4
2.2. Aquatic site surveys	4
2.3. Fisheries assessment (electro-fishing)	6
2.4. White-clawed Crayfish survey	6
2.5. eDNA analysis	6
2.6. Biological water quality (Q-sampling)	7
2.7. Lacustrine macro-invertebrate communities	7
2.8. Macrophytes and aquatic bryophytes	7
2.9. Otter signs	8
2.10. Aquatic ecological evaluation	8
2.11. Biosecurity	8
3. Methodology	9
3.1. Desktop review	9
3.1.1. Survey area description	9
3.1.2. Fisheries asset of the survey area	9
3.1.3. Protected aquatic species	9
4. Results of aquatic surveys	10
4.1. Aquatic survey sites	10
4.1.1. Site A1 – Culliagh Stream, Culleenaghmore	10
4.1.2. Site A2 – Culliagh Stream, Northyard	11
4.1.3. Site A3 – Culliagh Stream, Cloonmore	12
4.1.4. Site A4 – Feorish River, Cloonshannagh	13
4.1.5. Site P1 – pond, Ballyfeeny	14
4.1.6. Site B1 – Ballymartin Stream, Ballyfeeny	16
4.1.7. Site B2 – Ballymartin Stream, Tully	17
4.1.8. Site B3 – Glen Stream, Tully	18
4.1.9. Site L1 – Kilglass Lough	18
4.1.10. Site C1 – Gortlustia Stream, R371 road crossing	20
4.1.11. Site C2 – Bellmount Stream, R371 road crossing	21
4.1.12. Site C3 – unnamed stream, R371 road crossing	22
4.1.13. Site C4 – unnamed river, R371 road crossing	22
4.1.14. Site C5 – unnamed stream, R371 road crossing	23
4.1.15. Site C6 – Curraghroe Stream, R371 road crossing	24
4.2. White-Clawed Crayfish	26

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4.3. eDNA analysis	26
4.4. Invasive aquatic species	26
4.5. Biological water quality (macro-invertebrates)	26
4.6. Lake macro-invertebrate communities	29
4.7. Macrophytes and aquatic bryophytes	29
4.8. Otter signs	29
4.9. Aquatic ecological evaluation	31
5. Discussion	35
5.1. Introduction	35
5.1.1. Watercourses	35
5.1.2. Fisheries	35
5.1.3. Otter	36
5.1.4. Other protected aquatic species	36
5.1.5. Invasive aquatic species	37
5.1.6. Macro-invertebrates & biological water quality	37
5.2. Summary of ecological features	38
6. References	39
Appendix 6.8A – fisheries assessment report	42
Appendix 6.8B – Macro-invertebrates (biological water quality) & lake macro-invertebrate communities	43
Appendix 6.8C – eDNA analysis lab report	49

Appendices

Appendix 6.8A – fisheries assessment report

Appendix 6.8B – Macro-invertebrates (biological water quality) & lake macro-invertebrate communities

Appendix 6.8C – eDNA analysis lab report

1. INTRODUCTION

1.1. Background

Triturus Environmental Ltd. were commissioned by Inis Environmental Consultants Ltd. to conduct baseline aquatic surveys to inform the EIAR for the proposed Ballyfeeny Green Energy Project (herein referred to as the 'Project'), located approximately 6km northeast of Strokestown, Co. Roscommon (**Figure 1.1**). Undertaken on a catchment-wide scale, this report provides a baseline assessment of the aquatic ecology including fisheries and biological water quality, as well as protected species and habitats in the vicinity of the Project, inclusive of the proposed Grid Connection Route (GCR). Aquatic surveys were undertaken in August 2023.

1.2. Statement of Authority

Mr Ross Macklin B.Sc. (Hons) MCIEEM., MIFM, HDip GIS, PDip IPM is an ecologist with over 16 years' professional experience in Ireland. He specialises in freshwater fisheries ecology, biology and water quality. He has considerable experience in a wide range of ecological and environmental projects including EIAR, EcIA, AA/NIS, CEMP reporting, as well as biodiversity, water quality monitoring, invasive species and fisheries management. He also has expert identification skills in macrophytes, freshwater invertebrates, protected aquatic habitats and protected aquatic species including freshwater pearl mussel. His diverse project list includes work on renewable energy developments, flood relief schemes, road schemes, blueways/greenways, biodiversity projects, fisheries management projects and catchment wide water quality management. He is currently completing his Ph.D. on the ecology and impact of Common Carp (*Cyprinus carpio*) in Irish waters.

Mr Bill Brazier B.Sc. (Hons) MIFM is an aquatic ecologist with over 10 years' professional experience in Ireland. He specialises in freshwater fisheries ecology, biology and water quality. He has considerable experience in a wide range of ecological and environmental projects including EIAR, EcIA and AA/NIS reporting, as well as biodiversity, invasive species and fisheries management. His diverse project list includes work on renewal energy developments, flood relief schemes, road schemes, blueways/greenways and biodiversity projects. He is currently completing his Ph.D. on the genetics, reproductive biology and invasive potential impact of Common Carp (*Cyprinus carpio*) in Irish waters. Additionally, Bill runs the highly respected Off the Scale magazine, Ireland's most-read recreational angling publication and is the national coordinator for the novel Anglers National Line Recycling Scheme (ANLRS).

Dr Alex Copland BSc PhD MEnvSc MCIEEM is Technical Director with INIS. Alex has over 25 years of professional experience working in both statutory and private companies, in third-level research institutions and with environmental NGOs. He is a full member of the Institute of Environmental Sciences (IES) and the Chartered Institute of Ecology and Environmental Management (CIEEM). He is proficient in experimental design and data analysis and has managed several large-scale, multi-disciplinary ecological projects. These have included research and targeted management work for species of conservation concern, the design and delivery of practical conservation actions with a range of stakeholders and end-users, education and interpretation on the interface between people and the environment and the development of coordinated, strategic plans for birds and biodiversity. He has written numerous scientific papers, developed and contributed to evidence-based position papers, visions and strategies on birds and habitats in Ireland. He has supervised the successful completion of

research theses for several post-graduate students, including doctoral candidates and is a collaborative researcher with both UCD and UCC. He also sits on the Editorial Panel of the scientific journal, *Irish Birds*, which publishes original ornithological research relevant to Ireland's avifauna, and CIEEM'S *Irish Policy Group*.

Mr. Conor Daly MSc BSc ACIEEM is an Ecologist and report team lead with Inis Environmental Consultants Ltd. who amended this report. Conor was awarded a MSc in Biodiversity and Conservation and an Honours BSc in Zoology. As part of his BSc and MSc, Conor has compiled reports for environmental impact assessments and conservation management. As an ecologist, Conor has written Preliminary Environmental Assessments (PEA) and Appropriate Assessment (AA) Screening reports during his career prior to Inis for large and complex windfarms in Co. Offaly and water sourcing projects across Ireland. As an ecologist with Inis, Conor has been involved in conducting a range of reports, including AA Screenings, Natura Impact Statements (NIS), and Environmental Impact Assessment (EIA) Screenings for windfarms of small scale (4-8 turbines) and large scale (22 turbines) which involved complex mitigation measures including curtailment for bat species and breach management for HDD works crossing under SAC river watercourses. As EIAR and report team lead, Conor oversees the report template standard and has ensured the Inis teams report writing is in line with CIEEM best practice in accordance with the registered practice code of conduct.

1.3. Project description

A detailed description of the proposed Project is outlined in **Chapter 2 – Project Description** of this EIAR. A detailed description of the watercourses located in proximity of the proposed Project is outlined in **Chapter 8 – Hydrology and Hydrogeology**.

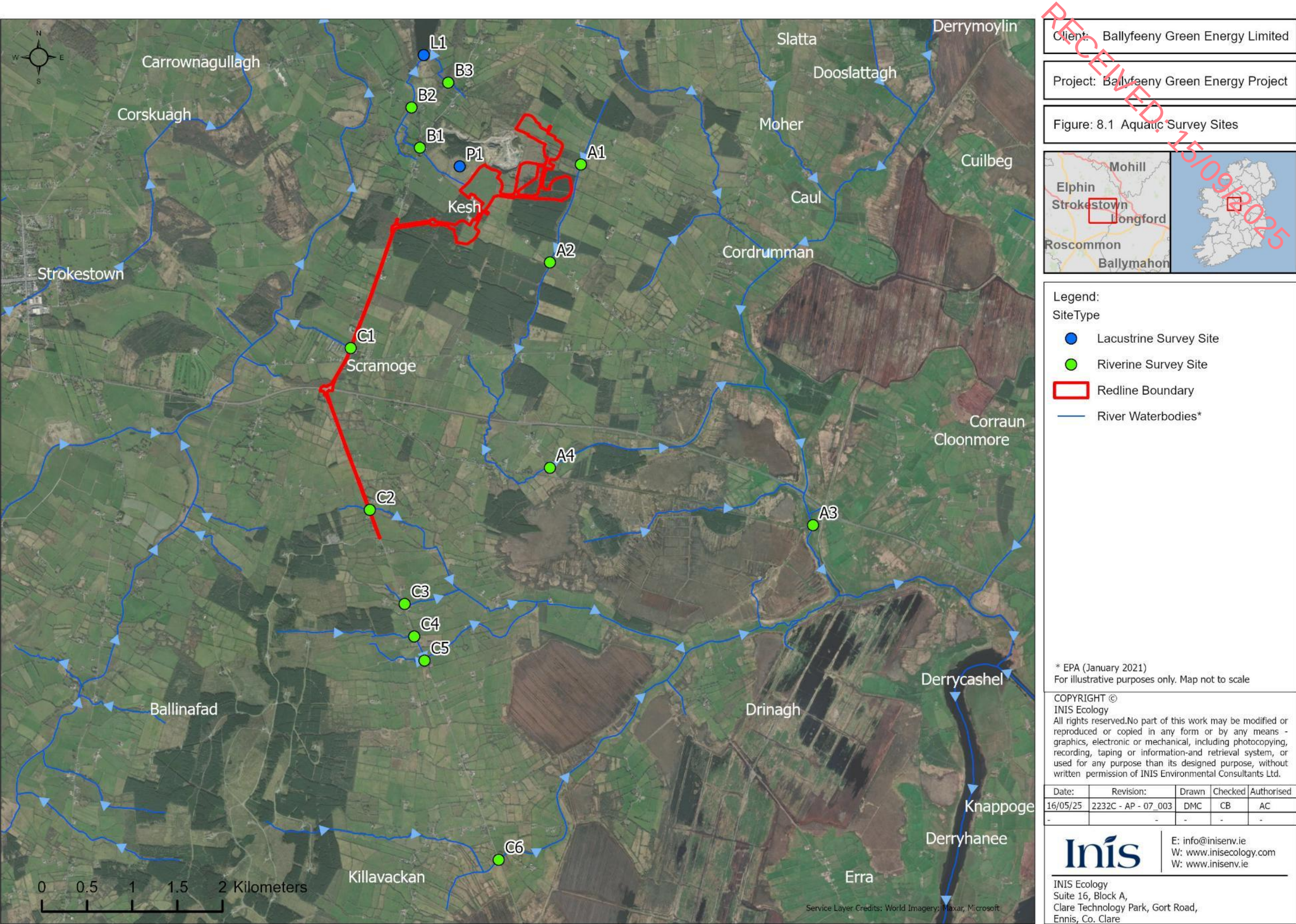


Figure 1.1: Overview of the aquatic survey sites in the vicinity of the Project, Co. Roscommon.

