TIRAWLEY WIND FARM
AQUATIC ECOLOGY ASSESSMENT

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SUMMARY

This report presents the findings of an aquatic ecology assessment undertaken for the proposed Tirawley Wind Farm development in north County Mayo, including the associated grid connection route. The assessment characterises the receiving aquatic environment, establishes baseline ecological conditions, and evaluates the potential for impacts on aquatic habitats, species, and water quality arising from the proposed development.

The study area is located within the Blacksod–Broadhaven and Moy & Killala Bay catchments, encompassing a network of predominantly small, upper catchment streams. These watercourses are typical of upland and marginal agricultural landscapes and range from very small, intermittently flowing channels to larger 2nd and 3rd order streams. Downstream receptors include more substantial watercourses with direct hydrological connectivity to the Killala Bay/Moy Estuary SAC and SPA, which are designated for a range of aquatic and estuarine Qualifying Interests.

Baseline field surveys were completed in September 2023 at 20 representative sites and included aquatic habitat assessments, biological water quality sampling (Q-value and SSRS methods), and electrofishing surveys. The results indicate that the majority of headwater streams within the wind farm site are of limited aquatic ecology value, often characterised by small size, partial drying, and evidence of agricultural or historical drainage impacts. However, several downstream reaches support viable salmonid nursery habitat and achieve Good ecological status, with healthy populations of Brown Trout. No evidence of Freshwater Pearl Mussel or White-clawed Crayfish was recorded, although some downstream habitats are considered to have limited potential.

The primary potential impacts on aquatic ecology arise during the construction phase and relate to the risk of deterioration in water quality, particularly through the mobilisation of suspended solids, nutrient release, and accidental pollution events. There is also potential for localised disturbance to instream habitats at watercourse crossings and indirect downstream effects on sensitive ecological receptors, including Natura 2000 sites with hydrological connectivity to the development. Operational phase impacts are predicted to be negligible, while decommissioning effects are expected to be similar in nature but of reduced magnitude compared to construction.

A comprehensive suite of mitigation measures is proposed, centred on the implementation of a Construction Environmental Management Plan (CEMP) and associated Surface Water Management Plan (SWMP). These measures include strict controls on works near watercourses, sediment and erosion control, appropriate design of watercourse crossings, pollution prevention procedures, and timing restrictions to avoid sensitive periods for aquatic species. With the effective implementation of these measures, the risk of significant impacts on water quality and aquatic ecology can be avoided.

Overall, while the receiving environment includes watercourses of local ecological value and downstream connections to designated European sites, the predicted impacts of the proposed development on aquatic ecology are not significant, provided that best practice mitigation is fully implemented. Residual impacts are expected to be slight and localised during the construction phase and imperceptible once the project is built.

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1. INTRODUCTION

This report provides a description of the receiving aquatic environment of the proposed Tirawley wind farm project. The proposed Tirawley Wind farm is located in the northern parts of Co. Mayo, to the west of Killala Bay. This document provides a description of the receiving aquatic environment of the proposed wind farm and includes an assessment of the impact of the proposed development on aquatic habitats, aquatic ecological communities, and individual aquatic species.

The proposed development consists of the construction of 16 wind turbines, with a combined output of up to 68.80 MW. The site is located c.14.5 km northwest of Ballina Town, c.5.2 km northwest of the village of Killala and c.2.4 km east of Ballycastle village in north Co. Mayo. The Wind Farm Site has a total area of c.108.06 ha. The project will also include the construction of a 110 kV underground cable and tail-fed grid connection from the Wind Farm site to the existing Tawnaghmore 110 kV Substation. No works will occur within a distance of at least 50 m from watercourses (excluding watercourse crossings). No works will occur within a distance to land drains of at least 20 m. Figures 1 and 2 show the location of the proposed Tirawley Wind Farm and grid connection route.

Field survey work to inform the current assessment included kick/sweep sampling and visual assessments as well as electrical fishing surveying during September 2023. The current report was prepared by Ecofact on behalf of Jennings O'Donovan.

1.2 Legislative Context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000, which includes the Flora Protection Order (1999). The Habitats Directive 1992 has been transposed into Irish legislation as the European Union (Natural Habitats) Regulations SI 94/1997 and amended in 1998 and 2005. The Habitat Regulations have been updated in 2011 as the European Communities (Birds and Natural Habitats) Regulations (2011) to bring the Irish transposition of these regulations into line with the requirements of the EU Habitats Directive (1992).

Under the Fisheries (Consolidation) Act, 1959, it is an offence to disturb the bed of a river; therefore, it will be necessary to get written permission from Inland Fisheries Ireland to proceed with the works in any areas where disturbance to the spawning and nursery areas of both salmonids and lampreys will occur as a result of the proposed development. Salmon, all lamprey species, and their habitats are further protected under the EU Habitats Directive, 1992.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters. Suspended solids would be a key parameter here. Likewise, any visual evidence of oil/fuel in the river would constitute an offence.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting, or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

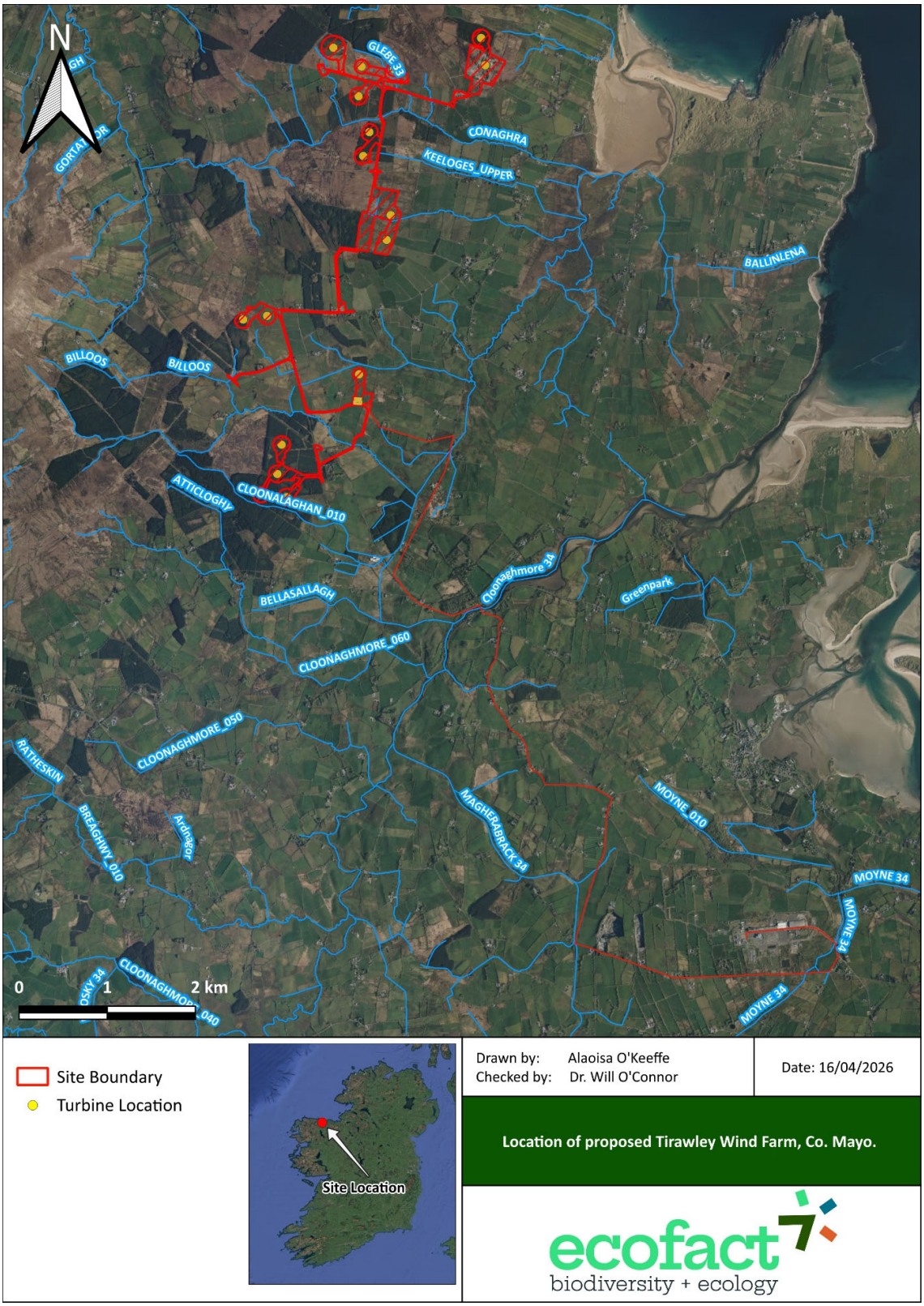

Figure 1 Location of the proposed Tirawley Wind Farm and grid connection.

2. METHODOLOGY

2.1 Introduction

This report presents the aquatic ecology assessment conducted for the proposed Tirawley Wind Farm. The assessment was based on a comprehensive desk study and baseline aquatic ecological surveys of 20 sites, completed in September 2023. Figures 2 and 3 depict the locations of the surveyed aquatic ecology sites. The conducted surveys encompassed aquatic habitat evaluations, fish population studies via electrofishing, and biological water quality assessments using kick sampling techniques. The selection of survey sites was made in agreement with the client. The survey was licenced by the Department of the Environment, Climate, and Communications under Section 14 of the Fisheries (Consolidation) Act of 1959.

2.2 Desk Study

A desktop study was undertaken to describe the aquatic ecology of the study area of the proposed Tirawley Wind Farm, Co. Mayo.

The purpose of this desk study was to identify previous records of aquatic species. This involved accessing the National Biodiversity Data Centre (NBDC) (www.biodiversityireland.ie) and the databases available here for any records of sensitive aquatic ecology receptors. The proposed development lies within the 10km grid squares G13, G12, and G22 (aquatic macroinvertebrate records were checked for downstream areas also; G23). All the records for the Glencullin North Mayo sub catchment (Glencullin[NorthMayo]_SC_010), Cloonaghmore sub catchment (Cloonaghmore_SC_010), and Abbeytown sub catchment (Abbeytown_SC_010) were reviewed.

The National Biodiversity Data Centre holds records for aquatic (freshwater) macroinvertebrates within the subject 10 km grid squares from multiple databases. These include the '*A national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018 (EPA)*', '*River Biologists' Database (EPA)*'. The information present in the relevant databases were accessed and reviewed. Moreover, any available and relevant literature was searched for using Google Scholar and all sources accessed are provided in the bibliography.

The National Parks and Wildlife Service (www.npws.ie) website and online maps were also accessed in relation to designated areas, qualifying interests, and site synopses on relevant Special Areas of Conservation with regard to aquatic ecology.

The Environmental Protection Agency (www.gis.epa.ie/EPAMaps/) websites including Catchments.ie (www.catchments.ie) and publications relating to the Water Framework Directive (WFD) were accessed to identify watercourse in study area, in relation to water quality status, and also water quality pressures in the study area. Similarly, any relevant information on the website of Inland Fisheries Ireland (www.fisheriesireland.ie) was reviewed. The Environmental Sensitivity Mapping (ESM) tool was also used to gather data on aquatic biodiversity, flora, and fauna in the study area.

Aerial imagery was accessed online in order to gain a better understanding of the study area and its surrounding habitats. All documents reviewed are included in the bibliography section of the current report.

2.3 Field Surveys

2.3.1 Selection of Watercourses for Assessment

All watercourses/water bodies which could be affected directly (i.e., within the site) or indirectly (i.e., in drainage areas close to the site) were considered as part of the current appraisal. Aquatic habitat surveys were carried out on the entire study area. The approach was to first look at orthophotography and then conduct a windshield survey. Following this, aquatic ecological surveys were completed at 20 representative sites. Aquatic habitat surveys were conducted on all watercourses draining the Proposed Wind Farm Site, and a total of 20 sites were selected for detailed assessment. The purpose of these surveys is to provide baseline information and can also be used for monitoring during the construction of the Proposed Wind Farm.

The locations of the sites are provided in Table 1 and depicted in Figures 2 and 3. This is considered to be a high-resolution survey for the study area in question. The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and the presence of rare/protected/notable aquatic species at each site.

2.3.2 Licensing and personnel

The electrofishing survey was completed under authorisation from the Department of the Environment, Climate and Communications under Section 14 of the Fisheries (Consolidation) Act (1959). During the licencing process consultation with Inland Fisheries Ireland was completed. Freshwater Pearl Mussel (FPM) surveys were carried out under license (NPWS License No. C46/2023).

The surveys and assessments were completed by Dr William O' Connor *PhD, MSc, BSc, CBiol, CEnv, FRSB, MCIEEM, MIFM* with the assistance of Dr Lucy Hardy, Grace Walsh, and Eoin McMahon.

2.3.3 Biosecurity

Strict biosecurity measures were employed during the survey. This included disinfecting gear between sites and working at the upstream sites first. The IFI (2011) '*Biosecurity Protocol for Field Survey Work'* was followed during all survey work.

2.3.4 Aquatic Habitat Surveys

The habitat surveys were completed with regard to the Environment Agency's manual "*River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*" (EA, 2003) and "*A Guide to Habitats in Ireland*" by Fossitt (2000). Fish habitat was evaluated with reference the Department of Agriculture for Northern Irelands Fisheries Division document, the '*Evaluation of habitat for Salmon and Trout'* (DANI, 1995), the English Nature manuals 'Ecology of the Atlantic Salmon' by Hendry K & Cragg-Hine D (2003), and '*Ecology of the River Brook and Sea Lamprey'* by Maitland (2013). River habitat types characterised at each survey site. The status of the watercourses surveyed was categorised on a scale of High-Good-Moderate-Poor-Bad.

2.3.5 Biological Water Quality

A biological water quality rating was assigned at each site following the methodology given in Toner *et al*., (2005). For the smaller streams the a "risk level" was given as described in the 'Small Stream Risk Score Method Manual' Anon (2005). This was a rapid assessment and estimated water quality ratings

were assigned for each of the 20 aquatic survey sites. The SSRS categories are “Probably not at risk”, “Probably at risk”, and “At risk” of not meeting the Good Status requirements of the Water Framework Directive.

2.3.6 Electrofishing Surveys

Electrical fishing surveys were undertaken at 20 selected sites during September 2023. September is the optimal time for this type of a survey, and the survey was completed under ideal weather conditions. The sites were surveyed following the methodology outlined in the CFB (2008) guidance "*Methods for the Water Framework Directive-Electric fishing in wadable reaches*" and had regard to Matson *et al*, (2018). A portable electrical fishing unit (Smith Root-LR 24 backpack) was used to carry out the survey. The sites were fished continuously for 10 minutes each. Juvenile Lamprey surveys were completed following the methodology for ammocoete surveys given in the manual *'Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri* and *Petromyzon marinus'* by Harvey & Cowx (2003).

Captured fish were collected into a container of river water using dip nets. The fish were released alive and spread evenly over the sampling area. Strict biosecurity measures were followed during all fieldwork (IFI, 2010).

It was not considered necessary to do any depletion / quantitative electrofishing at any of the sites due to the result obtained.

2.3.7 Rare species surveys

During the course of the survey the possible presence of rare/notable species including Freshwater Pearl Mussel (*Margaritifera margaritifera*) and White-clawed crayfish (*Austropotamobius pallipes*) was fully considered. Checks for Crayfish were completed at each site and it is noted that crayfish are often detected during electrofishing surveys. A Freshwater Pearl Mussel survey (rapid presence/absence) survey was completed at each site. At the majority of the sites the presence of mussels was ruled out based on the habitats present. Surveying for Freshwater Pearl Mussel (FPM) was carried out under license (NPWS License No. C46/2023) following the NPWS guidance *‘Margaritifera margaritifera Stage 1 and Stage 2 survey guidelines’* (Anon, 2004).

2.4 Limitations

There were no limitations in relation to the surveys completed at the 20 sites during September 2023. The surveys were timed to coincide with normal water levels and very good weather conditions. September is the optimal time for electrofishing surveys.

Table 1 Location of the aquatic ecology sites assessed for the Proposed Tirawley Wind Farm Site.

