Appendix 6-3 Aquatic Survey Report

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Scart Mountain Wind Farm

Aquatic Ecology Survey Report

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1. INTRODUCTION

FuturEnergy Ireland (FEI) are proposing to develop the proposed Scart Mountain Wind Farm in County Waterford (which along with all of the associated infrastructure and works is hereafter referred to as the proposed project).

1.1 DETAILS OF THE PROPOSED PROJECT

The proposed project comprises a wind farm of 15 no. wind turbines and all associated infrastructure including turbine foundations, hardstanding areas, borrow pits, access tracks, 110kV grid connection and works along the turbine delivery route. Full details of the project description are provided in Chapter 2 of the EIAR. It is proposed to supply the power from the Scart Mountain Wind Farm to the Irish electricity network via 110kV underground cables (approximately 16km cable length of which approximately 12.6km is proposed along the public road corridor) to the existing Dungarvan 110kV substation in the townland of Killadangan, Co. Waterford. Some works are also required along the TDR to allow transport of the turbine components and material to the site.

The report assesses the entire land holding including the proposed wind farm, and the associated infrastructure as one subject site.

1.2 PURPOSE OF THIS REPORT

The purpose of this report is to identify, quantify, and evaluate potential risks from the proposed project to aquatic species or habitats.

1.3 RELEVANT LEGISLATION AND GUIDANCE

The following relevant legislation has been considered for this report.

- The Habitats Directive. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora;
- The EU Water Framework Directive (2000/60/EC);
- The EIA Directive 2011/92/EU, as amended by Directive 2014/52/EU;
- European Union (EU) (Environmental Impact Assessment and Habitats) (No. 2) Regulations 2015 (S.I. No. 320/2015);
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, hereafter referred to as the Birds Directive;
- European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272/2009) and (Amendment) Regulations 2012 and 2015;
- European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) (as amended);
- Wildlife Act 1976 (as amended); and
- The Inland Fisheries Acts 1959-2017, as amended. hereafter referred to as the Fisheries Acts.

The European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) and (Amendment) Regulations 2012 and 2015 establish legally binding quality

objectives for all surface waters and environmental quality standards for pollutants for the purpose of implementing provisions of EU legislation on protection of surface waters. These regulations clarify the role of public authorities in the protection of surface waters and also concern the protection of designated habitats.

Relevant guidance published by the National Roads Authority (NRA), and applicable to assessing watercourses in Ireland were followed, including 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (NRA, 2008). Inland Fisheries Ireland (IFI) (2016) 'Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters', the 'River Crossings and Migratory Fish: Design Guidance' (Scottish Executive, 2000), 'Control of water pollution from construction sites - Guidance for consultants and contractors' (Masters-Williams *et al.* 2001) and 'Control of water pollution from linear construction projects' (Murnane *et al.* 2006) were also all consulted in relation to necessary mitigation.

1.4 Project Team

This report was prepared by Senior Ecologist Sinead O' Reilly (M.Res) within TOBIN and sets out the aquatic field survey data of watercourses potentially affected by the proposed project. Information collated from desk studies was also considered. Sinead has 13 years of professional experience, holds an honors degree in Zoology from University College Dublin and a Research Masters in Science in Freshwater Ecology from the University of Glasgow. This report was reviewed by TOBIN Lead Ecologist and Associate Director Laura Kennedy (M.Sc.). Laura is an Associate Director and Lead Ecologist with TOBIN. She has over 14 years' experience in environmental sciences and environmental consulting.

1.5 Study Area

The proposed project includes the proposed wind farm site (located approximately 4km northwest of Cappoquin, Co. Waterford – ITM grid ref: 613998, 604437), the proposed grid connection route (GCR) to connect the wind farm to the national grid near Dungarvan, and the works along the proposed turbine delivery route (TDR) that extends to Bellview Harbour in Co. Kilkenny.

The proposed wind farm site is approximately 976 hectares (ha) in size, with a total permanent infrastructure footprint of 37 ha. In general, the site is predominantly covered by conifer plantations with a scattered mix of grassland, heath, and broadleaved and riparian woodland. Drainage across the site includes numerous watercourses, including streams and rivers flowing southwards outside of the proposed windfarm site.

The study area for the aquatic assessment comprised the proposed wind farm site and associated network infrastructure, plus the wider surrounding hinterland, and comprises all lands located within the zone of influence (ZoI) of the proposed development. The study area includes the aquatic habitats (rivers and streams) within and draining the proposed project. The ZoI determines the extents of the study area.

The ZoI for a project is defined in ecological impact assessment guidance (CIEEM, 2018) as follows:

"The 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries" and that "The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change."

The ZoI was first assessed through a desk study review of ecological information that was pertinent to the proposed project. As noted, the study area was defined as surface waters potentially affected by the proposed project, including watercourses within the proposed project site and those downstream.

1.6 Description of Watercourses in the Study Area

The proposed wind farm site is mainly situated within Coillte Forestry. This site is mountainous in nature with ground levels ranging from approximately 131m OD at the southern boundary of the site up to 482m OD at the northern boundary of the site. The site falls in a southerly direction, with the southern boundary of the subject site low lying, and the eastern side of the subject site considerably higher.

The study area is located in the WFD catchments/ Hydrometric Area 18 within the Blackwater (Munster) catchment and the Finisk_SC_010, Colligan_SC_010 and Blackwater (Munster)_SC_010 subcatchments.

The study area includes eight watercourses located within both the proposed wind farm site and adjacent or downstream of the site. The watercourses in the study area were the Glenshelane_010, Glennafallia_010, Glennafallia_020, Farnane_010, Monavugga_010, Finisk_020, Finisk_030 and the Colligan_040.

All watercourses drain in a southerly direction towards the Blackwater River (with the exception of the Colligan River) which flows in a south-westerly direction before discharging to the Atlantic Ocean approximately 35km from the northern site boundary. The Blackwater River is part of the Blackwater River (Cork/Waterford) SAC (002170). The Colligan River flows south before entering into the Colligan Estuary. The Colligan Estuary is part of the Dungarvan Harbour SPA (004032).

Six of the eight watercourses are located within the proposed project site boundary, these include the Glenshelane_010, Glennafallia_010, Farnane_010, Finisk_020, Finisk_030 and the Colligan_030. The remaining watercourses are located outside the proposed project site but within the study area. The water features in the study area are illustrated in Figure 2-1.

The Glennafallia watercourse is located in the northern section of the proposed wind farm site. It rises on the western slope of Knocknanask. It is fed by 1st order streams as it flows south, one of which is located within the proposed project.

The Glenshelane watercourse is located to the north and northwest of the proposed project. It rises on the eastern slope of the Knocknanask. It passes directly through the proposed wind farm site and is fed by first order streams, two of which are located within the proposed wind farm site. The Glenshelane River is located within the Blackwater River (Cork/Waterford) SAC. The proposed bridge crossings will be over the Glenshelane River.

The Farnane watercourse is located along the eastern boundary of the proposed wind farm site. It rises on the western side of Broemountain and eastern side of Knocknasheega. It flows along the border of the proposed wind farm site.

The Finisk watercourse is located to the south of the proposed project site and rises to the northeast of Broemountain. One of its 1st order streams located with the proposed project.

The Colligan watercourse is located east of the proposed project. It rises west of the Tooreen Mountain and flows in a southerly direction.

All of these waterbodies are of gradual to steep sloping gradient with a fast flow rate and represent natural watercourses typical of eroding/upland rivers (FW1), that are actively eroding, with unstable and undercut banks where there is little or no deposition of fine sediment. The upper catchment of the Glennafallia, Glenshelane and Farnane River drain an elevated area of peat, much of which has been planted with commercial coniferous forestry.

Due to the elevation of the proposed project site and its location in the environs of the catchments' watershed, the watercourses within the proposed project site are no larger than 2nd order. Drainage associated with afforestation and commercial forestry in the catchments may be affecting the flow regime of the study watercourses. For example, low flows during the summer could have been exacerbated by drainage of peat habitats, where potential water reserves in peat are released faster than natural processes by lowering the water table. The development of large areas of commercial forestry can also limit precipitation reaching the soil and therefore reduce surface water flow.

2. METHODOLOGY

2.1 DESKTOP REVIEW

An ecological desktop review was carried out to collate information on aquatic species and to identify features of aquatic ecological importance within the study area. Records of aquatic faunal species and protected species in the environs of the proposed project were identified. This information was obtained by accessing the website of the National Parks & Wildlife Service (NPWS)[1], IFI[2] and the database of the National Biodiversity Data Centre (NBDC)[3]. The document *'Quantification of the Freshwater Salmon Habitat Asset in Ireland'* by McGinnity *et al.* (2003) was also reviewed to classify salmonid habitats in the study area.

2.2 FIELD STUDY

The aquatic field surveys comprised of an evaluation of the aquatic habitats, a biotic assessment using aquatic macroinvertebrates, and eDNA sampling for the presence/absence of protected species. Field surveys of aquatic habitats and macroinvertebrates were carried out by TOBIN ecologists during base flow conditions, where the flow of water within the stream or river has not increased from the contribution of direct runoff from rainfall. Field surveys of Site 1 to Site 18 were undertaken between the 15th and 19th of August 2022. Additional Sites 19 to 23 were surveyed between 19-20th July 2023. The eDNA water sampling was carried out by TOBIN ecologists on the 11th of September 2023.

2.2.1 Survey Locations

Representative locations on watercourses both draining the proposed project and within the study area were selected for surveying. Aquatic field survey sites were, where feasible, selected relevant to the proposed works areas including installation sites for turbines and road crossings. These sites were selected based on a preliminary layout of the study area within the Blackwater (Munster) catchment area. These included the following streams and rivers: Glennallia_010, Glenshelane_010, Glennafallia_010, Glennafallia_020, Farnane_010, Monavugga_010, Finisk_020, Finisk_030 and Colligan_040. A total of 23 sites were selected within the study area, on known watercourses mapped by the Environmental Protection Agency (EPA)/Ordnance Survey Ireland (OSI). All 23 aquatic survey sites were accessed using public roadways, forest tracks and across lands where permitted. In this report, 1st and 2nd order watercourses are referred to as streams. Watercourses of 3rd order and larger are referred to as rivers.

A list of survey sites is provided in Table 2-1. A map of the entire study area and the survey locations within the study area is shown on Figure 2-1.

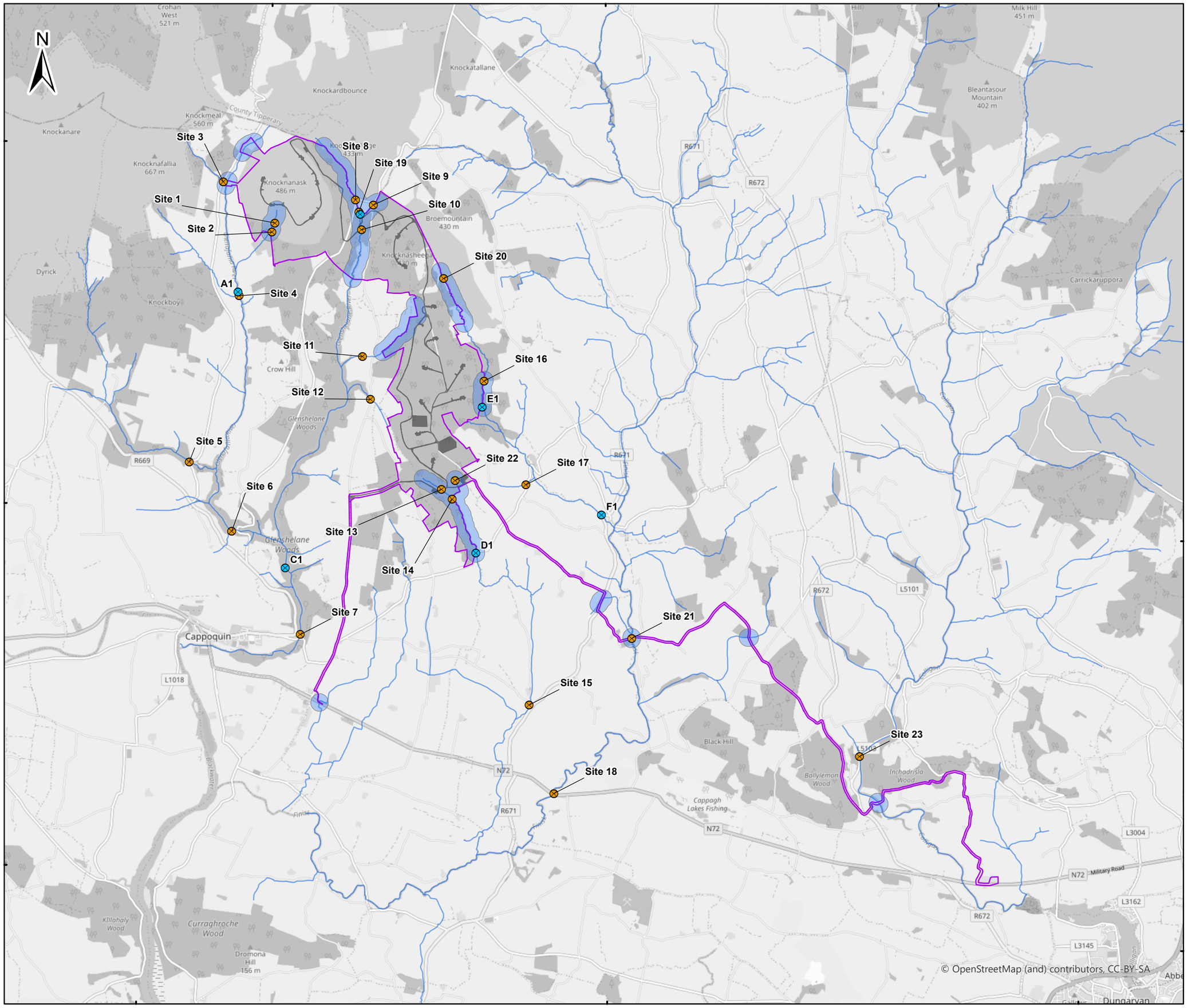
While survey sites down-gradient of the proposed project may be influenced by factors outside of the site boundary, downstream biota are nonetheless receptors for the proposed project, and acquisition of baseline information at these locations was deemed important to provide a complete understanding of aquatic sensitivities. It is acknowledged that the larger size of