2. METHODOLOGY

2.1. Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed Project were considered as part of the current assessment. This included watercourses in the vicinity of the proposed Site boundary and proposed turbine array in addition to watercourse crossings on the proposed GCR. Thus, a total of 13 riverine sites and 2 lacustrine sites were selected for detailed aquatic assessment (**Table 2.1**). The courses and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

Aquatic survey sites were present on the Culliagh Stream (EPA code: 26C14), Feorish River (26F03), Ballymartin Stream (26B82), Glen Stream (26G38), Gortlustia Stream (26G29), Bellmount Stream (26B99), Curraghroe Stream (26C15), Gortgallan River (26G47), River Shannon (26S02) and several unnamed watercourses (**Table 2.1**). A small quarry pond site adjacent to the proposed Project and the downstream-connecting Kilglass Lough were also surveyed. The aquatic survey sites were located within the Shannon [Upper]_SC_070 and Scramaoge_SC_010 river sub-catchments in Water Framework Directive (WFD) catchment 26C (Upper Shannon). The proposed Project and associated infrastructure are not located within a European site. The proposed GCR crosses the upper reaches of the Feorish (Tarmonbarry)_020. Further downstream of these crossings includes the confluences with the River Shannon (Upper)_100. The River Shannon (upper) flows into the Lough Ree SAC (000440) and Lough Ree SPA (004064). The GCR crossing is 18.6km of both these sites, with the windfarm element adjacent to the Culliagh stream which is 22.1km upstream of this SPA and SAC. .

2.2. Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the Project were conducted on the 13th, 14th, and 15th August 2023. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Table 2.1**). Surveys at each of these sites included a fisheries assessment (electro-fishing and / or fisheries habitat appraisal), White-clawed Crayfish (*Austropotamobius pallipes*) survey, macrophyte and aquatic bryophyte survey and biological water quality sampling (Q-sampling) or macro-invertebrate sweep sampling (at lacustrine survey areas and or deep-water riverine sites). This holistic approach informed the overall aquatic ecological evaluation of each site in context of the Project and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

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

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

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

Table 2.1: Location of 15 aquatic survey sites in the vicinity of the Project, Co. Roscommon¹.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)	Distance to Project (m)	Hydrological Distance to Project (m)
A1	Culliagh Stream	26C14	Culleenaghmore	599315	782096	192	Upstream of surface run-off contact point
A2	Culliagh Stream	26C14	Northyard	598969	781012	698	Downstream of surface run-off contact point
A3	Culliagh Stream	26C14	Cloonshannagh	601882	778105	4,535	Downstream of surface run-off contact point
A4**	Feorish River	26F03	Cloonmore	598969	778742	2,032	Downstream of surface run-off contact point
P1∞	Pond	n/a	Ballyfeeny	597971	782075	185	NA
B1	Ballymartin Stream	26B82	Ballyfeeny	597532	782282	645	701
B2	Ballymartin Stream	26B82	Tully (bridge u/s Kilglass Lough)	597437	782729	1,009	1375
B3	Glen Stream	26G38	Tully	597847	783004	905	NA
L1∞	Kilglass Lough	n/a	Kilglass South	597572	783310	1,301	2062
C1	Gortlustia Stream	26G29	R371 road crossing	596764	780064	4	NA
C2	Bellmount Stream	26B99	R371 road crossing	596977	778274	1	1
C3	Unnamed stream	n/a	R371 road crossing	597364	777235	759	NA
C4	Unnamed river	n/a	R371 road crossing	597469	776874	1,135	NA
C5	Unnamed stream	n/a	R371 road crossing	597581	776607	1,424	NA
C6	Curraghroe Stream	26C15	R371 road crossing	598402	774402	3,777	NA

*eDNA sampling for freshwater pearl mussel, White-Clawed Crayfish & crayfish plague

+ Labelled A3 in Chapter 8 of EIAR

∞eDNA sample for Smooth Newt & Eel

¹ Sites C1-C2 (inclusive) were located along the proposed GCR. C3-C6 are points upstream of confluences with watercourses crossed by the GCR.

2.3. Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the Project in August 2023 following notification to Inland Fisheries Ireland, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The survey was undertaken in accordance with best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of the aquatic survey sites, inclusive of two lacustrine sites (**Figure 1.1**), was undertaken to establish their importance for salmonids, Lamprey, Eel (*Anguilla anguilla*) and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites. For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix 6.8A**.

2.4. White-clawed Crayfish survey

White-clawed Crayfish surveys were undertaken at the aquatic survey sites in August 2023 under a National Parks and Wildlife (NPWS) open national licence (no. C24/2023), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2023), to capture and release crayfish to their site of capture. As per Inland Fisheries Ireland aquatic biosecurity recommendations, the crayfish sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area (moving downstream) to minimise the risk of upstream transfer of invasive species or pathogens.

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 validate site surveys and to detect potentially cryptically low populations within the study area, a composite water sample was collected from the Feorish River (A4) in August 2023 and analysed for Freshwater Pearl Mussel (*Margaritifera margaritifera*), White-clawed Crayfish and Crayfish Plague (*Aphanomyces astaci*) environmental DNA (eDNA) to identify any need of for more targeted surveys. A water sample from pond site P1 was analysed for White-clawed Crayfish, Eel and Smooth Newt (*Lissotriton vulgaris*) eDNA. The riverine sites were 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 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 6.8C** for full eDNA laboratory analysis methodology.

2.6. Biological water quality (Q-sampling)

The 13 riverine survey sites were assessed for biological water quality through Q-sampling in August 2023 (**Figure 1.1**). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a two-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley *et al.*, 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley *et al.*, 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification to species level. Samples were converted to Q-ratings as per Toner *et al.* (2005) and assigned to WFD status classes (**Table 2.2**). Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster *et al.*, 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley *et al.*, 2020) and other relevant taxa (i.e. Byrne *et al.*, 2009; Nelson *et al.*, 2011).

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

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

2.7. Lacustrine macro-invertebrate communities

The two lacustrine sites P1 and L1 were sampled for macro-invertebrates via sweep netting in August 2023. 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/pond 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 onsite identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte or bryophyte species listed under the Flora (Protection) Order, 2022 and or Irish Red lists (Wyse-Jackson *et al.*, 2016; Lockhart *et al.*, 2012) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the Ranunculion fluitantis and *Callitriche*-

Batrachion (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

2.9. Otter signs

The presence of Otter (*Lutra lutra*) was determined through the recording of Otter signs within a 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. Aquatic ecological evaluation

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

2.11. Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and personal protective equipment (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 care was given towards preventing the spread or introduction of highly virulent crayfish plague. Furthermore, staff did not undertake any work in a known crayfish plague catchment for a period of <72hrs in advance of the survey. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in '*Good fieldwork practice: slowing the spread of invasive non-native species*' by the University of Leeds.

3. METHODOLOGY

3.1. Desktop review

3.1.1. Survey area description

The proposed Project is located in an elevated area approximately 6km northeast of Strokestown, Co Roscommon (**Figure 1.1**). Most of the watercourses surveyed were historically modified (drained) lowland depositing rivers (FW2; Fossitt; 2000) and drainage channels (FW4) that were situated in a landscape dominated by heavily improved pasture.

3.1.2. Fisheries asset of the survey area

The Culligh Stream, a tributary of the Feorish River, is known to support Brown Trout (*Salmo trutta*), lamprey (*Lampreria* sp.) and Three-spined Stickleback (*Gasterosteus aculeatus*) (Matson *et al.*, 2018).

The Feorish also supports Brown Trout and Three-spined Stickleback (Matson *et al.*, 2018) in addition a range of coarse fish species including Pike (*Esox lucius*), Perch (*Perca fluviatilis*) and Roach (*Rutilus rutilus*) (pers. obs.). The Curraghroe Stream, crossed by the proposed GCR is known to support Three-spined Stickleback (Matson *et al.*, 2018).

The proposed Project is in the Upper Shannon catchment. The River Shannon supports a range of fish species including Pike, Perch, Roach, Rudd (*Scardinius erythrophthalmus*), Bream (*Abramis brama*), Gudgeon (*Gobio gobio*), lamprey, Eel and Tench (*Tinca tinca*) (Matson *et al.*, 2018; pers. obs.).

Kilglass Lough is a renowned recreationally coarse fishery which supports Pike, Perch, Rudd, Bream, Roach, Bream hybrids, Tench and Eel (*Triturus* pers. obs.). Fisheries data for the other survey watercourses was not available prior to this survey.

3.1.3. Protected aquatic species

A comprehensive desktop review of available data from the National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC), Inland Fisheries Ireland (IFI), Botanical Society of Britain and Ireland (BSBI), National Crayfish Plague Surveillance Programme (NCPSP), Environmental Protection Agency (EPA) and *Triturus* databases for the 10km grid squares containing and adjoining the Project (i.e. M96, M97, M98, N06 & N07) identified a low number of records for rare and or protected aquatic species within the vicinity of the proposed.

White-clawed Crayfish records collated between 2009-2011 were recorded at Drimmon Lough (M98), the Hind River (M96) and the Camlin River (N07) (NPWS & EPA data). A healthy extant crayfish population is also known from Lough Incha (pers. obs.). There was no downstream hydrological connectivity with these sites and the Project.

A low number of Otter records were available in the vicinity of the Project although most were historical only (i.e. 1980). More contemporary records (2005-2014) were available for the Curraghroe Stream and Gortgallan River, in addition to the River Shannon at Lanesborough Bridge (NPWS, EPA & NBDC data). A low number of records from 2020 for the rare and protected (Flora (Protection) Order, 2022) macrophyte Short-leaved Water Starwort (*Callitriche truncata*) were available for Lough Ree (NPWS data; not shown).

4. RESULTS OF AQUATIC SURVEYS

The following section summarises each of the 15 survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, White-clawed Crayfish and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) results are also summarised for each riverine sampling site and in **Appendix 6.8B**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in August 2023. Please refer to **Appendix 6.8A** (fisheries assessment report) for more detailed fisheries results.

4.1. Aquatic survey sites

4.1.1. Site A1 – Culliagh Stream, Culleenaghmore

Site A1 was located on the upper reaches of the Culliagh Stream (EPA code: 26C14). The lowland depositing stream (FW2) had been straightened and deepened throughout, resulting in a shallow trapezoidal channel with very poor hydromorphology. The stream was 2m wide and 0.2-0.3m deep in a profile dominated by slow-flowing glide and pool with slow flowing water. Riffle areas were present but highly localised. The substrata were dominated by mixed gravels and sand, but these were heavily silted and compacted. Siltation was moderate overall with evident livestock poaching. Due to high riparian shading, macrophytes were limited to localised Fool's Watercress (*Apium nodiflorum*) in rare open areas of channel. Aquatic bryophytes were not recorded although *Pellia* sp. liverwort and *Fissidens* sp. moss were present on muddy banks. The stream was heavily shaded by mature treelines of Hawthorn (*Crataegus monogyna*), Ivy (*Hedera helix*), Bramble (*Rubus fruticosus* agg.) and ferns. The site was bordered by wet grassland (GS4), utilised for grazing, and coniferous afforestation (WD4) upstream.

