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CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

APPENDIX 9.3

Aquatic Survey reports

AQUATIC ECOLOGY SURVEYS FOR COUMNAGAPPUL WIND FARM.

(Biological Water Quality, Freshwater Pearl Mussel, White-clawed Crayfish and Riparian Invasive Alien Plant Species)

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1. INTRODUCTION

1.1 Background

Sweeney Consultancy was commissioned by Fehily Timoney & Co. Consultants, to undertake an ecological assessment of watercourses at and downstream of a proposed wind farm development site and the proposed cable route options crossing points.

1.2 Catchments Potentially Impacted

The subject site is at Coumnagappal, in the Monavullagh Mountains in Co. Waterford. While the site overlaps the catchment of the River Nier (EPA Code 16N01), all the proposed turbine locations are within the catchment of the Colligan River (EPA Code 17C01). The proposed cable route options cross watercourses in the catchment of River Finisk (EPA Code 18F02), as well as several in the Colligan and Nier catchments.

1.3 Consultations & Desktop Assessment

Dr. Evelyn Moorkens was consulted by telephone on 21/07/2020 for information on freshwater pearl mussel (*Margaritifera margaritifera*) presence in the catchments of the Colligan, Nier and Finisk. She stated that there were no know records in these rivers, but she was of the opinion that it might be possible that mussels are present in suitable habitat in the Colligan.

Mr. Cyril Saich, District Conservation Officer, National Parks and Wildlife Service, was consulted by telephone on 21/07/2020 for information on presence of other protected aquatic species in the catchments of the Colligan, Nier and Finisk. He stated that there were no know records of white-clawed crayfish (*Austropotamobius pallipes*) in these rivers.

Demers et al (2005) does not indicate the presence of white-clawed crayfish in the Rivers Finisk or Colligan. During the 2015 and 2017 rounds of the EPA Rivers Monitoring Programme, for which Sweeney Consultancy was contracted to carry out the assessments on the Blackwater and Suir catchments, respectively, crayfish were checked for at the three EPA sampling stations on the Finisk, and at the three EPA sampling stations on the Nier. No live crayfish were found at any of these sites.

The National Biodiversity Data Centre (NBDC) website was checked for records of protected species.

2. METHODOLOGY

2.1 Waterbodies Surveyed

Watercourse names used in this report are in accordance with OS Historic 25 Inch Maps and OS Discovery Series Maps.

Watercourses within the proposed wind farm site and those which could receive surface runoff from the development site were surveyed. In addition, all watercourses indicated by blue lines on the Ordnance Survey Discovery Series maps which would be crossed by either of the proposed cable routes were checked from the proposed crossing point to 100m downstream. Larger, named streams were also checked downstream, towards the confluence with the main river (the Rivers Colligan, Nier or Finisk).

2.2 Biological Water Quality Assessment Method

At twelve sites, biological water quality was assessed, following the Standard Operating Procedures of the EPA (2020). At each site, notes on the physical habitat were recorded. A two-to-three-minute macroinvertebrate kick sample was collected, preferably from faster flowing riffle habitat. A further one-minute hand search was carried out to locate macroinvertebrates that remained attached to the underside of the cobbles. The entire sample was placed in a white tray on the riverbank. All macroinvertebrates were identified to at least genus/family level and the relative percentage abundance was recorded for each taxon. A Q-value was assigned based on the relative abundance of the pollution sensitive and tolerant taxa present in the sample. River typology and seasonality were considered when assigning the Q-value status.

2.3 Species Survey Methods

Freshwater pearl mussel (*Margaritifera margaritifera*): Initial visual assessment of the habitat quality, based on the criteria outlined by Skinner et al. (2003). Where the habitat was assessed as being possibly suitable for mussels, a licensed survey (Licence No C15/2020) was carried out in accordance with the standard methodology (Anon 2004) on a minimum of 500m of river. In addition, a bank of gravel at Kildangan Bridge at the lower end of the Colligan was searched for mussel shell fragments.

White-clawed crayfish (*Austropotamobius pallipes*): Initial visual assessment of the habitat quality, based on the criteria outlined by Holdich (2003). Where the habitat at the biological water quality assessment sites was assessed as being possibly suitable for

crayfish, a licensed survey (Licence No C29/2020) was carried out in accordance with the standard methodology (Peay 2003).

Invasive alien plant species: Visual checking for the presence of any aquatic invasive alien species, listed in the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011).

At the sampling sites surveyed, evidence of the presence of protected riparian species was checked for by direct observations.

Fish stocks were assessed by an electrofishing survey carried out by Triturus Environmental Ltd. and are reported on separately.

3. SURVEY RESULTS

3.1 Fieldwork

Fieldwork was carried out in dry, calm, bright weather conditions with clear water and good. Initial habitat and species assessments, biological water quality sampling and crayfish surveying was carried out from 22/07/2020 to 25/07/2020 and freshwater pearl mussel surveying was undertaken on 25/09/2020 by Pascal Sweeney, with Niamh O'Flynn as bankside assistant.

3.2 Results by Waterbody

3.2.1 Colligan Catchment

3.2.1.1 Description

Photographs referred to below are presented in Appendix 1 and the locations where they were taken are mapped (Maps 1 to 4).