Site No.	Catchment	Sub-catchment	Watercourse Name	Order	Segment Code	EPA Code
1	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Knockboha River	2nd	33_1210	33K03
2	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Knockboha River	1st	33_1237	33K03
3	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Conaghra river	2nd	33_2820	33C54
4	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Glebe river	1st	33_2890	33G09
5	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Conaghra river	1st	33_2806	33C54
6	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Conaghra river	1st	33_2806	33C54
7	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Keeloges Upper	1st	33_3153	33K05
8	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Lissadrone East	2nd	33_3134	33L01
9	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Cloonalaghan river	3rd	33_312	33C01
10	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Ballymurphy stream	1st	33_3148	33B06
11	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Cloonalaghan river	3rd	33_2912	33C01
12	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Cloonalaghan river	3rd	33_2917	33C01
13	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Confluence of the Billoos river and Carn river	Billoos (2nd) / Carn (1st)	33_3137 / 33_2731	Billoos (33B36) / Carn (33C44)
14	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Cloonalaghan river	2nd	33_2732	33C01
15	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Cloonavarry river	1st	33_2471	33C43
16	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Gortmore stream	3rd	33_2268	33G04
17	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Lecarrowntemple river	2nd	33_971	33L13
18	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Lecarrowntemple river	2nd	33_1791	33L13
19	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Gortmore Stream	2nd	33_2244	33G04
20	Blacksod-Broadhaven	Glencullin [NorthMayo]_SC_010	Cabintown river	2nd	33_1132	33C52

Figure 2 Location of the September 2023 aquatic ecology survey sites.

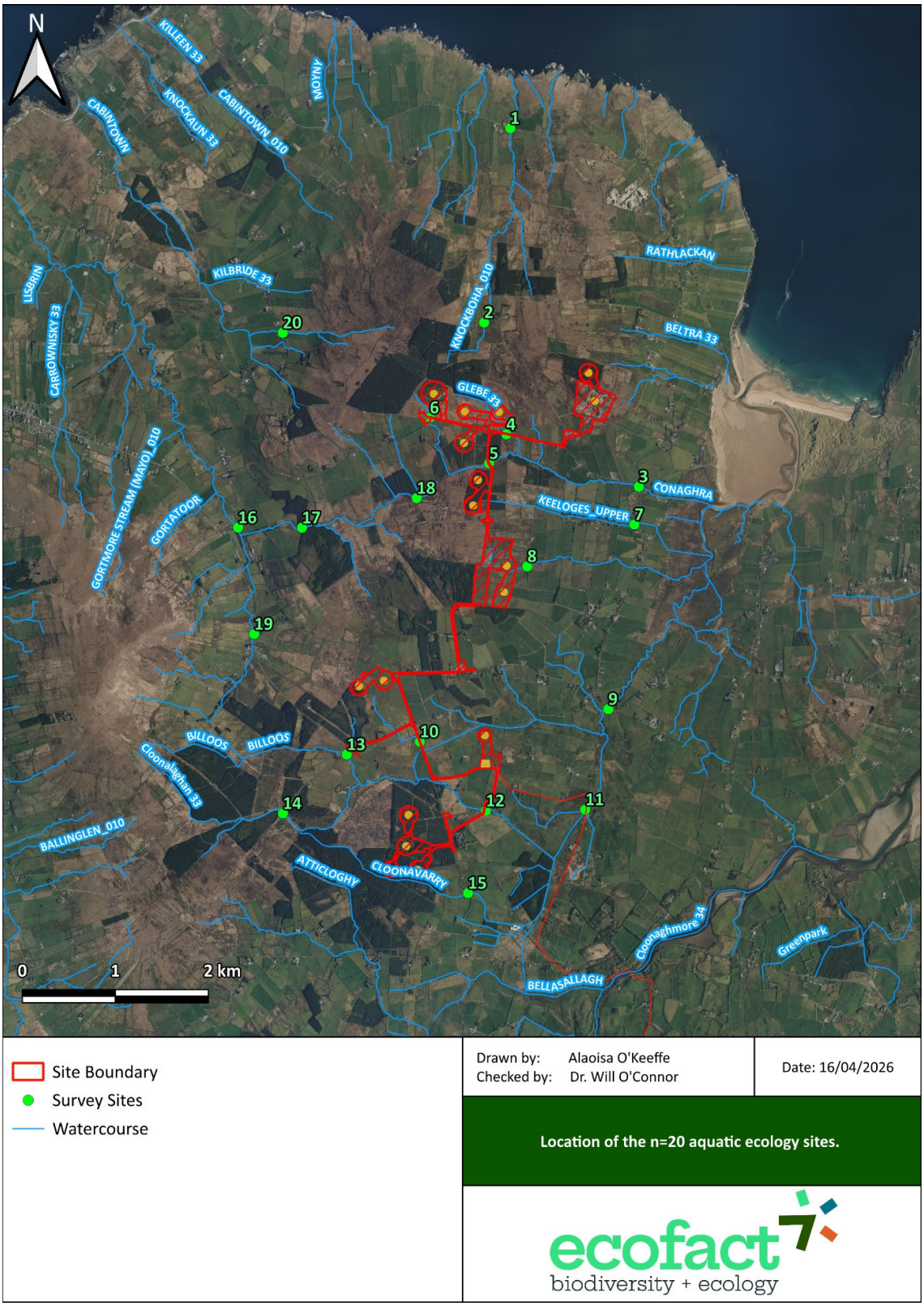

Figure 3 Location of the proposed Tirawley Wind Farm and the September 2023 aquatic ecology survey sites.

3. RECEIVING ENVIRONMENT

3.1 Designated Areas

The Proposed Tirawley Wind Farm Development is not located within the boundary of any Natura 2000 sites (Figure 4). There are nine Natura 2000 sites within 15 km of the proposed development, and four within 5 km of the proposed development. These consist of three SAC's (Glenamoy Bog Complex SAC, Lackan Saltmarsh and Kilcummin Head SAC, and Killala Bay/ Moy Estuary SAC) and one SPA (Killala Bay/ Moy Estuary SPA). These sites are listed in Table 2.

Glenamoy Bog Complex SAC (Site code: 000500) is located c. 3.8km west of the proposed development and has no direct hydrological connection. Lackan Saltmarsh and Kilcummin Head SAC (Site code: 000516) is located c. 1.2 km east of the proposed development and is downstream of a number of locations within the Proposed Development. This SAC is designated for Salicornia and other annuals colonising mud and sand [1310], Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330], Mediterranean salt meadows (*Juncetalia maritimi*) [1410], Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120], and Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]. Killala Bay/ Moy Estuary SAC (Site code: 000458) is located c. 4 km east of the Proposed Development and has no direct hydrological connection.

The other three Natura 2000 sites within 5 km of the Proposed Development have hydrological connectivity with the Proposed Wind Farm, and all three are designated for aquatic Qualifying Interests. These sites are discussed in more detail below.

3.1.1 SAC's designated for aquatic interests

Lackan Saltmarsh and Kilcummin Head SAC (000516) is located c. 1.2km, at the nearest point, east of the Proposed Development and has direct hydrological connectivity with the Proposed Development. This site is designated for a number of habitats, including Mediterranean Salt Meadows (*Juncetalia maritimi*) which is a salt marsh habitat that occurs in the uppermost levels of salt marshes. Vegetation is typically dominated by rushes and sedges, e.g. *Juncus maritimus, J. gerardii* and *Carex extensa*.

Killala Bay / Moy Estuary SAC (000458) is located east of the Proposed Development and the grid connection route intersects with this SAC at Palmerstown Bridge. This site has direct hydrological connectivity with the proposed development. This site is designated for a number of coastal habitats and three faunal species, including the aquatic Sea Lamprey *Petromyzon marinus* and Harbour Seal *Phoca vitulina*.

3.1.2 SPAs designated for aquatic interests.

Killala Bay/ Moy Estuary SPA (004036) is located c. 1 km, at the nearest point, east of the Proposed Development and has direct hydrological connectivity with the Proposed Development. This site is designated for nine protected bird species: Ringed Plover (*Charadrius hiaticula*), Golden Plover (*Pluvialis apricaria*), Grey Plover (*Pluvialis squatarola*), Sanderling (*Calidris alba*), Dunlin (*Calidris alpina*), Bar-tailed Godwit (*Limosa lapponica*), Curlew (*Numenius arquata*), Redshank (*Tringa totanus*), and Wetland and Waterbirds.

Table 2 Designated Natura 2000 sites within 15 km of the proposed Tirawley wind farm development, Co. Mayo.

Site name	Site code	Distance (km) from proposed development	Aquatic Qualifying Interests?	Hydrological connectivity?
Glenamoy Bog Complex SAC	000500	c. 3.8km west	Yes – • Natural dystrophic lakes and ponds [3160] • *Salmo salar* (Salmon) [1106]	None
Bellacorick Bog Complex SAC	001922	c. 7 km southwest	Yes – • Natural dystrophic lakes and ponds [3160]	None
River Moy SAC	002298	c. 6.2 km southwest	Yes – • *Austropotamobius pallipes* (White-clawed Crayfish) [1092] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355]	None
Lackan Saltmarsh and Kilcummin Head SAC	000516	c. 1.2 km east	Yes – • Mediterranean Salt Meadows (*Juncetalia maritimi*) [1410]	Yes
Killala Bay / Moy Estuary SAC	000458	c. 11 km north at nearest point of wind farm, and also at Palmerstown bridge.	Yes – • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Phoca vitulina* (Harbour Seal) [1365]	Yes
Lough Hoe Bog SAC	000633	c. 14.4 km southeast	Yes – • Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092]	None
Ox Mountains Bogs SAC	002006	c. 14.7 km southeast	Yes – • Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3110] • Natural dystrophic lakes and ponds [3160]	None
Killala Bay / Moy Estuary SPA	004036	< 1m at Palmerstown Bridge	Yes – • Wetland and Waterbirds [A999]	Yes
Lough Conn and Lough Cullin SPA	004228	c. 9.4 km southeast	Yes – • Wetland and Waterbirds [A999]	None

3.1.3 Ramsar sites

Killala Bay/Moy Estuary is a Ramsar Convention site (Ramsar ID: 843). Ramsar sites are wetlands that are of significant value for nature. At Killala Bay/Moy Estuary the dunes support a rich and diverse flora that includes several rare or threatened plants. The intertidal flats provide important feeding sites for birds (Ramsar, 1996).

3.2 Description of the Study Area

3.2.1 Wind Farm Site

The Proposed Tirawley Wind Farm and grid connection, Co. Mayo spans three subcatchments; (i) the Glencullin [NorthMayo]_SC_010 sub catchment (Code: 33_9), which is within the Blacksod-Broadhaven catchment, and hydrometric area 33 (Blacksod-Broadhaven); (ii) the Cloonaghmore_SC_010 sub catchment (Code: 34_13), which is within the Moy & Killala Bay catchment, and hydrometric area 34 (Moy & Killala Bay); and (iii) Abbeytown_SC_010 sub catchment (Code: 34_19), which is within the Moy & Killala Bay catchment, and hydrometric area 34 (Moy & Killala Bay). There are 16 wind turbines proposed for the Site and the Proposed Wind Farm Site lies within the Glencullin [NorthMayo]_SC_010 sub catchment.

3.2.2 Grid Connection Route

The proposed grid connection begins on the southern end of the wind farm, turns east at windfarm site along local road then turns south along local road before joining the R314, crossing, Palmerstown Bridge, then running south along the Western Way, and then running east at Cloonmaan, until it reaches the Tawnaghmore 110kV substation. The proposed route passes through the Cloonaghmore_SC_010 and Abbeytown_SC_010 subcatchments. The route crosses the 5th order Cloonagmore river at the Palmerstown Bridge, directly adjacent to the Cloonaghmore Estuary.

3.2.3 Glencullin North Mayo subcatchment

The Glencullin North Mayo subcatchment drains an area of 164.31 km^2. There are ten rivers sub-basins within this subcatchment: Ballinglen_010 (Code: IE_WE_33B010100), Ballinglen_020 (Code: IE_WE_33B010200), Cloonalaghan_010 (Code: IE_WE_33C010700), Cabintown_010 (Code: IE_WE_33C520880), Glencullin (North Mayo)_010 (Code: IE_WE_33G020200), Gortmore Stream (Mayo)_010 (Code: IE_WE_33G040800), Glenglassera_010 (Code: IE_WE_33G050100), Keerglen_010 (Code: IE_WE_33K010200), Knockboha_010 (Code: IE_WE_33K030830), and Killerduff_010 (Code: IE_WE_33K100650). The proposed Tirawley Wind Farm Development intersects with four of these rivers sub-basins and all of the aquatic ecology survey sites are contained within: Cabintown_010, Cloonalaghan_010, Knockboha_010, and Gortmore Stream (Mayo)_010.

Cabintown_010 is located east of Ballycastle and is 18.98 km long, consisting of several smaller streams. One of the larger and longer streams rises around the townlands of Carrowmore and Kilbride. The primary land use around this area is forestry (Local Authority Waters Programme, 2019). The river flow of the Cabintown river is monitored at the rivers discharge point into the North Atlantic Ocean / Western Atlantic Seaboard (EU code: IE_WE_250_0000) at the beach in Castletown (HYDRO station code: 33_2825); according to the Environmental Protection Agency (EPA), the catchment area upstream is 5.27 km^2 and the 95%ile flow of the Cabintown river here is 0.625 m^3 sec^{-1} (EPA website accessed August 2023).

Cloonalaghan_010 is 51.29 km long, and the river flow of the Cloonalaghan river is monitored at 11 HYDRO stations. The most downstream station is at the rivers discharge point into Lacken Strand (HYDRO station code: 33_2821); according to the Environmental Protection Agency (EPA), the catchment area upstream is 23.314 km^2 and the 95%ile flow of the river here is 2.469 m^3 sec^{-1} (EPA website accessed August 2023).

Knockboha_010 is located east of Cabintown_010. As with Cabintown_010 this waterbody consists of several small streams flowing in a northerly direction, discharging into the North Atlantic Ocean / Western Atlantic Seaboard (EU code: IE_WE_250_0000). Knockboha_010 rises in Knockboha and flows through a landscape dominated by blanket bog and semi – improved agricultural grassland (Local Authority Waters Programme, 2019). Knockboha_10 is 20.43 km long, and there are no HYDRO stations monitoring river flow within this sub-basin (EPA website accessed August 2023).

Gortmore Stream (Mayo)_010 is 30.83 km long and the river flow is monitored at 5 HYDRO stations. The 2nd most downstream station (HYDRO station code: 33_2142), is located c. 1.5 km upstream of the Gortmore Stream's discharge into Bunatrahir Bay. The catchment area upstream is 13.932 km^2 and the 95%ile flow of the river here is 1.554 m^3 sec^{-1} (EPA website accessed August 2023).

The underlying geology of the upper and central Glencullin North Mayo sub catchment is dominated by mudstone and siltstone, with eastern and western sections dominated by sandstone. There are bands of shale running north to south, primarily in the northern coastal regions. There are limited pockets of oolite and dolerite and gabbro in within proximity to the Proposed Development. The characteristic soils of the Cabintown_010 river sub-basin are peat, coarse loamy drift with siliceous stones and coarse loamy over calcareous gravels. The characteristic soils of the Cloonalaghan_010 river sub-basin are peat, river alluvium, coarse loamy drift with siliceous stones and tidal marsh. The characteristic soils of the Gortmore Stream (Mayo)_010 river sub-basin are peat, coarse loamy drift with siliceous stones, river alluvium, and coarse loamy over calcareous gravels (Teagasc, 2006).

3.2.3.1 Water quality

Of the river sub-basins which the Proposed Development spans two are monitored by the EPA and two are now. The Cabintown_010 and Knockboha_010 are not monitored by EPA and are therefore classified as unassigned, and their ecological status is unknown. Cloonalaghan_010 and the Gortmore Stream (Mayo)_010 were assessed during the reporting period 2016 – 2021: Cloonalaghan_010 was classified as having 'Good' status with high confidence, and the Gortmore Stream (Mayo)_010 was classified as having 'Good' status with high confidence also.