Three-spined Stickleback and Ten-spined Stickleback (*Pungitius pungitius*) were the only fish species recorded via electro-fishing at site A1 (**Appendix 6.8A**). Apart from low densities of stickleback, the site was not of fisheries value given poor flows, poor hydromorphology and poor connectivity with downstream habitats. There was no suitability for White-clawed Crayfish and none were recorded. No Otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix 6.8B**). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner *et al.*, 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site A1 was of Local Importance (Lower Value).



Plate 4.1: Representative image of site A1 on the Culliagh Stream, August 2023.

4.1.2. Site A2 – Culliagh Stream, Northyard

Site A2 was located on the Culliagh Stream (26C14) at a local road crossing approximately 1.1km downstream of site A1. The small stream (FW2) had been straightened and deepened locally although some recovery was evident with semi-natural characteristics present (e.g. meanders). The swift-flowing stream was 2.5-3m wide and 0.1-0.2m deep, with occasional deeper areas to 0.5m. The substrata were dominated by cobble and mixed gravels with abundant sand accumulations. Boulder was rare overall. Siltation was high and associated with widespread livestock poaching. Due to very high riparian shading (tunnelling), macrophytes were limited to rare Fool's Watercress and Brooklime (*Veronica beccabunga*) in open areas of channel. Similarly, aquatic bryophyte coverage was also low with very occasional *Leptodictyum riparium*, a species associated with enrichment pressures. The muddy, scoured banks supported *Fissidens* sp. moss and *Pellia epiphylla*. The stream was tunnelled by very dense hedgerows of Hawthorn, Blackthorn (*Prunus spinosa*), Grey Willow (*Salix cinerea*) and Bramble. The survey area was bordered by wet, semi-improved pasture (GA1) and coniferous afforestation (WD4).

Three-spined Stickleback was the only fish species recorded via electro-fishing at site A2 (**Appendix 6.8A**). Despite some moderate physical suitability for salmonids in terms of spawning and nursery habitat, none were recorded, suggesting significant enrichment, hydromorphological and siltation pressures were impacting these species. Likewise, despite some suitability for Eel, none were recorded. There was poor suitability for White-clawed Crayfish, and none were recorded. No Otter signs were recorded within the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix 6.8B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site A2 was of Local Importance (Lower Value).



Plate 4.2: Representative image of site A2 on the Culliagh Stream, August 2023.

4.1.3. Site A3 – Culliagh Stream, Cloonmore

Site A3 was located on the Culliagh Stream (26C14) at a local road crossing (box culvert), approximately 3km downstream of site A2. As per upstream, the lowland depositing stream (FW2) had been straightened and deepened, resulting in a trapezoidal channel with poor hydromorphology. The narrow homogenous channel was 2.5m wide and 0.2-0.4m deep with a profile dominated by slow-flowing glide. The substrata were dominated by fine and medium gravels and abundant sands with only very localised cobble and rare small boulder. These were moderately silted (depositing glide). Given the narrow width of the channel and subsequent riparian shading, macrophytes were limited to Fool's Watercress and intermediate Water Starwort (*Callitriche hamulata*) that were very localised. Aquatic bryophytes were limited to very occasional *Leptodictyum riparium*. Filamentous algae was present (2%), indicating enrichment. The stream was heavily shaded by abundant nitrophilous vegetation including Hedge Bindweed (*Calystegia sepium*), Great Willowherb (*Epilobium hirsutum*), Meadowsweet (*Filipendula ulmaria*) and Nettle (*Urtica dioica*) with scattered Grey Willow, Osier (*Salix viminalis*), Dog Rose (*Rosa canina*), Bramble and Hawthorn. The site was bordered by wet grassland (GS4) with coniferous afforestation (WD4) upstream.

Lamprey and Three-spined Stickleback were the only fish species recorded via electro-fishing at site A3 (**Appendix 6.8A**). Despite good suitability for salmonids, none were recorded (as per upstream). However, the site was of good value for lamprey with locally high-quality nursery habitat present downstream of the bridge (in sand-dominated soft sediment). This supported a high density of ammocoetes. Good quality lamprey spawning habitat was also present, but this was reduced in quality from siltation pressures. Despite some suitability for White-clawed Crayfish and Eel, none were recorded. No Otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as Q3 (poor status) (**Appendix 6.8B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Lamprey, the aquatic ecological evaluation of site A3 was of **Local Importance (Higher Value)**.



Plate 4.3: Representative image of site A3 on the Culliagh Stream, August 2023.

4.1.4. Site A4 – Feorish River, Cloonshannagh

Site A4 was located on the lower reaches of the Feorish River (26F03), approximately 1.6km downstream of the Culliagh Stream confluence. The lowland depositing river (FW2) had been extensively straightened and deepened historically, resulting in a homogenous canalised channel that was 7m wide and >2m deep. The profile was comprised entirely of deep, slow-flowing glide with a bed of silt and mixed coarse substrata. The steeply sloping margins of the heavily peat-stained river supported narrow, intermittent stands of Yellow Lily (*Nuphar lutea*) and Arrowhead (*Sagittaria sagittifolia*) with patches of Common Duckweed (*Lemna minor*). The margins and littoral inundation areas supported abundant Reed Canary Grass (*Phalaris arundinacea*). The littorals also supported Nettle, Meadowsweet and Purple Loosestrife (*Lythrum salicaria*). Scattered mature Grey Willow overhung the channel, providing valuable flow refugia for fish. The site was bordered by wet grassland (GS4) and reed swamp (FS1).

Electro-fishing was not undertaken at site A4 due to prohibitive depths of >2m. The site was however considered of high value for a range of coarse fish species including Pike, Perch and non-native Roach. There was also high suitability for Eel given adequate depth and refugia. The deep, slow-moving channel was unsuitable for lamprey but had some low suitability for adult Brown Trout despite poor spawning and nursery characteristics. There was poor suitability for White-clawed Crayfish and the species not detected via environmental DNA sampling. Despite some good foraging suitability for Otter, no signs were recorded in vicinity of the site (poor marking opportunities).

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (Appendix 6.8B). However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner *et al.*, 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the suitability for Red-listed Eel, adult Brown Trout, in addition to a range of coarse fish species and commuting/foraging Otter, the aquatic ecological evaluation of site A4 was of **Local Importance (Higher Value)**.



Plate 4.4: Representative image of site A4 on the Feorish River, August 2023.

4.1.5. Site P1 – pond, Ballyfeeny

Site P1 was located at a disused quarry pond 185m West of the wind farm Site boundary, adjacent to an active quarry. The mature pond (flooded c.15 years previous, pers. obs.) covered approx. 0.12ha surface area with a loosely circular basin of deep water (2-4m) adjoined by an annex of shallow littorals prone to flooding in the northern corner. This pond is located west downslope of the site boundary. The pond featured characteristic steep banks typical of a quarry site and shelved steeply in the margins to a depth of >4m. The bed comprised compacted sandstone gravels and cobble with abundant soft sediment and clay. The clear-water pond was heavily vegetated with a high diversity of macrophytes. However, the steep margins were dominated by Broad-leaved Pondweed (*Potamogeton natans*) and Common Clubrush (*Schoenoplectus lacustris*) with frequent submerged Blue Water Speedwell (*Veronica anagallis-aquatica*), Water Plantain (*Alisma plantago-aquatica*) and Common Water Crowfoot (*Ranunculus aquatilis*). Water Starwort species (including *Callitriche hamulata*), Water Purslane (*Lythrum portula*), Spike Rush (*Eleocharis palustris*), Bottle Sedge (*Carex rostrata*) and Bulrush (*Typha latifolia*) were present in the littorals along with abundant Lesser Spearwort (*Ranunculus flammula*). Lesser Pondweed (*Potamogeton pusillus*) was also present. The inundated margins also supported frequent terrestrial grasses, rushes and grey willow saplings. The steep pond banks supported abundant Gorse (*Ulex europaeus*) and Grey Willow. The site was bordered by recolonising bare ground (ED2/ED3).

Although site P1 was not of fisheries value (no fish recorded present) given its artificial nature and an absence of connectivity to other aquatic habitats, the pond was of very high value for amphibians supporting a breeding population of Smooth Newt. Both adults and a low density of efts were recorded via sweep sampling. White-clawed Crayfish and Eel were not detected via eDNA sampling. 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 6.8B**).

Given the presence of a healthy Smooth Newt population and the pond being 50m west of Red Line Boundary, the aquatic ecological evaluation of site P1 was of **Local Importance (Higher Value)**.



Plate 4. 5: Representative image of pond site P1 on, August 2023.



Plate 4.6: Adult male Smooth Newt and Emperor Dragonfly (*Anax imperator*) larvae recorded at pond site P1 on, August 2023.

4.1.6. Site B1 – Ballymartin Stream, Ballyfeeny

Site B1 was located on the upper reaches of the Ballymartin Stream (26B82) at the R371 road and proposed GCR crossing. The small upland eroding spate channel (FW1) flowed over a steep gradient in a deeply incised channel that was 1.5m wide and 0.1m deep. The profile comprised boulder and bedrock cascades with frequent plunge pools (to 0.3m depth) and connecting riffle areas.

The substrata were dominated by bedrock with abundant angular cobble and mixed gravels. Siltation was moderate overall (higher than expected for river type), with livestock poaching widespread. Bank slumping of the spate channel also contributed to siltation. Given very high shading (tunnelling) and high flow rates, macrophytes were absent with only very localised *Rhynchostegium riparioides* on larger boulder. The unstable banks supported abundant terrestrial mosses including (*Thamnobryum* sp.). The stream was tunnelled by mature treelines of Sycamore (*Acer pseudoplatanus*), Hawthorn and Ash (*Fraxinus excelsior*) with Bramble. The site was bordered by sloping improved pasture (GA1).

No fish were recorded via electro-fishing at site B1 (**Appendix 6.8A**). The site was not of fisheries value given its location in the headwaters of the stream and high natural gradients. There was no suitability for White-clawed Crayfish, and none were recorded. No Otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix 6.8B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site B1 was of Local Importance (Lower Value).



Plate 4.7: Representative image of site B1 on the Ballymartin Stream, August 2023.

4.1.7. Site B2 – Ballymartin Stream, Tully

Site B2 was located on the Ballymartin Stream (25B82) at a local road crossing, approximately 0.7km downstream of site B1. The small lowland depositing stream (FW1) had been straightened and deepened historically resulting in a narrow, steep-sided channel with poor hydromorphology. The stream was 1m wide and 0.05m deep with a profile dominated by shallow glide and riffle. Pool was present locally, formed through bank slumping and instream sediment accumulations caused by livestock poaching. The substrata were dominated by fine to medium gravels and sands with occasional small cobble. Siltation was high with frequent soft sediment accumulations instream. Some calcification (cyanobacterial deposits) was evident on larger instream substrata.

Macrophytes were limited to very occasional Fool's Watercress and Water Starwort (*Callitriche sp.*) with rare *Rhynchosstegium riparioides*. The channel was lined by intermittent hedgerows of Hawthorn, Bramble and Great Willowherb, with scattered Grey Willow and Ash. The site was bordered by improved pasture (GA1) and wet grassland (GS4).

Three-spined Stickleback were the only fish species recorded via electro-fishing at site B2 (**Appendix 6.8A**). Apart from low densities of stickleback, the site was not of fisheries value given poor flows, poor hydromorphology and poor connectivity with downstream habitats. There was no suitability for White-clawed Crayfish, and none were recorded. No Otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix 6.8B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site B2 was of Local Importance (Lower Value).