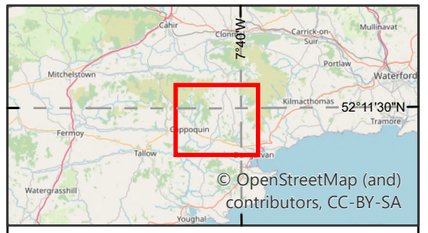
[1] https://www.npws.ie/maps-and-data
[2] https://www.fisheriesireland.ie/
[3] http://www.biodiversityireland.ie/

watercourses downstream of the proposed project provide more habitat and are considered more suitable for salmonids than reaches inside the proposed project boundary.

2.2.2 Biosecurity

A biosecurity protocol, recommended by IFI, was also adhered to during the surveys. All equipment and Personal Protection Equipment (PPE) was disinfected with Virkon® prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of invasive species and water-borne pathogens between sites, according to standard IFI biosecurity protocols (IFI 2010).





Legend

- Proposed project
- Proposed infrastructure footprint within the proposed wind farm site
- eDNA sampling sites
- Aquatic Survey Locations
- Otter Survey Area
- WFD - River Water Bodies

0 1.5 3
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING\
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE\
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY \ WORK COMMENCES\
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Rev	Date	Description	By	Chkd.
A	17/12/2024	First issue	S.P	J.S

Client: FuturEnergy Ireland

Project: Scart Mountain Wind Farm

Title: Figure 2-1: Watercourses and Aquatic Survey Sites within the Study Area of the Proposed Development

Scale @ A3:	1:60,000	
Prepared by:	Checked by:	Date:
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Draft: A

Table 2-1: Aquatic Ecological Survey Site Locations on Watercourses Within the Study Area of the Proposed Project

Site Number	WFD River Sub-Catchment	WFD River Waterbody Code	ITM (x)	ITM (y)
Site 1	Blackwater [Munster]_SC_140	Glennafallia_010	611422	606434
Site 2			611373	606276
Site 3			610542	607135
Site 4			610812	605192
Site 5		Monavugga_010	609958	602351
Site 6		Glennafallia_020	610684	601171
Site 7			611857	599406
Site 8		Glenshelane_010	612801	606829
Site 9			613104	606741
Site 10			612903	606318
Site 11			612919	604155
Site 12			613054	603422
Site 13	Finisk_SC_010	Finisk_030	614268	601888
Site 14		Finisk_030	614450	601716
Site 15		Finisk_030	615766	598203
Site 16		Farnane_010	614995	603735
Site 17			615710	601963
Site 18		Finisk_030	616190	596691
Site 19	Blackwater [Munster]_SC_140	Glenshelane_010	612858	606622
Site 20	Finisk_SC_010	Farnane_010	614305	605483
Site 21		Finisk_020	617520	599341
Site 22		Finisk_030	614502	602037
Site 23	Colligan_SC_010	Colligan_040	621413	597324

2.2.3 Riverine Habitat Assessment

The aquatic ecological assessment included a habitat assessment of the receiving watercourses within the study area. This included the suitability of the habitat to support aquatic species of conservation concern such as White-clawed Crayfish (*Austropotamobius pallipes*), River Lamprey (*Lampetra fluviatilis)*, Brook Lamprey (*Lampetra planeri*), Atlantic Salmon (*Salmo salar*) and Freshwater Pearl Mussel (FPM) (*Margaritifera margaritifera*).

The riverine habitat assessment of the watercourses followed methodologies outlined in the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual'* (EA, 2003), the Irish Heritage Council's *'A Guide to Habitats in Ireland'* (Fossitt, 2000) and and Inland Fisheries Ireland's "*Aquatic Plants in Ireland - A Photographic Guide*" (2023).

All watercourse survey locations were assessed in terms of physical habitat variables:

- Stream width and depth and other physical characteristics, bank height and width, bankside vegetation;
- Substrate type, listing substrate fractions in order of dominance, i.e. bedrock, boulder, cobble, gravel, sand, silt etc;
- Flow type and rate, listing percentage of riffle, glide and pool in the sampling area;
- In-stream macrophyte and bryophytes occurring and their percentage coverage at the sampling sites; and
- Riparian vegetation composition on banksides and percentage of overhead shade.

Each sampling site along the watercourse was described in terms of the important aquatic habitats and species recorded (i.e. based on their conservation value). This determined the ecological evaluation of each aquatic survey site and informed site-specific mitigation for the proposed project. Watercourses were photographed at survey site locations throughout the study area. Anthropogenic and livestock influences on fluvial and riparian habitats were noted along the surveyed stretches.

2.2.4 Fisheries Assessment

A fisheries assessments were carried out utilising elements of the approaches in the Fishery Assessment Methodology (O'Grady, 2006) and '*Ecology of the Atlantic Salmon*' (Hendry & Cragg-Hine, 2003) to broadly characterise the river sites (i.e. channel profiles, substrata etc.). Fisheries suitability and value was taken into account during the aquatic surveys. Suitable spawning and nursery habitat for salmonids was assessed. The potential for lamprey (river and brook) habitat and presence was also assessed at each survey site. A broad appraisal/overview of the upstream and downstream habitat at each site was undertaken to evaluate the wider contribution to salmonid and lamprey spawning, to assess if the watercourse could support salmonids and to access the general fisheries habitat. This included identifying the overall habitat diversity provided by natural features in the channel and river corridor. The presence of features such as point, side and mid-channel bars, eroding riverbanks, large woody debris, waterfalls, backwaters and floodplain wetlands were noted if present. Additionally, channel substrata, flow-types, in-channel vegetation, and also the distribution of bank-side trees and hedgerows and the extent of near-natural land-use adjacent to the river were accessed. It was also noted if there was evidence of artificial modification to the river channel morphology. This information provided a broad assessment of the naturalness of the channel and its ability to support these species.

An evaluation of potential lamprey habitats within the study area was made with reference to methodologies outlined in '*Ecology of the River, Brook, and Sea Lamprey*' (Maitland, 2003). A visual assessment was carried out on the habitat suitability for lamprey such as slower flowing water, nursery areas of sandy silt beds, an assessment on potential barriers on migration route, potential spawning areas, suitable hiding places and clean spawning gravels over stretches of running water. Juvenile lamprey habitat was identified from the descriptions given in Maitland (2003). Substrate depth and composition was examined for potential ammocoete habitat, especially focusing on the composition of mud, silt, or silt and sand and its suitability for ammocoetes. Areas where suitable spawning gravels may occur, were searched, especially at tails of pools where the gravels have been deposited from upstream and the scouring of pools were examined for potential spawning habitats for adults.

2.2.5 Fish

Any fish captured during biological sampling were identified and recorded with reference to the Freshwater Biological Association's publication *'Key to British Freshwater Fish with notes on their ecology and distribution'* (Maitland, 2004) and other referenced sources. Lamprey were identified using the document '*Identifying Lamprey - A field key for Sea, River and Brook Lamprey'* by Gardiner (2003). Captured fish were removed from the kick net and placed on a white try for identification. Identification was based on their anatomical features including location of fins on the body, position of jaw line, shape and colour and colour pattern. a lamprey scoop survey was also carried out at each site where suitable habitat (i.e. sediment) was present. This involved taking a sample of the silt (at the edge of the riverbank) with a hand net. The hand net is inserted into the sediment at a 45° angle and silt is scooped into the net. The fast-flowing high gradient nature of watercourses in the study area provided unsuitable conditions for lamprey larvae, which require soft substrates into which they can burrow. Juvenile lamprey brook and river lampreys (ammocoetes) could not be distinguishable from each other.

2.2.6 Protected Aquatic Species Survey

White-clawed Crayfish are protected species under the EU Habitats Directive and the European Union (Invasive Alien Species) (Freshwater Crayfish) Regulations 2018 (S.I. 354/2018). White-clawed Crayfish habitat and presence was assessed at each survey site. An assessment of the habitat to support White-clawed Crayfish was undertaken following methodologies outlined in '*Guidance on Habitat for White-clawed Crayfish'* (Peay, 2002). This included a visual and hand search for suitable refuge such as boulders, crevices, burrows in the bank, the presence of a partial, or even a complete barrier, food source including leaf litter, instream macrophytes, aquatic invertebrates and fish and good water quality absent of pollution.

The Freshwater Pearl Mussel is listed under Annex II and V of the EU Habitats Directive. It is legally protected under the EU Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2018 (S.I. 355/2018). A broad appraisal / overview of the upstream and downstream habitat at each aquatic survey site was undertaken to evaluate the wider contribution to FPM and the potential for this species to be present within the proposed project. An assessment of habitat to support FPM was undertaken following methodologies outlined "*Monitoring Populations of the Freshwater Peral Mussel Margaritifera margaritifera) Stage 3 and Stage 4 Survey"* (Moorkens & Killeen, 2020) and *"Guidance standard on monitoring Freshwater Pearl Mussel (Margaritifera margaritifera) populations and their environment"* (National Standards Authority of Ireland, 2017). This included a visual assessment of 1m^2 areas with each site on the habitat condition of the river including river substratum: physical substrate parameters (assessment of the substrate surface composition), plants cover (presence of excessive filamentous algae and presence/absence of macrophytes) and coarse decomposing organic matter.

2.2.7 Macrophytes

Aquatic plants as well as rare and/or protected plant species and non-native flora were recorded at each site where present. Plant species nomenclature followed '*New Flora of the British Isles*' (Stace 2019).

2.2.8 Macroinvertebrate Survey

Semi-quantitative sampling of benthic (or bottom dwelling macroinvertebrates was undertaken at selected sites using standard EPA kick-sampling methods (Toner *et al.,* 2005). A two-minute kick-sample was collected from the riverbed, using a standard 500µm mesh D-shaped kick net, submerged on the riverbed with the mouth of the net directed upstream. The substrate just upstream of the net was disturbed (with the foot, in a kicking motion) in order to dislodge invertebrates into the net. The surveyor moved in a diagonal direction upstream to ensure that different micro-habitats in the waterbody, such as fast-moving riffles, glides and pools were included in the sample during the two minutes.

A further one-minute hand search was carried out to locate macroinvertebrates that may have remained attached to the underside of the cobbles (Toner *et al.*, 2005). This sampling approach is sufficient to achieve a suitable representation of taxa for bioassessment. Occasionally, when the substratum (e.g. bedrock) or flow conditions made kick-sampling difficult, or the abundance of macroinvertebrates collected was extremely low, it was necessary to spend a longer amount of time sampling the river to accumulate a sufficient diversity and abundance of macroinvertebrates. This sampling approach requires avoidance of obvious localized disturbance (e.g. cattle access points) which may adversely influence the sample taken. Stone washings were also undertaken to ensure a representative sample of the fauna present at each site was collected. Large cobbles collected within the net from the riverbed were gently wash inside the net to remove anything macroinvertebrates attached.