There are 14 EPA monitoring stations within the Glencullin sub catchment, with five stations located on rivers which have hydrological connectivity with the Proposed Development. Station RS33B060100, called 'Ballymurphy Stream - Bridge just upstream Cloonalaghan Road' is located c. 400 m upstream of the Proposed Development. The water quality was last assessed in 1990 and scored Q 1, indicating 'Bad' water quality. Downstream from this, Station RS33C010700 is located on the 3rd order Cloonalaghan river (EPA code: 33C01), on the bridge southeast of the Carrowmore. The river was classified as having 'Good' status, with a Q 4 rating when last assessed in 2020. This station is located c. 2.4 km downstream of the Proposed Development. Station RS33C010300 is located at the Bridge southeast of Billoos crossroads and was last assessed in 2005, when the water quality was scored Q4, 'Good' status. This station is located c. 440m upstream of the crossing point of the river and the Proposed Development. There are two stations on the Gortmore stream, downstream of the Proposed Development: Station RS33G040500, on the bridge east of Ballycastle, was scored Q5, 'High' status when last assessed in 1990 and Station RS33G040800, located on the bridge west of Gortmore, was

scored Q4, 'good' status when last assessed in 2020. All values have been obtained from https://gis.epa.ie/EPAMaps/Water. During the WFD Cycle 3 assessment (WFD, 2022) Ballinglen_010 was classified as "At Risk" and was last assessed in 2023, when the water quality was scored 4-5 "High" status, Station RS33B010100. Fish status caused Ballinglen_010 to deteriorate from Good to Moderate ecological status in 2013-2015.

Ballinglen_020 was classified as 'Under Review', and scored Q4, "Good" status when last assessed in 2023. Pressures identified affecting the sub catchment included anthropogenic pressures, urban wastewater, hydro morphology issues, and agriculture.

There are 16 EPA monitoring stations within the Cloonaghmore sub catchment. There are three located at the Palmerstown Bridge, where the 5th order Cloonaghmore river crosses the proposed grid connection route and discharges into the Cloonaghmore Estuary. All three stations, RS34C030280, RS34C030300, RS34C030310 assessed had a water quality Q rating of 4, status "Good" when last assessed in 1989, 1993, and 1989 respectively, with station RS34C030300 directly intersecting with the Grid connection route "GWC03". There is one station further upstream c. 1 km from Palmerstown Bridge on Cloonaghmore_050. This station is RS34C030270, which was last assessed in 2022, achieving a Q4 water quality rating and 'Good' status.

3.3 Aquatic Flora & Habitats Records

The Proposed Development lies within the 10 km grid squares G13, G12, and G22. The National Biodiversity Data Centre holds records for flowering plants within these 10 km grid squares from the National Vegetation Database, the Online Atlas of Vascular Plants (2012 onwards), Irish Vascular Plant Data (Paul Green), Irish Crop Wild Relative Database, River Biologists' Database (EPA), and National Vegetation Database.

3.3.1 Protected habitats

Within the Lackan Saltmarsh and Kilcummin Head SAC, in the Lackan bay estuary and along the margins of the Cloonalaghan river, exists an extensive saltmarsh which has formed from built up deposits of sediment from the river (DAHG, 2013). This habitat is composed of a closely cropped turf of Common Saltmarsh-grass (*Puccinellia maritima*), Thrift (*Armeria maritima*), Annual Sea-blite (*Suaeda maritima*), Sea Milkwort (*Glaux maritima*) and Sea Plantain (*Plantago maritima*). Sea Rush (*Juncus maritimus*) occurs on slightly elevated sites, along with two succulent plants, Common Scurvygrass (*Cochlearia officinalis*) and Sea Aster (*Aster tripolium*).

3.3.2 Non-native, invasive flora

Fifteen invasive, flowering plant species have been recorded within the 10 km grid squares G, G13 and G22. Six high impact invasives – Canadian Waterweed (*Elodea canadensis*), Giant Knotweed (*Fallopia sachalinensis*), *Rhododendron ponticum*, Cherry Laurel (*Prunus laurocerasus*), Giant Hogweed (*Heracleum mantegazzianum*), and Japanese Knotweed (*Fallopia japonica*) – and nine medium impact invasives – Sycamore (*Acer pseudoplatanus*), Wall Cotoneaster (*Cotoneaster horizontalis*), Butterfly-bush (*Buddleja davidii*), Himalayan Honeysuckle (*Leycesteria formosa*), Traveller's-joy (*Clematis vitalba*), Virginia-creeper (*Parthenocissus quinquefolia*), Wall Cotoneaster (*Cotoneaster horizontalis*), Himalayan Knotweed (*Persicaria wallichii*), and Three-cornered Garlic (*Allium triquetrum*). Japanese Knotweed was recorded within the Cabintown_010 sub-basin, at Carrowcor in 2015 (2km grid square G14K).

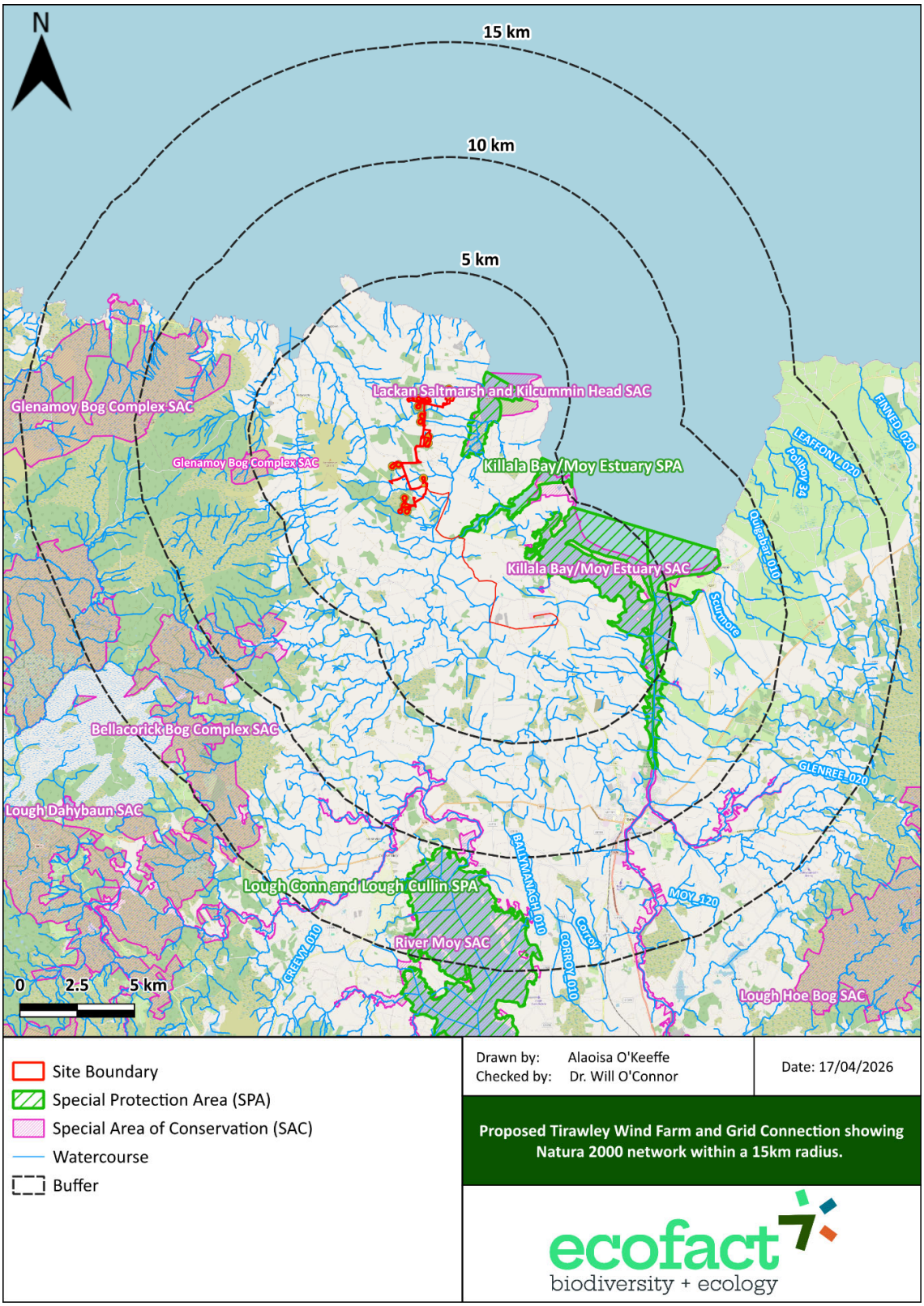

Figure 4 Natura 2000 sites within 15 km of the Proposed Tirawley Wind Farm, Co. Mayo.

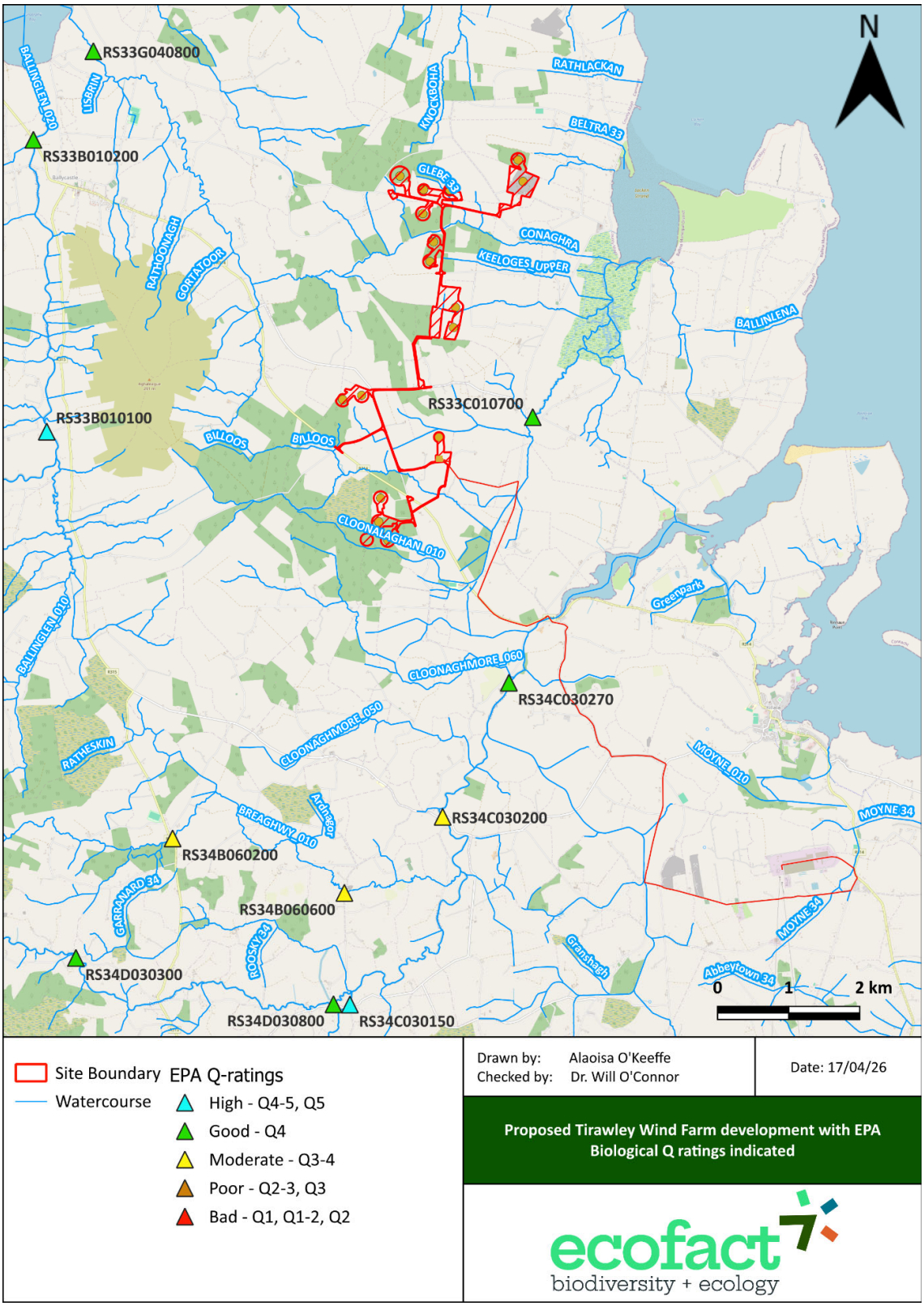

Figure 5 Location of the Proposed Tirawley Wind Farm in relation to watercourses and operational EPA biological water quality monitoring stations.

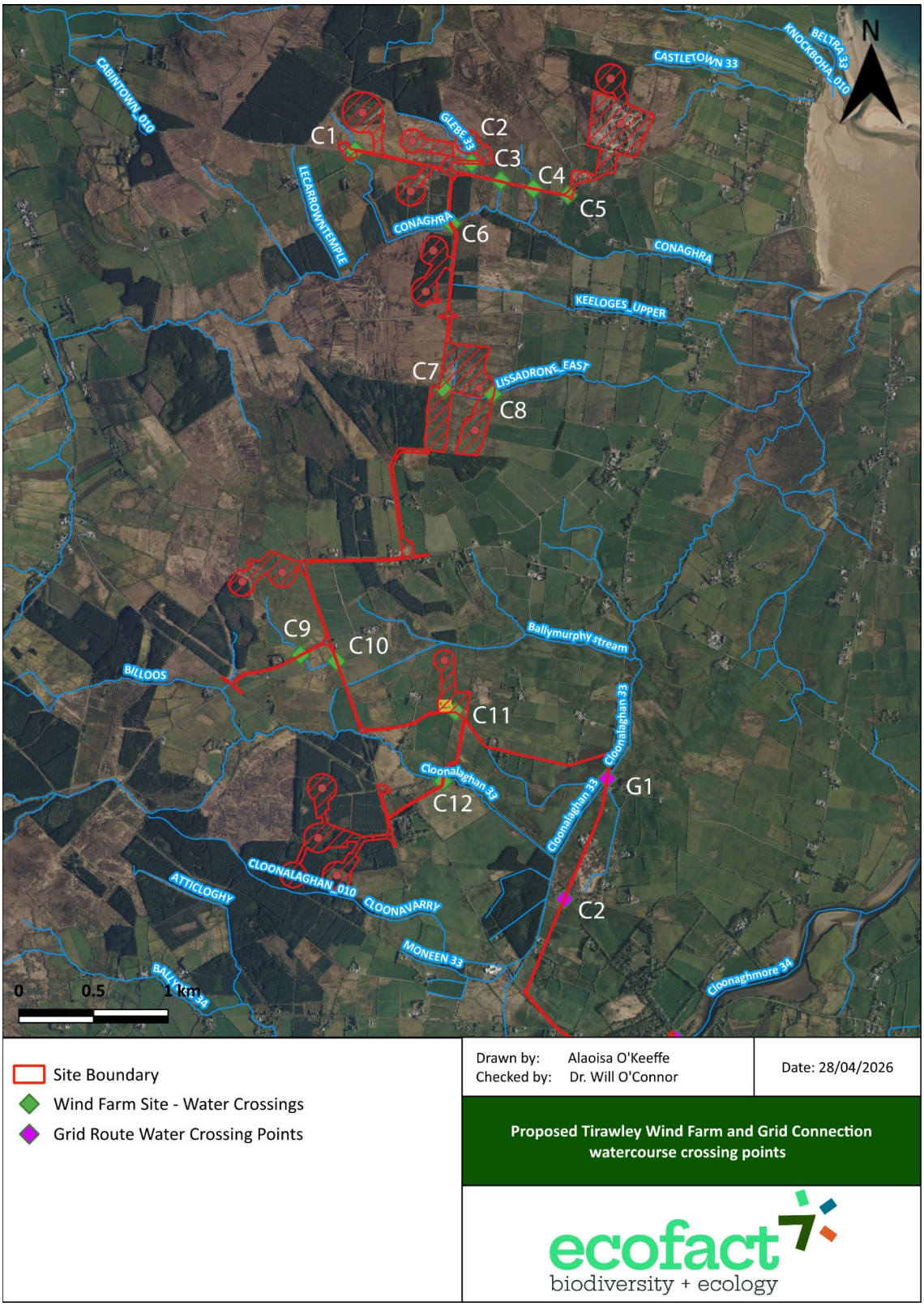

Figure 6a Location of the Proposed Tirawley Wind Farm and Grid Connection watercourse crossing points.