Plate 4.8: Representative image of site B2 on the Ballymartin Stream, August 2023.

4.1.8. Site B3 – Glen Stream, Tully

Site B3 was located on the Glen Stream (26G38), a tributary of Kilglass Lough, at a local road crossing. The small upland stream (FW1) flowed over a high gradient and under the local road via a Perched pipe culvert. The stream was 2m wide and 0.1-0.2m deep with occasional deeper plunge pool associated with natural cascades to 0.3m. The profile was of boulder cascade with frequent pool. Angular boulder and cobble dominated the substrata with localised patches of mixed gravels and sands. Siltation was low overall. Given high riparian shading and the high energy conditions, macrophytes were not present. However, the aquatic bryophytes *Hygroamblystegium sp.* and *Rhynchostegium riparioides* were present on more stable substrata. The stream was heavily tunnelled by scrub vegetation including Bramble, Hawthorn, Elder (*Sambucus nigra*), Ash, Grey Willow and Ivy. The site was bordered by scrub (WS1) and semi-improved pasture (GA1) and wet grassland (GS4). Coniferous afforestation (WD4) was present upstream.

No fish were recorded via electro-fishing at site B3 (**Appendix 6.8A**). The site was not of fisheries value given its location in the headwaters of the stream and high natural gradients. There was no suitability for White-clawed Crayfish, and none were recorded. No Otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix 6.8B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site B3 was of Local Importance (Lower Value).



Plate 4.9: Representative image of site B3 on the Glen Stream, August 2023.

4.1.9. Site L1 – Kilglass Lough

Site L1 was located at the southern extent of Kilglass Lake where a large elliptical bay of c.25ha was present. This area of the lake was 3-8m in deep. The lake was fringed by extensive reed swamp habitat (FS1) dominated by Common Reed (*Phragmites australis*) and Common Clubrush. Marginal beds of

Yellow Lily and Arrowhead with occasional Frogbit (*Hydrocharis morus-ranae*) were present with beds of invasive Canadian Pondweed (*Elodea canadensis*) and Ivy-leaved Duckweed (*Lemna trisulca*) extending down the steep, silted marginal slopes. Much of the lakeshore was fringed by wet grassland and marsh communities exposed to grazing pressures, supporting abundant Iris, Greater Tussock sedge (*Carex paniculata*), Common Valerian (*Valeriana officinalis*), Meadowsweet, Marsh Woundwort (*Stachys palustris*), Marsh Cinquefoil (*Comarum palustre*) and Common Reed with abundant Grey Willow.

Kilglass Lough is known to support a range of coarse fish species, including Pike, Perch, Rudd, Bream, Roach, Bream hybrids and Tench, in addition to Red-listed Eel (*Triturus pers. obs.*). Despite some physical suitability for White-clawed Crayfish, none were recorded via hand-searching or sweep netting, and the species is not known from the lake. Although no Otter signs were recorded during the site visit, the species is known from the lake.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep sampling (**Appendix 6.8B**). The invasive Zebra Mussel (*Dreissena polymorpha*) was abundant on instream structure, with low numbers of the non-native shrimp species *Crangonyx sp.* also present.

Given the location of Kilglass Lough within the Kilglass and Grange Loughs pNHA (000608), the aquatic ecological evaluation of site L1 was of **National Importance**.



Plate 4.10: Representative image of site L1 at Kilglass Lough, August 2023 showing extensive fringing reed swamp habitat.



Plate 4.11: Facing towards Kilglass Lough from site B3, August 2023.

4.1.10. Site C1 – Gortlustia Stream, R371 road crossing

Site C1 was located on the Gortlustia Stream (26G29) at the R371 and proposed GCR crossing, adjacent to a residential area. The Scramoge River tributary was dry at the time of survey and was evidently a straightened channel that was situated under a hawthorn-bramble hedgerow. The channel was 0.75m wide with 1m banks. The dry channel was not of aquatic or fisheries value and a biological water quality sample was not possible.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site C1 was of Local Importance (Lower Value).



Plate 4.12: Representative image of site C1 on the Gortlustia Stream, August 2023 (dry channel).

4.1.11. Site C2 – Bellmount Stream, R371 road crossing

Site C2 was located on the Bellmount Stream (26B99) at the R371 road and proposed GCR crossing. The small upland eroding stream (FW1) flowed over a moderate gradient under the R371 (large box culvert) in a naturally incised and locally modified channel (bank revetment near culvert). The swift-flowing spate stream was 2 - 2.5m wide (narrower under bridge) and 0.1 - 0.2m deep with a flow profile typified by riffle and small natural cascade areas. The substrata comprised cobbles, angular boulder and mixed gravels with abundant sands. Siltation was low given high flow rates. Bank erosion was evidently contributing to the silt load of the stream. Given high flow rates and mobile substrata, macrophytes were not present. Aquatic bryophyte coverage was limited to localised *Rhynchostegium riparioides* on larger substrata. The stream was heavily shaded by mature treelines and scrub supporting Grey Willow, Holly (*Ilex aquilinum*), Ash and Gorse with abundant Bramble. Tunnelling was present upstream of the bridge. The site was bordered by improved pasture (GA1).

Despite some low suitability for salmonids, no fish were recorded via electro-fishing at site C2 (**Appendix 6.8A**). The upper reaches of the small upland stream were of poor suitability for resident fish given the shallow and potentially ephemeral nature of the site (shallow even following heavy rainfall). There was no suitability for White-clawed Crayfish, and none were recorded. No Otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status) (Appendix 6.8B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site C2 was of Local Importance (Lower Value).



Plate 4.13: Representative image of site C3 on an unnamed stream, August 2023.

4.1.12. Site C3 – unnamed stream, R371 road crossing

Site C3 was located on an unnamed stream at the R371 road upstream of a confluence to streams crossed by the GCR. The small stream (FW2) had been historically deepened and locally straightened in vicinity of the road crossing and supported a near imperceptible flow at the time of survey. The channel was 0.5-1m wide and 0.05m deep, with occasional small pools to 0.2m formed by instream debris and sediment accumulations. The profile was of very shallow glide and pool. The substrata comprised superficial fine gravels and sands on a soft sediment base. Given very high riparian shading (tunnelling) from ash, hawthorn and bramble, macrophytes were limited to Fool's Watercress downstream of the road culvert (open channel). Aquatic bryophytes were not recorded. The site was bordered by improved pasture (GA1) and residential properties (GA2, BL3).

No fish were recorded via electro-fishing at site C3 (**Appendix 6.8A**). The site was not of fisheries value given its location in the headwaters of the stream, historical modifications, siltation pressures, poor flows and poor connectivity with downstream habitats. There was no suitability for White-clawed Crayfish, and none were recorded. No Otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status) (Appendix 6.8B)**. However, it should be noted that this was a tentative rating given an absence of suitable riffle areas for sampling (Toner *et al.*, 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site C3 was of Local Importance (Lower Value).



Plate 4.14: Representative image of site C3 on an unnamed stream, August 2023.

4.1.13. Site C4 – unnamed river, R371 road crossing

Site C4 was located on an unnamed river at the R371 road upstream of a confluence to streams crossed by the GCR. The small upland eroding stream (FW1) flowed over a moderate gradient in a naturally incised channel and under the road via a rendered sloping culvert. The stream was 1-1.5m wide and 0.1m deep (even after recent rainfall) with a profile dominated by riffle and small cascades.

Typical of a high energy (spate) channel, the substrata were dominated by mobile cobble and boulder with frequent mixed gravels and sands. Siltation was low and no soft sediment accumulations were present. Given high energy conditions and very high riparian shading (tunnelling), macrophytes were absent. Some very localised *Rhynchosstegium riparioides* was present with *Pellia epiphylla* on localised muddy banks. The sloping banks were very heavily scrubbed with abundant Bramble, Blackthorn, Grey Willow and mature Ash. Invasive Japanese knotweed (*Reynoutria japonica*) was abundant in the vicinity of the bridge and along the roadside and was evidently contributing to bank instability. The site was bordered by improved pasture (GA1) and residential properties (GA2/BL3).

Despite some low suitability for salmonids, no fish were recorded via electro-fishing at site C4 (**Appendix 6.8A**). The small upland stream was of poor suitability for resident fish due to the shallow depths and poor connectivity with downstream habitats (shallow even following heavy rainfall). There was no suitability for White-clawed Crayfish, and none were recorded. No Otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix 6.8B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the semi-natural nature of the channel and the presence of **Q4 (good status)** water quality, the aquatic ecological evaluation of site C4 was of **Local Importance (Higher Value)**.



Plate 4.15: Representative image of site C4 on an unnamed river, August 2023.

4.1.14. Site C5 – unnamed stream, R371 road crossing

Site C5 was located on an unnamed Curraghroe Stream tributary at the R371 road upstream of a confluence to streams crossed by the GCR. The small semi-natural upland eroding stream (FW1) flowed under the road via a box culvert and was adjoined by drainage channels via two 900mm pipe culverts. The stream had been deepened and straightened upstream of the road crossing. The stream was 2m wide and 0.05m deep with very occasional plunge pools to 0.3m. The stream suffered from low flows at the time of survey (even following heavy rainfall) and several blockages to flow (instream woody debris) were present. The profile comprised shallow glide and riffle with occasional small pool.

The substrata were dominated by mixed gravels and cobble with abundant sands. Sand accumulations were widespread on the banks and along channel margins. Soft sediment deposits were abundant upstream because of recent instream excavations and livestock poaching. Moving downstream, boulder and larger cobble became more frequent. The hard substrata were typically compacted and silted. Given high riparian shading, macrophytes were limited to localised fool's watercress upstream of the culvert (open, cleared banks). The moss *Rhynchostegium riparioides* was occasional on larger instream substrata. The liverwort species *Pellia epiphylla* and *Conocephalum conicum* were abundant on muddy sections of scoured banks. The stream was heavily shaded by a mature treeline dominated by sycamore with Hawthorn, Blackthorn, Grey Willow and scattered Montbretia (*Crocsmia x crocosmiiflora*). The site was bordered by improved pasture (GA1).

Three-spined Stickleback were the only fish species recorded via electro-fishing at site C5 (**Appendix 6.8A**). Apart from moderate densities of stickleback, the site was of poor fisheries value. Despite some physical suitability for small salmonids the shallow, modified and silted nature of the stream at this location would likely preclude the species. There was no suitability for White-clawed Crayfish, and none were recorded. Otter prints were recorded under the bridge in marginal sand accumulations (ITM 597587, 776617).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix 6.8B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given utilisation by Otter, the aquatic ecological evaluation of site C4 was of **Local Importance (Higher Value)**.



Plate 4.16: Representative image of site C5 on an unnamed stream, August 2023.