Once a live sample was collected, the macroinvertebrate assemblages of each sample were places in a white tray and identified and counted on the riverbank. Once all taxa and their relative abundance were recorded, the sample was returned to the river.

The Quality Rating (Q) System (Toner *et al.,* 2005) and the Small Streams Risk Score (SSRS) was used to obtain a water quality rating and risk status for each site.

Biotic Index (Q-value)

The Biotic Index is a quality measurement for freshwater bodies. In order to determine the biological quality of the river, the Q-scheme index is used whereby the analyst assigns a Biotic Index value (Q-Value) based on macroinvertebrate results. Biological water quality data, as prescribed by the EPA (EPA; Toner *et al.* 2005), group invertebrates into classes whereby species highly intolerant to pollution and low dissolved oxygen levels are denoted class A, and species with greater tolerance to pollution and dissolved oxygen levels fall into the successive classes B through E respectively. As such the presence or absence of these groups and their relative abundances facilitates an assessment of biological river health.

The macroinvertebrate data were used to derive a Q-value using the EPA methodology *(McGarrigle et al., 2001).* This Q-value system is a five point scale (Q1-Q5: with intermediate scores obtainable, e.g. Q3-4) based on the proportions of five groups of macroinvertebrates, with different pollution tolerances with Q1 being of poorest quality and Q5 being pristine/unpolluted (see Table A 1.1 in Appendix A). The system facilitates rapid and effective assessment of the water quality of rivers and streams.

Small Stream Risk Score

The Small Streams Risk Score (SSRS) is a biological risk assessment system for identifying rivers that are definitely 'at risk' of failing to achieve the 'good' water quality status goals of the WFD. It was developed by the EPA in association with the Western River Basin District (WRBD) in 2006 (Walsh 2006).

The SSRS method is a rapid field methodology for risk assessment that is based solely on macroinvertebrate indicators of water quality and their well-understood response to pollution. Importantly the SSRS score indicates whether or not the stream is at risk from pollution and not the ecological health of the stream. The SSRS score ranges from 0-11.2.

In this method, the resulting species list obtained from the kick sample results are analysed and a grade of water quality is given to the water course based on the numbers and types of macroinvertebrate species present. The system looks at five main groups of macroinvertebrate;

- Ephemeroptera (Mayfly)
- Plecoptera (Stonefly)
- Trichoptera (Caddis Fly)
- G.O.L.D. (Gastropods, Oligochaetes, Leeches, Diptera)
- Asellus

Each group is given a score based on the number of taxa present and their abundance. Species that are more sensitive to pollution (e.g. Mayfly) are given a higher score and those that are more tolerant of pollution (e.g. Asellus) are given a lower score. To obtain the final score, the score associated with each group is added together and divided by 5 to get an average result. This average is then multiplied by two to give the final SSRS. Details of biotic indices and categories associated with the final score can be found in Table A 1.2 in Appendix A.

2.2.9 eDNA Sampling

An eDNA sampling survey was carried out at six sites within and downstream of the proposed project. This was undertaken to screen for the presence/absence of specific targeted species within each waterbody sampled. This non-intrusive, highly sensitive method has the ability to detect very low levels of species presence. This was carried out to detect of the presence of White-clawed Crayfish, Atlantic salmon, and FPM. The sampling carried out on selected watercourses also sought to confirm if the FPM population has expanded into the Blackwater [Munster]_SC_140 and/or Finisk_SC_010 sub catchment from the 'FPM sensitive areas' located upstream. Samples were taken against the flow of the stream/river in a diagonal pattern ensuring no disturbed debris was collected. Each sample was taken from the middle of the water column (at least 10cm from bottom where possible). All samples were labelled and sent to a laboratory for analysis and results.

2.3 LIMITATIONS

Access was granted in all areas of the proposed project site which were subsequently surveyed by TOBIN Ecologists during the appropriate optimal season. This aquatic study did not encounter any limitations during desktop assessment or surveying that would affect its findings.

3. RESULTS

This section describes the baseline aquatic ecology of the study area for proposed Scart Mountain Wind Farm.

3.1 DESKTOP REVIEW

3.1.1 EPA Water Quality Data

The EPA carries out biological monitoring at various locations on the watercourses draining the proposed project. The most recent EPA biological water quality results[4] from water quality monitoring surveys at WFD monitoring stations in the study area are located along the Glenshelane, Glennafallia, Farnane, Monavugga, Finisk and Colligan watercourses and are presented in Table 3-1. These are within close proximity to the proposed project and indicate the overall water quality in this area. During the most recent (2021 and 2020) assessment, good or high ecological quality was recorded at all sites. This overall indicates that these watercourses are meeting the requirements of the Water Framework Directive (2000/60/EEC).

Table 3-1: Most Recent EPA Biological Quality Ratings (Q-values) at Stations Within the Study Area

River	Station Code	Station Name	Year	Q-Value	WFD River Waterbody Approved Risks
Glenshelane_010	RS18G110100	Br S of Knocknasculloge	2020	Q4-5	Not At Risk
Glennafallia_010	RS18G100040	Br. NW of Crow Hill	2020	Q4-5	Not At Risk
Monavugga_010	RS18M010100	Br u/s Glennafallia R confl	2020	Q4	Not At Risk
Glennafallia_020	RS18G100050	Br u/s Monavugga R confl	Pre WFD	Q4-5	Not At Risk
Glennafallia_020	RS18G100060	LyreBr 1.5km d/s Monavugga R conf	2022	Q4	Not At Risk
Glennafallia_020	RS18G100100	Beallicky Br	Pre WFD	Q4	Not At Risk
Farnane_010	RS18F060300	D/s Derry Br Millstreet	2021	Q4-5	Not At Risk
Finisk_030	RS18F020500	Kilmolash Br	2021	Q4-5	Not At Risk
Colligan_040	RS17C010250	Br nr Killadangan	2022	Q4	Not At Risk

[4] https://www.catchments.ie/data/#/waterbody/IE_SW_18G100040?_k=uz5k46

3.1.2 Fish

As part of fish sampling for the WFD program, IFI carried out electrofishing surveys on the Finisk River (in 2022[5], 2017[6], and 2014[7]). In 2022, one site was surveyed within the river at Modelligo (Br._A.), downstream of Modelligo Bridge, approximately 2km south of the proposed project. Brown trout, salmon European eel (*Anguilla anguilla*) and three-spined stickleback (*Gasterosteus aculeatus*) were recorded present. A fish ecological status of "Good" was assigned to this river in 2022.

In 2017, five sites were surveyed within the river. Brown trout, salmon, Stone loach (*Barbatula barbatula*), European eel, lamprey and three-spined stickleback were recorded present. A fish ecological status of "Moderate" was assigned to this river in 2017.

In 2014, the Finisk River was surveyed at Modelligo (Br._A). Salmon, Brown trout, Stone loach, European eel, lamprey and three-spined stickleback were also recorded in present.

The Colligan Estuary was surveyed in 2008[8]. The Colligan River flows directly into this estuary. This river has been noted for having excellent runs of sea trout (*Salmo trutta trutta*). Overall, a total of sixteen fish species were captured during the survey including one sea trout was recorded. The EPA have not assigned a fish ecological status to this estuary, however they have given an interim draft classification of "Moderate" status, based on general physio-chemical elements, phytoplankton and macroalgal growths (SERBD 2008).

Previous surveys by IFI in 2021[9] show lamprey ammocoetes were recorded across 21 sites on the Blackwater River. Records show they are also present in the Finisk River and the Glennafallia River. Sea lamprey spawning habitat has also been recorded on the Blackwater River in Kilmurray in Co. Waterford. There are currently no other records available on these species.

3.1.3 Macroinvertebrates

There are currently no records of White-clawed Crayfish present within watercourses of the study area[10]. A sensitive data request was sent to the NPWS for records of FPM within the study area and its subcatchments. The data received indicated that there are currently no records of FPM populations present within the subcatchments of the study area. Suitable habitat is present within the Araglin (Blackwater)_020 catchment, located west of the proposed wind farm site.

3.1.4 Barriers

A review of the barrier atlas map of Europe[1] was undertaken for the study area. There are ramp barriers located at three locations within the study site, as shown in Figure 3-1. The first barrier is located on the Glennafallia River at Site 7. The second barrier is also located on the Glennafallia River above Site 9. The third ramp is below Site 6 on the Glenshelane River. The

[5]http://wfdfish.ie/index.php/fish-in-rivers-factsheet-2022-no-6-swrbd-blackwater-munster-river-catchment/
[6] https://www.fisheriesireland.ie/sites/default/files/2019-03/SWRBD_Finisk_2017.pdf
[7] http://wfdfish.ie/wp-content/uploads/2011/11/Rivers_report_2014.pdf

[8] http://wfdfish.ie/index.php/colligan-estuary-2008/
[9]https://www.fisheriesireland.ie/sites/default/files/202207/Habitats%20Directive%20And%20Red%20Data%20Book%20Species%20%20Summary%20Report%202021.pdf
[10] https://maps.biodiversityireland.ie/Map/Terrestrial/Species/17487

dimensions of these ramps are unknown and therefore it cannot be stated to what level these structures form migration barriers to diadromous fish species such as sea lamprey, river lamprey, sea trout and Atlantic salmon.

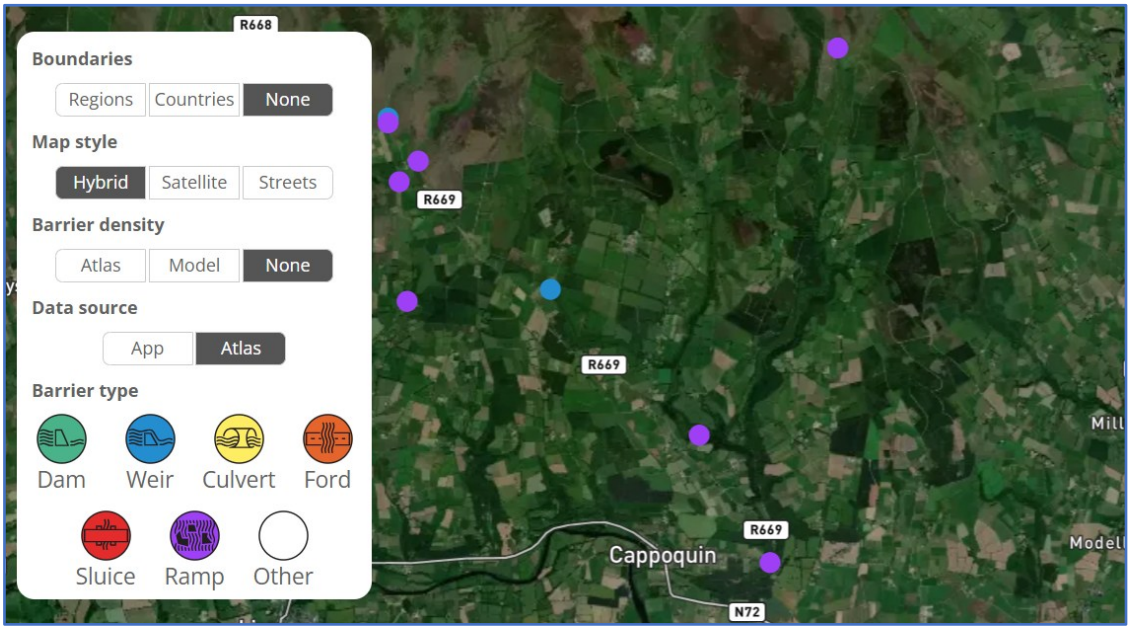

Figure 3-1: A Map of the Physical Barriers on Rivers Located Within the Study Area (Source: Barrier Atlas Map of Europe)

3.2 FIELD SURVEY RESULTS

3.2.1 Biological water quality

The biological water quality survey provided baseline data for future reference. These values must not deteriorate as a result of the proposed project. According to the WFD (2000/60/EC) target 'good status' i.e. Q4 is required in all Irish rivers.

The macroinvertebrate communities recorded at study sites comprised of a wide range of macroinvertebrate taxa. A detailed list of the macroinvertebrate taxa recorded during the surveys with the classification of macroinvertebrate species recorded in terms of their pollution sensitivity is provided in Appendix D, Table D II-1. Note, one site (Site 1) was dried out due to the recent the heat wave and did not contain water to allow for kick sampling. The Q-value, SSRS score and category, and the ecological status of each site surveyed (i.e. Sites 1-23) is provided in Table 3-2 with detailed information from the kick sample results provided in Appendix D. Of the 22 sites sampled, the target of Q4 unpolluted water was only achieved at six sampling sites, a Q3-Q4 status slightly polluted water at five sites and a Q3 status of moderately polluted water at 11 sites. The SSRS score for all sites ranged from 2.4 to 10.8 indicating that 15 of these streams and rivers are "At Risk" of failing to meet "Good" ecological status as required under the WFD.