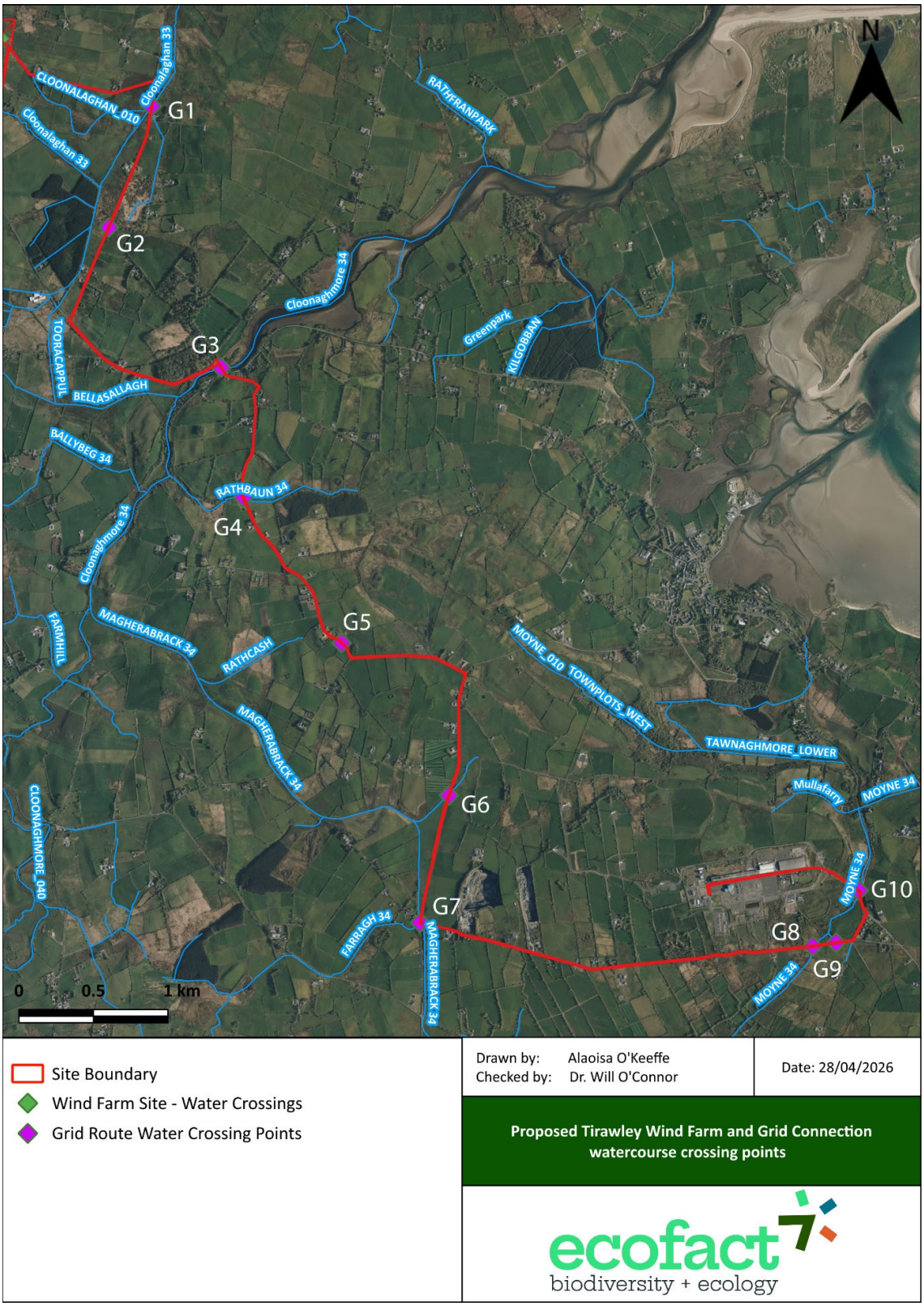

Figure 6b Location of the Proposed Tirawley Wind Farm and Grid Connection watercourse crossing points.

Table 3 EPA biological water quality results from stations located near the proposed wind farm site.

Station code	Station name	River water body	Segment	Year	Rating	Status
RS33G040500	GORTMORE STREAM (MAYO) - Bridge E. of Ballycastle	GORTMORE STREAM (MAYO)_010	33_2063	1990	5	High
RS33G040800	Bridge W. of Gortmore	GORTMORE STREAM (MAYO)_010	33_2186	2020	4	Good
RS33B060100	BALLYMURPHY STREAM - Br just u/s Cloonalaghan R	CLOONALAGHAN_010	33_3148	1990	1	Bad
RS33C010300	CLOONALAGHAN - Bridge S.E. of Billoos X-Rds	CLOONALAGHAN_010	33_2965	2005	4	Good
RS33C010700	Bridge S.E. of Carrowmore	CLOONALAGHAN_010	33_3097	2020	4	Good

Table 4 EPA biological water quality results from stations located near the approach works to the west of the proposed wind farm site (inset areas in Figure 1).

Station code	Station name	River water body	Segment code	Year	Rating	Status
RS33B010110	BALLINGLEN - Bridge d/s Ballinglen Bridge	BALLINGLEN_020	33_1747	1994	5	High
RS33B010100	Ballinglen Bridge	BALLINGLEN_010	33_1748	2023	4-5	High
RS33B010200	New Bridge	BALLINGLEN_020	33_2091	2023	4	Good
RS33B010210	BALLINGLEN - New Bridge (RHS)	BALLINGLEN_020	33_2091	2002	3	Poor

Table 5 EPA biological water quality results from stations located near the proposed grid connection route.

Station code	Station name	River water body		Year	Rating	Status
RS34C030310	Palmerstown Bridge (RH side)	CLOONAGHMORE_060	34_4501	1989	4	Good
RS34C030300	Palmerstown Bridge (LH side)	CLOONAGHMORE_060	34_4690	1993	4	Good
RS34C030280	200 m u/s Palmerstown Bridge	CLOONAGHMORE_060	34_4690	1989	4	Good
RS34C030270	1.2 km u/s Palmerstown Br	CLOONAGHMORE_050	34_3077	2022	4	Good

3.3.3 Protected aquatic flora

No protected floral species have been recorded in the 10 km grid squares G12, G13 and G22 (NBDC, 2023).

The Killala Bay/Moy Estuary SPA comprises the estuary of the River Moy and the inner part of Killala Bay, including Lackan Bay and Rathfran Bay. This site is designated for nine species of waterbirds and their associated wetlands. Extensive intertidal sand and mud flats are exposed at low tide. For the most part, these flats are unvegetated, but mats of Eelgrass (*Zostera* spp.), Beaked Tasselweed (*Ruppia maritima*) and green algae (*Ulva* spp.) occur, which provide important feeding material for waterfowl species (DAHG, 2014).

3.4 Aquatic macroinvertebrate records

3.4.1 Annelids

Eight species of freshwater or terrestrial annelids have been recorded in the 10km grid square G13; *Eiseniella tetraedra, Glossiphonia, Glossiphonia complanata, Helobdella, Lumbricidae, Lumbriculidae, Pomatoceros triqueter*, and *Tubificidae*, with the most recent being a record for *Pomatoceros triqueter* in 2021. Six species of annelids have been recorded in the 10km grid square G12; *Eiseniella tetraedra,*

Erpobdella, Glossiphonia complanata, Helobdella, Lumbricidae, and *Tubificidae*. A further three species have been recorded in the 10km grid square G22 but they were all marine species.

3.4.2 Crustaceans

Three freshwater crustaceans have been recorded in the 10km grid square G13; *Asellus*, *Gammarus duebeni*, and *Talitridae*. *Gammarus duebeni* and *Asellus* have also been recorded in the 10km grid square G12 and G22. *Bathyporeia pelagica*, an estuarine species, have been recorded in the 10km grid square G22.

3.4.3 Beetles

There are records of 34 beetles in the 10km grid square G13, with 22 taken from the Water Beetles of Ireland dataset and the other 12 taken from the 'national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018 (EPA)'. A total of 11 beetle species/groups were recorded during this same survey period in the 10km grid square G12. The near threatened 'vulnerable' water beetle *Ochthebius (Asiobates) bicolon* was recorded in the 10km grid square G22 in 1901. A further 34 species/groups of aquatic beetles were recorded in the 10km grid square G22, and 4 records from the 10km grid square G23, none of which are classified as threatened or protected.

3.4.4 Caddisflies

Following review of the dataset 'A national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018 (EPA)' records of 16 Caddisfly species/groups were identified in the 10km grid squares G12, G22 and G13 – *Anabolia nervosa, Glossosomatidae, Goeridae, Hydropsyche, Hydroptilidae, Lepidostomatidae, Odontocerum albicorne, .Phryganeidae, Polycentropus, Rhyacophila, Sericostoma* – all recorded in 2016, with the exception of *Limnephilidae* recorded in 2013 in G12 and 2016 in G22, and *Philopotamidae* recorded in 2007, *Hydropsychidae* and *Leptoceridae* (recorded in 2017) and *Polycentropodidae* (recorded in 2014).

3.4.5 Damselflies

There are records of 14 Damselflies (*Zygoptera*) from the 10km grid square G12.

3.4.6 Mayflies and stoneflies

Nine species/groups of Mayfly have been recorded in both of the 10km grid squares G12, G22 and G13; *Alainites muticus, Baetis, Caenis rivulorum, Ecdyonurus*, Green Drake (*Ephemera danica*), *Heptagenia, Rhithrogena, Rhithrogena semicolorata,* and *Serratella ignita*.

There are records of eight species/groups of Stonefly in the 10km grid squares G12, G22 and G13; *Amphinemura, Amphinemura sulcicollis, Chloroperlidae, Isoperla grammatica, Leuctra, Perla bipunctata, Dinocras cephalotes,* and *Protonemura meyeri*.

3.4.7 True flies

Fourteen records of true fly (*Diptera*) have been recorded in the 10km grid squares G12 and G13; *Ceratopogonidae, Chironomidae, Dicranota, Limnophora*, Marmalade Hoverfly (*Episyrphus balteatus*), *Simuliidae, Tipulidae*, *Eristalis arbustorum, Helophilus pendulus, Melanostoma mellinum, Melanostoma scalare, Platycheirus albimanus, Platycheirus manicatus*, and *Rheocricotopus chalybeatus*. A further four species were recorded in G22: *Cheilotrichia cinerascens, Chironomidae, Eristalis tenax*, and *Molophilus griseus*.

3.4.8 Molluscs

There are four records of freshwater aquatic mollusc from 10km grid square G13; the River limpet (*Ancylus fluviatilis*) (also recorded in G12), Pond snails (*Lymnaeidae*), Wandering Snail (*Radix balthica*) and Jenkins' Spire Snail (*Potamopyrgus antipodarum*) which is a medium impact invasive species. There are over 20 records of this species in proximity of the proposed development site (including within the 10km grid square G12) and it likely occurs in the watercourses crossing the proposed development.

The near threatened Globular Pea Mussel (*Pisidium hibernicum*) was recorded in Rathoma, Co. Mayo, c. 20km south of the proposed development in 1972, in the 10km grid square G12. Two other freshwater mussel species were also recorded in G12; Shining Pea Mussel (*Pisidium nitidum*) and Short-ended Pea Mussel (*Pisidium subtruncatum*). Other freshwater molluscs recorded in this grid square include Valve Snail (*Valvata (Cincinna) piscinalis*), Wandering Snail (*Radix balthica*), *Sphaeriidae,and Pisidium.*

The marine molluscs Banded wedge shell (*Donax vittatus*), *Mytilus edulis*, Peppery Furrow Shell (*Scrobicularia plana*), Rayed Artemis (*Dosinia exoleta*), Rayed Trough Shell (*Mactra stultorum*), Sand Gaper (*Mya arenaria*), Thin Tellin (*Angulus tenuis*), and Netted Dog Whelk (*Hinia reticulata*), were recorded in the 10km grid square G22 in 2021.

Freshwater Pearl Mussels are discussed in Section 3.4.2.4.

3.5 Protected aquatic fauna

Several species protected under Annex II of EU Habitats Directive have been recorded within the 10km grid squares G12, G13 and G22, a number of which may occur along watercourses within or crossing the area of the Proposed Development.

3.5.1 European Eel

The European Eel (*Anguilla anguilla*) is critically endangered in Europe and is an Annex II species according to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In Ireland, eels are widespread and are found in rivers, lakes, streams, and brooks where they can gain access (King *et al*. 2011). An isolated sighting of European Eel has been reported in proximity to the study area, in the 1km grid square G0939. EPA River Biologists recorded the eel in 2005, on the Glencullin River, c. 650 m upstream of the discharge point at Ballycastle beach (NDBC, 2023).

3.5.2 Lampreys

The Brook Lamprey (*Lampetra planeri*) is the smallest of the three lamprey species native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater. The River Lamprey (*Lampetra fluviatilis*) is larger in size than the brook lamprey and exhibits an anadromous[1] life cycle. The Sea Lamprey (*Petromyzon marinus*) is the largest of the Irish lampreys. Brook Lamprey and Sea Lamprey are listed in Appendix II, while River Lamprey is listed in both Appendices II and IV of the Habitats Directive (92:43: EEC). All three species are listed in Appendix III of the Bern Convention.

There are no records of lamprey on the National Biodiversity Data Centre database for the study area, however, they are likely to occur within this region. A lamprey survey carried out in 2023, which surveyed the Moy catchment, including Lough Conn, south of the Proposed Development, recorded both Sea lamprey and Brook lamprey within the catchment (IFI, 2023).

[1] Anadromous fish spend most of their adult lives in salt water and migrate to freshwater rivers and lakes to reproduce.

3.5.3 White-clawed crayfish

The white-clawed crayfish is protected under the Habitats Directive and Wildlife Act and the nearest record to the proposed development is a record from 2016 in the 100m grid square G194224, recorded by EPA biologists at the 'SLIEVECLAUR - Br near Slieveclaur' station (Station code: RS34S060200) on the Slieveclaur river (WFD River Waterbody Code: IE_WE_34S060400). This station is c. 4.9km south of the proposed development at the nearest point and has no downstream hydrological connectivity with the proposed development.

There are several other records of this species within 10km of the proposed development though none occur within waterbodies hydrologically connected with the proposed development site.

3.5.4 Freshwater Pearl Mussel

The nearest confirmed record of Freshwater Pearl Mussel (*Margaritifera margaritifera*) is from the 10km grid square L98, and it is a record from 2009 in Owenwee, Co. Mayo, taken from the 'River Biologists' Database (EPA)', c. 50km southwest of the proposed development. No records of this species occur upstream or downstream of the proposed development and so are unlikely to occur in watercourses crossing the site.

3.5.5 European Otter

European Otter (*Lutra lutra*) are a semi-aquatic species and are also strictly protected under Annex IV of the Habitats Directive, Appendix II of the Bern Convention, and the Wildlife Act. Several records of Otter have been recorded in proximity of the proposed development; in 2005 at Killerduff Bridge, on the Glencullin River (1km grid square G0939); two records at Bunatrathir Bay, Ballycastle, in 2015 and 2015 (1km grid square G1039); a record of spraint in 2010 (1km grid square G0741); a record of mucous and droppings a Lackan pier in 1980; and a record in the 10km grid square G13 in 2016.

3.5.6 Others

No dedicated / published fish surveys have been carried out by Inland Fisheries Ireland within the sub catchment area of the proposed wind farm. Several fish species were recorded in the three 10 km grid squares G12, G13 and G22 within which the proposed development spans (Table 6).

The Common porpoise is a threatened species included on the OSPAR List of Threatened and/or Declining Species and Habitats and was recorded in the 10km grid square G22 in 2020. This is a marine species and so will not occur within the Proposed Development Site or adjacent freshwater watercourses. However, it may be present in the estuarine waters adjacent to the proposed Grid Connection route.

The Basking shark is a threatened species included on the OSPAR List of Threatened and/or Declining Species and Habitats since 2003. This is a marine species and so will not occur within the Proposed Development Site or adjacent freshwater watercourses.

The Common seal and Grey seal are protected under the Habitats Directive and Wildlife Acts and were recorded in the 10km grid square G22 in 2013 and 2011 respectively. These are a marine species and so will not occur within the Proposed Development Site or adjacent freshwater watercourses. However, they may be present in the estuarine waters adjacent to the proposed Grid Connection route.

These dolphin species are protected under the Habitats Directive and Wildlife Acts and were recorded in the 10km grid square G22 in 2019, 1970, and 2018 respectively. These are a marine species and so will not occur within the Proposed Development Site or adjacent freshwater watercourses. However, they may be present in the estuarine waters adjacent to the proposed Grid Connection route.
These whale species are protected under the Habitats Directive and Wildlife Acts and were recorded in the 10km grid square G22 in 1893 and 2009 respectively. These are a marine, deep water species and so will not occur within the Proposed Development Site or adjacent watercourses.

Table 6 Fish species recorded within 10km grid squares G12, G13 and G22.