Within the proposed wind farm site, the headwaters (northern and eastern branches) of the River Colligan (Map 1), above 300m OD in the Monavullagh Mountains, are small rocky high energy streams (Photos 1 & 2). While the channel of the watercourse increases in size downstream of the confluence of these two tributaries (Photo 3) and increases farther downstream of the Coumduane Stream confluence (Photo 4), the substratum of the Colligan is indicative of very turbulent conditions in high flows. Lower gradients downstream of the confluence of the Araglin River (Map 2), result in stretches of the Colligan with glide over cobble, gravels and some sand (Photo 11). The downstream reaches of the Colligan (Map 4), from Colligan Bridge to downstream of Kildangan Bridge consists of a series of stretches of fast-flowing stony riffle (Photo 17), deeper, slow-flowing glide over slightly silted stones (Photo 18) and faster glide (Photo 19).

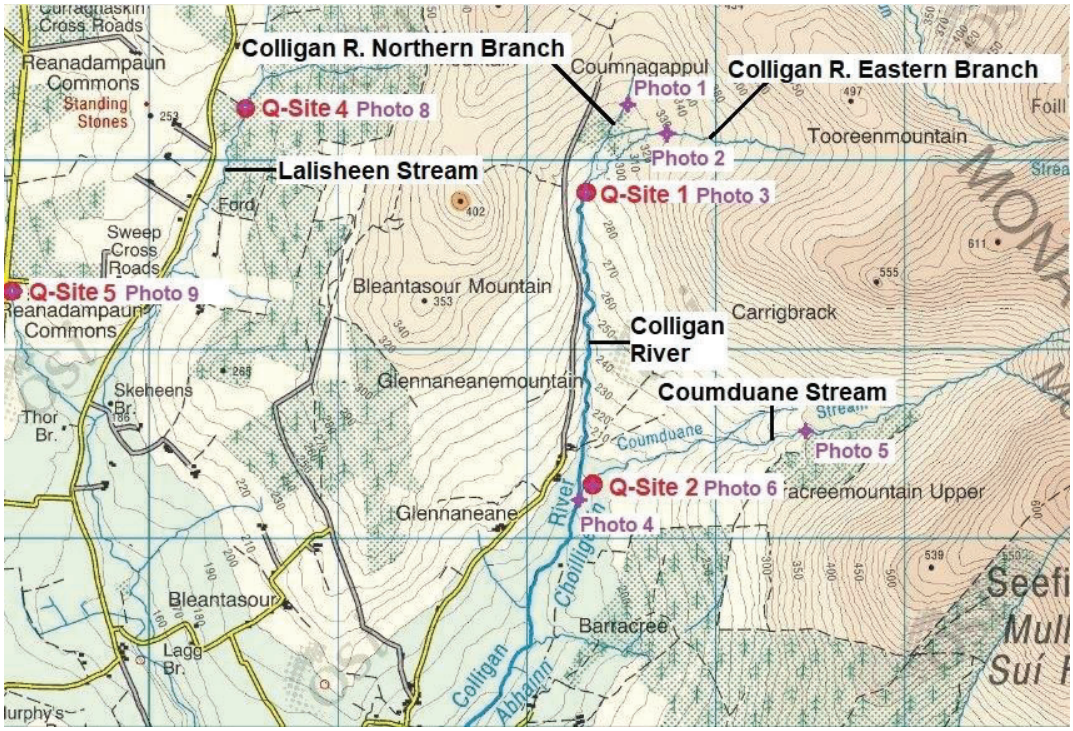
The Coumduane Stream, which drains part of the southern side of the proposed wind farm site, is the first significant potentially affected tributary of the Colligan. At 300m OD, it is very small (Photo 5), but, nearer the Colligan confluence, additional runoff increases the stream volume (Photo 6). Similar to the northern parts of the Colligan main channel, this is a high energy watercourse.

The western side of the proposed wind farm site drains to the Lalisheen Stream (Map 1). The habitat of the upper parts of this stony stream is affected by shade and siltation

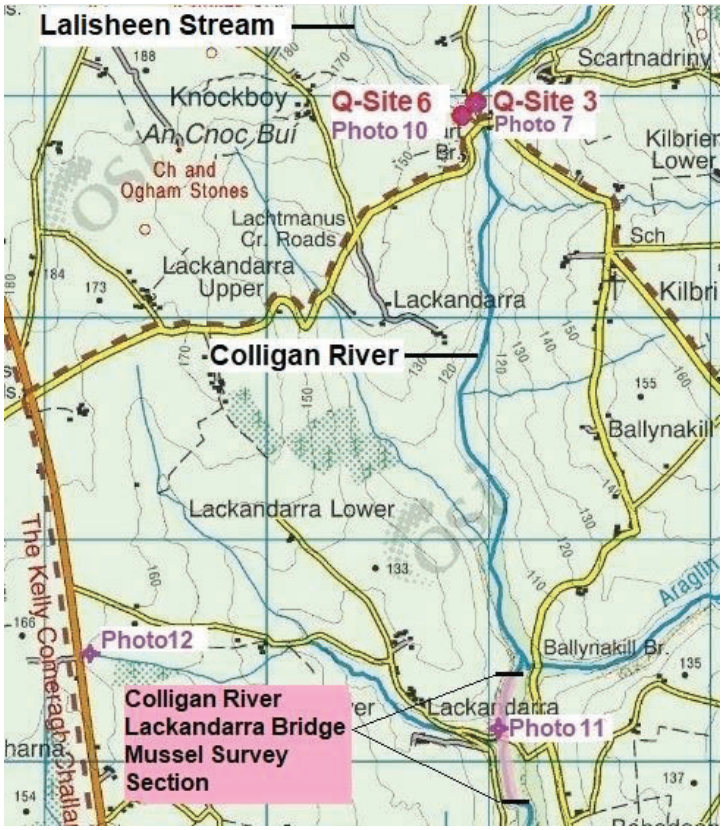
where it passes through or adjacent to commercial conifer forestry plantations (Photo 8) A small tributary of the Lalisheen Stream is crossed by the two proposed cable routes at Bryan's Cross Roads (Photo 9). Near the confluence with the Colligan, the bed of Lalisheen Stream consists mainly of large cobble and boulders, with some gravel, indicating high velocities at times of higher flow (Photo 10).