Table 3-2: Biological Water Quality and Interpretations at Study Sites on Watercourses Draining the Proposed Project.

Site	Q-value	SSRS score	SSRS category	WFD Ecological Status
1	N/A	N/A	N/A	N/A
2	Q3	8.8	Probably not at risk	Moderately Polluted (Poor Status)
3	Q3-4	6.4	Stream at risk	Slightly Polluted (Moderate Status)
4	Q4	8.8	Probably not at risk	Unpolluted (Good Status)
5	Q4	6.4	Stream at risk	Unpolluted (Good Status)
6	Q3	4	Stream at risk	Moderately Polluted (Poor Status)
7	Q3-4	10.4	Probably not at risk	Slightly Polluted (Moderate Status)
8	Q4	8	Probably not at risk	Unpolluted (Good Status)
9	Q3	3.2	Stream at risk	Moderately Polluted (Poor Status)
10	Q3	8	Probably not at risk	Moderately Polluted (Poor Status)
11	Q3-4	3.2	Stream at risk	Slightly Polluted (Moderate Status)
12	Q3-4	4	Stream at risk	Slightly Polluted (Moderate Status)
13	Q3	2.4	Stream at risk	Moderately Polluted (Poor Status)
14	Q3	4	Stream at risk	Moderately Polluted (Poor Status)
15	Q3	5.6	Stream at risk	Moderately Polluted (Poor Status)
16	Q3	5.6	Stream at risk	Moderately Polluted (Poor Status)
17	Q3	2.4	Stream at risk	Moderately Polluted (Poor Status)
18	Q3	5.6	Stream at risk	Moderately Polluted (Poor Status)
19	Q3-4	8	Probably not at risk	Slightly Polluted (Moderate Status)
20	Q3	4	Stream at risk	Moderately Polluted (Poor Status)
21	Q4	8	Probably not at risk	Unpolluted (Good Status)
22	Q3	2.4	Stream at risk	Moderately Polluted (Poor Status)
23	Q4	6.4	Stream at risk	Unpolluted (Good Status)

3.2.2 Riverine habitat

This describes the physical characteristics of the aquatic study sites, the substrate composition at each site and its suitability for aquatic fauna. Note, at the time of survey water levels were very low due to recent high temperatures. The stream and river substrates comprise mainly of boulders, cobble and gravel with little/no silt deposits. Bedrock is the main component of the streambed along some high gradient reaches (e.g. the Glenafallia_010 upstream of Site 4 and the Glenshelane_010 at downstream of Site 10). The subject watercourses are generally characterised by riffle-glide-pool sequences with a mean depth of 3-5cm in the 1st and 2nd order rivers and 10cm-35cm in the 3rd and 4th order rivers in summer months.

There is an abundance of riffle (broken water), instream boulders, overhanging banks and dappled shade, or combinations present within the upper reached of the watercourses within the proposed wind farm site. Within the streams and rivers surveyed, a proportion of the riverine habitat was classified as suitable for salmonid spawning.

There was spawning gravels and holding pools present in some of the watercourses surveyed which also providing limited salmonid nursery habitat, namely Site 6, 7, 15 and 18. The fast-flowing high gradient nature of watercourses in the study area provided unsuitable conditions for lamprey larvae, which require soft substrates into which they can burrow.

The streams located within the proposed wind farm site did not have potential habitat for White-clawed Crayfish due to unsuitable geology, peatland afforested catchments, high energy channels and unsuitable substrate habitat, especially gravels for crayfish hatchlings. There was also a lack of instream vegetation and suitable burrowing habitat required for crayfish. As such there is no suitable availability of refuges for this species. There is potential for crayfish in the 3rd and 4th order rivers downstream of the site, such as Finisk River at Site 21 and the Colligan River at Site 23 where the river is of gentle gradient and there is suitable habitat present.

Based on the general riverine habitat, topography, steep gradient, substrate and surrounding habitat, the potential for FPM to be present within and downstream of the proposed project was considered to be poor.

The results of the general physical river habitat assessment are presented in Table B1-1 in Appendix B. Photographs of all sampling sites on each watercourse are shown in Appendix C. The river habitat assessment taken at survey sites along each river is discussed in Section 3.2.3. The results from these sites are discussed in this context in order to interpret potential changes in the riverine community composition.

3.2.3 Summary of Results of Each Watercourse

Glennafallia River

Sample Sites 1-4, 6 & 7 are on the Glennafallia River. Sites 1-4 are located on the Glennafallia_010 northwest of the site. Site 6 and Site 7 are located on the Glennafallia_020, downstream of the tributaries Glennafallia_010.

This watercourse contains clear waters, with steep banks and predominantly bedrock substrate with boulders dominating in the upper reaches of the 1st and 2nd order streams.

Sites 1 to Site 4 all contained salmonid habitat, however there was limited spawning gravels, holding or nursery habitat. Further downstream, the river has a gently sloping gradient, natural sinuosity and no barriers.

Site 6 and Site 7 also had very clear waters with no evidence of pollution or other pressures. These lower sections of the river contained adequate spawning and nursery habitat for salmonid parr and holding pools for young salmonids.

Salmonids were recorded present at Site 7 from visual recording. No other fish were visually recorded present at the remaining sites within this river. No White-clawed Crayfish were captured during kick sampling. There was also no evidence recorded of crayfish carapace or claw remains on the riverbanks or bridge ledges in the form of Otter scat or remains from predation. There was no evidence of FPM present.

Site 1 was completely dry due to the recent heat wave and therefore no sampling was undertaken at this site.

Site 2 showed evidence of enrichment from forestry and animals due to the presence of algae. The water was also slightly peat stained. The water quality at this site was of poor quality reflected by the dominance of Chironomids present in the sample, these represent Class C moderately pollution tolerant species. Overall, Site 2 scored an SSRS rating of 8.8 indicating it is not at risk of failing to achieve the 'good' water quality status goals of the WFD. Site 2 is evaluated as Q3, indicating moderately polluted water.

Site 3 is the furthest upstream sample on this river with low numbers of pollution intolerant class A and B invertebrates and a dominance of class C invertebrates (more pollution tolerant). The dominance of Class C species within the sample indicates biological water quality rating of Q3-Q4 slightly polluted site. This site scored an SSRS rating of 6.4 indicating it is at risk.

Site 4 on the Glennafallia_010 is located downstream of sites 1-3. The high diversity (9 families) within this sample, coupled with the presence of clean water stonefly and mayfly species means that this sample site is evaluated as Q4, an unpolluted site. This site scored an SSRS rating of 8.8 indicating it is not at risk.

Site 6 contained a very low number of species present (n=8) and is evaluated as Q3, a moderately polluted site, due to the presence of the small number of Class B and Class C species. This site scored an SSRS rating of 4.0 indicating it is at risk.

Site 7 was dominated by pollution intolerant species however it contained four families of Class C invertebrates. The biological water quality at this sample site is evaluated as Q3-4 slightly polluted. This site scored an SSRS rating of 10.4 indicating it is probably not at risk.

Monavugga River

Site 5 is located on the Monavugga River. This is a very slow flowing, river that was very clean, and of a gentle sloping gradient. This is a good salmonid river with adequate spawning and nursery habitat present. No fish were recorded present here after a visual survey. During the surveys, no White-clawed Crayfish were captured during kick sampling. There was also no evidence recorded of crayfish carapace or claw remains on the riverbanks or bridge ledges in the form of Otter scat or remains from predation. There was no evidence of FPM present.

The kick sample carried out at Site 5 contained species of Class A and Class B invertebrates which resulted in an evaluation of the biological water quality as Q4 unpolluted site. This site scored an SSRS rating of 6.4 indicating it is at risk.

Glenshelane River

The Glenshelane Rivers upper reaches are steep, fast flowing, natural streams. Sites 8, 9, 10, 11, 12 and 19 are located on the Glenshelane_010, west of the proposed wind farm site.

Sites 8, 9, 10 and 19 are all sites within 1st and 2nd order streams. These sites all contained suitable substrate, cobbles and gravels for salmonid spawning and nursery habitat. They also contained areas of suitable holding pools. Salmonids were also visually recorded at site 10. This indicates that there are no potential downstream barriers and that trout are spawning at this altitude. No fish were recorded present at sites 9 and 19 after a visual survey. During the surveys, no White-clawed Crayfish were captured during kick sampling. There was also no

evidence recorded of crayfish carapace or claw remains on the riverbanks or bridge ledges in the form of Otter scat or remains from predation.

The downstream tributaries at Site 11 and 12, are 2nd order streams that contain a steep profile, dominated by boulders and cobbles. These sites lacked suitable habitat for salmonids. They contained minimal spawning gravels, nursery habitat and holding pools. Suitable silt habitat for lamprey ammocetes was recorded present at Site 11.

There is also a natural barrier to fish migration at site 11, due to the large drop in the riverbed. No fish were recorded present at these sites here after a visual survey. During the surveys, no White-clawed Crayfish were captured during kick sampling. There was also no evidence recorded of crayfish carapace or claw remains on the riverbanks or bridge ledges in the form of Otter scat or remains from predation. There was no evidence of FPM present.

Site 8 sample contained invertebrate species of Class A and Class B and Class C category. During kick sampling at site 8, a young brown trout parr (4cm in length) was caught in the net (see **Error! Reference source not found.**). The biological water quality evaluation for Site 8 is Q4 unpolluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Site 9 only contained EPA Class C (n=7) water invertebrates representing four families within the sample indicating an invertebrate community towards pollution tolerant forms. This included mayfly Baetidae, caddis Hydropsychidae, beetle Elmidae and Gammaridae. This site contained very small species numbers and was only represented by Class C. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 3.2 indicating it is at risk.

Site 10 contained 8 families (n=23) and represent EPA Class B and C. It contained mayfly Ephemeridae (n=4), Class B and Baetidae (n=1) Class C. Stonefly was also present, represented by Leuctridae (n=2) Class B. There were three families of cased caddis present, Goeridae (n=3), Sericostomatidae (n=3), both Class B and Philopotamidae (n=3) Class C. This site contained very small species numbers and was represented by Class B and C species. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Site 11 was poorly represented with only four families present. It was dominated by Class C (moderately pollution tolerant) species. The largest number of these Class C species was Gammarus sp. (n=20). Also present was Baetis sp. (n=2) which is also Class C, a mayfly species characteristic of slightly polluted waters. Chironomidae were also present (n=6), another Class C species. Only one clean water species was present, one stonefly, Nemouridae (*Nemurella picteti*) representing Class A. This site was mostly represented by Class C however the presence of the stonefly gives the site an assigned Q3-4 value, a slightly polluted site. This site scored an SSRS rating of 3.2 indicating it is at risk.

Site 12, there was an absence of Class A species and an absence of stonefly and mayfly. This sample was dominated by cased caddis, Sericostomatidae (n=15) which is a Class B species. It also contained freshwater beetles including four species of Dytiscidae and one Elmidae as well as one Chironomidae and two Gammarus sp. Which all represent Class C moderately pollution tolerant species. Based on the presence of species of Class B and Class C category within the sample, this site represents a Q3-4 slightly polluted site. This site scored an SSRS rating of 4 indicating it is at risk.

Site 19 contained eight families which were representing Class A, B and C species. Stonefly was present, represented by Perlodidae (n=1) Class A. The sample was dominated by mayfly, Ephemeridae (n=3), Class B and Baetidae (n=5) Class C. It also contained freshwater beetles, one Elmidae as well as Gammarus sp. which all represent Class C moderately pollution tolerant species. This site represents a Q3-4 slightly polluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Finisk River

Sites 13, 14, 15, 18 and 22 are located on the Finisk_030. Sites 13, 14 and 22 are located in the upper reached of the Finisk_030. During the surveys, no White-clawed Crayfish were captured during kick sampling. There was also no evidence recorded of crayfish carapace or claw remains on the riverbanks or bridge ledges in the form of Otter scat or remains from predation. There was no evidence of FPM present.

Site 13 contained the lowest numbers of macroinvertebrate families. This site had very low species diversity and was dominated by Gammarus sp., a Class C (moderately pollution tolerant) species. The biological water quality at this sample site was evaluated as Q3, a moderately polluted site. This site scored an SSRS rating of 2.4 indicating it is at risk.