Species	Species name	G12	G13	G22	Year of record
Brown/Sea Trout	*Salmo trutta*			✓	23/05/2022
Saithe	*Pollachius virens*			✓	24/09/2014
Spotted Ray	*Raja montagui*			✓	16/02/2018
Thornback Ray	*Raja clavata*			✓	31/08/2012
Blonde Ray	*Bathyraja brachyurops*			✓	26/10/2012
Flapper Skate	*Dipturus intermedia*			✓	29/11/2022
Lesser Spotted Dogfish	*Scyliorhinus canicula*			✓	25/04/2021
Nursehound	*Scyliorhinus stellaris*			✓	10/10/2018
Small-eyed Ray	*Raja microocellata*			✓	20/11/2018
Thresher	*Alopias vulpinus*			✓	31/10/1899
Basking Shark	*Cetorhinus maximus*		✓		27/06/2010 (G13)
Cornish clingfish	*Lepadogaster purpurea*		✓		18/04/2022
Flounder	*Platichthys flesus*		✓	✓	11/10/2015 (G13) / 10/10/2015 (G22)
Thin-lipped Mullet	*Liza ramada*		✓	✓	11/10/2015 (G13) / 31/12/1971 (G22)
Turbot	*Psetta maxima*		✓	✓	11/10/2015 (G13) / 10/10/2015 (G22)
European Eel	*Anguilla Anguilla*		✓		16/08/2007

3.6 Baseline Aquatic Ecology Surveys 2023

The results of the baseline aquatic ecology surveys completed are outlined below and the full survey results are given in Appendix 1 – Field Results. In Plates section photos for the survey and each site are provided.

3.6.1. Site 1

Site 1 was located on the 2nd order Knockboha River (EPA code: 33K03) in Creevagh, Co. Mayo. This site was located c. 0.6 km from where the Knockboha river discharges into the North Atlantic Ocean / Western Atlantic Seaboard (EU code: IE_WE_250_0000). This site was modified and has been dredged and/or otherwise modified in the past. The substrate was dominated by bedrock. It had high gradient and a series of cascades were present in the survey area. A natural falls on the lower reaches of this river is likely to prevent access for migratory fish. However, otherwise it was considered to have physically suitable salmonid habitat.

The site was visibly polluted and was rated as 'Q3 - Moderately Polluted' due to the amount of filamentous algae and siltation present. A limited macroinvertebrate community dominated by pollution tolerant organisms was present. No fish were recorded during the electrofishing survey which was

carried out on two stretches for 10 minutes each. There are no EPA water quality monitoring stations along this river. Site 1 is shown in Plate 1. Overall this site was considered to be of poor habitat and ecological status. The source of the pollution if thought to be agricultural activities.

3.6.2. Site 2

Site 2 was located c. 2.3 km upstream of Site 1, on the 1st order Knockboha River (EPA code: 33K03) in the townland of Knockboha. This is a small stream which was very difficult to access, as can be seen in Plate 2. The stream was partially dry and no fish were present. It was classified as 'At Risk' under Small Streams Risk Score (SSRS) system and was rated as 'Moderate Status'. There are no EPA water quality monitoring stations along this river.

3.6.3. Site 3

This site was located on the 2nd order Conaghra river (EPA code: 33C54) on the border of Killogeary and Keeloges Lower, c. 0.8 km from the confluence with 4th order Cloonalaghan river (EPA code: 33C01). There are no EPA water quality monitoring stations upstream or downstream of this site. This site was silted with agricultural impacts apparent (Plate 3). It has also been modified in the past.

This site was rated as 'Q3-4 – Slightly Polluted' (borderline). There were physically suitable spawning and nursery habitats present, and small numbers of Brown Trout (Plate 4) were recorded in the electrofishing survey. Three-spined sticklebacks were also present (Plate 5).

3.6.4. Site 4

This site was located on the 1st order Glebe river, c. 0.3 km upstream of the confluence with the 2nd order Conaghra river (EPA code: 33C54), in the townland of Lecarrowntemple. There are no EPA water quality monitoring stations upstream or downstream of this site. This stream is very overgrown and partially dry (Plate 6). It was classified as 'At Risk' under the SSRS system. No fish were recorded during the survey.

3.6.5. Site 5

Site 5 was located on the 1st order Conaghra river (EPA code: 33C54), on the border of Lissadrone West and Lecarrowntemple. This site is located c. 2.6 km upstream of the confluence with the 4th order Cloonalaghan river (EPA code: 33C01). There are no EPA water quality monitoring stations upstream or downstream of this site. This site is shown in Plate 7.

The stream here was classified as 'At Risk' under the SSRS system and no fish were recorded. Tiny overgrown stream, very little invert life, and is too small to provide any habitat for fish.

3.6.6. Site 6

This site was located on the 1st order Conaghra river (EPA code: 33C54), c 1.2 km upstream of Site 5. Site 6 is located in the townland of Conaghra. There are no EPA water quality monitoring stations upstream or downstream of this site. It is a tiny stream with limited macroinvertebrate fauna and fisheries potential. It was classified as 'At Risk' under the SSRS system. No fish were recorded. The site is shown in Plate 8.

3.6.7. Site 7

Site 7 was located on the 1st order river Keeloges Upper (EPA code: 33K05). This site was located approximately 1 km upstream of the confluence with the 4th order Cloonalaghan river (EPA code: 33C01). The site was located in the Killogeary townland. There are no EPA water quality monitoring stations upstream or downstream of this site. This stream is very small, was partially dry, had limited macroinvertebrate fauna, and was not considered to provide a habitat for fish. It was rated as 'At Risk' under the SSRS system. No fish were recorded. The site is shown in Plate 9.

3.6.8. Site 8

Site 8 was located on the 2nd order river Lissadrone East (EPA code: 33L01), on the border of the townlands of Carrowmore and Lissadrone East. There are no EPA water quality monitoring stations upstream or downstream of this site. This stream is very small, had limited macroinvertebrate fauna, and was not considered to provide a significant habitat for fish.

Three-spined sticklebacks were recorded during the survey. The site was rated as being 'Moderate Status'. The site is shown in Plate 9.

3.6.9. Site 9

This site was located on the 3rd order Cloonalaghan river (EPA code: 33C01), on the border of the townlands of Carrowmore and Cloonalaghan townlands. There is an EPA monitoring station (Site reference RS33C010700) here. The river was classified as having 'Good' status, with a Q4 rating when last assessed in 2020. This was the same rating assigned in the current survey. Class A Heptageniid mayfly larvae were present.

This river site has been modified in the past but is physically suitable for salmonid and lamprey habitats. Good numbers of Brown trout were recorded during the electrofishing survey (see Plates 12, 13 & 14). Good numbers of European eels were also recorded (see Plates 15 & 16). No juvenile salmon or lampreys were recorded. Overall, this site was considered to be meeting 'Good status criteria. This site is shown in Plate 11.

3.6.10 Site 10

Site 10 was located on the 1st order Ballymurphy stream (EPA code: 33B06). There is an EPA water quality monitoring station (Station code: RS33B060100) called 'Ballymurphy Stream - Bridge just upstream Cloonalaghan Road' located c. 0.5 km upstream from Site 10 (Plate 17). The EPA rated this station as Q1 in 1990, indicating 'Bad' water quality, but has not been monitored since.

This site was classified as 'At Risk' using the SSRS system during the current survey. No fish were present. The site was assessed as 'Moderate Status' and is shown in Plate 17.

3.6.11 Site 11

Site 11 was located in Carrad More on the 3rd order Cloonalaghan river (EPA code: 33C01), c. 15m upstream of the confluence with the 1st order Knockroe river. There is an EPA water quality monitoring station (Station code: RS33C010700) located approximately 1.2 km downstream, at the Bridge southeast of Carrowmore. This station was rated as 'Q4 – Unpolluted' when last assessed by the EPA in 2020. This indicates 'Good' water quality.

This is a small stream that has been deepened and channelised in the past. It is considered to offer marginal fish habitat and a limited macroinvertebrate community was recorded. It was rated as 'Q3 – Moderately Polluted' in the current survey due to the absence of Class A indicators, and the dominance of pollution tolerant taxa. There was evidence of agricultural impacts at the site. Brown trout and Three-spined sticklebacks were present. No lampreys were recorded. This site is shown in Plates 18 with some of the Three-spined sticklebacks recorded shown in Plate 19.

3.6.12 Site 12

Site 12 was located on the 3rd order Cloonalaghan river (EPA code: 33C01), on the border of the townlands of Carn and Barroe. The site was located c. 0.9 km upstream of the confluence with 2nd order Cloonavarry river. This site is shown in Plate 20. There is an EPA water quality monitoring station (Station code: RS33C010300) located c. 1.1 km upstream at the Bridge southeast of Billoos crossroads. The EPA rated this station as 'Q4 - Good' status' in 2005. This site has not been monitored since this time.

This is a small stream (see Plate 20) and agricultural impacts were apparent during the survey. A limited macroinvertebrate fauna was recorded, with Class C and D groups dominating. Silt and algae levels were considered to be elevated. The site was considered to be 'Q3 – Moderately Polluted'. Small number of Brown trout were present however (Plate 21). No other fish species recorded.

3.6.13 Site 13

Site 13 was located on the 1st order Carn river (EPA code: 33C44). The site was located in the townland of Billoos, at the confluence of the 2nd order Billoos river (EPA code: 33B36) An EPA water quality monitoring station (Station code: RS33C010300) is located c. 0.8 km downstream at the Bridge southeast of Billoos crossroads. This station was rated as 'Q4 - Good' status' in 2005. This is a small stream (see Plate 22) but has some habitat suitable for salmonids, and nominal numbers of juvenile Brown trout were recorded during the survey confirming that this is a salmonid nursery stream.

3.6.14 Site 14

Site 14 was located on the 2nd order Cloonalaghan river (EPA code: 33C01), on the border of Ballybeg and Billoos. This site is located c. 1.2 km upstream of the confluence with the 2nd order Billoos river and c. 1.7 km upstream of the EPA water quality monitoring station (Station code: RS33C010300) mentioned above. During the current survey, forestry and agricultural impacts were noted (Plate 23), and the site was classified as 'At Risk' under the SSRS system. No fish were recorded.

3.6.15 Site 15

Site 15 was located on the 1st order Cloonavarry river (EPA code: 33C43), c. 0.8 km upstream of its confluence with the 2nd order Moneen river (EPA code: 33M22) at St Patrick's College, Lackan Cross. This site (Plate 24) is heavily impacted by agricultural pollution (rated Q2-3). No fish were recorded during the current survey.

3.6.16 Site 16

Site 16 is located on the 3rd order Gortmore Stream, c 0.9 km downstream of the confluence of the 2nd order Lecarrowntemple river (EPA code: 33L13) and 3rd order Gortmore stream. The EPA monitoring

station RS33G040500 is located c. 2.1 km downstream at the Bridge east of Ballycastle. This station was last assessed in 1990 when it was rated 'Q5 – High Status'.

This site is shown in Plate 25. This watercourse was considered to provide ideal salmonid spawning and nursery habitat. Potential lamprey habitats were also recorded. This was a clean watercourse with a diverse macroinvertebrate community present. It was rated a 'Q4 – Unpolluted' in the current survey. Good stocks of Brown trout were recorded (see Plate 27, 28 & 29). No lampreys were recorded. This catchment has some potential for Freshwater Pearl Mussels. However, they were not recorded at this site and some spot checks downstream of the site were also completed. The EPA site at Ballycastle was also visited. Although this site was not surveyed it was visibly not a 'Q5' channel with algae and siltation apparent. There are no records of Freshwater Pearl Mussels from this river.

3.6.17 Site 17

Site 17 was located on the 2nd order Lecarrowntemple river (EPA code: 33L13), c. 0.75 km upstream of the confluence with the 3rd order Gortmore Stream. The nearest EPA monitoring station is c. 3 km downstream (Station: RS33G040500), at the Bridge east of Ballycastle. This site is shown in Plate 30.

This site is a small stream but has physically suitable salmonid spawning and nursery habitat. A relatively diverse macroinvertebrate community was present, and normal siltation and sparce filamentous algae levels were present. The site was therefore rated as 'Q4 Good status' in the current survey. Small numbers of juvenile Brown trout were present confirming that this is a salmonid spawning and nursery channel.

This catchment has some potential for Freshwater Pearl Mussels. However, they were not recorded at this site and some spot checks downstream of the site were also completed (at Site 16).

3.6.18 Site 18

Site 18 was located on the 2nd order Lecarrowntemple river (EPA code: 33L13), c. 2.3 km upstream of the confluence with 3rd order Gortmore Stream. This site is located in the townlands of Lissadrone West and Lecarrowntemple. This is a tiny overgrown stream (Plate 31). No fish were recorded at this site and the site was classified as 'At Risk' following the SSRS system.

3.6.19 Site 19

Site 19 was located on the 2nd order Gortmore Stream (EPA code: 33G04). The site was located c. 1.2 km upstream of the confluence with the 2nd order Lecarrowntemple river. This is a small stream (see Plate 32) with some potential salmonid spawning and nursery habitat present. It was considered to meet the criteria for a 'Q4 - Good Status' rating. Brown trout were recorded (Plate 33) here.

3.6.20 Site 20

This final site was located on the 2nd order Cabintown river (EPA code: 33C52) on the border of Carrowmore and Kilbride. It was also located c. 0.47 km upstream of the confluence with the 2nd order Carrowmore river (EPA code: 33C57). There is no EPA monitoring station on this channel. This is a tiny overgrown stream (see Plate 34). No fish were recorded, and the site was rated 'Moderate status', or classified as 'At Risk' under the SSRS system.

Table 7 Summary and evaluation of the aquatic ecology survey of 20 sites during September 2023.

Site No.	Watercourse name	Biological Water quality	Aquatic habitat	Fish population	Rare / notable species	Overall evaluation
1	Knockboha River	Poor (Q3) visible eutrophication	Modified but physically suitable for salmonids. Natural falls likely to prevent access for migratory fish.	No fish recorded – two 10-minute sites fished.	None	Poor Status
2	Knockboha River	SSRS – "At risk"	Partially dry, tiny overgrown stream	No fish present	None	Moderate Status
3	Conaghra river	Q3-4	Has suitable spawning and nursery habitats. Agricultural impacts and modifications.	Small numbers of salmonids present. Three spined sticklebacks present. No lampreys present.	None	Moderate Status
4	Glebe river	SSRS – "At risk"	Tiny overgrown stream	No fish present	None	Moderate Status
5	Conaghra river	SSRS – "At risk"	Tiny overgrown stream	No fish present	None	Moderate Status
6	Conaghra river	SSRS – "At risk"	Tiny overgrown stream	No fish present	None	Moderate Status
7	Keeloges Upper	SSRS – "At risk"	Tiny overgrown stream	No fish present	None	Moderate Status
8	Lissadrone East	SSRS – "At risk"	Tiny stream	Three-spined sticklebacks	None	Moderate Status
9	Cloonalaghan river	Q4	Modified in the past but has physically suitable salmonid and lamprey habitats.	Brown trout present in good numbers, good numbers of eels, no lampreys.	None	Good status
10	Ballymurphy stream	SSRS – "At risk"	Small stream with agricultural impacts	No fish present	None	Moderate Status
11	Cloonalaghan river	Q3	Small stream with agricultural impacts	Brown trout (nominal numbers) and Three-spined sticklebacks present. No lampreys.	None	Moderate Status
12	Cloonalaghan river	Q3	Small stream with agricultural impacts	Brown trout (nominal numbers).	None	Moderate Status

Site No.	Watercourse name	Biological Water quality	Aquatic habitat	Fish population	Rare / notable species	Overall evaluation
13	Confluence of the Billoos river and Carn river	Q4	Small stream with some physically suitable salmonid habitat.	Brown trout (nominal numbers). No lampreys.	None	Good Status
14	Cloonalaghan river	SSRS – "At risk"	Tiny stream with forestry and agricultural impacts	None	None	Moderate Status
15	Cloonavarry river	Polluted – Q2-3	Small stream with agricultural pollution	None	None	Poor Status
16	Gortmore stream	Q4+	Ideal salmonid spawning and nursery habitat	Good healthy trout stock present. No lampreys recorded.	None present at this site. This catchment has some potential for FPMs in the it's lower reaches.	Good status +
17	Lecarrowntemple river	Q4	Small stream but potential salmonid spawning and nursery habitat	Brown trout present (nominal numbers). No lampreys recorded.	None present at this site. This catchment has some potential for FPMs in the it's lower reaches.	Good status +
18	Lecarrowntemple river	SSRS – "At risk"	Tiny overgrown stream	No fish present	None	Moderate Status
19	Gortmore Stream	Q4	Small stream but potential salmonid spawning and nursery habitat	Brown trout present (nominal numbers). No lampreys recorded.	None	Good status
20	Cabintown river	SSRS – "At risk"	Tiny overgrown stream	No fish present	None	Moderate Status

Table 8 Proposed Tirawley Wind Farm infrastructure watercourse crossing points.