Four small watercourses, indicated on Ordnance Survey Discovery Series maps, are crossed by the R672 road, along which one of the proposed cable routes runs. The first of these at ITM 62111 60253 in the Lackandarra townland (Map 2) is at an overgrown field boundary, with no flowing water at the time of fieldwork (Photo 12). The second is the Knockanpower Stream, which is a small watercourse with heavy instream plant growth (Photo 13) immediately downstream of Knockanpower Bridge on the R672 at ITM 621236 60161 (Figure 3). At ITM 62255 60038, just upstream of its confluence with the Colligan, the Knockanpower Stream consists of a riffle-cascade-pool sequence in heavy shade. A small trout was seen here. The channel at ITM 62073 60048, near Garryduff Cross Roads (Map 3) was dry at the time of fieldwork (Photo 15). Downstream of the R672 road crossing at ITM 62090 59935, the small watercourse in the Garryclone townland is an overgrown drain with very little flow (Photo 16).

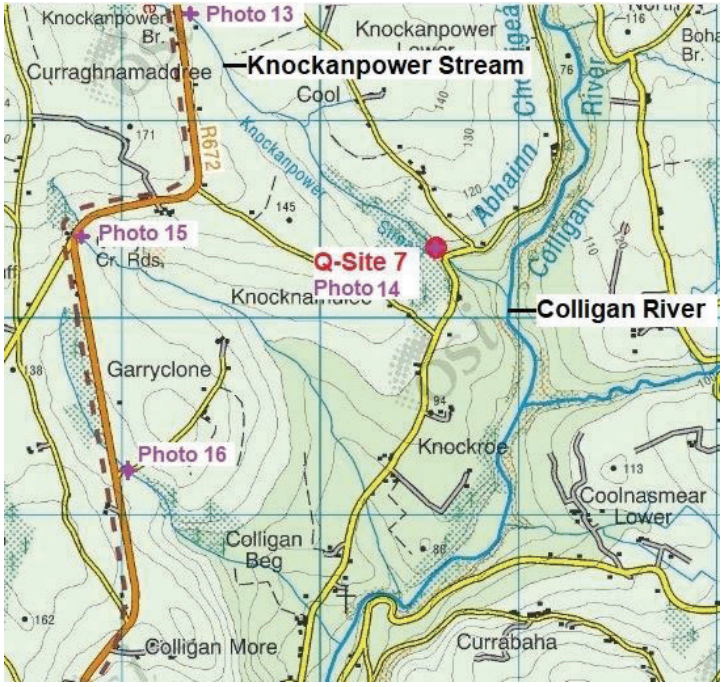
Map 1.


Colligan R. Northern Branch
Colligan R. Eastern Branch
Coumnagappul
Photo 1
Photo 2
Tooreenmountain
Q-Site 4 Photo 8
Lalisheen Stream
Q-Site 1 Photo 3
Ford
Sweep Cross Roads
Q-Site 5 Photo 9
Reanadampaun Commons
Bleantasour Mountain
Carrigbrack
Colligan River
Glennaneanemountain
Coumduane Stream
Coumduane
Photo 5
Q-Site 2 Photo 6
Glennaneane
Photo 4
Bleantasour
Bartacree
Lagg Br.
Thor Br.
Skeheens Br.
Colligan Abhainn

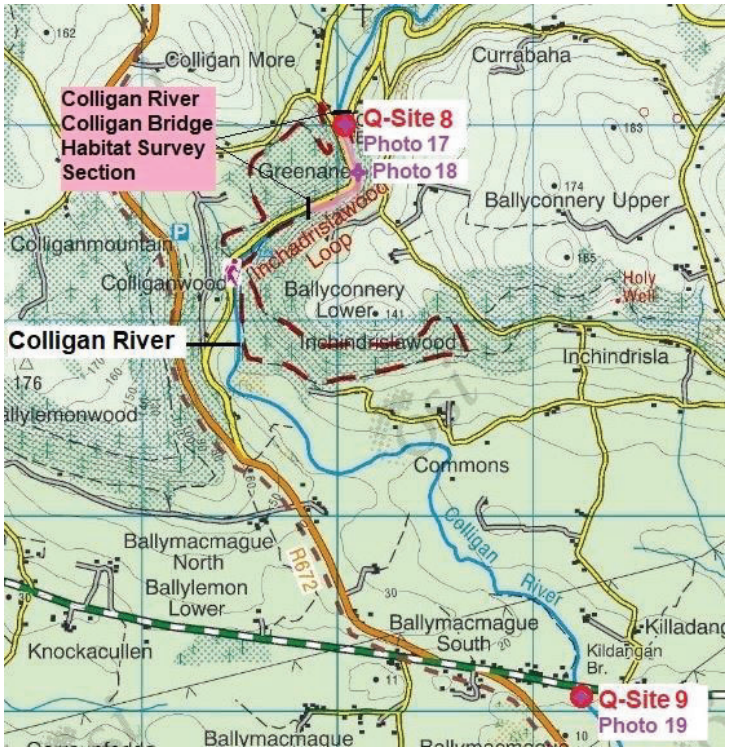
Map 2.