Site 14 was dominated by Class C (moderately pollution tolerant) species and was assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 4.0 indicating it is at risk.

Site 15 substrate was dominated at both sites by cobble and contained gravels suitable for salmonid spawning. Its profile was riffle and glide with no holding pools present. It contained both spawning and nursery habitat for salmonids. No fish were recorded present at Site 15. There is a bridge apron present at Site 15 which may become are barrier at low water levels. The waters were clean with no evidence of pollution. The macroinvertebrate sample collected at Site 15 was dominated by Class B and C macroinvertebrate species, based on this, it is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 5.6 indicating it is at risk.

Site 18 waters were clean with no evidence of pollution. The substrate was dominated at both sites by cobble and contained gravels suitable for salmonid spawning. Its profile was riffle and glide with no holding pools present. It contained both spawning and nursery habitat for salmonids. Suitable silt habitat for lamprey ammocetes was recorded present at this site. Salmonids were recorded present at Site 18 after a visual survey. Site 18 contained six lamprey, ranging from 1.5cm-7cm.The kick sample taken at Site 18 was largely dominated by *Gammarus* sp., a Class C (moderately pollution tolerant) species. This site was assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 5.6 indicating it is at risk.

Site 21 on the Finisk_020 watercourse had very clean waters with no evidence of pollution or enrichment. It had a gentle sloping gradient with a natural profile. The substrate present was dominated by cobble and contained good spawning gravels. This section of river contained a riffle-glide-pool sequence and provided adequate spawning and nursery habitat for salmonids as well as holding pools. Suitable silt habitat for lamprey ammocetes was recorded present at this site. During kick sampling, eight three-spined stickleback were recorded within the sample. No other fish were recorded present at this site after a visual survey. Site 21 contained four lamprey ammocetes that were all 2cm in length (See Appendix Plate C-13). This site was estimated to contain over 250 macroinvertebrates across nine families. The biological water

quality at this site is evaluated as Q4 unpolluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Site 22 is located along the boundary of a conifer plantation where it showed signs of modification as it had been deepened and given a V-shaped profile. No fish were recorded present at these sites after a visual survey. Suitable silt habitat for lamprey ammocetes was recorded present at this site. Site 22 contained eight families of macroinvertebrates represented by Class B and Class C species. The biological water quality was assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 2.4 indicating it is at risk.

Farnane River

Sites 16 and 17 are located on the Farnane_010. During the surveys, no White-clawed Crayfish were captured during kick sampling. There was also no evidence recorded of crayfish carapace or claw remains on the riverbanks or bridge ledges in the form of Otter scat or remains from predation. There was no evidence of FPM present.

Site 16 is located on a section of the river that is clear with no evidence of modification, barriers, pollution or enrichment. Its substrate was dominated by boulder and cobble with some gravels present. The flow profile comprised of a sequence of riffles and glide with no pools present. It contained adequate spawning and nursery habitat but lacked adequate holding habitat. No fish were recorded present at this site after a visual survey. Site 16 was dominated by Class C (moderately pollution tolerant) species. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 5.6 indicating it is at risk.

Site 17 is a 2nd order stream located within a steep valley that is moderately sloping. This section of the river has no evidence of modification, barriers, pollution or enrichment however, it was heavily shaded. The substrate is dominated by boulder and cobble with some gravel present. The flow profile contained riffle and glide sections but no pools were recorded. Spawning habitat with limited nursery habitat was recorded at this site but no holding habitat for fish was recorded. No fish were recorded present at this site after a visual survey. Site 17 was dominated by Class C (moderately pollution tolerant) species. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 2.4 indicating it is at risk.

Site 20 is located at the upper reaches of this river, as it borders the conifer plantation. This is a narrow natural unmodified shallow stream, with a gradual gradient. There is no shading present at this site. There is no evidence of pollution or enrichment at this site. Its substrate is dominated by cobble over exposed bedrock, with some gravels and boulders present. Its profile is predominately riffle with limited pools. There was no spawning and nursery habitat present at this site, and there were minimal holding pools for salmonids. Suitable silt habitat for lamprey ammocetes was recorded present this site. No fish were recorded present at this site after a visual survey. Site 20 was assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 4.0 indicating it is at risk.

Colligan River

Site 23 is located on the Colligan River, where the proposed directional drilling will take place for the proposed GCR This river contained heterogenous fluvial habitat and provides ideal rearing conditions for salmonids and is known to be a very good sea trout river. There was no evidence of pollution and the water was very clean at the time of surveying. Its substrate is

dominated by gravels and it has a riffle-glide-pool sequence. This section of river contained very good spawning and nursery habitat for salmonids with numerous large holding pools present. No other fish were recorded present at this site after a visual survey. There was potential for both river, brook and lamprey spawning habitat as it contained suitable gravels. There was limited silt present however and no ammocetes were recorded. During the surveys, no White-clawed Crayfish were captured during kick sampling. There was also no evidence recorded of crayfish carapace or claw remains on the riverbanks or bridge ledges in the form of Otter scat or remains from predation. There was no evidence of FPM present.

3.2.4 eDNA Survey Results

Salmon, White Clawed Crayfish and FPM presence/absence was screened for in the eDNA samples. Samples were collected at six sites across the Glennafallia_010, Glennafallia_020, Glenshelane_010, Finisk_030 and the Farnane_010. A table of the eDNA laboratory sampling results obtained from the collected water samples are in provided in Appendix E, Table E 1-1. Results showed salmon to be present in three locations on the Glennafallia_020 and the Franane_010 watercourses at the sample sites and potentially upstream. However, salmon was not detected by eDNA sampling in the remaining watercourses sampled upstream. White Clawed Crayfish and FWM eDNA sample results showed these species to be absent from these watercourses at the sample sites and upstream.

4. DISCUSSION

4.1 RIVERINE HABITAT

As mentioned, a total of 11 sites were surveyed within the proposed wind farm site and 12 site downstream of the proposed project. Many of the upper reaches of the watercourses surveyed within the proposed project site boundary are first order, small, shallow, high-energy, upland eroding streams draining afforested and or blanket bog areas.

The lower reaches of watercourses within the proposed are second and third order watercourses that have a moderate energy and flow at a lower gradient and less energy. Overall the watercourses within the proposed project featured cobble/boulder-dominated substrata over exposed bedrock and lacked (not absence) of finer gravels. These contained limited spawning gravels present (5-25%) within these sites with the exception of Site 20 that contained 70% gravels. There was also limited presences of riffle and glide sequences and a mixed substrata bed within the rivers and lack hold deep holding pools.

Downstream of the proposed project site, the watercourses are third and fourth order and have a low energy with moderate flow with deposition features. These watercourses contained a similar range of gravels however there is a reduction in boulder dominated habitat and increase in deposition material of sand and silt and holding pools.

4.2 FISHERIES

4.2.1 Salmonids

The watercourses within the proposed wind farm site are located within an upland area and invariably featured high-energy flows exposed to regular spate conditions, often flowing over moderate to steep gradients. The streams comprising of high natural gradient habitat, such as the Glennafallia_010 and the Glenshelane_010 which are located within the site boundary, offer limited spawning and quality nursery habitat value for salmonids and limited holding habitat for larger salmonids. high energy flows of the streams. This is mainly due to these being 1st order streams been small in size with shallow water depth, cascading boulder-pool profile, High-energy flow, inaccessible reaches, and steep gradient. These upper reaches of watercourses are considered inaccessible for migratory salmon and not suitable for spawning or provide suitable nursery habitat for alvins and parr.

The lower reaches of the streams within the proposed project, provide suitable spawning and nursery habitat, as seen at Sites 13, 14 and 22 on the Finisk River, however these sections of river were impacted by siltation and filamentous algae due to the adjacent peat and forestry influences and deer and sheep access to the rivers. Results from eDNA sample also confirm the absence of salmon in watercourses within the proposed project.

However, the streams located within the proposed project are considered likely to be used as trout spawning and nursery areas, as seen with a brown trout parr captured at Site 8 during kick sampling. Young brown trout are typically the dominant species in these upland reaches and are known to occur at high altitudes however these upper reaches are not suitable for adult brown trout. In general, adult salmonids are deemed to enter these upper reaches only during the salmonid spawning season.

The sites located on watercourses downstream of the proposed project site, outside of its boundary, offer improved salmonid habitat due to the low-lying topography, substrate composition and lower energy nature of the watercourses. This was evident in the lower reaches, where suitable salmonid holding habitat was recorded present at Site 21 and 23 on the Finisk and Colligan River, as it contained deep glides and holding pools as well as, ideal substrate conditions for the early life stages of salmonids. Suitable salmonid habitat is confirmed by their presence from positive EDNA samples on the Farnane_010 and Glennafallia_020 watercourse.

Overall, the smaller upland eroding streams located with this proposed project lacked quality spawning and nursery for salmonids nursery habitat resulting from higher gradients, higher-energy flows and spate nature of the waters. Stream gradient is known to be one of the principal determinants of juvenile salmonid production, with medium gradients most optimal in terms of successful recruitment and population persistence (Wood & Budy, 2009; O'Grady, 2006). As would be expected in upland catchments exposed to pressures from afforestation and peat escapement.

Salmonids are present within the rivers and tributaries of these catchments where good spawning and nursery habitat is available at a suitable altitude for these species. Based on the habitats present at the sites surveyed, as well as water quality, the watercourses draining the site are considered optimal for the early life stages of salmonids. However due to the high attitude in the northern sections of the proposed wind farm site, there is limited fisheries spawning or nursery habitat suitability in the upper reached of the watercourses located within the proposed wind farm site.

It must be noted that there were a number of barriers include bridge aprons and perched culverts were recorded present within the proposed project site, especially at roadway crossings within the proposed project. These represents an upstream migration barrier for migratory fish species including salmonids, lamprey and perhaps European eel. Despite the agility and persistence of salmon in leaping obstacles, falls and rapids on certain reaches of watercourses, these are considered barriers for upstream migrating salmon and European eel.

4.2.2 Lamprey

Generally, survey sites located on upland watercourses within the proposed wind farm site are not considered suitable for lamprey larval (ammocoete) species given the absence finer soft sediment accumulations required for settlement given the high-energy, fast flowing nature of watercourses. The majority of sites represented upland eroding watercourses and naturally such sites do not encourage the deposition of fine, organic rich sediment required by larval lamprey (Goodwin *et al.*, 2008; Aronsuu & Virkkala, 2014). Lamprey may occur in low densities in the mid upper reaches of the rivers assessed such as Finisk_020, Finisk_030 and Colligan_040, where flows are sufficiently slow to allow accumulation of fine substrates.

Adequate lamprey spawning habitat by way of finer, unbedded gravels was present at five sites, all located on the Finisk River downstream of the proposed project. Suitable juvenile lamprey habitat and lamprey ammocetes was also recorded in the Finisk River. The two sites positive for lamprey ammocetes on the Finisk River also concurs with surveys carried out by IFI confirming their presence on the Finisk River.

4.2.3 European eel

Suitable habitat for this species occurs in the smallest of watercourses affected by the proposed project, namely rocky substrates. However, many sites were considered sub-optimal or even unsuitable for the species given the often high gradients, high-energy profiles and typically upland nature of the channels.

All watercourses in the study area have the potential to support European eel. The European eel is subject to European Council Regulation 1100/2007 *'Establishing measures for the recovery of the stock of European eel'*. European eel is listed as 'Critically endangered' and is now 'Red Listed' according to 'Red List No. 5: Amphibians, Reptiles & Freshwater Fish' (King *et al.*, 2011).

4.2.4 Other Fish Species

Three-spined stickleback, stone loach and minnow (*Phoxinus phoxinus*) are likely to occur in most of the watercourses within and downstream of the proposed project, particularly in the lower gradient reaches of these watercourses as previously recorded by IFI.

4.3 INVERTEBRATES

4.3.1 Macroinvertebrates Assemblage

The habitats for macroinvertebrates in the watercourses draining the proposed project are generally suboptimal for macroinvertebrate production. This is a function of their erosive nature (beds dominated by larger sized substrates) and small pool size.

Macroinvertebrate assemblage's characteristic of unpolluted upland oligotrophic streams were recorded. Based on the relative abundance of macroinvertebrates that specialize in shredding (Plecoptera) and collecting (Trichoptera) as a feeding strategy, it is concluded that the aquatic ecosystems at the study sites are driven primarily by energy sources derived outside of the aquatic zone. The macroinvertebrate compositions are indicative of watercourses that require an external supply of organic matter (allochthonous organic matter) for biological sustenance. The naturally low nutrient concentrations of surface waters in the study area, coupled in some instances with their peaty nature mean that benthic life and therefore higher organisms are highly dependent on terrestrial energy sources for survival, rather than primary production instream. For example, leaf litter and aerial insects are likely important food sources for macroinvertebrates and fish, respectively. Low crustacean diversity and abundance reflects the siliceous nature of the study area.