Crossing	Catchment	Sub-catchment	Watercourse name	Segment code	EPA code	Order
C1	Blacksod-Broadhaven	Glencullin (North Mayo) 010	CONAGHRA	33_2806	33C54	1
C2	Blacksod-Broadhaven	Glencullin (North Mayo) 010	GLEBE 33	33_2890	33G09	1
C3	Blacksod-Broadhaven	Glencullin (North Mayo) 010	Not registered	n/a	n/a	n/a
C4	Blacksod-Broadhaven	Glencullin (North Mayo) 010	LACKANHILL	33_621	33L02	1
C5	Blacksod-Broadhaven	Glencullin (North Mayo) 010	Unregistered watercourse	n/a	n/a	n/a
C6	Blacksod-Broadhaven	Glencullin (North Mayo) 010	CONAGHRA	33_2806	33C54	1
C7	Blacksod-Broadhaven	Glencullin (North Mayo) 010	LISSADRONE_EAST	33_3134	33L01	1
C8	Blacksod-Broadhaven	Glencullin (North Mayo) 010	CARN 33	33_2731	33C44	1
C9	Blacksod-Broadhaven	Glencullin (North Mayo) 010	Ballymurphy stream	33_3148	33B06	1
C10	Blacksod-Broadhaven	Glencullin (North Mayo) 010	Ballymurphy stream	33_3148	33B06	1
C11	Blacksod-Broadhaven	Glencullin (North Mayo) 010	Unregistered watercourse	n/a	n/a	n/a
C12	Blacksod-Broadhaven	Glencullin (North Mayo) 010	Cloonalaghan 33	33_2917	33C01	3

Table 9 Proposed Tirawley Wind Farm grid connection watercourse crossing points.

Grid crossing	Catchment	Sub-catchment	Watercourse name	Segment code	EPA Code	Order
G1	Blacksod-Broadhaven	Cloonaghmore 010	Cloonalaghan 33	33_2986	33C01	3
G2	Blacksod-Broadhaven	Cloonaghmore 010	Unregistered watercourse	n/a	n/a	n/a
G3	Moy & Killala Bay	Cloonaghmore 060	Cloonaghmore 34	34_4690	34C03	5
G4	Moy & Killala Bay	Cloonaghmore 060	RATHBAUN 34	34_1223	34R33	1
G5	Moy & Killala Bay	Cloonaghmore 050	Unregistered watercourse	n/a	n/a	n/a
G6	Moy & Killala Bay	Cloonaghmore 050	RATHOWEN_EAST	34_1064	34R25	1
G7	Moy & Killala Bay	Abbeytown 010	FARRAGH 34	34_1214	34F20	2
G8	Moy & Killala Bay	Abbeytown 010	MOYNE 34	34_3474	34M19	1
G9	Moy & Killala Bay	Abbeytown 010	MEELICK 34	34_600	34M20	1
G10	Moy & Killala Bay	Cloonaghmore 050	MOYNE 34	34_3476	34M19	2

4. POTENTIAL IMPACTS

4.1 Introduction

The potential impacts of wind farm developments on aquatic ecology have been reviewed in the book '*Wildlife and Wind Farms: Conflicts and Solutions'* by O'Connor (2017). According to O'Connor (2017), wind farm developments have the potential to significantly affect aquatic ecosystems. During construction, activities such as vegetation clearance and soil excavation can result in increased runoff and suspended solids in water bodies. This can lead to sedimentation that can negatively impact aquatic species like fish and invertebrates by disrupting their habitats, clogging gills, and smothering eggs. Nutrient runoff from deforestation and construction can also potentially alter the chemical balance of water bodies, potentially triggering eutrophication and disrupting aquatic plant and animal communities. O'Connor (2017) also notes that physical alterations in the landscape, like soil compaction and excavation during wind farm construction, have the potential to significantly modify natural hydrological processes. These changes can lead to altered water flow patterns, affecting the quantity and quality of water in streams and rivers. Such alterations are detrimental to aquatic biota, impacting physical habitats and leading to erosion and sedimentation. Moreover, construction activities can directly lead to habitat loss or degradation. The introduction of infrastructure such as roads and bridges can furthermore fragment habitats and obstruct the natural movement of aquatic species, disrupting migration patterns and breeding grounds. Indirect impacts, such as increased sedimentation and changes in water chemistry due to runoff, further compound these effects. O'Connor (2017) raises additional concerns, such as noise and vibration, which can have localized effects on aquatic life. Moreover, the risk of introducing invasive species through construction activities presents a significant threat to native biodiversity.

While the potential environmental impacts of wind farm projects are well-understood, the actual effects can vary greatly based on site-specific factors, including the scale of the project, management practices, and the pre-existing vulnerability of the local ecosystem. Ensuring a balanced approach to wind farm development necessitates careful consideration of these environmental factors to mitigate potential adverse effects on water quality, hydrology, and aquatic ecosystems (O'Connor, 2017).

Wind farms are large-scale construction projects and affect aquatic areas, such as streams and rivers, in ways similar to other types of development. Therefore, the potential impacts and required mitigation measures are well understood (O'Connor, 2017). The construction of turbines and associated infrastructure such as access roads, cable connections, and site drainage works can have comparable effects to other major construction projects such as roads, water pipelines, and large-scale forestry, when undertaken in similar landscapes (O'Connor, 2017). However, wind farms are often installed in remote upland areas, which have little other development, and can be especially sensitive to change. Wind farm sites are often located near the headwaters of catchments, and these smaller watercourses can be more vulnerable than larger bodies of water because of their size. Such areas are often the nursery areas for fish populations of conservation value or may support recreational or commercial fisheries farther downstream (O'Connor, 2017).

The impacts of wind farm developments on aquatic areas generally occur only during the construction phase. Ongoing operation and maintenance of wind farms is unlikely to result in any significant effects in the receiving aquatic environment (O'Connor, 2017). Impacts may also potentially occur during wind farm decommissioning.

The Proposed Development will require clearance of trees/vegetation, particularly conifer plantation, to build site access roads, turbine foundations, hardstanding areas, cable trenches, and provide site

drainage. These operations can impact the quality of habitats present for aquatic organisms. Wind farm construction can increase suspended solids loading of watercourses, alter recharge or drainage/runoff patterns, and change surface water quantity, thereby increasing flood risk for downstream watercourses, eroding watercourse banks and edges, widening channels, and altering stream beds (O'Connor, 2017). Upland areas also have an increased risk of erosion or landslides, although impacts can also occur on low slopes, where ditching and rerouting of water will be required (O'Connor, 2017).

As concluded in O'Connor (2017), most potential issues arising between wind farms and the aquatic environment can be avoided or mitigated through careful project design and management. This is the case for the current proposed development, and general mitigation measures are outlined in Section 5.

The general potential impacts of the Proposed Tirawley Wind Farm Development are outlined below for the construction, operation, and decommissioning (as applicable) phases of the project. These are the potential impacts that could occur in the absence of mitigation measures.

4.2 Potential Impacts - Wind Farm Development

The Proposed Tirawley Wind Farm Site is drained by three river subbasins: Cloonalaghan_010, Gortmore Stream (Mayo)_010, and Knockboha_010. The watercourses on the proposed Tirawley wind farm site itself are all small – medium 3rd, 2nd, and 1st order streams. These streams are in the upper reaches of the Gortmore Stream (Mayo)_010 and Cloonalaghan_010 sub catchments. These watercourses are of limited aquatic ecological value. However, downstream at the receptor sites where the rivers increase in size fish diversity and habitat quality improves. Many of these watercourses have been identified as being salmonid nursery and spawning areas.

The grid connection route passes a number of 4th and 5th order rivers, primarily in the Cloonaghmore_060 sub catchment (see Section 4.2).

4.2.1 Construction Phase

4.2.1.1 Direct

There is potential for releases of suspended solids and other substances associated with upgrading, realigning, and construction of access roads within the Site and also during the excavation work associated with this proposed work. The installation and upgrading and/or extension of an internal road network on a wind farm site and associated excavations can result in increased silt runoff. Suspended solids in even quite small quantities may have a serious effect on the spawning sites of salmonids.

A total of n=12 watercourse crossings are proposed. The proposed crossing points are listed in Table 8 and indicated in 6a. No other works will occur within a distance of at least 50 m from watercourses (excluding watercourse crossings). No works will occur within a distance to land drains of at least 20 m.

Engineering works in the vicinity of streams and at stream crossings can also impact directly on physical habitat, for example nursery areas for fish. Permanent loss of aquatic habitats can also occur where access roads are constructed over or in close proximity to streams/rivers. Obstruction to upstream movement of fish, particularly salmonids, due to construction of culverts can also potentially occur.

'Improved' drainage of the Site can potentially result in increased erosion of nearby streams and may result in lower water levels in dry weather, which will reduce the habitat available to fish. Any operations which result in loss of sediment will also result in increased nutrients being released from the soil. This

has the potential to cause eutrophication of streams thereby lowering the capacity of the streams to support fish and invertebrate fauna.

The construction of the proposed wind farm is not expected to significantly affect the drainage regime on the site, with direct impacts affecting watercourses and aquatic ecology minimised via the protection of water quality within the site. The site surveys also revealed that the watercourses draining this area are currently impacted by background water quality issues, such as agricultural practise. Potential direct construction phase impacts on aquatic ecology, in the absence of mitigation, are assessed as being *slight negative, short-term and in the local context*. Best practice mitigation is required to avoid potential impacts.

4.2.1.2 Indirect

The most likely potential indirect impact during the construction phase of the wind energy development on receiving watercourses and aquatic habitats arises indirectly via impacts affecting water quality. This type of impact would include an accidental releases of silt laden runoff, or an accidental spillage of cement or hydrocarbons stored on site. Waste from on-site toilets and wash facilities could also potentially be released. These impacts could potentially occur on any construction site and can be avoided with best practice mitigation.

Indirect water quality impacts can potentially occur during the construction of access roads, the laying of cable route as well as any works required to facilitate the indicative turbine delivery route. These works could result in silt run-off, pollution events originating from the site works and machinery used, which could indirectly affect areas elsewhere in the catchment. These indirect impacts could give rise to the potential for impacts affecting fish, as well as aquatic invertebrate communities within the study area.

Any engineering works which cause runoff of sediments can also increase the levels of nutrients in receiving streams. This can result in the enrichment or eutrophication of the affected streams and catchment areas further downstream, and a possible change in overall water quality status. Suspended solids or sediment in a river is also a major concern and can have serious negative impacts on aquatic invertebrate and instream flora.

There is also a risk that machinery or materials imported onto the Site could act as a vector for introducing or dispersing non-native invasive species.

Potential indirect construction phase impacts on aquatic ecology, in the absence of mitigation, are assessed as being *slight negative, short-term and in the local context*. Mitigation is required to avoid potential impacts.

4.2.1.3 Cumulative

The area of the Proposed Site is subject to additional pressures on water quality and aquatic ecology, particularly in relation to agricultural and forestry activities. Where wind farm construction and agricultural activities occur at the same time there is the potential for in-combination or cumulative impacts on local watercourses. The risk of such impacts would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Conifer forestry and peat extraction and associated operations could also have the potential to adversely affect water quality in the area; therefore, could impact watercourses in-combination with the Proposed Tirawley Wind

Farm. Potential cumulative impacts on aquatic ecology, in the absence of mitigation, are assessed as being *moderate negative, short-term and in the local context*.

4.2.2 Operational

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment (O'Connor, 2017). The main risk to watercourses is when oils and lubricants are used on the Site. If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water pollution. However, the likelihood of this occurring is very low and the potential significance of this impact can be mitigated through proper site management. In addition, the watercourses on the Proposed Development Site are of relatively low ecological value. Spills of any oil or fuels from site vehicles onto the access roads may find their way to the local stream network. However, this is unlikely to be a significant impact considering the low numbers of vehicles involved and the high-quality standards that are implemented on a well-managed site.

Upgrading of the site track/road network could allow increased public access to the Site. This could potentially result in illegal dumping of domestic rubbish which could impact the watercourses in the area by causing deterioration in water quality. Potential operational phase impacts on aquatic ecology are assessed as being *imperceptible negative, temporary and in the local context.*

4.2.3 Decommissioning

The decommissioning phase of the Proposed Wind Farm Site gives rise to similar potential impacts as can be realised during the construction phase; although the magnitude of the impact of decommissioning is normally reduced as all infrastructure is already in place on the Site. With suitable planning and provision of adequate mitigation potential impacts on the receiving aquatic environment during decommissioning can be minimised. Potential decommissioning impacts on aquatic ecology, in the absence of mitigation, is assessed as being *slight negative, short-term and in the local context.*

4.3 Potential Impacts - Grid Connection Route

4.3.1 Construction Phase

4.3.1.1 Direct

The Grid Connection route crosses the Cloonavarry river at St. Patricks College, Lackan Cross. It also crosses the Cloonaghmore river at the Palmerstown Bridge, and two tributaries of the Cloonaghmore river further south. It then crosses the Moyne river at the Tawnaghmore ESB substation. These sites are all in the Moy & Killala Bay Catchment.

There is potential for releases of suspended solids and other substances associated with these types or works. Vegetation clearance will be required along with tree felling as well as some excavations works. These activities could result in increased silt runoff. Suspended solids in even quite small quantities may have a serious effect on the spawning sites of salmonids.

Engineering works in the vicinity of streams and at stream crossings can also impact directly on physical habitat, for example nursery areas for fish. There is Natura 2000 sites bordering these sites (e.g. Killala Bay/Moy Estuary SPA and SAC), which are designated for aquatic interests. Mitigation is required to avoid these potential impacts. If instream works are required there is also the potential for direct disturbance to aquatic species and the destruction of habitats. This can occur from machines, personnel

and equipment entering the water and trampling these areas. There is the potential for some impacts and mitigation is required to avoid potential impacts.

4.3.1.2 Indirect

The most likely potential impact during the construction phase of the Grid Connection route on receiving watercourses and aquatic habitats arises indirectly via impacts affecting water quality, such as accidental releases of silt laden runoff and vegetation removal resulting in erosion.

Any engineering works which cause runoff of sediments can also increase the levels of nutrients in receiving streams. This can result in the enrichment or eutrophication of the affected streams and catchment areas further downstream, and a possible change in overall water quality status. Suspended solids or sediment in a river is also a major concern and can have serious negative impacts on aquatic invertebrate and instream flora.

There is also a risk that machinery or materials imported onto the Site could act as a vector for introducing or dispersing non-native invasive species. Mitigation is required to avoid potential impacts.

4.3.1.3 Cumulative

Several of the sites upstream of the Grid Connection are subject to additional pressures on water quality and aquatic ecology, particularly in relation to agricultural and forestry activities. Where construction and agricultural activities occur at the same time there is the potential for in-combination or cumulative impacts on local watercourses. The risk of such impacts would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Conifer forestry and associated operations could also have the potential to adversely affect water quality in the area; therefore, could impact watercourses in-combination with the proposed Tirawley wind farm. Potential cumulative impacts on aquatic ecology, in the absence of mitigation, are assessed as being *moderate negative, short-term and in the local context*.

4.3.2 Operational

Impacts on aquatic ecology during the operational phase of the Proposed Development are unlikely. There is the potential for spills of any oil or fuels from site vehicles finding its way to the local stream network. In addition, if repairs need to be carried out and soil is excavated there is the potential for impacts regarding suspended solids. However, this is unlikely to be a significant impact considering the low numbers of vehicles involved and the unlikelihood of maintenance. Potential operational phase impacts on aquatic ecology are assessed as being *imperceptible negative, temporary and in the local context.*

4.3.3 Decommissioning

During the decommissioning phase, the Grid Connection will be left in place. Therefore, it is considered that there is no potential for impacts.