Lalisheen Stream
Scartnadriny
Knockboy
Q-Site 6
Photo 10
Q-Site 3
Photo 7
An Cnoc Buí
Ch and Ogham Stones
Kilbrier Lower
Lachtmanus Cr. Roads
Lackandarra Upper
Lackandarra
Colligan River
Ballynakill
Lackandarra Lower
The Kelly Commeragh Challa
Photo12
Colligan River Lackandarra Bridge Mussel Survey Section
Ballynakill Br.
Photo 11

Map 3.



Map 4.



3.2.1.2 Biological Water Quality Assessment

Biological water quality was assessed at nine locations in the Colligan catchment, indicated on Maps 1 to 4 above. Photographs of the sampling sites are presented in

Appendix 1. Relevant descriptive information for the macroinvertebrate sampling sites is presented in Appendix 2 and macroinvertebrate taxa and abundance are presented in Appendix 3.

The Q-value ascribed to each site, together with current ecological condition, as classified by EPA. is shown in Table 1. In this table, it is also indicated if the invertebrate community composition places it towards the upper or lower end of the Q-value.

Table 1: Colligan catchment Q-value results.

Site	Watercourse	Q-value	Ecological Condition
1	Colligan Main Channel	Q4	Good
2	Coumduane Stream	Q4	Good
3	Colligan Main Channel	Q4	Good
4	Lalisheen Stream	Q3-4	Moderate
5	Tributary of Lalisheen Stream	Q3-4	Moderate
6	Lalisheen Stream	Q4 lower	Good
7	Knockanpower Stream	Q3-4	Moderate
8	Colligan Main Channel	Q4	Good
9	Colligan Main Channel	Q4	Good

Good water quality, with Q4 assigned, was found at all four sites assessed on the main channel of the Colligan. The Coumduane Stream, to which some of the southern part of the wind farm site drains, is also at Q4. The upper stretch of the Lalisheen Stream to which some of the western part of the wind farm site drains, was assessed as being in unsatisfactory moderate ecological condition (Q3-4), as was a small tributary of this stream that could be impacted by the cable route at Bryan's Cross Roads. A short distance upstream of its confluence with the Colligan, the ecological condition of the Lalisheen Stream was found to have improved and just qualified for assigning Q4 (Good condition). The Knockanpower Stream, which is the only other tributary of the Colligan that could potentially be impacted by the proposed development that has sufficient flow for assessment by the Q-scheme methodology, was found to be in unsatisfactory moderate ecological condition (Q3-4).

3.2.1.3 Freshwater Pearl Mussel (*Margaritifera margaritifera*)

The unstable nature of the substratum in the high energy upper stretches of the Colligan and its tributaries is unsuitable for freshwater pearl mussels. The physical habitat of some main channel stretches farther downstream appears to be very suitable for this species, although the water quality is not high enough for regeneration of a population, if one were present. Two sections of the Colligan where the most suitable habitat was found, were surveyed for mussels. The upper section is both upstream and downstream of Lackandarra Bridge (Map 2; Photo 11) from ITM 62304 60243 to 62304 60189. The lower section is downstream of Colligan Bridge (Map 4; Photo 18) from ITM 62197 59802 to 62180 59762. No mussels were found in either stretch.

As no freshwater pearl mussels were found in sections of the Colligan where the habitat is most suitable for this species, combined with no shell fragments found in the gravel bank at Kildangan Bridge and the lack of any historical records of its presence in the Colligan, it can be concluded that freshwater pearl mussels are absent from the Colligan catchment.

3.2.1.4 White-clawed crayfish (*Austropotamobius pallipes*)

No crayfish were found at any of the invertebrate sampling sites. From this, combined with unsuitable geology and the lack of any historical records of its presence in the Colligan, it can be concluded that white-clawed crayfish are absent from the Colligan catchment.

3.2.1.5 Protected Riparian Species

While no evidence of European otter (*Lutra lutra*) was recorded at any of the stretches of watercourse surveyed in the Colligan catchment, the NBDC website shows records of this species at several locations, including one record from 2007 within the subject site.

While no evidence of European kingfisher (*Alcedo atthis*) was recorded at any of the stretches of watercourse surveyed in the Colligan catchment, the NBDC website shows records of the presence of this species.

Grey wagtails (*Motacilla cinerea*) were observed at Scart Br. (ITM 62289 60500) and at Colligan Br. (ITM 62195 59806)

No plant species listed for protection under the Flora Protection Order (2015) was recorded during the surveys.