Ephemeroptera was present through the majority of the samples with the exception of five sites. Plecoptera, were recorded at just over 50% of the sites. Plecoptera are herbivores and are generally found in cold, well oxygenated, fast-moving streams.

Along with the Plecoptera, both Ephemeroptera and Tricoptera are often good indicators of cool, well oxygenated waters and are sensitive to pollution. In fact, these taxa are used as indicators of high water quality, and their abundance is quantified as the EPT index (Ephermoptera, Plecoptera, Tricoptera). It is likely that the particularly low abundance or absence of Ephemeroptera and Tricoptera in sites is due to both the riverbed and a water quality issue.

4.3.2 White-clawed Crayfish

No White-clawed Crayfish were recorded during kick sampling and hand searching at each site. The watercourses located within the proposed wind farm site did not have suitable habitat for White-clawed Crayfish due to unsuitable geology, peatland afforested catchments, high energy channels and unsuitable substrate habitat, especially gravels for crayfish hatchlings. There was also a lack of instream vegetation and suitable burrowing habitat required for crayfish. As such there is no suitable availability of refuges for this species. Results from the eDNA samples also confirmed their absence from Glennafallia_010, Finisk_030 and the Farnane_010 watercourses.

In most of its range, White-clawed Crayfish is found most commonly in first-order streams, but in Ireland it has a much wider habitat range occurring in small and medium-sized lakes, large rivers, streams and drains wherever there is sufficient lime (Lucey and McGarrigle 1987). White-clawed Crayfish have not been recorded in any of the watercourses within or downstream of the proposed project. This species is not expected to occur in the other watercourses draining the proposed project, considering the siliceous underlying geology. Therefore, it can be assumed that there is no potential impact on this species.

4.3.3 Freshwater Pearl Mussel

FPM were not found in any of the watercourses surveyed within the study area of this proposed project. FPM were not detected from eDNA sampling for their presence in the Glennafallia_010, Finisk_030 and the Farnane_010 watercourses. The riverine habitats in the surveyed reaches of these channels were also unsuitable for FPM, both river stretches failing ecological quality objectives for FPM habitat, with reference to the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.

FPM are found in rivers with clean, well oxygenated riverbeds with stable cobble and gravel beds which contain very little fine material required to successfully reproduce. This type of substrate allows for free water exchange between the open river and the water within the substrate. The continuous exchange of water ensures high oxygen levels in the substrate, which is essential for juvenile development.

While the majority of streams within the proposed project site are fast flowing, and lack sedimentation, the upper reaches of watercourses located within the proposed project are also at risk of drying out during summer months as seen at Site 1 on the upper reaches of the Glennafallia River.

The streams within the proposed project flow through upland heath and conifer plantation that contain inorganic silt, organic peat, and detritus (pine needles) which results in unsuitable oxygen levels.

No inorganic silt, organic peat, and detritus should be present in the water as this material can not only block oxygen exchange, but also consume oxygen as a result of decomposition processes. Extremely low levels of nutrients in the water are therefore also key for the species to complete its life cycle (Moorkens *et al.*, 2017). Tree clearing and planting and areas of cleared forestry was present within areas of the proposed project site, and also evident was the undercutting on the banks of the streams. The species is very sensitive to the deterioration of its natural habitat, and initiatives to stabilise riverbanks and riverbed re-profiling can be highly

detrimental (Layman Report 2008). Tree planting contributes to the release of sludge and silt into the river system due to wetland drainage and destabilization of the riverbank.

Nutrient enrichment may impact upon the species and/or its habitat. Nutrient enrichment is the increase in the concentration of nutrients such as phosphorus and/or nitrogen in the water. Phosphorus and nitrogen compounds can be directly toxic to FPM. Again, the streams within the proposed project would have exposure to nutrients due to the forestry plantation.

As outlined, the steams within the proposed project hold limited suitable habitat for salmonids upstream due to the steep gradient, poor spawning habitat and minimal nursery habitats. There is an absence of the sandy, gravelly substrate, which is needed by both the juvenile mussel to develop, but also the salmonids to spawn.

Areas which are stabilised by larger boulders, and which contain sand and small gravel, make an ideal habitat for juvenile FPM (Hendelberg 1960, Hastie *et al.* 2003, Geist and Auerswald 2007). Within the majority of the streams across the proposed project, large boulders were present. The site must also be a fast-flowing area without too much sedimentation, with sufficiently low water temperatures. Areas with major siltation do not contain FPM (Hendelberg 1960). The stability of the substrate is important (Strayer 2008) and is governed by the substrate's composition, the extremes of flow and the gradient of the watercourse.

It is important both on the meta- and macro-habitat scale that the area close to the watercourse has a high degree of tree coverage. The optimal habitat for FPM has shade of 60-100 percent (Moog *et al.* 1993). The forest provides shade and thereby reduces the water temperature, which is an increasingly important factor (Morales *et al.* 2004). The streams within the proposed project site do not have a high degree of tree coverage and the majority of streams had 0-25% shading present. The streams with heavy shading are located within a conifer plantation.

The proposed project occurs west of a FPM sensitive area, namely the Suir_SC_120 sub-catchment which is not hydrologically linked to the proposed project. The Suir_SC_120 sub-catchment is identified having 'Previous records of Margaritifera, but current status unknown'. FPM were not detected from eDNA sampling for their presence in the Glennafallia_010, Finisk_030 and the Farnane_010 watercourses. The riverine habitats in the surveyed reaches of these channels were also unsuitable for FPM, both river stretches failing ecological quality objectives for FPM habitat, with reference to the European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009[11].

Overall, it can be seen that the ecological requirements for FPM are not present within the streams of the proposed project due to a number of factors, as discussed above. Therefore, it can be assumed that there is no potential impact on this species.

4.4 Biological Water Quality

The latest EPA biological monitoring of watercourses in the study area showed water quality to be satisfactory as indicated by the latest EPA Q-ratings. The biotic indices derived at the study sites also indicate water quality of the watercourses within and downstream of the proposed project is achieving satisfactory water quality with Q values that ranging from Q3, to Q4. These ratings indicated a range from unpolluted to moderately polluted water quality and range from "Moderate to High" ecological status. However, the SSRS score indicates a large percentage of

these watercourses are “At Risk” of failing to meet “Good” ecological status as required under the WFD.

Within the Glennafallia River, the water quality ranges from moderately polluted to unpolluted within both the upper reaches and downstream with the upper reaches at risk, and the lower reaches probably not at risk, indicating an improvement of water quality downstream. The Monavugga River showed to be moderately polluted and is at risk.

The Glenshelane River water quality ranges from moderately polluted to unpolluted both within the upper and lower reaches with no immediate reasoning for the range however the downstream unpolluted tributaries of the Glenshelane River are not located within forestry plantation. Within the Finisk River, the upper section of this river shows to be unpolluted and not at risk. Sites downstream were moderately polluted and at risk. Sites located with the Sitka spruce plantation showed signs of modification and are moderately polluted. This forestry may be a contributing factor here.

The Farnane River indicate it’s moderately polluted and at risk. This river rises on the northern boundary of the site and flows south downstream through the Sitka spruce plantation. This plantation may be a contributor to the poor water quality result of this river. The Colligan River achieved good status, however this river is also at risk.

As such the majority of the sites have a moderate status, while only a few are achieving the target Q4 good status water quality required under the WFD. It is likely that diffuse agricultural and forestry enrichment are contributing factors to the localised declines in water quality. Macroinvertebrate diversity corresponded with habitat suitability, with greater diversity recorded in areas of better habitat. In the Irish context, biological water quality in the study area is considered good, considering the range of pressures on surface waters at a national level, such as nutrient, organic, chemical, and sediment pollution.

IFI and EPA have identified significant pressures for waterbodies that are at risk of not meeting their water quality objectives under the WFD by incorporating over 140 datasets, a suite of modelling tools, and local knowledge from field and enforcement staff from the local authorities. While there are a multitude of pressures in every waterbody, the significant pressures are those pressures which need to be addressed in order to improve water quality. A robust scientific assessment process has been carried out to determine which pressures are the significant pressures. The Blackwater River and its tributary, the Glennafallia are categorised as watercourses under significant pressure from forestry and industry (EPA 2024).

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Appendix A-I BIOTIC INDICES

Table A 1-1: Biotic Index Scoring System for the Q-Scheme

Q5, 4-5, 4	Unpolluted	Class A
Q3-4,	Slightly Polluted	Class B
Q3, 2-3	Moderately Polluted	Class C
Q2, 1-2, 1	Seriously Polluted	Class D

Table A1-2: Small Streams Risk Score Categories

<6.5	Stream at Risk
>6.5-7.25	Indeterminate stream may be at risk
>7.25	Probably not at risk

Appendix B-I PHYSICAL CHARACTERISTICS OF THE STUDY SITES

TABLE B1-1: PHYSICAL CHARACTERISTICS OF THE STUDY SITES

Site	Mean Dept (cm)	Instream vegetation (%)	Bank Height (m)	Bank Width (m)	Riffle (%)	Glide (%)	Pool (%)	Shade (%)	Boulder (%)	Cobble (%)	Gravel (%)	Sand (%)	Silt (%)	Algae (%)
1 (Dried out)	N/A	N/A	8.5	7	N/A	N/A	N/A	0	40	40	15	5	0	None present
2	3.3	0	.5	2	30	70	0	0	70	25	5	0	0	Present, 20%
3	7	0	.25	4	20	75	5	25	40	40	15	5	0	None present
4	6.5	25	.5	4	50	50	0	25	10	75	15	0	0	None present
5	10.5	0	.5	6	40	30	30	75	45	30	20	5	0	None present
6	16.8	0	.3	9	50	50	0	75	40	40	15	5	0	None present
7	13	5	.55	9	70	25	5	50	40	40	15	5	0	Present, 10%
8	3.5	0	.3	4	40	30	30	75	70	20	10	0	0	Present, 70%
9	8	0	1	1.5	45	25	30	25	60	30	10	0	0	Present, 5%
10	5.4	0	3	6	25	60	15	25	60	25	10	5	0	None present
11	6	5	.5	2	80	20	0	25	2	55	35	5	3	None present
12	4.5	0	12	8	60	20	20	75	40	45	5	10	0	None present
13	4.5	0	1	2.5	60	40	0	75	50	30	10	10	0	None present

Site	Mean Dept (cm)	Instream vegetation (%)	Bank Height (m)	Bank Width (m)	Riffle (%)	Glide (%)	Pool (%)	Shade (%)	Boulder (%)	Cobble (%)	Gravel (%)	Sand (%)	Silt (%)	Algae (%)
14	9.7	0	1	3	20	10	70	50	40	45	20	10	0	None present
15	3.5	0	1	6	60	40	0	50	30	40	20	10	0	None present
16	8	0	.9	6	60	40	0	50	40	40	15	5	0	None present
17	3.2	0	2	4	40	60	0	75	50	25	20	5	0	None present
18	12.5	25	1	10	80	20	0	25	5	60	30	5	0	None present
19	14.5	0	5.5	7	70	25	5	50	60	10	20	10	0	None present
20	4.8	0	.2	.4	90	10	0	0	10	10	70	10	0	None present
21	22.8	15	2.5	20	40	40	20	25	20	50	25	0	5	None present
22	8	0	3	5	50	0	50	50	10	60	25	0	5	None present
23	35	0	2.5	15	20	30	50	50	25	23	30	15	2	None present

Appendix C-I PHOTOGRAPHS OF THE SAMPLING SITES AT EACH WATERCOURSE

Plate C- 1: Site 1 on the Left, Dried Out, Site 2 on the Right, Heavy Presence of Filamentous Algae.

Plate C- 2: Site 3, on the Left, a 1st Order Stream and Site 4, on the Right, a 2nd Order Stream. These Run South of the Site, Outside of the Proposed Project.

Plate C- 3: Site 6, on the Left and Site 7 on the Right. These 3rd Order Rivers Contain Nursery Habitat for Salmonid Parr and Holding Pools Suitable for Young Salmonids.

Plate C- 1: Site 5 on the Monavugga River Containing Spawning Gravels.