4.1.15. Site C6 – Curraghroe Stream, R371 road crossing

Site C6 was located on the Curraghroe Stream (26C15) at the R371 road upstream of a confluence to streams crossed by the GCR. The upland eroding tributary of the Feorish River had been extensively straightened and deepened downstream of the road box culvert although retained some semi-natural characteristics upstream. The stream was 3-4m wide and 0.05m deep. The profile comprised

homogenous shallow glide and riffle. The substrata were dominated by abundant fine to medium mobile gravels and sands with more localised cobble. Boulder substrata were rare. Sand accumulations with low fractions of silt were also present locally. Siltation was moderate overall. Given high shading and mobile substrata, macrophytes were not present. Aquatic bryophyte coverage was low with only rare *Rhynchostegium riparioides*. The loamy banks supported abundant *Conocephalum conicum* and were lined by mature treelines supporting Alder (*Alnus glutinosa*), Sycamore, Grey Willow and scattered Cherry Laurel (*Prunus laurocerasus*) with Bramble scrub. Tunnelling was very high upstream. The site was bordered by improved pasture (GA1) with well-developed buffers.

Brown Trout, lamprey and Three-spined Stickleback were recorded via electro-fishing at site C6 (**Appendix 6.8A**). The site had good physical suitability as a salmonid and lamprey spawning habitat (abundant mixed gravels). However, the site was a poor-quality salmonid nursery owing to the very shallow glide and riffle and paucity of larger substrata refugia (none recorded). A single adult Brown Trout was recorded from deeper glide under the bridge. Sand accumulations supported a low density of lamprey ammocetes only (sub-optimal conditions). Suitability for Eel and White-clawed Crayfish was poor, and none were recorded. A regular Otter spraint site (two locations) was recorded on marginal cobbles under the road bridge (ITM 598407, 774403).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status) (Appendix 6.8B)**. No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and Lamprey, in addition to utilisation by Otter, the aquatic ecological evaluation of site C6 was of **Local Importance (Higher Value)**.

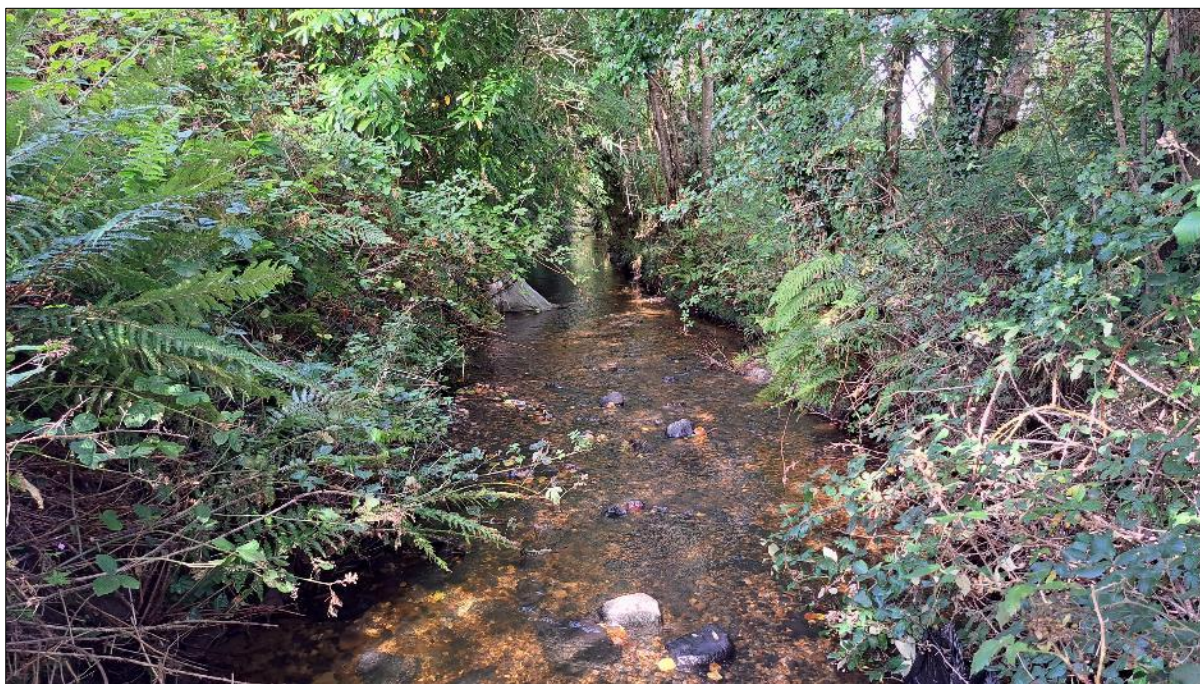


Plate 4.17: Representative image of site C6 on the Curraghroe Stream, August 2023.

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 15 survey sites. Furthermore, environmental DNA sampling of the Feorish River, River Shannon and pond site P1 did not detect the species (see **section 4.3**).

4.3. eDNA analysis

The invasive bivalve molluscs Asian Clam and Quagga Mussel were detected in composite water samples at site at the mouth of Lough Ree on the River Shannon (ITM: 600501, 769376) (5 & 5 positive qPCR replicates out of 5, respectively) (**Table 4.1; Appendix 6.8C**).

Table 4.1: eDNA results in the vicinity of the Project, Co. Roscommon (positive qPCR replicates out of 5 or 12 in parentheses).

Site	Watercourse	Freshwater Pearl Mussel	White-clawed Crayfish	Crayfish Plague	Eel	Asian Clam	Quagga mussel	Smooth Newt
A4	Feorish River	Negative (0/12)	Negative (0/12)	Negative (0/12)	n/a	n/a	n/a	n/a
P1	Pond	n/a	Negative (0/12)	n/a	Negative (0/12)	n/a	n/a	Positive (12/12)

Smooth Newt were recorded in moderate abundances via sweep netting at site P1 and the species was also detected via eDNA sampling at the site.

No White-clawed Crayfish eDNA was detected in composite water samples collected on the Feorish River (site C4) or pond site P1. No Eel eDNA was detected at pond site P1. No Freshwater Pearl Mussel eDNA was detected in the Feorish River (C4), supporting the absence of records for the Upper Shannon catchment (HA 26). No Crayfish Plague was detected in the samples from sites C4. These results were considered as evidence of the species' absence at and/or upstream of the sampling locations.

4.4. Invasive aquatic species

Several aquatic invasive species were recorded during the August 2023 surveys, in addition to Japanese knotweed at site C4.

The invasive macrophyte Canadian Pondweed was recorded from Kilglass Lough (L1).

Zebra Mussel was observed on submerged structure and recorded at Kilglass Lough (L1) (**Appendix 6.8B**). The species is also listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011) and is considered a high-risk impact species in Ireland (O' Flynn et al., 2014).

The non-native amphipod crustacean *Crangonyx sp.* was recorded in low numbers from sites on the Culligh Stream (A3), Feorish River (A4) and Kilglass Lough (L1) (**Appendix 6.8B**).

4.5. Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from a total of 12² riverine sites in August 2023 (**Appendix 6.8B**).

² Site C1 was dry at the time of survey

Site C4 on an unnamed tributary of the Curraghroe Stream achieved **Q4 (good status)** give the presence of fair numbers of the EPA group A (most pollution sensitive) Mayfly (*Electrogena lateralis*) (5-10% of total sample abundance). This was the only site, therefore, 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**).

Site A5 on the River Shannon (Lanesborough Bridge) achieved **Q3-4 (moderate status)** given the presence of low numbers of the EPA group A Mayfly (*Ephemera Danica*) (**Appendix 6.8B**).

The remaining 10 sites on the Culliagh Stream (A1, A2, A3), Feorish River (A4), Ballymartin Stream (A1, A2), Glen Stream (B3), unnamed stream (C3), unnamed stream (C5) and Curraghroe Stream (C6), achieved **Q2-3 or Q3 (poor status)** based on a dominance of EPA group C and D species, including the Mayfly (*Baetis rhodani*), the mollusc *Potamopyrgus antipodarum*, the Freshwater Shrimp (*Gammarus duebeni*) and blackfly larvae (*Simuliidae*) (**Appendix 6.8B**). These sites did not support any group A species and typically low numbers of group B species such as the cased caddis species *Agapetus fuscipes*.

It should be noted that the rating for sites A1, A4 and C3 were tentative due to poor flows and an absence of riffle areas for sampling at the time of survey (as per Toner *et al.*, 2005). Site C1 was dry at the time of survey and thus it was not possible to collect a biological water quality sample.

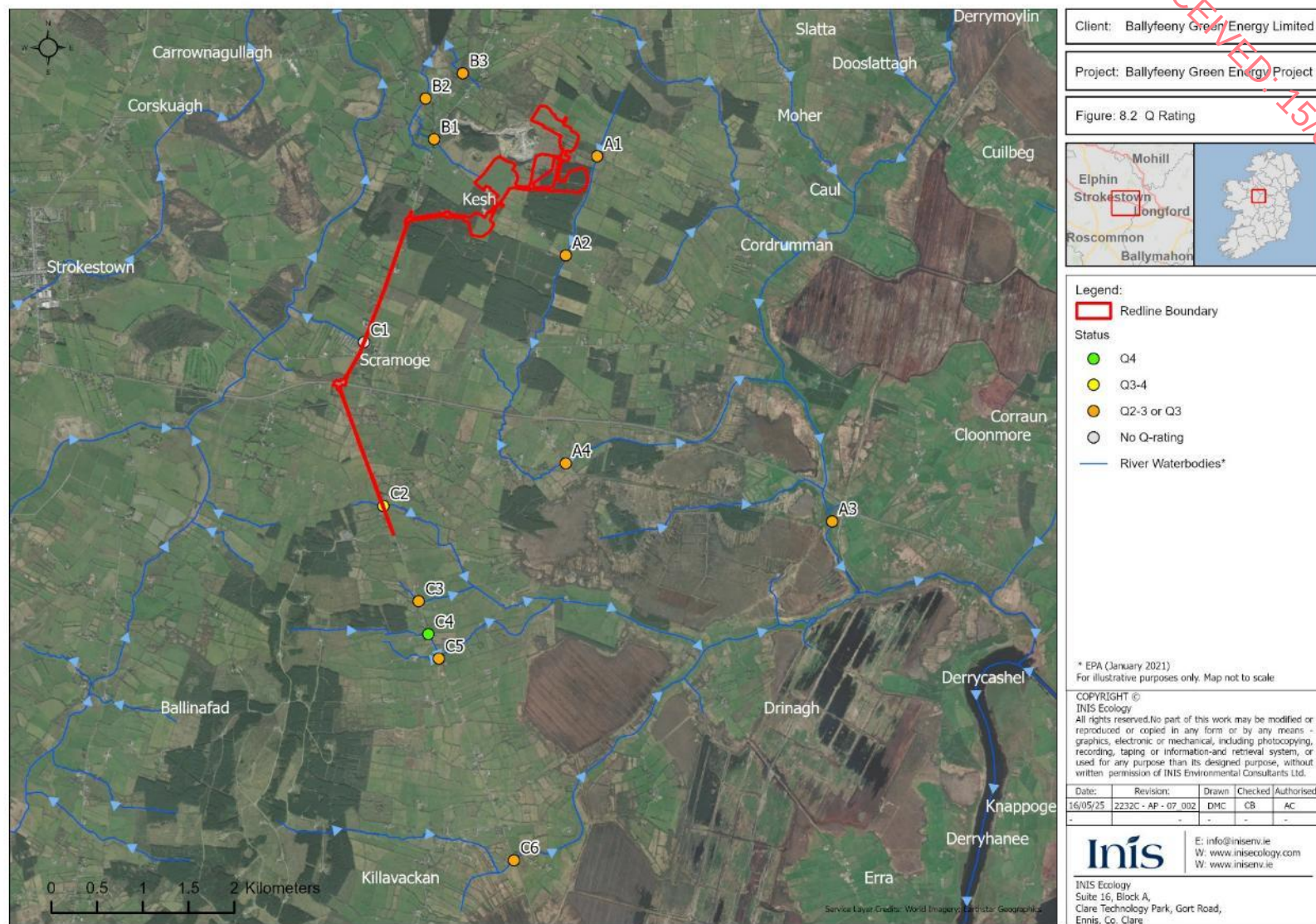


Figure 4.1: Overview of the biological water quality status in the vicinity of the Project, Co. Roscommon, August 2023.