3.2.1.6 Invasive Species

No invasive species that is included in Part 1 of the Third Schedule of S.I. No. 477 of 2011, the European Communities (Birds and Natural Habitats) Regulations 2011 was found within the proposed wind farm site. Two such invasive plant species, Himalayan balsam (*Impatiens glandulifera*) and Japanese knotweed (*Fallopia japonica*) occur beside the lower reaches of the Colligan and both are abundant in proximity to Kildangan Bridge (N72), where a cable route crossing is proposed (Photos 32 and 33).

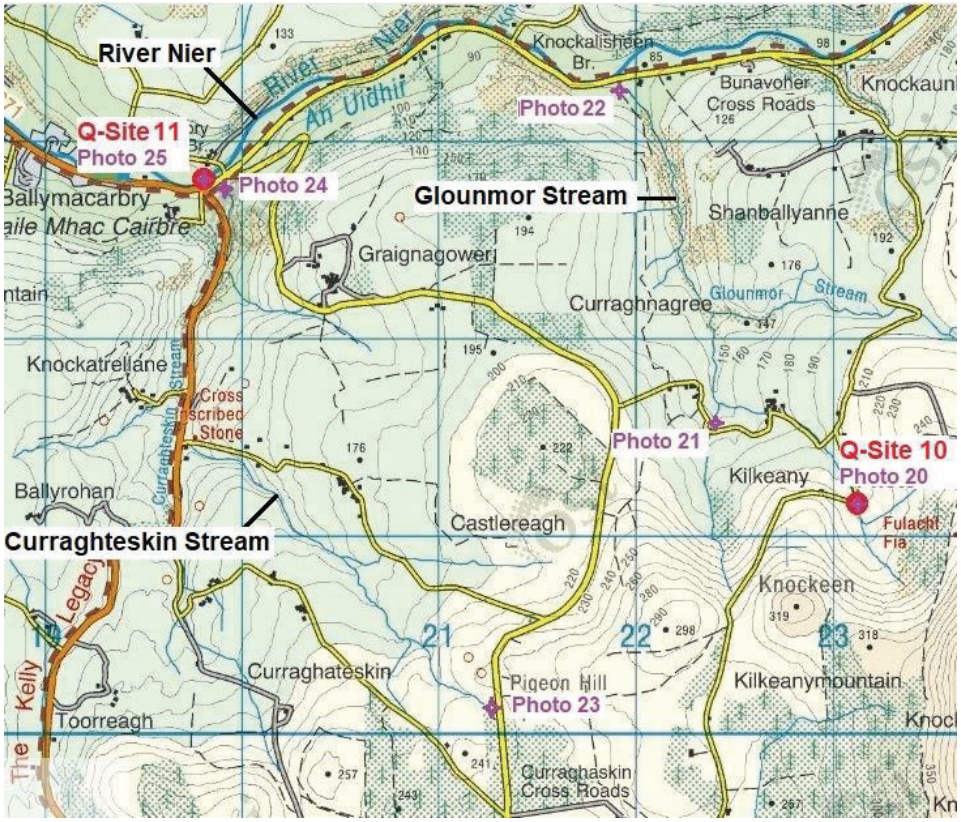
3.2.2 Nier Catchment

3.2.2.1 Description

Photographs referred to below are presented in Appendix 1 and the locations where they were taken are mapped (Map 5).

The Glounmor Stream (Map 5) drains part of the northern end of the proposed wind farm site, where turbines are to be located. In addition, upper branches of this stream are crossed by proposed cable routes. Where the branch on the Knockavannia/Kilkeany townland boundary at ITM 62305 61124 is crossed by the proposed cable route, the flow consists of moderate shallow riffle over silted cobble and gravel in heavy shade (Photo 20). The siltation is due to livestock access. Where the branch on the western side of the Kilkeany townland at ITM 62232 61159 is crossed by the proposed cable route, there is very little flowing water (Photo 21). Immediately upstream of its confluence with the River Nier, the Glounmor Stream is fast-flowing over boulders and cobbles in heavy shade (Photo 22). At the time of the fieldwork, there was practically no flow in the channel of the headwater of the Curraghteskin Stream at the crossing point of the cable route at Pigeon Hill (Photo 23). Immediately upstream of its confluence with the River Nier, the Curraghteskin Stream is fast-flowing over bedrock, boulders and cobbles in moderate shade (Photo 24). The Nier, in the vicinity of and for several hundred metres downstream of tributaries that could potentially be impacted by the proposed development, is a river of moderate size, with flashy fast flow over a substratum consisting mainly of bedrock, boulders and large cobble.(Photo 25).

Map 5.



3.2.2.2 Biological Water Quality Assessment

Biological water quality was assessed at two locations in the Nier catchment, one on the Glounmor Stream and one in the Nier main channel immediately downstream of the Curraghteskin Stream confluence, as indicated on Maps 5 above. Photographs of the sampling sites are presented in Appendix 1. Relevant descriptive information for the macroinvertebrate sampling sites is presented in Appendix 2 and macroinvertebrate taxa and abundance are presented in Appendix 3. The Q-value ascribed to each site, together with current ecological condition, as classified by EPA. is shown in Table 2.

Table 2: Nier catchment Q-value results.

Site	Watercourse	Q-value	Ecological Condition
10	Glounmor Stream	Q3-4*	Moderate
11	Nier Main Channel	Q4 upper	Good

Impacts by livestock access to the Glounmor Stream have resulted in moderate water quality (Q3-4) and siltation, as indicated by the * affix. The water quality of the Nier main channel is good.