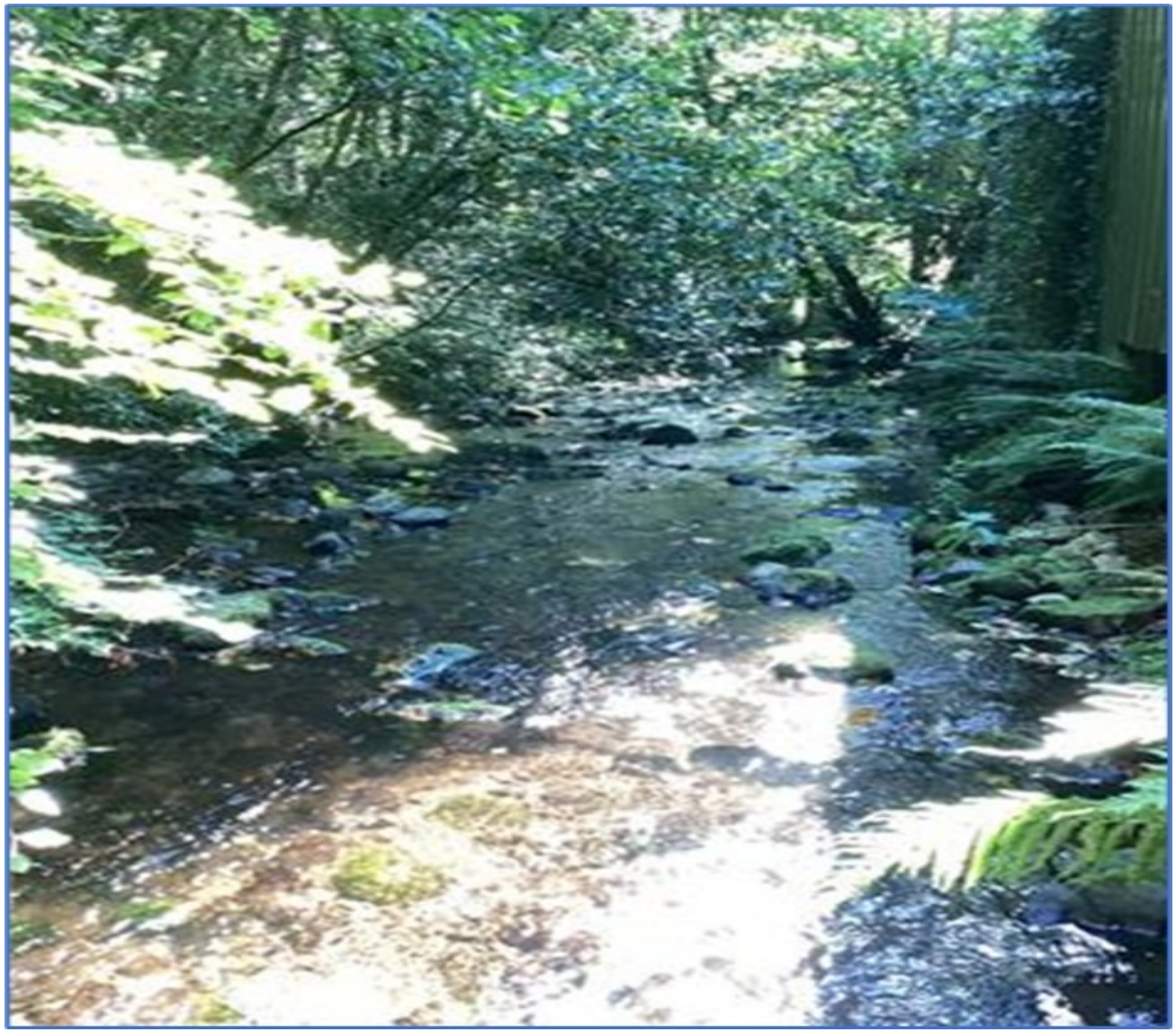


Plate C- 2: Site 8, a 1st Order Stream Containing Shallow Holding Pools for Trout on the Left and Site 9, a Narrow Straight 1st Order Stream With Limited Spawning Gravels for Salmonids on the Right.

Plate C- 3: Site 10 and Site 19 on the Glenshelane River, a Fast Steep Gradient 2nd Order Stream Dominated by Boulders.

Plate C- 4: Site 11 on the Left, a Tributary of the Glenshelane River That is Prone to Drying Out and Site 12 on the Right, With Limited Spawning Habitat Present for Salmonids.

Plate C- 5: Site 21, Located Outside the Proposed Project, This 3rd Order River Contains Ideal Spawning and Nursery Habitat for Salmonids and Spawning and Silt Habitat for Lamprey.

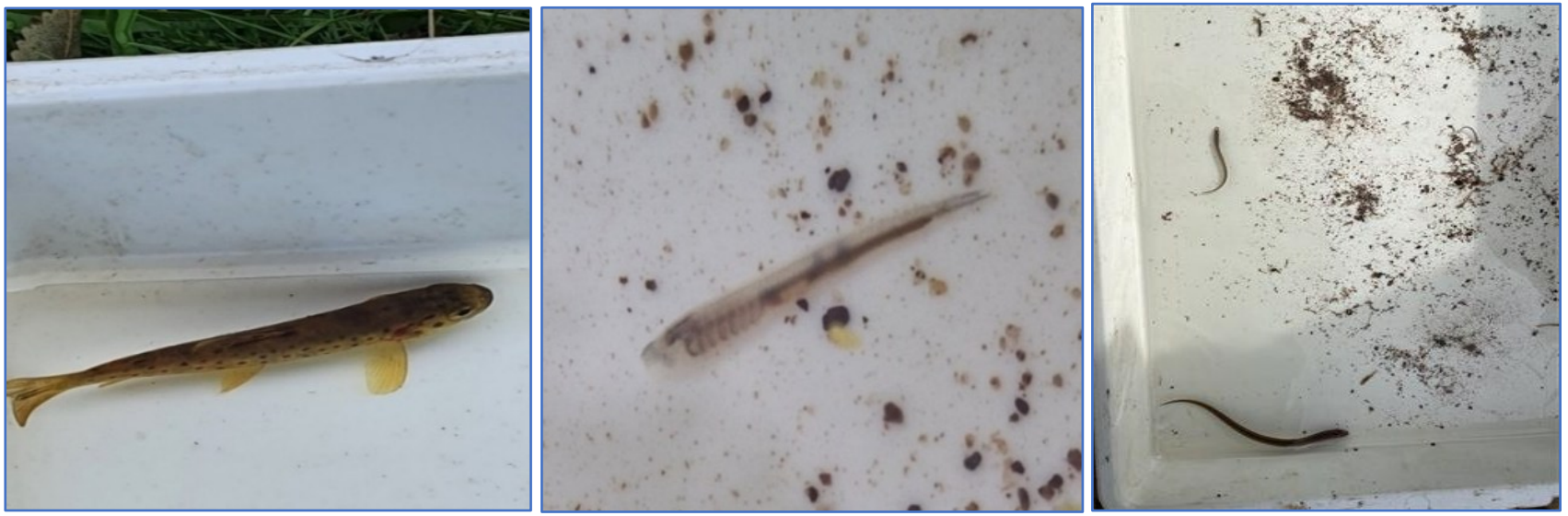
Plate C- 6: First Order Streams at Site 13, 14 and 22 on the Finisk River, Flowing on the Boundary of a Sitka Plantation.

Plate C- 7: Salmonid Spawning and Nursery Habitat Present at Site 15, on the Left and Site 18 on the Right of the Finisk River Downstream of the Proposed Project

Plate C- 8: Site 20 on the Left is a peat stained 1st Order Stream Lacking Salmonid Habitat. Site 16, Centre, is a Fast-Flowing 2nd Order Stream Containing Adequate Salmonid Spawning Habitat. Site 17, Right, Lacking Holding Habitat for Fish.

Plate C- 9: The Colligan River, Sampled at Site 23. This 4th Order River Contained Ideal Spawning and Nursery Habitat for Salmonids.

Plate C- 10: Brown Trout Parr Recorded at Site 8 on the Glenshelane River, (Left Photo). Lamprey Ammocetes Recorded at Site 18, (Centre Photo), and Site 21 on the Finisk River, (Right Photo).



Appendix D-I MACROINVERTEBRATES

A table listing all of the macroinvertebrates recorded at each site is provided in Appendix D Table D1-1. The species listed are separated by the EPA taxonomic classes as prescribed above and colour coded for clarity.

Glennafallia River

Site 1-4, located on the Glennafallia_010 northwest of the site. Water levels were very low due to recent high temperatures. Site 1 was completely dry due to the recent heat wave and therefore no sampling was undertaken at this site. At site 2, there was evidence of enrichment from forestry and animals due to the presence of algae. The water was also slightly peat stained. The water quality was poor and reflected by the dominance of Chironomids present in the sample, these represent Class C moderately pollution tolerant species. There was one species of stonefly present, Leuctra sp. Which is a Class A species. Overall, this site scored an SSRS rating of 8.8 indicating it is not at risk. The results indicate to represent a Q3, indicating moderately polluted water.

The furthest upstream sample on this river was Site 3. The composition of this sample had low numbers of pollution intolerant class A and B invertebrates and a dominance of class C invertebrates (more pollution tolerant). The class A invertebrates included, one stonefly species, a single specimen of *Nemurella picteti.* The more pollution tolerant class C was found in higher numbers, including Mayfly species *Caenis luctuosa*, caddis fly species *Rhyacophila dorsalis, Philopotamus montanus* and *Odontoceium albicorne* and one species of Elmidae and *Gammarus pulex*. The dominance of Class C species within the sample indicates the sample is representative of Q3-Q4 slightly polluted site. This site scored an SSRS rating of 6.4 indicating it is at risk.

Site 4 on the Glennafallia_010 was located downstream of sites 1-3. The site had a high number of the mayfly species Baetis sp. (n=20) which is Class C. It also contained mayfly species of Heptageniidae and Ephemeridae which belong to Class A and B. Stonefly were also in the sample, Leuctridae, *Leuctra hippopus* (n=10) (Class B clean water species). There was also evidence of cased caddis within the sample Goeridae (class B) and Rhyacophila sp. (Class C) in low numbers. Elmidae, Chironomidae and Gammarus sp. Which are Class C pollution tolerant species were present in low numbers. The high diversity (9 families) within this sample, coupled with the presence of clean water stonefly and mayfly species and the dominance of Baetis sp. And the other Class C families, the sample indicates to represent a Q4, an unpolluted site. This site scored an SSRS rating of 8.8 indicating it is not at risk.

Site 6 and Site 7 are located on the Glennafallia_020, downstream of the tributaries Glennafallia_010. Within Site 6, it contained a very low sample number of species present (n=8). Odontoceridae (Class B) cased caddis was dominant (n=3). Other families recorded included Leuctridae (stonefly Class B) and Philopotamidae caseless caddis, Class C). One species of mayfly was present, Baetis sp. (Class C), and one species of stonefly was also present, Leuctridae, *Leuctra hippopus* which is a Class A species. Gammarus sp. Was also present, however only one was counted. Based on the sample, the presence of the small number of Class B and Class C species represents a Q3, a moderately polluted site. This site scored an SSRS rating of 4.0 indicating it is at risk.

Site 7 was dominated by mayfly with two families recorded, Ephemeridae (n=6), Class B and Baetidae (n=5) Class C. It also contained the pollution intolerant Class A stonefly Nemouridae (n=2) and Class B Leuctridae (n=2). The sample also included species of cased and caseless caddis species Goeridae (Class B) and Polycentropodidae (Class C). Class C was also represented by the presence of Elmidae and Chironomidae, both containing one species. The sample was dominated by pollution intolerant species however it contained four families of Class C invertebrates. This indicated that the sample was representative of a Q3-4 slightly polluted site. This site scored an SSRS rating of 10.4 indicating it is probably not at risk.

Monavugga River

The Monavugga River at Site 5 contained similar amounts of Class B and Class C invertebrates. The site had equal number of mayfly Ephemeridae (n=12) and Baetidae present (n=12). It also contained one species of stonefly Taeniopterygidae which is pollution intolerant. It contained cased caddis species Limnephilidae, Goeridae and Odontoceridae which are Class B in low numbers (n=7) and also Rhyacophila sp. Which is Class C (n=2). Class C was also represented by the presence of Gammarus within the sample (n=5). Based on the presence of species of Class A and Class B present within the sample, this site represents a Q4 unpolluted site. This site scored an SSRS rating of 6.4 indicating it is at risk.

Glenshelane River

Sites 8, 9, 10, 11, 12 and 19 are located on the Glenshelane_010, west of the proposed wind farm site.