4.6. Lake macro-invertebrate communities

No rare or protected macro-invertebrate species (according to national red lists (Feeley *et al.*, 2020; (Kelly-Quinn & Regan, 2012)) were recorded in the composite sweep samples collected from pond site P1 or Kilglass Lough (L1) in August 2023.

The invertebrate sample collected at pond site (P1) was dominated by Phantom Midge larvae (*Chaoboridae*), Pond Olive (*Cloeon simile*), the diving beetle (*Graptodytes pictus*) and relatively high numbers of *Coenagrionidae* Damselfly larvae and Emperor Dragonfly larvae (*Anax imperator*) (**Appendix 6.8B**). The Kilglass Lough (L1) invertebrate sample was dominated by *Coenagrionidae* Damselfly larvae, freshwater Hoglouse, gastropod molluscs such as *Potamopyrgus antipodarum*, and the non-native crustacean *Crangonyx* sp. (**Appendix 6.8B**).

4.7. Macrophytes and aquatic bryophytes

No rare or protected macrophytes or aquatic bryophytes or Annex I aquatic vegetation habitats were recorded during the surveys in August 2023.

4.8. Otter signs

A small number of Otter signs were recorded within a 150m radius of the survey sites in August 2023. A regular Otter spraint site (on two discrete rocks) was recorded under the R371 road crossing on the Curraghroe Stream at site C6 (ITM 598407, 774403) (Plate 4.18). Otter prints were recorded in marginal sand accumulations under the R371 road bridge on an unnamed Curraghroe Stream tributary (ITM 597587, 776617) (**Figure 4.2**).

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



Plate 4.18: Fresh Otter spraint recorded on the Curraghroe Stream under the R371 road bridge, August 2023.

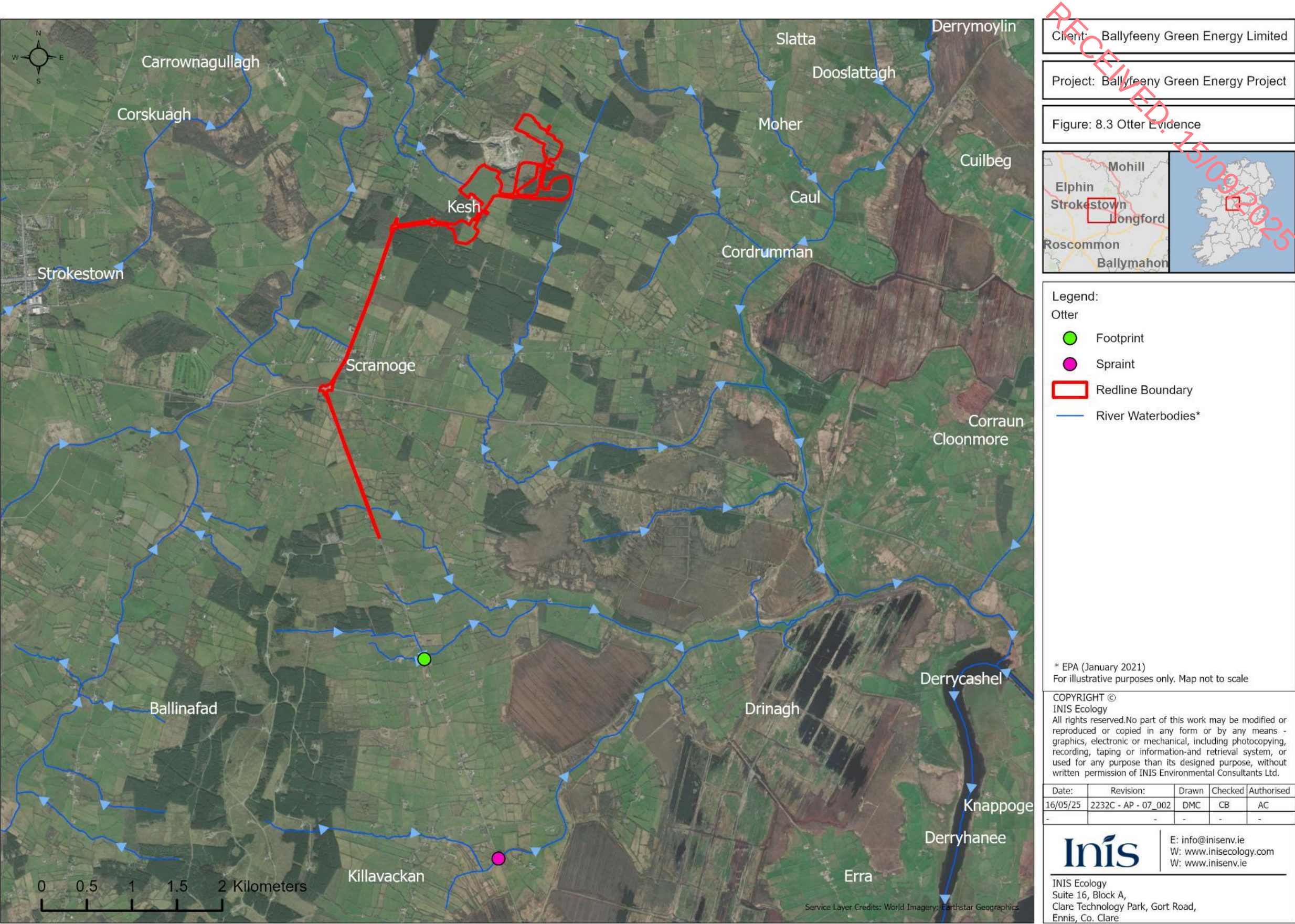


Figure 4.2: Overview of the evidence for Otter recorded within survey area, August 2023.

4.9. Aquatic ecological evaluation

The relative abundance of fish species of higher conservation value recorded per survey site is shown in **Table 4.2** and a summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the Project is shown in **Table 4.3**.

Table 4.2: Relative abundance of fish species of higher conservation value recorded per survey site in the vicinity of the Project, August 2023.

Site	Watercourse	Brown Trout	Lampetra sp.	Other species
A1	Culliagh Stream	No fish recorded		
A2	Culliagh Stream			Three-spined stickleback, ten-spined stickleback
A3	Culliagh Stream		High	Three-spined stickleback
A4	Feorish River	Fisheries appraisal only		
P1	Pond	Fisheries appraisal only (European not detected via eDNA)		
B1	Ballymartin Stream	No fish recorded		
B2	Ballymartin Stream			Three-spined stickleback
B3	Glen Stream	No fish recorded		
L1	Kilglass Lough	Fisheries appraisal only		
C1	Gortlustia Stream	No fish recorded (dry channel)		
C2	Bellmount Stream	No fish recorded		
C3	Unnamed stream	No fish recorded		
C4	Unnamed river	No fish recorded		
C5	Unnamed stream			Three-spined stickleback
C6	Curraghroe Stream	Low	Low	Three-spined stickleback

An aquatic ecological evaluation of each survey site was based on the results of desktop review (i.e., presence of fish of conservation value), fisheries habitat assessments, the presence of protected or rare invertebrates (e.g. White-Clawed Crayfish, freshwater pearl mussel) or amphibians (e.g. Smooth Newt), environmental DNA analysis, the presence of rare macrophytes and aquatic bryophytes, and/or associated representations of Annex I habitats. Furthermore, biological water quality status also informed the aquatic evaluation (**Table 4.4**).

Kilglass Lough (site L1) was evaluated of **National Importance** given it formed part of the Kilglass and Grange Lough pNHA (000608), a site of importance for its reedbed and wildfowl habitats (NPWS, 2009).

A total of five sites on the Culliagh Stream (A3), Feorish River (A4), unnamed stream (C5), Curraghroe Stream (C6) and pond site P1 were evaluated as **Local Importance (Higher Value)** in terms of their aquatic ecology. This evaluation was due to the presence of aquatic species of high conservation value.

The remaining eight sites on the Culliagh Stream (A1, A2), Ballymartin Stream (B1, B2), Glen Stream (B3), Gortlustia Stream (C1), Bellmount Stream (C2) and unnamed watercourses (C3, C4 & C5) were evaluated as **Local Importance (Lower Value)** given an absence of aquatic species or habitats of high conservation value and less than good status biological water quality.

Table 4.3: Summary of aquatic species and habitats of higher conservation value recorded in the vicinity of the Project, August and September 2023.

Site	Watercourse	White-Clawed Crayfish	Freshwater pearl mussel	Otter signs ⁴	Annex I aquatic habitats	Rare or protected macrophytes/aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
A1	Culliagh Stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded
A2	Culliagh Stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded
A3	Culliagh Stream	None recorded		No signs	Not present	None recorded	None recorded	Lamprey
A4	Feorish River	None recorded; negative eDNA result at site	Negative eDNA result at site, no records in catchment	No signs	Not present	None recorded	None recorded	None recorded (but Eel likely present)
P1	Pond	None recorded; negative eDNA result at site		No signs	Not present	None recorded	None recorded	Smooth Newt (physically detected & also in eDNA); Eel (eDNA)
B1	Ballymartin Stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded
B2	Ballymartin Stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded
B3	Glen Stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded
L1	Kilglass Lough	None recorded		No signs	Not present	None recorded	None recorded	None recorded (but Eel known to present)
C1	Gortlustia Stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded
C2	Bellmount Stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded
C3	Unnamed stream	None recorded		No signs	Not present	None recorded	None recorded	None recorded

C4	Unnamed river	None recorded		No signs	Not present	None recorded	None recorded	None recorded
C5	Unnamed stream	None recorded		Prints	Not present	None recorded	None recorded	None recorded
C6	Curraghroe Stream	None recorded		Regular spraint site	Not present	None recorded	None recorded	None recorded

Conservation value: Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), White-clawed Crayfish, freshwater pearl mussel and Otter are listed under Annex II of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive') and all are protected under the Irish Wildlife Acts 1976-2023. White-Clawed Crayfish (Füreder et al., 2010) and freshwater pearl mussel (Moorkens et al., 2017) are also both listed as 'Endangered' according to the IUCN Red List. Eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Smooth Newt (*Lissotriton vulgaris*) are protected under the Irish Wildlife Acts 1976-2023.