3.2.2.3 Freshwater Pearl Mussel (*Margaritifera margaritifera*)

The small size of the tributaries and the high energy and unstable nature of the Nier main channel makes this catchment unsuitable for freshwater pearl mussels. There has never been any evidence of this species in the Nier catchment.

3.2.2.4 White-clawed crayfish (*Austropotamobius pallipes*)

No crayfish were found at either of the invertebrate sampling sites. From this, combined with unsuitable geology and the lack of any historical records of its presence in the Nier, it can be concluded that white-clawed crayfish are absent from the upper parts of the Nier catchment. In 2014, crayfish remains were observed in an otter spraint at the lowermost Nier site, near the Suir confluence (*pers. obs*.). While crayfish were plentiful in the Suir downstream of the Nier confluence until 2017, crayfish plague has since advanced up the Suir and no live crayfish were been recorded downstream of Thurles in the 2020 round of the EPA River Monitoring Programme (*pers. obs*.).

3.2.2.5 Protected Riparian Species

While no evidence of European otter (*Lutra lutra*) was recorded at any of the stretches of watercourse surveyed in the Nier catchment, the NBDC website shows records of this species by the Nier and the Curraghteskin Stream.

While no evidence of European kingfisher (*Alcedo atthis*) was recorded at any of the stretches of watercourse surveyed in the Nier catchment, the NBDC website shows records of the presence of this species.

No plant species listed for protection under the Flora Protection Order (2015) was recorded during the surveys.

3.2.2.6 Invasive Species

While stands of Japanese knotweed (*Fallopia japonica*) and Himalayan knotweed (*Persicaria wallichii*) occur along the Nier main channel, none were found at the cable route crossing points of the tributary headwaters.

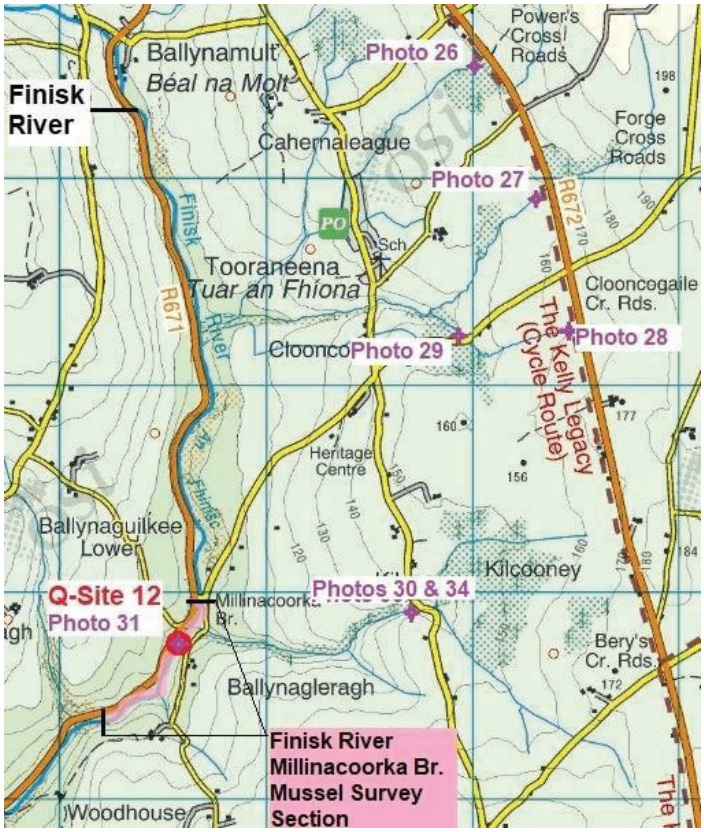
3.2.3 Finisk Catchment

3.2.3.1 Description

Photographs referred to below are presented in Appendix 1 and the locations where they were taken are mapped (Map 6).

Four small unnamed watercourses in the Finisk catchment, that are shown on the OS Discovery Series map, are crossed by the proposed cable routes. The most northerly of these crossings at ITM 62000 60665 was dry at the time of fieldwork (Photo 26). The next of these to the south, crossed at ITM 62031 60602 had very little flow (Photo 27). The next watercourse would be crossed by either cable routes at different points, ITM 62048 60532 (Photo 28) and ITM 61990 60528 (Photo 29). There was very little flow at either of these points. The final location where a tributary of the Finisk could be crossed is at ITM 61970 60398 (Photo 30), where there was little flow at the time of fieldwork, but where the stony channel indicates that flows are considerable in wet periods. The Finisk main channel, downstream of all tributaries that could potentially be impacted by the proposed development consists of a riffle and glide over cobble, gravel and sand in a relatively open channel (Photo 31).

Map 6.



3.2.3.2 Biological Water Quality Assessment

The tributaries of this section of the Finisk have too little flow to apply the Q-scheme methodology. Biological water quality was assessed at one site on the main channel of the Finisk (Site 12, Map 6). Relevant descriptive information for the macroinvertebrate sampling site is presented in Appendix 2 and macroinvertebrate taxa and abundance are presented in Appendix 3. Q3-4 was assigned here, indicating moderate ecological condition. This unsatisfactory condition appears to be influenced by agricultural practices, including access to watercourses by livestock. At the most southerly of the small tributaries visited, not only were banks badly poached, but a sheep carcass was decaying in the water (Photo 34).