5. MITIGATION MEASURES

5.1 Introduction

According to O'Connor (2017), sensitive design is the most important mitigation measure to reduce the impacts associated with wind farm developments - for example ensuring the geotechnical stability of the site, minimising works near watercourses, and providing a suitable Surface Water Management Plan. Avoidance mitigation would include not undertaking instream works during fish and lamprey spawning seasons, and locating turbines at least 50 m away from the nearest watercourse. It is noted that erosion control preventing runoff in the first place is much more effective than sediment control in preventing water pollution (O'Connor, 2017). Any works programme associated with wind farm construction needs to incorporate erosion and sediment control before starting site works, and provide monitoring and maintenance of these controls throughout the project.

There is a range of suitable good practice guidance available, including the NatureScot (2019) '*Good practice during Wind Farm construction'* and the CIRIA (2006) 'Control of water pollution from linear construction projects' guidelines. Other relevant guidelines include the '*Guidelines for the crossing of watercourses during the construction of national road schemes*' (NRA, 2008b) and '*Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*' (IFI, 2016).

5.2 Mitigation - Wind Farm Site

5.2.1 Construction Phase

A Construction Environmental Management Plan will be drawn up for the proposed project, prior to the commencement of any works on Site. All mitigation measures included in this document for the Proposed Development will be incorporated into the CEMP. Compliance with the CEMP, the procedures, work practises and controls will be mandatory and must be adhered to by all personnel and contractors employed on the construction of the Proposed Development.

A Surface Water Management Plan will be included in the CEMP. This will have regard to the NatureScot (2019), CIRIA (2016), NRA (2008b), and IFI (2016) guidelines. This is considered to be the key mitigation measure for the protection of aquatic species located in downstream receiving waters. The Surface Water Management Plan will set out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the Site during the construction phase. It will also include preparatory works on the Site, including installation of silt fences and bunds.

All access tracks will be designed to minimise excavation on the site and reduce the risk of sediment runoff. A sealed silt fence must be placed at both sides of points where rivers or streams are crossed and to a minimum of 10m upstream and downstream of each crossing at both sides of the road. Swales for turbine bases and hard standings must be constructed.

All infrastructures must have a setback distance of 50 m away from all streams within the Site except for the watercourse crossings. If access tracks cross watercourses they will be constructed as clear span bridges or precast concrete culverts. No instream wet concrete operations or construction will be permitted, and installation of any instream elements should be completed in dry conditions. There are also 12 stream crossings proposed within the Windfarm Site. Where access tracks pass close to watercourses, silt fencing will be used to protect the streams. The maintenance and monitoring of such silt fences must be subject to an on-site quality management system which will be set out in the CEMP.

Stream crossings will be constructed during low flow conditions and within a 5-day weather window. How this will take place will be detailed in the SWMP. A silt fence will be placed downstream of all works and regularly maintained. Materials used to install culverts and stream crossings should be pre-cast.

Spoil heaps from the excavations for the turbine bases and trenches (where cables are to be buried) will be covered with geotextile and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Any berms will be covered with a geo-textile matting to avoid sediment runoff; berms will be surrounded by silt fencing until vegetation has been established in the following growing season. If cables will be installed in trenches, they will be located underneath and directly adjacent to access tracks as far as possible. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods to avoid acting as a conduit for surface water flows. Clay bunds will be constructed within any cable trenches at intervals.

A Surface Water Management Plan will be included in the CEMP, the final version of which will be distributed for consultation, detailing the required measures for the Contractor to implement in the event of a 'worst case' scenario on the site. Timing of the proposed instream works will also take account of the fisheries constraints within the study area, where no works will be undertaken in the instream environment during the salmonid close season (October–June annually), which also avoids the lamprey spawning season.

Secure concrete washout areas will be designated on Site and detailed in the CEMP, the final version of which will be distributed for consultation. Standing water in the excavations at the turbine bases will contain an increased concentration of suspended solids. The excavations will be pumped into temporary settlement basins as necessary which should be lined and which should drain into existing or proposed drainage channels on Site. The settlement basins will be constructed in advance of any excavations for the turbine bases.

Wheel washing facilities will be provided at the Site entrance draining to silt traps. Additional silt fencing will be kept on Site for the ongoing maintenance of the structures provided. Portaloos will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from Site via a licensed waste disposal contractor and will not be discharged on Site.

Any diesel or fuel oils stored on Site will be bunded to 110% of the capacity of the storage tank. Such facilities will not be located near any drain or watercourse. Design and installation of fuel tanks will be in accordance with best practice guidelines. Refuelling of plant during construction will be carried out in an appropriately designed designated area, away from watercourses. Drip trays and spill kits will be kept available on Site. Appropriate containment facilities will be provided to ensure that any spills from the vehicle are contained and removed off Site.

Appropriate preventative measures will be detailed in the CEMP to ensure that non-native aquatic/riparian species are not introduced into the Site. These measures will follow as relevant the manual *'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads*' by NRA (2010).

5.2.2 Operational Phase

The operational wind farm will have a negligible effect on aquatic ecological interests and fisheries, as there are no further potential impacts on surface water run-off or watercourses within the Site. During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil

spills within the Site. However, the transformers should be bunded to over 110 % of the volume of oil within them.

It is not envisaged that maintenance will involve any significant impacts on the hydrological regime of the area. Weekly inspections of the erosion and sediment control measures on Site should be required during the construction period, followed by fortnightly inspections until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

Access to the Site will be limited using a gate to prevent illegal dumping on the Site and the unauthorised use of off-road vehicles etc.

5.2.3 Decommissioning Phase

In the event of decommissioning of the Proposed Tirawley Wind Farm, activities will take place in a similar fashion to the construction phase. There will be disturbance to underlying soils and therefore a risk again of silt laden run-off entering the receiving watercourse. The mitigation measures outlined above for the construction phase will also be implemented as relevant for the protection of aquatic ecological interests during the decommissioning phase.

5.3 Mitigation - Grid Connection Route

5.3.1 Construction Phase

A Construction Environmental Management Plan will be completed for the proposed project. This will include the Wind Farm Site, and the proposed Grid Connection route. The final CEMP will be drawn up by the Contractor appointed for the works prior to the commencement of any works on Site. All mitigation measures included in this document for the Proposed Development will be incorporated into the CEMP. Compliance with the CEMP, the procedures, work practises and controls will be mandatory and must be adhered to by all personnel and contractors employed on the construction of the Proposed Development.

A Surface Water Management Plan will be included in the CEMP. This will have regard to guidelines listed above for the wind farm site. The Surface Water Management Plan will set out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase. This will be focused on areas of the Grid Connection route near waterways and at crossing points. Works on riverbanks can potentially lead to destabilisation, erosion, and increased siltation downstream. The river crossings will be carried out using horizontal directional drilling. The proposed crossing points are listed in Table 8 and indicated in 6a.

A sealed silt fence will be placed at both sides of points where rivers or streams are crossed and to a minimum of 10m upstream and downstream of each crossing at both sides of the road. The maintenance and monitoring of such silt fences will be subject to an on-site quality management system which will be set out in the CEMP.

Spoil heaps from any excavations will be covered with geotextile and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Spoil heaps will be placed at least 10m from the boundary of the Killala Bay/Moy Estuary SPA. Any berms will be covered with a geo-textile matting to avoid sediment runoff; berms will be surrounded by silt fencing until vegetation has been established in the following growing season. If cables will be installed in trenches, they will be

located underneath and directly adjacent to access tracks as far as possible. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods to avoid acting as a conduit for surface water flows. Clay bunds will be constructed within any cable trenches at intervals.

A Surface Water Management Plan will be included in the CEMP, the final version of which will detail the required measures for the Contractor to implement in the event of a 'worst case' scenario on the Site. Timing of the proposed works will also take account of the fisheries constraints within the study area, where no works will be undertaken in the instream environment during the salmonid close season (October–June annually).

Machinery will be stored in the Site compound. Wheel washing facilities will be provided at the Site entrance draining to silt traps. Portaloos will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor and will not be discharged on Site.

Any diesel or fuel oils stored on Site will be bunded to 110% of the capacity of the storage tank. Such facilities will not be located near any drain or watercourse. Design and installation of fuel tanks will be in accordance with best practice guidelines. Refuelling of plant during construction will be carried out on a designated and appropriately managed area, away from watercourses. Drip trays and spill kits will be kept available on Site. Appropriate containment facilities will be provided to ensure that any spills from the vehicle are contained and removed off Site.

Appropriate preventative measures will again be detailed in the CEMP to ensure that non-native aquatic/riparian species are not introduced into the site. These measures will again follow as relevant the manual *'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads*' by NRA (2010).

5.3.2 Operational Phase

The operational Grid Connection route would have a negligible effect on aquatic ecological interests and fisheries, as there are no further potential impacts on surface water run-off or watercourses within the site. During the operational phase there is the potential for impacts regarding maintenance. If there are faults with the cable route excavations may be required. However, the scale of this is considered minor. Weekly inspections of the erosion and sediment control measures on site will be required during the construction period, followed by fortnightly inspections until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

5.3.3 Decommissioning Phase

If the Proposed Tirawley Wind Farm is decommissioned the proposed Grid Connection route will be left in place. Therefore, there is no potential for impacts.

6. RESIDUAL IMPACTS

The Proposed Tirawley Wind Farm will have an overall slight negative impact on aquatic ecology during the construction phase in the local context in the absence of mitigation measures. The Grid Connection route would also have a slight negative impact on aquatic ecology/ in the absence of mitigation. The Grid Connection route crosses sensitive ecological areas near Natura 2000 sites designated for aquatic qualifying interests. Impacts will be effectively reduced to an imperceptible negative impact with the mitigation measures proposed. The limitation through mitigation of impacts arising from water quality pollution events such as siltation and run-off of suspended solids will significantly reduce the potential for impacts affecting aquatic ecological interests within the Site.

Localised water quality impacts as a result of construction phase will be reduced by undertaking the most sensitive elements of the works outside the salmonid close season and protection of water quality following the implementation of the water management measures. Sensitive elements or work include all instream works in addition to works near watercourses where significant releases of silt / sediment could occur.

All mitigation measures provided for the protection of aquatic ecology and fisheries within the proposed development sites, will effectively protect aquatic ecological interests downstream of the proposed developments.

It is important to note that the failure to implement the mitigation measures proposed for the minimisation of impacts affecting aquatic ecology and fisheries would negate the results of the impact assessment provided in the current assessment.

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PLATES

Plate 1 Electrofishing survey at Site 1 on the 2nd order Knockboha River (EPA code: 33K03). This site had poor water quality and no fish were recorded. Two stretches were surveyed.

Plate 2 Site 2 on the 1st order Knockboha River (EPA code: 33K03) c. 2.3 km upstream of Site 1. This stream was inaccessible, partially dry, and no fish were present.

Plate 3 The 2nd order River Conaghra (EPA code: 33C54) at Site 3 with agricultural impacts apparent.

Plate 4 Juvenile Brown Trout (*Salmo trutta*) from the River Conaghra at Site 3.

Plate 5 Three-spined sticklebacks (*Gasterosteus aculeatus*) from the River Conaghra at Site 3.

Plate 6 The 1st order River Glebe at Site 4. This stream was very overgrown and was partially dry. No fish were present.

Plate 7 The 1st order River Conaghra (EPA code: 33C54) at Site 5. No fish were recorded in this small stream.

Plate 8 The 1st order River Conaghra (EPA code: 33C54) at Site 6. This site is located c 1.2 km upstream of Site 5. No fish were recorded in this tiny stream.

Plate 9 The 1st order River Keeloges Upper (EPA code: 33K05) at Site 7. This stream was overgrown, partially dry, and no fish were present.

Plate 10 The 2nd order River Lissadrone East (EPA code: 33L01) at Site 8. Only small numbers of three-spined sticklebacks were recorded.

Plate 11 Electrofishing survey on the 3rd order River Cloonalaghan (EPA code: 33C01) at Site 9.

Plate 12 Brown trout from Site 9 on the Cloonalaghan river. Reasonable stocks of trout were present.

Plate 13 Brown trout from Site 9 on the Cloonalaghan river.

Plate 14 Brown trout from Site 9 on the Cloonalaghan river.

Plate 15 European Eels (*Anguilla anguilla*) from Site 9 on the Cloonalaghan river.

Plate 16 European Eel from Site 9 on the Cloonalaghan river.

Plate 17 The 1st order Ballymurphy stream (EPA code: 33B06) at Site 10. No fish were recorded.

Plate 18 Kick sampling on the 3rd order Cloonalaghan river (EPA code: 33C01) at Site 11.

Plate 19 Three-spined sticklebacks from the Cloonalaghan river at Site 11. Small numbers of Brown trout were also present.

Plate 20 The River Cloonalaghan (EPA code: 33C01) at Site 12.

Plate 21 Brown trout from the River Cloonalaghan at Site 12.

Plate 22 The 2nd order Billoos river (EPA code: 33B36) at Site 13. Nominal numbers of Brown Tout were present.

Plate 23 The 2nd order River Cloonalaghan (EPA code: 33C01) at Site 14. No fish were recorded.

Plate 24 The 1st order Cloonavarry river (EPA code: 33C43) at Site 15. This stream was grossly polluted and no fish were recorded.

Plate 25 The 3rd order Gortmore Stream (EPA Code 33G04) at Site 16.

Plate 26 Electrofishing survey on the Gortmore Stream (EPA Code 33G04) at Site 16.

Plate 27 Brown trout from the Gortmore Stream at Site 16.

Plate 28 Well conditioned Brown trout from the Gortmore Stream at Site 16.

Plate 29 More Brown trout from the Gortmore Stream at Site 16. Good stocks of trout were present.

Plate 30 The River Lecarrowntemple (EPA code: 33L13) at Site 17. Small numbers of juvenile trout were present.

Plate 31 The River Lecarrowntemple (EPA code: 33L13) at Site 18. No fish were recorded.

Plate 32 The 2nd order Gortmore Stream (EPA code: 33G04) at Site 19. Small numbers of juvenile trout were present.

Plate 33 Brown trout from the Gortmore Stream at Site 19.

Plate 34 Site 20 on the 2nd order Cabintown river (EPA code: 33C52). No fish were recorded.

Plate 35 The 5th order Cloonagmore river at Palmerstown Bridge. The proposed grid connection route crosses here. An Otter was seen at this site.

Plate 36 Osprey (with prey, thought to be a mullet) near Site 11 on the 7th of September 2023.

APPENDIX 1 FIELD RESULTS

Table A1.1 Summary of the results of the aquatic habitat surveys completed at the 20 sites assessed for the proposed Tirawley Wind Farm site during September 2023.