Site 8 contained mayfly, Heptageniidae (n=1) Class A and Ephemeridae (n=5) Class B and also stonefly Leuctridae (n=1) Class B. The sample also contained cased caddis Goeridae (n=1) Class B as well as the riffle beetle Elmidae (n=3) and Chironomidae (n=3) both Class C. Based on the presence of species of Class A and Class B and Class C category within the sample, this site represents a Q4 unpolluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Site 9 only contained EPA Class C (n=7) water invertebrates representing four families within the sample indicating an invertebrate community towards pollution tolerant forms. This included mayfly Baetidae, caddis Hydropsychidae, beetle Elmidae and Gammaridae. This site contained very small species numbers and was only represented by Class C. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 3.2 indicating it is at risk.

Site 10 contained 8 families (n=23) and represent EPA Class B and C. It contained mayfly Ephemeridae (n=4), Class B and Baetidae (n=1) Class C. Stonefly was also present, represented by Leuctridae (n=2) Class B. There were three families of cased caddis present, Goeridae (n=3), Sericostomatidae (n=3), both Class B and Philopotamidae (n=3) Class C. This site contained very small species numbers and was represented by Class B and C species. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Site 11 was poorly represented with only four families present. It was dominated by Class C (moderately pollution tolerant) species. The largest number of these Class C species was Gammarus sp. (n=20). Also present was Baetis sp. (n=2) which is also Class C, a mayfly species characteristic of slightly polluted waters. Chironomidae were also present (n=6), another Class

C species. Only one clean water species was present, one stonefly, Nemouridae (*Nemurella picteti*) representing Class A. This site was mostly represented by Class C however the presence of the stonefly gives the site an assigned Q3-4 value, a slightly polluted site. This site scored an SSRS rating of 3.2 indicating it is at risk.

Site 12, there was an absence of Class A species and an absence of stonefly and mayfly. This sample was dominated by cased caddis, Sericostomatidae (n=15) which is a Class B species. It also contained freshwater beetles including four species of Dytiscidae and one Elmidae as well as one Chironomidae and two Gammarus sp. Which all represent Class C moderately pollution tolerant species. Based on the presence of species of Class B and Class C category within the sample, this site represents a Q3-4 slightly polluted site. This site scored an SSRS rating of 4 indicating it is at risk.

Site 19 contained eight families which were representing Class A, B and C species. Stonefly was present, represented by Perlodidae (n=1) Class A. The sample was dominated by mayfly, Ephemeridae (n=3), Class B and Baetidae (n=5) Class C. It also contained freshwater beetles, one Elmidae as well as Gammarus sp. which all represent Class C moderately pollution tolerant species. This site represents a Q3-4 slightly polluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Finisk River

Site 21, located on the Finisk_020. This site contained the high number of species recorded on site and contained an estimate of over 250 macroinvertebrates across nine families. It was dominated by Baetis mayfly with over n=100+ present. It also contained two other mayfly families, the Ephemeridae (n=25), a Class B and Heptageniidae (n=40), a Class A. There were two families of stonefly, Perlodidae (n=12) Class A and Leuctridae, a Class B which are pollution intolerant. There were two families of cased caddis present, Goeridae (n=3) Class B, and Rhyacophilidae (n=4) Class C. Chironomidae (n=10) and Gammarus sp. (n=30) which all represent Class C moderately pollution tolerant species were present. This site represents a Q4 unpolluted site. This site scored an SSRS rating of 8 indicating it is probably not at risk.

Site 13, 14, 15, 18 and 22 are located on the Finisk_030. Site 13 contained the lowest numbers of families present. It contained one species of caddis, *Goera Pilosa* (n=5), a Class B species and also Gammarus sp. (n=8). This site had very low species richness and was dominated by Gammarus sp., a Class C (moderately pollution tolerant) species. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 2.4 indicating it is at risk.

Site 14 did not contain any mayfly or stonefly species. There were three different families of caddis present. These were Limnephilidae (*Limnephilus flavicornis*) (n=1), Goeridae (*Silo pallipes*) (n=4) and (*Beraea maura*) (n=1), all of which are Class B species and Philopotamidae (*Philopotamus montanus*) (n=1), a Class C species. The site also contained Great Diving Beetle (*Dytiscus marginalis*) (n=1), and Elmidae, both of which are Class C (moderately pollution tolerant) species. Chromomid sp. (n=6) and Gammarus sp. (n=15) were recorded and both species are also Class C (moderately pollution tolerant) species. This site was dominated by Class C (moderately pollution tolerant) species and based on this, it is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 4.0 indicating it is at risk.

Site 15 contained two mayfly families, Baetidae *Baetis sp*. (n=3), a Class C species and Ephemeridae (*Serratella ignita*) (n=1), a Class B species. This site also contained two families of

caddis, Beraeidae and Goeridae which contained two species, *Goera sp.* (n=4) and *Beraea maura* (n=6), and the family Odontoceridae (*Odontoceium albicorne*) (n=5). These are all Class B families. The site also contained one Elmidae and Gammarus sp. (n=8), both Class C (moderately pollution tolerant) species. This site was represented by Class B and C species, based on this, it is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 5.6 indicating it is at risk.

Site 18 had a high count of invertebrates, n=55 across five families. Two families of mayfly were present, Baetidae *Baetis sp.* (n=1), a Class C species and Ephemeridae (*Serratella ignita*) (n=3), a Class B species. The site contained one family of caddis, Goeridae, which was represented by two species, *Goera Pilosa* (n=3) and *Beraea maura* (n=7). These are Class B species. The site also contained one Elmis sp. and a large number of Gammarus sp. (n=40), both Class C (moderately pollution tolerant) species. This site was largely dominated by Gammarus sp., a Class C (moderately pollution tolerant) species. This site was assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 5.6 indicating it is at risk.

Site 22 contained eight families of macroinvertebrates represented by Class B and Class C species. Mayfly Baetis sp. (n=3), a Class C species was present. Cased caddis families, Limnephilidae sp. (n=1), a Class B and Polycentropodidae (n=1), a Class C were recorded. Beetles within the families Dytiscidae and Elmidae (*Elmis* sp.) were present, five species of these Class C were recorded. This site also contained Chironomidae (n=3) and Simulidae (n=2), both a Class C (moderately pollution tolerant) species. This site was assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 2.4 indicating it is at risk.

Farnane River

Sites 16 and 17 are located on the Farnane_010. Site 16 was represented by 7 families containing 28 invertebrates in total. This site was also dominated by Class C (moderately pollution tolerant) species with the largest number of one species been Gammarus sp. (n=13). Again, mayfly was represented by Baetis sp. (n=7), a Class C species. The mayfly family Ephemeridae (*Serratella ignita*) was also present (n=1), a Class B species. There were three different caddis families recorded at this site, Goeridae (n=2) Class B, Hydropsychidae (n=1) and Polycentropodidae (n=3), both Class C. *Chironomid* sp. Was also present (n=1). This site was dominated by Class C (moderately pollution tolerant) species. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 5.6 indicating it is at risk.

Site 17 only contained 3 different families of invertebrates. Gammarus was the dominant Class C species (n-50). The site also contained 1 Great Diving Beetle (*Dytiscus marginalis*), which is a Class C species and 1 Cased caddis (*Silo pallipes*) which is a Class B species. This site was dominated by Class C (moderately pollution tolerant) species. It is assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 2.4 indicating it is at risk.

Site 20 contained the lowest number of taxa and only five species present. This 1st order stream was very narrow (40cm) and shallow (4.8cm) with no shading present. This site was located in the most upper reaches of the Farnane River and it had reduced the capacity of the stream to support macrophytes, and very high energy have limited the diversity and abundance of species present at the site.

The site contained two cased caddis, *Beraea maura,* Class B. Beetle was present, the family Hydrophilidae (n=3). This is a Class C species. This site assigned a Q3 value, a moderately polluted site. This site scored an SSRS rating of 4.0 indicating it is at risk.

Colligan River

Site 23 contained eight families. Class A species was represented by mayfly Heptageniidae sp. (n=1). Class B species was represented by stonefly Leuctridae sp. (n=1), mayfly Ephemeridae sp. (n=5). Baetis sp. Were also present (n=15), a Class C species. There were two different caddis families recorded at this site, Rhyacophila sp. (n=1), a Class C and Odontoceridae (n=1), a Class B. It was assigned a Q4 value, an unpolluted site. This site scored an SSRS rating of 6.4 indicating it is at risk.

Plate D- 1: Larva of the Ephemeroptera / mayfly Ecdyonurus sp. at Site 4 on the Glennafallia River (Left Photo). Larva of the Stonefly (Plecoptera) *Perla bipunctate* at Site 21 on the Finisk River (Right Photo).

Appendix D-II Macroinvertebrates Recorded During Biological Sampling on Watercourses Draining The Proposed Project

Table D II-I: Macroinvertebrates Recorded During Biological Sampling on Watercourses Draining the Proposed Project

Group/organism	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	EPA Class Pollution sensitivity group
Mayfly (Ephemeroptera)																							
Potamanthidae																							**B**
Potamanthus luteus		2																					
Baetidae																							**C**
Baetis			20	6	2	5		1	1	2				3	7		1	5		100	3	15	
Ephemeridae																							**B**
Serratella ignita			2	6		6	5		4					1	1		3	3		25		5	
Heptageniidae																							**A**
Heptagenia sulphurea			3																	20		1	
Ecdyonurus venosus			2				1													20		1	
Stonefly (Plecoptera)																							
Nemouridae																							**A**
Nemurella picteti		1				2				1													
Perlodidae																							**A**

Group/organism	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	EPA Class Pollution sensitivity group
Isoperla grammatica																		1					
Perla bipunctate																				12			
Leuctridae																							B
Leuctra hippopus	2		10	1	1	2	1		2											10		1	
Cased Caddisflies (Tricoptera)																							
Limnephilidae																							B
Potamophylax latipennis				1																	1		
Limnephilus flavicornis													1										
Drusus annulatas																		1					
Goeridae																							B
Goera pilosa	4		1	4		4	1					5		4			3			3			
Silo pallipes									3				4		2	1							
Beraeidae																							
Beraea maura													1	6			7	1	2				B
Rhyacophila sp.																							C
Rhyacophila dorsalis		1	1	2																4		1	
Philopotamidae																							C

Group/organism	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	EPA Class Pollution sensitivity group
Philopotamus montanus		1			1				3				1										
Hydropsychidae																							C
Hydropsyche sp.								1							1			1					
Odontoceridae																							B
Odontoceium albicorne		1		2	3									5								1	
Polycentropodidae																							C
Polycentropus flavomaculata	4					1									3								
Polycentropus kingi																					1		
Sericostomatidae																							B
Sericostoma personatum									3		15												
Beetle (Coleoptera)																							
Dytiscidae																							C
Dytiscus sp.											1												
Dytiscus marginalis													1			1							
Potamonectes depressus											1												
Ilybius ater											1										3		

Group/organism	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	EPA Class Pollution sensitivity group
Stictotarsus											2												
Cybister laterimarginalis																					1		
Hydrophilidae																							C
Hydrobius fuscipes																			2				
Berosus affinis																			1				
Elmidae																							C
Elmis		1	1			1	3	1	2		1		2	1			1	1			3		
Two Winged Flies (Diptera)																							
Chironomidae																							C
Chironomus sp.	10	2	1			1	3			6			6		1					10	3	1	
Simulidae																							C
Simulium sp.																					2	1	
Water Bugs (Hemiptera)																							
Gerridae																							C
Gerris najas											2												
Crustaceans																							
Gammerus pulex		3	5	5	1			4	5	20	2	8	15	8	13	50	40	4		30	2		C
No. of different families	4	8	9	8	5	8	6	4	8	4	5	2	7	6	7	3	5	8	2	9	8	8	
Total No. of organisms N	20	12	46	27	8	22	14	7	21	29	25	13	31	28	28	52	55	17	5	234	19	25	

Appendix E-I eDNA Results From Watercourses Draining The Proposed Project

Table E 1-1: EDNA Results From Watercourses Draining the Proposed Project

Site	Watercourse	Atlantic Salmon	White Clawed Crayfish	Freshwater Pearl Mussel	ITM (x)	ITM (y)
A1	Glennafallia_010	-	N/A	N/A	601815	605203
B1	Glenshelane_010	-	N/A	N/A	612840	606667
C1	Glennafallia_020	+	-	N/A	611861	599387
D1	Finisk_030	-	-	-	614883	600643
E1	Farnane_010	+	-	-	614966	603687
F1	Farnane_010	+	-	-	616913	601536

*Positive sample indicated by + symbol, negative sample indicated by – symbol

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