3.2.3.3 Freshwater Pearl Mussel (*Margaritifera margaritifera*)

The small size of the tributaries in this section of the Finisk makes them unsuitable for freshwater pearl mussels. The physical habitat of the main channel of the Finisk downstream of the tributaries appears to be quite suitable for this species, although the water quality recorded here is not suitable. One section of the Finisk, from ITM 61857 60389 to 61808 60344, was surveyed for mussels. No mussels were found.

As no freshwater pearl mussels were found in a section of the Finisk where the habitat is most suitable for this species, combined with unsuitable water quality and the lack of any historical records of its presence in the Finisk, it can be concluded that freshwater pearl mussels are absent from the Finisk catchment.

3.2.3.4 White-clawed crayfish (*Austropotamobius pallipes*)

No crayfish were found at the invertebrate sampling sites. From this, combined with unsuitable geology and the lack of any historical records of its presence in the Finisk, it can be concluded that white-clawed crayfish are absent this river.

3.2.3.5 Protected Riparian Species

A spraint of the European otter (*Lutra lutra*) was found by the Finisk downstream of Millinacoorka Br. (ITM 61853 60383). The NBDC website shows records of this species at several locations.

While no evidence of European kingfisher (*Alcedo atthis*) was recorded at any of the stretches of watercourse surveyed in the Finisk catchment, the NBDC website shows records of the presence of this species.

No plant species listed for protection under the Flora Protection Order (2015) was recorded during the surveys.

3.2.2.6 Invasive Species

No invasive plant species were found at any of the locations visited in the Finisk catchment.

4. CONCLUSIONS & DISCUSSION

The biological water quality of the main channel of the Rivers Colligan and Nier is good, but some of the smaller tributaries of these rivers, as well as the main channel of the Finisk are of moderate biological water quality.

There is no evidence of any legally protected aquatic invertebrate in any watercourse draining the subject site or proposed cable routes.

Protected riparian animal species, including otter, kingfisher and grey wagtail, have been recorded at downstream locations and there is a 2007 record of otter within the proposed windfarm site on the NBDC website. The only record of otter in the current survey was a spraint by the Finisk, downstream of Millinacoorka Bridge.

No plant species listed for protection under the Flora Protection Order (2015) was recorded.

No invasive plant species that is included in Part 1 of the Third Schedule of S.I. No. 477 of 2011, the European Communities (Birds and Natural Habitats) Regulations 2011 was found within the proposed wind farm site. The only location at which a proposed cable route crosses a watercourse where such species were found is by Kildangan Bridge on the N72.