Site	Watercourse name	EPA Segment Code	Aquatic habitat description	River habitat type	Salmonid habitats	Lamprey habitats	Habitats for rare/notable species	Suitable for Q rating (Y/N)	Overall evaluation
1	Knockboha River	33_1210	Modified stream with poor water quality. Substrate was dominated by bedrock. Agricultural impacts and modifications apparent.	High gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Physically suitable for salmonids. However a natural falls on the lower reaches is likely to prevent access for migratory fish. Pollution problems.	High gradient and bedrock -no potential lamprey habitats. Polluted at the time of the survey.	No	Yes	Poor Habitat Status
2	Knockboha River	33_1237	Partially dry, tiny overgrown stream.	More a drain (FW4 - Drainage ditches).	Not a suitable habitat for fish.	Not a suitable habitat for fish.	No	No	Moderate Status
3	Conaghra river	33_2820	Has suitable spawning and nursery habitats. Agricultural impacts and modifications apparent.	Medium gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Sub-optimal potential salmonid spawning and nursery habitats present.	Potential lamprey spawning and nursery habitats present.	No	Yes	Moderate Status
4	Glebe river	33_2890	Tiny overgrown stream.	Very small but would fall into	Not a suitable habitat for fish.	Not a suitable	No	No	Moderate Status

Site	Watercourse name	EPA Segment Code	Aquatic habitat description	River habitat type	Salmonid habitats	Lamprey habitats	Habitats for rare/notable species	Suitable for Q rating (Y/N)	Overall evaluation
				'FW1 - Eroding/upland River' category.		habitat for fish.			
5	Conaghra river	33_2806	Tiny overgrown stream.	Very small but would again fall into 'FW1 - Eroding/upland River' category.	Not a suitable habitat for fish.	Not a suitable habitat for fish.	No	No	Moderate Status
6	Conaghra river	33_2806	Tiny overgrown stream.	Very small but would also fall into 'FW1 - Eroding/upland River' category. Riffle habitat.	Not a suitable habitat for fish.	Not a suitable habitat for fish.	No	No	Moderate Status
7	Keeloges Upper	33_3153	Tiny overgrown stream.	FW4 - Drainage ditch.	Not a suitable habitat for fish.	Not a suitable habitat for fish.	No	No	Moderate Status
8	Lissadrone East	33_3134	Tiny stream.	Very small but would fall into 'FW1 - Eroding/upland River' category.	Not a suitable habitat for fish.	Not a suitable habitat for fish.	No	No	Moderate Status
9	Cloonalaghan river	33_312	Modified in the past but has physically suitable salmonid and lamprey habitats. Relatively clean.	Medium gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Salmonid spawning and nursery habitats present. Accessible to migratory fish.	Physically suitable habitats present.	Probably too small for FPMs, outside of the range of crayfish.	Yes	Good status

Site	Watercourse name	EPA Segment Code	Aquatic habitat description	River habitat type	Salmonid habitats	Lamprey habitats	Habitats for rare/notable species	Suitable for Q rating (Y/N)	Overall evaluation
10	Ballymurphy stream	33_3148	Small stream with agricultural impacts	Low gradient, glide dominating. Would fall into the FW1 category.	Not a suitable habitat for fish.	Not a suitable habitat for fish.	No	No	Moderate Status
11	Cloonalaghan river	33_2912	Small stream with agricultural impacts. Has been deepened and channelised in the past.	Medium gradient, glide dominating, eroding. (FW1 - Eroding/upland River).	Marginal salmonid habitat.	Marginal lamprey habitat.	No	Yes	Moderate Status
12	Cloonalaghan river	33_2917	Small stream with some physically suitable salmonid habitat.	Medium gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Marginal salmonid habitat.	Marginal lamprey habitat.	No	Yes	Good Status
13	Confluence of the Billoos river and Carn river	33_3137 / 33_2731	Small stream with some physically suitable salmonid habitat.	Medium gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Marginal salmonid habitat.	Marginal lamprey habitat.	No	Yes	Good Status
14	Cloonalaghan river	33_2732	Tiny stream with forestry and agricultural impacts	Medium gradient, riffle dominating, eroding. Falls	Not a suitable habitat for fish.	Not a suitable habitat for lampreys.	No	No	Moderate Status

Site	Watercourse name	EPA Segment Code	Aquatic habitat description	River habitat type	Salmonid habitats	Lamprey habitats	Habitats for rare/notable species	Suitable for Q rating (Y/N)	Overall evaluation
				into FW1 category despite small size.					
15	Cloonavarry river	33_2471	Small stream with agricultural pollution	Medium gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Too polluted – but physically has some limited potential.	Not a suitable habitat for lampreys.	No	Yes	Poor Status
16	Gortmore stream	33_2268	Ideal salmonid spawning and nursery habitat	Medium gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Good salmonid channel.	Lamprey habitats present.	This catchment has some potential for FPMs.	Yes	Good status +
17	Lecarrowntemple river	33_971	Small stream but potential salmonid spawning and nursery habitat	Medium gradient, riffle dominating, eroding. (FW1 - Eroding/upland River).	Salmonid habitats present.	Lamprey habitats present.	This catchment has some potential for FPMs.	Yes	Good status +
18	Lecarrowntemple river	33_1791	Tiny overgrown stream	More a drain (FW4 - Drainage ditches).	Not a suitable habitat for fish.	Not a suitable habitat for lampreys.	No	No	Moderate Status
19	Gortmore Stream	33_2244	Small stream but potential salmonid spawning and nursery habitat	Medium gradient, riffle dominating,	Salmonid habitats present.	Lamprey habitats present (marginal).	No	Yes	Good status

Site	Watercourse name	EPA Segment Code	Aquatic habitat description	River habitat type	Salmonid habitats	Lamprey habitats	Habitats for rare/notable species	Suitable for Q rating (Y/N)	Overall evaluation
				eroding. (FW1 - Eroding/upland River).					
20	Cabintown river	33_1132	Tiny overgrown stream	High gradient, riffle dominating, eroding, but tiny (FW1 - Eroding/upland River).	Not a suitable habitat for fish.	Not a suitable habitat for fish.	No	No	Moderate Status

Table A1.2 Summary of the results of the kick sampling surveys completed at the 20 sites assessed for the proposed Tirawley Wind Farm site during September 2023.

Site	Watercourse name	EPA Segment Code	Survey results	Biological Water quality	White-clawed crayfish (P/A)	Freshwater Peal Mussels (P/A)	Overall evaluation
1	Knockboha River	33_1210	Polluted stream, heavily silted, excessive algae, Macroinvertebrate community dominated by pollution tolerant species, mainly Dipteran larvae.	Poor (Q3)	Absent	Absent	Poor Status
2	Knockboha River	33_1237	Tiny stream – partially dry.	SSRS – "At risk"	Absent	Absent	Moderate Status
3	Conaghra river	33_2820	Silted with agricultural impacts apparent. Only Class C, D, and E organisms recorded but was considered to meet Q3-4 status; *Baetis rhodani*, uncased caddis, *Gammarus*, Jenkins' Spire Snail (Potamopyrgus antipodarum), and Dipteran larvae present.	Q3-4	Absent	Absent	Moderate Status
4	Glebe river	33_2890	Tiny overgrown stream, very little invert life.	SSRS – "At risk"	Absent	Absent	Moderate Status

Site	Watercourse name	EPA Segment Code	Survey results	Biological Water quality	White-clawed crayfish (P/A)	Freshwater Peal Mussels (P/A)	Overall evaluation
5	Conaghra river	33_2806	Very small stream, limited macroinvertebrate fauna; Group C mayfly larvae, uncased caddis, Dipterans recorded.	SSRS – "At risk"	Absent	Absent	Moderate Status
6	Conaghra river	33_2806	Very small stream, limited macroinvertebrate fauna.	SSRS – "At risk"	Absent	Absent	Moderate Status
7	Keeloges Upper	33_3153	Very small stream, limited macroinvertebrate fauna.	SSRS – "At risk"	Absent	Absent	Moderate Status
8	Lissadrone East	33_3134	Very small stream, limited macroinvertebrate fauna.	SSRS – "At risk"	Absent	Absent	Moderate Status
9	Cloonalaghan river	33_312	Class A Heptageniids present, *Baetis rhodani*, Gammarus, cased and uncased Trichopterans, River limpet and Jenkin's Spire Snail. Normal siltation and sparce filamentous algae.	Q4	Absent	Absent	Good status
10	Ballymurphy stream	33_3148	Very small stream, limited macroinvertebrate fauna.	SSRS – "At risk"	Absent	Absent	Moderate Status
11	Cloonalaghan river	33_2912	Poor habitats and limited fauna. Stream has been deepened and channelised in the past. Gammarus, Baetids, Dipterans, caseless Trichopterans.	Q3	Absent	Absent	Moderate Status
12	Cloonalaghan river	33_2917	Small stream, limited macroinvertebrate fauna. Class C and D groups dominating. Silt and algae levels bit elevated. A bit small for Q rating scheme.	Q3	Absent	Absent	
13	Confluence of the Billoos river and Carn river	33_3137 / 33_2731	Small stream and limited macroinvertebrate community. A bit small for Q rating scheme - but was relatively clean.	Q4	Absent	Absent	Good Status
14	Cloonalaghan river	33_2732	Small stream and limited macroinvertebrate community - but relatively clean. A bit small	SSRS – "At risk"	Absent	Absent	Moderate Status

Site	Watercourse name	EPA Segment Code	Survey results	Biological Water quality	White-clawed crayfish (P/A)	Freshwater Peal Mussels (P/A)	Overall evaluation
			for Q rating scheme, only Group C and Group D species.				
15	Cloonavarry river	33_2471	Very polluted – agricultural impacts. Sparce macroinvertebrate community, all Class C and lower.	Polluted – Q2-3	Absent	Absent	Poor Status
16	Gortmore stream	33_2268	Clean watercourse with diverse community. Class A Heptageniids present. Other mayfly larvae present included Baetids, Ephemerellids, and Caenids. Both cased and uncased Trichopterans recorded. Gammarus was common.	Q4+	Absent	Absent at this site. This catchment has some potential for FPMs in the its lower reaches.	Good status +
17	Lecarrowntemple river	33_971	Mayflies present included Heptageniids, Baetids, and Ephemerellids. Freshwater shrimp and both cased and uncased caddis. Normal siltation and sparce filamentous algae.	Q4	Absent	Absent at this site. This catchment has some potential for FPMs in the its lower reaches.	Good status +
18	Lecarrowntemple river	33_1791	Very small stream, limited macroinvertebrate fauna.	SSRS – "At risk"	Absent	Absent	Moderate Status
19	Gortmore Stream	33_2244	Small and relatively clean stream. Leuctrids, Baetids, cased caddis and Dipterans present. No siltation of algal growths.	Q4	Absent	Absent	Good status
20	Cabintown river	33_1132	Very small stream, limited macroinvertebrate fauna.	SSRS – "At risk"	Absent	Absent	Moderate Status

A1.3 Summary of the results of the electrofishing assessment surveys completed at the 20 sites assessed for the proposed Tirawley Wind Farm site during September 2023.

Site	Watercourse name	EPA Segment Code	Fish population	Overall evaluation
1	Knockboha River	33_1210	No fish recorded – two 10-minute sites fished. Stream polluted.	Poor Status
2	Knockboha River	33_1237	No fish recorded. Too small to support fish, partially dry.	Moderate Status
3	Conaghra river	33_2820	Small numbers of salmonids present. Three spined sticklebacks present. No lampreys present. Agricultural impacts at the site with cattle crossing.	Moderate Status
4	Glebe river	33_2890	This stream is to small to provide a habitat for fish.	Moderate Status
5	Conaghra river	33_2806	Tiny stream, no fish present.	Moderate Status
6	Conaghra river	33_2806	No fish present, this stream is very small.	Moderate Status
7	Keeloges Upper	33_3153	Not a suitable habitat for fish – too small and partially dry.	Moderate Status
8	Lissadrone East	33_3134	Three-spined sticklebacks were the only fish recorded. Very small stream.	Moderate Status
9	Cloonalaghan river	33_312	Brown trout present in good numbers, good numbers of eels, no lampreys. Salmon were also absent despite suitable habitat. Locally important salmonid stream with four age groups of trout.	Good status
10	Ballymurphy stream	33_3148	No fish present in this tiny stream.	Moderate Status
11	Cloonalaghan river	33_2912	Brown trout (nominal numbers) and Three-spined sticklebacks present. Lampreys were not recorded. This stream has been dredged and modified in the past.	Moderate Status
12	Cloonalaghan river	33_2917	Small number of Brown trout present. No other fish species recorded.	Moderate Status
13	Confluence of the Billoos river and Carn river	33_3137 / 33_2731	Brown trout (nominal numbers). No lampreys.	Good Status
14	Cloonalaghan river	33_2732	No fish recorded.	Moderate Status
15	Cloonavarry river	33_2471	No fish recorded. This stream was very polluted – agricultural impacts.	Poor Status
16	Gortmore stream	33_2268	Good healthy trout stock present. No lampreys or other fish species recorded.	Good status +

Site	Watercourse name	EPA Segment Code	Fish population	Overall evaluation
17	Lecarrowntemple river	33_971	Brown trout present. No lampreys present. No other fish species recorded. Nice little salmonid stream but very small.	Good status +
18	Lecarrowntemple river	33_1791	No fish present – no suitable habitats.	Moderate Status
19	Gortmore Stream	33_2244	Small numbers of brown trout were present. No other fish species recorded.	Good status
20	Cabintown river	33_1132	No fish present in this tiny stream.	Moderate Status

Table A1.4 Results of the electrical fishing surveys undertaken at the 20 survey sites during September 2023 (Numbers recorded).

Site	Watercourse Name	Brown Trout	Salmon	Brook Lamprey	Minnow	Three-spined stickleback	European eel	Others and comments
1	Knockboha River	0	0	0	0	0	0	No fish recorded
2	Knockboha River	0	0	0	0	0	0	No fish recorded
3	Conaghra river	6	0	0	0	12	0	
4	Glebe river	0	0	0	0	0	0	No fish recorded
5	Conaghra river	0	0	0	0	0	0	No fish recorded
6	Conaghra river	0	0	0	0	0	0	No fish recorded
7	Keeloges Upper	0	0	0	0	0	0	No fish recorded
8	Lissadrone East	0	0	0	0	5	0	
9	Cloonalaghan river	12	0	0	0	0	4	
10	Ballymurphy stream	0	0	0	0	0	0	No fish recorded
11	Cloonalaghan river	2	0	0	0	20	0	
12	Cloonalaghan river	6	0	0	0	0	0	

Site	Watercourse Name	Brown Trout	Salmon	Brook Lamprey	Minnow	Three-spined stickleback	European eel	Others and comments
13	Confluence of the Billoos river and Carn river	3	0	0	0	5	0	
14	Cloonalaghan river	0	0	0	0	0	0	No fish recorded
15	Cloonavarry river	0	0	0	0	0	0	No fish recorded
16	Gortmore stream	14	0	0	0	0	0	
17	Lecarrowntemple river	9	0	0	0	0	0	
18	Lecarrowntemple river	0	0	0	0	0	0	No fish recorded
19	Gortmore Stream	5	0	0	0	0	0	
20	Cabintown river	0	0	0	0	5	0	No fish recorded

Table A1.5 Results of the electrical fishing surveys at the 20 survey sites (CPUE fish/min).

Site	Watercourse Name	Brown trout	Salmon	Brook lamprey	Minnow	Three-spined stickleback	European eel
1	Knockboha River	-	-	-	-	-	-
2	Knockboha River	-	-	-	-	-	-
3	Conaghra river	0.60	-	-	-	1.20	-
4	Glebe river	-	-	-	-	-	-
5	Conaghra river	-	-	-	-	-	-
6	Conaghra river	-	-	-	-	-	-
7	Keeloges Upper	-	-	-	-	-	-
8	Lissadrone East	-	-	-	-	-	-
9	Cloonalaghan river	1.20	-	-	-	-	0.40
10	Ballymurphy stream	-	-	-	-	-	-
11	Cloonalaghan river	0.20	-	-	-	2.00	-
12	Cloonalaghan river	0.60	-	-	-	-	-

Site	Watercourse Name	Brown trout	Salmon	Brook lamprey	Minnow	Three-spined stickleback	European eel
13	Confluence of the Billoos river and Carn river	0.30	-	-	-	0.50	-
14	Cloonalaghan river	-	-	-	-	-	-
15	Cloonavarry river	-	-	-	-	-	-
16	Gortmore stream	1.40	-	-	-	-	-
17	Lecarrowntemple river	0.90	-	-	-	-	-
18	Lecarrowntemple river	-	-	-	-	-	-
19	Gortmore Stream	0.50	-	-	-	-	-
20	Cabintown river	-	-	-	-	0.50	-

Table A1.6 Results of the lamprey habitat/electrofishing surveys at the 20 survey sites (CPUE fish/min).

Site	Watercourse Name	Potential lamprey habitat present (Y/N)	Lampreys recorded	Evaluation
1	Knockboha River	No		Lamprey not recorded
2	Knockboha River	No		Lamprey not recorded
3	Conaghra river	Yes	No lampreys recorded	Lamprey not recorded
4	Glebe river	No		Lamprey not recorded
5	Conaghra river	No		Lamprey not recorded
6	Conaghra river	No		Lamprey not recorded
7	Keeloges Upper	No		Lamprey not recorded
8	Lissadrone East	No		Lamprey not recorded
9	Cloonalaghan river	Yes	No lampreys recorded	Lamprey not recorded
10	Ballymurphy stream	Yes	No lampreys recorded	Lamprey not recorded
11	Cloonalaghan river	Yes	No lampreys recorded	Lamprey not recorded
12	Cloonalaghan river	Yes	No lampreys recorded	Lamprey not recorded
13	Confluence of the Billoos river and Carn river	Yes	No lampreys recorded	Lamprey not recorded
14	Cloonalaghan river	Yes	No lampreys recorded	Lamprey not recorded

Site	Watercourse Name	Potential lamprey habitat present (Y/N)	Lampreys recorded	Evaluation
15	Cloonavarry river	Yes	No lampreys recorded	Lamprey not recorded
16	Gortmore stream	Yes	No lampreys recorded	Lamprey not recorded
17	Lecarrowntemple river	Yes	No lampreys recorded	Lamprey not recorded
18	Lecarrowntemple river	Yes	No lampreys recorded	Lamprey not recorded
19	Gortmore Stream	Yes	No lampreys recorded	Lamprey not recorded
20	Cabintown river	No		Lamprey not recorded