⁴ Otter signs within 150m of the survey site

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

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
A1	Culliagh Stream	26C14	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value; Q2-3 (poor status) water quality (tentative rating)
A2	Culliagh Stream	26C14	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality
A3	Culliagh Stream	26C14	Local Importance (Higher Value)	Lamprey recorded
A4	Feorish River	26F03	Local Importance (Higher Value)	High suitability for commuting/foraging Otter & Red-listed Eel
P1	Pond	n/a	Local Importance (Higher Value)	Smooth Newt recorded (sweep sampling & eDNA)
B1	Ballymartin Stream	26B82	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality
B2	Ballymartin Stream	26B82	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality
B3	Glen Stream	26G38	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality
L1	Kilglass Lough	n/a	National importance	Located within the Kilglass and Grange Loughs pNHA (000608)
C1	Gortlustia Stream	26G29	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value. Only site that did not meet 'Good' status from physiochemical sampling (Chapter 8 of EIAR, Table 8-16).
C2	Bellmount Stream	26B99	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value; Q3-4 (moderate status) water quality
C3	Unnamed stream	n/a	Local Importance (Lower Value)	No aquatic species or habitats of high conservation value; Q2-3 (poor status) water quality (tentative rating)
C4	Unnamed river	n/a	Local Importance (Higher Value)	Q4 (good status) water quality
C5	Unnamed stream	n/a	Local Importance (Higher Value)	Utilisation by Otter (prints)
C6	Curraghroe Stream	26C15	Local Importance (Higher Value)	Utilisation by Otter (regular spraint site)

Conservation value: Brook Lamprey (*Lampetra planeri*), river Lamprey (*Lampetra fluviatilis*), White-clawed Crayfish (*Austropotamobius pallipes*), freshwater pearl mussel (*Margaritifera margaritifera*) and Otter (*Lutra lutra*) are listed under Annex II of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive') and all are protected under the Irish Wildlife Acts 1976-2023. White-Clawed Crayfish (Füreder et al., 2010) and freshwater pearl mussel (Moorkens et al., 2017) are also both listed as 'Endangered' according to the IUCN Red List. Eel are 'critically endangered' according to most recent IUCN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). Smooth Newt (*Lissotriton vulgaris*) are protected under the Irish Wildlife Acts 1976-2023.

5. DISCUSSION

5.1. Introduction

The valuation methodology for the biodiversity environment in relation to aquatic species is described in the EIAR **Chapter 6 – Biodiversity**.

5.1.1. Watercourses

The watercourses in the vicinity of the Project were small lowland and upland channels which had typically been straightened and or deepened historically, resulting in watercourses with compromised hydromorphology and reduced aquatic value. Furthermore, siltation pressures (from various sources) were evident across much of the survey area. Over half of the riverine survey sites were of low fisheries and aquatic value and were evaluated as **Local Importance (Lower Value)** given an absence of aquatic species or habitats of high conservation value.

However, the Curraghroe Stream and Gortgallan River both supported salmonids, with Lamprey recorded from the Culliagh Stream. Otter signs were identified on the Curraghroe Stream and an unnamed tributary. Pond site P1 (near proposed turbine array) supported a breeding population of Smooth Newt. Site C2 featured **Q4 (good status)** water quality (the only site to achieve good status). Survey sites A3, A4, C2, C5, C6 and P1 were thus considered of **Local Importance (Higher Value)** in terms of their aquatic ecology and are **included** for further consideration as a KER.

Kilglass Lough (L1) was of **National Importance** given its location within designated conservation sites (**Table 4.4**). As such, Kilglass Lough is **included** for further consideration as an Key Ecological Receptor (KER).

5.1.2. Fisheries

A low diversity of fish species was recorded during targeted electro-fishing that included Brown Trout, Gudgeon, Roach, Three-spined Stickleback and Ten-spined Stickleback (**Appendix 6.8A**). Salmonid populations were restricted in vicinity of the Project, with Brown Trout recorded only from the Curraghroe Stream (C6). These sites provided the best quality salmonid habitat in the survey area, although it was still sub-optimal given hydromorphological and associated siltation pressures (**Appendix 6.8A**). Over half of the riverine survey sites were of low fisheries value, either supporting stickleback only (A1, B2, C5) or no resident fish (A1, B1, B3, C1, C2, C3, C4). Local populations of fish are evaluated as being of **Local Importance (Higher Value)**, which is equivalent to Low sensitivity. Due to the low diversity and numbers of fish species recorded during aquatic surveys, and limited habitat availability and sub-optimal habitat quality for fish species within the vicinity of the Project, fish are **not considered** KERs for detailed consideration in the impact assessment.

Atlantic Salmon (*Salmo salar*) are protected under the Wildlife Acts and are listed on Annex II and V of the EU Habitats Directive. Salmon populations not connected to designated sites are therefore evaluated as being of **County Importance** at a minimum, which is equivalent to a Moderate sensitivity rating. No Salmon were recorded during the surveys. The nearest site listing this species as a Qualifying Interest (QI) the Lower River Shannon SAC (002165). Which is beyond the identified Source-Pathway-Receptor ZoI for the Project. Due to a lack of both sightings and secondary evidence of Salmon throughout the aquatic surveying period, Atlantic Salmon is **not considered** a KER for detailed consideration in the impact assessment.

Lamprey species are protected under the Wildlife Act and are listed on Annex II and IV of the Habitats Directive. Local populations of Lamprey are evaluated as being of **Local Importance (Higher Value)**,

which is equivalent to Low/moderate sensitivity. Lamprey ammocoetes were recorded from only two sites on the Culliagh Stream (A3) (present in high densities) and Curraghroe Stream (C6) (low densities) and suitability for the species was typically poor or absent in the survey area. Despite the low numbers of lamprey recorded during aquatic surveys, and limited habitat availability and sub-optimal habitat quality for Lamprey within the vicinity of the proposed Project, Lampetra sp. are **considered** KERs for detailed consideration in the impact assessment under the precautionary principle.

Despite the species' likely/known presence on the Feorish River and Kilglass Lough (fisheries appraisal sites), no Eel was recorded via electro-fishing or detected via eDNA sampling. Local populations of Eel are evaluated as being of Local Importance (Lower Value). Due to a lack of both sightings and secondary evidence of Eel throughout the aquatic surveying period, Eel are **not considered** KERs for detailed consideration in the impact assessment.

5.1.3. Otter

Only two Otter signs were recorded in the current survey, with prints identified at site C5 on an unnamed Curraghroe River tributary and a regular spraint site at site C6 on the Curraghroe River (a site previously known to support Otter). However, Kilglass Lough was of high foraging suitability for the species (despite a lack of recorded signs).

The paucity of Otter signs was considered to reflect the often-poor foraging opportunities (small fish populations) for Otters on the heavily modified riverine channels in the vicinity of the Project, in addition to a paucity of suitable instream/riparian marking features such as boulders and large woody debris (features typically removed through historical drainage).

No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in August 2023. This mobile species has a foraging range of $13.2\text{km} \pm 5.3\text{km}$, (Reid *et al.*, 2013). The distance between the proposed Project and the Lough Ree SAC is 11.8km, therefore any Otter populations which may be found within the Project could be associated with the aforementioned SAC. Due to this connectivity with the Project, Otter is **considered** a KER of **International Importance** under the precautionary principle.

5.1.4. Other protected aquatic species

White-clawed Crayfish are protected under the Wildlife Acts and are listed on Annex II and V of the EU Habitats Directive. White-clawed Crayfish populations not connected to designated sites are therefore evaluated as being of **County Importance** at a minimum, which is equivalent to a Moderate sensitivity rating. No White-clawed Crayfish were recorded during the targeted site and eDNA surveys, thus supporting the known absence of the species in the Shannon [Upper]_SC_070 and Scramooge_SC_010 river sub-catchments. Whilst some locally suitable habitat was present (e.g. Culliagh Stream, Curraghroe Stream, Kilglass Lough), suitability for crayfish was poor overall across much of the study area given extensive drainage modifications, heavy siltation and/or other unsuitable habitat characteristics (e.g. high energy channels). The nearest site listing this species as a QI downstream of the Project is the Lower River Shannon SAC. Which is beyond the identified Source-Pathway-Receptor ZOI for the Project.

As a result, White-clawed Crayfish is **not included** as a KER.

Smooth Newt are protected under the Wildlife Acts. Smooth Newt were recorded in moderate abundances via sweep netting at pond site P1 and the species was also detected via eDNA sampling at the site. Local populations of Smooth Newt are evaluated as being of **Local Importance (Higher Value)**. Suitability in the artificial but mature and permanent pond was high given an absence of fish populations, a range of depths and meso-habitats and the presence of suitable riparian refugia (for

overwintering). Both adults and efts (juveniles) were recorded in August 2023. As this pond is located down slope of the substation works and is 185m from the Project boundary.

As a result, Smooth Newt is **included** for further consideration as a KER.

5.1.5. Invasive aquatic species

The non-native amphipod crustacean *Crangonyx* sp. was recorded in low numbers from the Cullagh Stream (A3), Feorish River (A4) and Kilglass Lough (L1) (**Appendix 6.8B**). Whilst *Crangonyx pseudogracilis* has been known in Ireland since 1969 (Phoenix Park, Dublin; Holmes, 1975) 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). The ecological impacts of either *Crangonyx* species in Ireland remains uncertain (Baars *et al.*, 2021). Due to the low numbers of *Crangonyx* sp. recorded within the vicinity of the Project, *Crangonyx* sp. is **not included** for further consideration as KERs. These species are considered as negative indicators on KERs as the increased spread of these species would impact KERs.

Asian Clam and Quagga Mussel were detected at the mouth of the Lough Ree within the River Shannon (600501 769376). This location is outside the relevant ZoI for the Project given the separation distance exceeding 18.6km downstream of the nearest watercourse crossing and 9.2km direct distance. Although neither species is considered as KERs These species are considered as negative indicators on KERs as the increased spread of these species would impact KERs.

5.1.6. Macro-invertebrates & biological water quality

No rare or protected macro-invertebrate species (according to national red lists (Feeley *et al.*, 2020; Kelly-Quinn & Regan, 2012)) were recorded in the biological water quality samples taken from 16 riverine or two lacustrine sites (**Appendix 6.8B**).

Apart from site C4 on an unnamed Curraghroe Stream tributary (**Q4, good status**), the riverine sites achieved **Q3-4 (moderate status)** or **Q2-3** or **Q3 (poor status)**, thus failing 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**).

Significant siltation (including from peat harvesting) and hydromorphological modifications were noted during the surveys and are known to be the primary threats to water quality in the wider survey area (EPA data).

Macro-invertebrates are **not included** for further consideration as a KER.

5.2. Summary of ecological features

Considering the desk study and field survey results described above, and the scope for impacts from the Project, the following KERs have been identified for the purposes of this assessment:

Table 5.1: *Summary of species importance and identification of Key Ecological Receptors.*

Species	Importance
Kilglass Lough	National Importance
Fish (Brown Trout, Gudgeon, Roach, Three-spined Stickleback and Ten-spined Stickleback)	Local Importance (Higher Value)
Otter	International Importance
Atlantic Salmon	County Importance
White-clawed Crayfish	County Importance
Smooth Newt	Local Importance (Higher Value)
Brown Trout	Local Importance (Lower Value)
Lamprey <i>sp.</i>	Local Importance (Higher Value)
European Eel	Local Importance (Lower Value)

Invasive species recorded within the aquatic ecological baseline are not considered KERs as their value to the ecological baseline is negative. These species are considered as “negative indicators” to address whether the Project poses any likelihood to increase the spread or distribution as this would be an adverse effect for any aquatic KERs.

The following are considered negative indicators for KERs:

- Crangonyx *sp.*
- Crangonyx pseudogracilis
- Crangonyx floridanus
- Asian Clam
- Quagga Mussel
- Japanese Knotweed

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APPENDIX 6.8A – FISHERIES ASSESSMENT REPORT

Please see the accompanying fisheries assessment report

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APPENDIX 6.8B – MACRO-INVERTEBRATES (BIOLOGICAL WATER QUALITY) & LAKE MACRO-INVERTEBRATE COMMUNITIES

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Table B.1: Macro-invertebrate Q-sampling results for riverine sites A1-A4 and B1-B3, August 2023

Group	Family	Species	A1	A2	A3	A4	B1	B2	B3	EPA class
Ephemeroptera	Heptageniidae	<i>Ecdyonurus dispar</i>			2					A
Ephemeroptera	Baetidae	<i>Alainites muticus</i>		5	4		1		4	B
Ephemeroptera	Baetidae	<i>Centroptilum luteolum</i>				1				B
Trichoptera	Glossosomatidae	<i>Agapetus fuscipes</i>		21	1					B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>		2	1					B
Trichoptera	Limnephilidae	<i>Halesus radiatus</i>		2	1					B
Odonata	Calopterygidae	<i>Calopteryx splendens</i>				1				B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>		10	17		14		26	C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>					3		7	C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	4	53	42		20	41	1	C
Coleoptera	Dytiscidae	Dytiscidae larva	3			1		1		C
Coleoptera	Dytiscidae	<i>Dytiscus marginalis</i>						1		C
Coleoptera	Elmidae	<i>Elmis aenea</i>		7	7					C
Coleoptera	Elmidae	<i>Limnius volckmari</i>		1	4				3	C
Coleoptera	Gyrinidae	Gyrinidae larva				2		1		C
Diptera	Pediciidae	<i>Dicranota</i> sp.	2			2	10	2	1	C
Diptera	Simuliidae	sp. indet.					15			C
Diptera	Stratiomyidae	sp. indet.			1					C
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	1	6		15				C
Hemiptera	Notonectidae	<i>Notonecta viridis</i>	4			9				C
Hemiptera	Gerridae	<i>Gerris</i> sp.	6			4		1		C
Gastropoda	Planorbidae	<i>Gyraulus albus</i>				3				C
Gastropoda	Planorbidae	<i>Planorbis planorbis</i>				6				C
Gastropoda	Lymnaeidae	<i>Galba truncatula</i>		2		9				C
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>				5				C
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>						103		C

Group	Family	Species	A1	A2	A3	A4	B1	B2	B3	EPA class
Platyhelminthes		sp. indet.	1			7	1	2		C
Crustacea	Crangonyctidae	<i>Crangonyx</i> sp.			2	1				D
Hirudinidae	Glossiphoniidae	<i>Glossiphonia complanata</i>			2			1		D
Crustacea	Asellidae	<i>Asellus aquaticus</i>	4		9	16		3		D
Gastropoda	Physidae	<i>Physa fontinalis</i>				7				D
Gastropoda	Physidae	<i>Aplexa hypnorum</i>				6				D
Diptera	Chironomidae	<i>Chironomus</i> spp.	4		1	3		1		E
Annelidae	Oligochaeta	sp. indet.	2				4	2	5	n/a
Abundance			31	109	94	98	68	159	47	
Q-rating			*Q2-3	Q3	Q3	*Q2-3	Q3	Q3	Q3	
WFD status			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 B.2: Macro-invertebrate Q-sampling results for riverine sites C2-C6, August 2023

Group	Family	Species	C2	C3	C4	C5	C6	EPA class
Ephemeroptera	Heptageniidae	<i>Electrogena lateralis</i>	1		16			A
Ephemeroptera	Ephemeridae	<i>Ephemera danica</i>						A
Ephemeroptera	Baetidae	<i>Alainites muticus</i>	1		2			B
Trichoptera	Glossosomatidae	<i>Agapetus fuscipes</i>	3		24			B
Trichoptera	Goeridae	<i>Silo pallipes</i>	6		14			B
Trichoptera	Limnephilidae	<i>Potamophylax cingulatus</i>					4	B
Trichoptera	Limnephilidae	Limnephilus early instar		1	2			B
Hemiptera	Aphelocheiridae	<i>Aphelocheirus aestivalis</i>						B
Ephemeroptera	Baetidae	<i>Baetis rhodani</i>	28		1		12	C
Trichoptera	Polycentropodidae	<i>Plectrocnemia conspersa</i>	9			4	2	C
Crustacea	Gammaridae	<i>Gammarus duebeni</i>	32	2	3	41	4	C
Coleoptera	Dytiscidae	Dytiscidae larva	1	1				C
Coleoptera	Elmidae	<i>Elmis aenea</i>	18			2		C
Coleoptera	Elmidae	<i>Limnius volckmari</i>	1		2	2		C
Coleoptera	Gyrinidae	Gyrinidae larva						C
Coleoptera	Hydraenidae	<i>Hydraena gracilis</i>			6	2		C
Diptera	Pediciidae	<i>Dicranota</i> sp.	9	2				C
Diptera	Psychodidae	sp. indet.			1			C
Diptera	Simuliidae	sp. indet.	18		48	25	31	C
Diptera	Chironomidae	Non-Chironomus spp.						C
Hemiptera	Notonectidae	<i>Notonecta viridis</i>		1				C
Hemiptera	Gerridae	<i>Gerris</i> sp.						C
Gastropoda	Bithyniidae	<i>Bithynia tentaculata</i>						C
Gastropoda	Neritidae	<i>Theodoxus fluviatilis</i>						C
Gastropoda	Planorbidae	<i>Ancylus fluviatilis</i>			3			C
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>						C

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Group	Family	Species	C2	C3	C4	C5	C6	EPA class
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>	6	5	10	5	21	C
Platyhelminthes		sp. indet.						C
Crustacea	Crangonyctidae	<i>Crangonyx</i> sp.						D
Hirudinidae	Glossiphoniidae	<i>Glossiphonia complanata</i>	1	2		1	3	D
Crustacea	Asellidae	<i>Asellus aquaticus</i>		6				D
Mollusca	Sphaeriidae	sp. indet.					4	D
Gastropoda	Physidae	<i>Physa fontinalis</i>						D
Diptera	Chironomidae	<i>Chironomus</i> spp.		6				E
Annelidae	Oligochaeta	sp. indet.	7			2	2	n/a
Mollusca	Dreissenidae	<i>Dreissena polymorpha</i>						n/a
Mollusca	Cyrenidae	<i>Corbicula fluminea</i>						n/a
Abundance			141	26	132	84	83	
Q-rating			Q3-4	*Q2-3	Q4	Q3	Q3	
WFD status			Mod	Poor	Good	Poor	Poor	

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

Table B.3: Macro-invertebrate Q-sampling results for lake sites P1 and L1, August 2023

Group	Family	Species	P1	L1
Diptera	Chaoboridae	sp. indet.	59	
Odonata	Aeshnidae	<i>Anax imperator</i>	55	
Odonata	Coenagrionidae	sp. indet.	38	24
Ephemeroptera	Baetidae	<i>Cloeon simile</i>	31	9
Coleoptera	Dytiscidae	<i>Graptodytes pictus</i>	18	
Arachnida	Hydrachnidae	sp. indet.	12	1
Coleoptera	Dytiscidae	Dytiscidae larva	6	1
Mollusca	Sphaeriidae	sp. indet.	6	10
Diptera	Chironomidae	<i>Chironomus</i> spp.	3	5
Diptera	Chironomidae	Non- <i>Chironomus</i> spp.	2	6
Diptera	Culicidae	sp. indet.	2	
Hemiptera	Notonectidae	<i>Notonecta obliqua</i>	2	
Coleoptera	Dytiscidae	<i>Stictonectes lepidus</i>	1	
Hemiptera	Corixidae	Corixidae nymph	1	4
Crustacea	Crangonyctidae	<i>Crangonyx</i> sp.		35
Coleoptera	Halpliidae	<i>Haliphus ruficollis</i> group		1
Hemiptera	Corixidae	<i>Callicorixa praeusta</i>		12
Crustacea	Asellidae	<i>Asellus aquaticus</i>		26
Gastropoda	Bithyniidae	<i>Bithynia tentaculata</i>		4
Gastropoda	Lymnaeidae	<i>Lymnaea stagnalis</i>		7
Gastropoda	Physidae	<i>Physa fontinalis</i>		2
Gastropoda	Planorbidae	<i>Planorbarius corneus</i>		12
Gastropoda	Planorbidae	<i>Planorbis carinatus</i>		5
Gastropoda	Tateidae	<i>Potamopyrgus antipodarum</i>		23
Gastropoda	Dreissenidae	<i>Dreissena polymorpha</i>		5
Abundance			236	192

APPENDIX 6.8C – eDNA ANALYSIS LAB REPORT

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Folio No: E19096
Report No: 1
Client: Triturus Environmental Limited
Contact: Bill Brazier

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TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN WATER FOR AQUATIC SPECIES DETECTION

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

Date sample received in laboratory: 23/08/2023
Date results reported: 01/09/2023
Matters affecting result: None

TARGET SPECIES: Asian clam
(Corbicula fluminea)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1452	C9 – River Shannon (Lanesboro), Ballyfeeny WF	-	Pass	Pass	Pass	Positive	5/5



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TARGET SPECIES: Crayfish plague
(*Aphanomyces astaci*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1452	C9 – River Shannon (Lanesboro), Ballyfeeny WF	-	Pass	Pass	Pass	Negative	0/12
FK1438	A4 – Feorish River, Ballyfeeny WF	-	Pass	Pass	Pass	Negative	0/12

TARGET SPECIES: European eel
(*Anguilla anguilla*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1439	P1 - Pond, Ballyfeeny WF	-	Pass	Pass	Pass	Negative	0/12

TARGET SPECIES: Freshwater pearl mussel
(*Margaritifera margaritifera*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1438	A4 – Feorish River, Ballyfeeny WF	-	Pass	Pass	Pass	Negative	0/12





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TARGET SPECIES: Quagga mussel
(*Dreissena bugensis*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1452	C9 – River Shannon (Lanesboro), Ballyfeeny WF	-	Pass	Pass	Pass	Positive	5/5

TARGET SPECIES: Smooth Newt
(*Lissotriton vulgaris*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1439	P1 - Pond, Ballyfeeny WF	-	Pass	Pass	Pass	Positive	12/12

TARGET SPECIES: White-clawed crayfish
(*Austropotamobius pallipes*)

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK1452	C9 – River Shannon (Lanesboro), Ballyfeeny WF	-	Pass	Pass	Pass	Negative	0/12
FK1439	P1 – Pond, Ballyfeeny WF	-	Pass	Pass	Pass	Negative	0/12
FK1438	A4 – Feorish River, Ballyfeeny WF	-	Pass	Pass	Pass	Negative	0/12

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: Jennifer Higginbottom

Approved by: Chelsea Warner



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METHODOLOGY

The samples detailed above have been analysed for the presence of target species eDNA following scientifically published eDNA assays and protocols which have been thoroughly tested, developed and verified for use by SureScreen Scientifics.

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 species 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 risk of contamination. 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 and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.



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INTERPRETATION OF RESULTS

SIC: Sample Integrity Check [Pass/Fail]

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.

DC: Degradation Check [Pass/Fail]

Analysis of the spiked DNA marker to see if there has been degradation 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.

IC: Inhibition Check [Pass/Fail]

The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected, samples are purified and re-analysed. 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 at the sampling location.

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.



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