APPENDIX 1

PHOTOGRAPHS

Photo 1: Colligan Northern branch within wind farm site

Photo 2: Colligan Eastern branch within wind farm site

Photo 3: Colligan downstream of confluences of N and E branches. Q-Site 1

Photo 4: Colligan downstream of Coumduane Stream confluence

Photo 5: Coumduane Stream south of wind farm site

Photo 6: Coumduane Stream near Colligan confluence. Q-Site 2

Photo 7: Colligan upstream of Lalisheen Stream confluence. Q-Site 3

Photo 8: Lalisheen Stream west of wind farm site. Q-Site 4

Photo 9: Lalisheen Stream tributary at Bryan's crossroads. Q-Site 5

Photo 10: Lalisheen Stream upstream of Colligan confluence. Q-Site 6

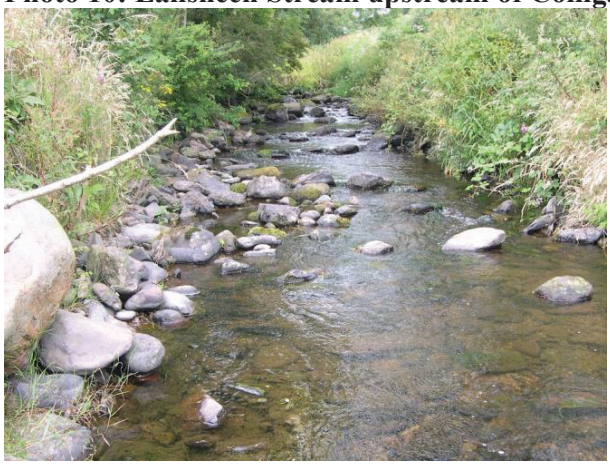


Photo 11: Colligan at Lackandarra Bridge. Mussel survey site

Photo 12: Dry channel of Colligan tributary on R672 at ITM 62111 60253

Photo 13: Knockanpower Stream at Knockanpower Bridge on R672

Photo 14: Knockanpower Stream upstream of Colligan confluence

Photo 15: Dry channel of Colligan tributary on R672 at Garryduff crossroads

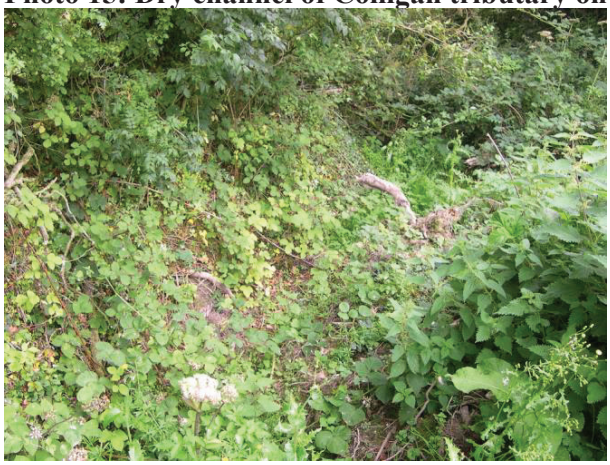


Photo 16: Colligan tributary on R672 at Garryclone

Photo 17: Colligan at Colligan Bridge. Q-Site 8

Photo 18: Colligan downstream of Colligan Bridge. Mussel survey site

Photo 19: Colligan at Kildangan Bridge. Q-Site 9

Photo 20: Glounmor Stream branch at ITM 62305 61124. Q-Site 10

Photo 21: Glounmor Stream western branch at ITM 62232 61159

Photo 22: Glounmor Stream upstream of Nier confluence

Photo 23: Curraghteskin Stream at Pigeon Hill

Photo 24: Curraghteskin Stream upstream of Nier confluence

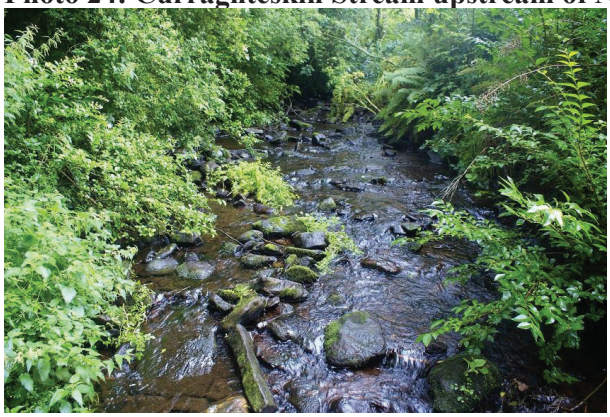


Photo 25: Nier downstream of Curraghteskin Stream confluence. Q-Site 11

Photo 26: Dry channel of Finisk tributary on R672 south of Power's crossroads

Photo 27: Finisk tributary on R672 north of Cloongaile crossroads

Photo 28: Finisk tributary in Clooncogaile townland

Photo 29: Finisk tributary on R672 south of Cloongaile crossroads

Photo 30: Finisk tributary in Kilclooney townland

Photo 31: Finisk downstream Millinacorkagh Br. Q-Site 12 and Mussel survey site

Photo 32: Japanese Knotweed at Kildangan Bridge

Photo 33: Himalayan Balsam at Kildangan Bridge

Photo 34: Decaying sheep carcass in Finisk tributary at Kilclooney

Photo 35: Otter spraint by Finisk downstream of Millinacoorka Br.

APPENDIX 2
MACROINVERTEBRATE SAMPLING SITE DETAILS

Watercourse	Colligan
Site Code	1
Exact Sample Location	Downstream of the confluence of the northern and western branches. ITM 62426 60890
Photograph	1
Wet Width (m)	3
Sampling depth (m)	0.25
Flow Type	Riffle – Step – Pool
Velocity	Fast
Substratum (in order of occurrence)	Boulder Cobble Gravel
Instream Vegetation	*Fontinalis squamosa* 10%
Shade	None

Watercourse	Coumduane Stream
Site Code	2
Exact Sample Location	Upstream of confluence with Colligan ITM 62435 60741
Photograph	2
Wet Width (m)	4
Sampling depth (m)	0.3
Flow Type	Riffle 100%
Velocity	Fast
Substratum (in order of occurrence)	Boulder Gravel Cobble
Instream Vegetation	*Fontinalis squamosa* 5% *Hygrohypnum sp.* 5% *Platyhypnidium riparoides* 10%
Shade	Light

Watercourse	Colligan
Site Code	3
Exact Sample Location	Upstream of Scart Br. and Lalisheen Stream confluence ITM 62289 60500
Photograph	7
Wet Width (m)	7
Sampling depth (m)	0.3
Flow Type	Riffle 100%
Velocity	Fast
Substratum (in order of occurrence)	Cobble Boulder Gravel
Instream Vegetation	*Fontinalis squamosa* 3% *Platyhypnidium riparoides* 5% *Spirogyra sp.* 2% *Ranunculus sp.* 5% *Oenanthe crocata* 3%
Shade	None

Watercourse	Lalisheen Stream
Site Code	4
Exact Sample Location	Ford at ITM 62226 60881
Photograph	8
Wet Width (m)	2.5
Sampling depth (m)	0.15
Flow Type	Riffle 50% Glide 50%
Velocity	Moderate
Substratum (in order of occurrence)	Cobble Gravel Silt Boulder
Instream Vegetation	*Spirogyra sp.* 10%
Shade	Light

Watercourse	Lalisheen Stream tributary
Site Code	5
Exact Sample Location	Bryan's crossroads ITM 62119 60841
Photograph	9
Wet Width (m)	1.5
Sampling depth (m)	0.03
Flow Type	Riffle 100%
Velocity	Moderate
Substratum (in order of occurrence)	Gravel Cobble
Instream Vegetation	*Scapania sp.* 10% *Spirogyra sp.* 10%
Shade	None

Watercourse	Lalisheen Stream
Site Code	6
Exact Sample Location	Upstream of Scart Br. and confluence with Colligan. ITM 62288 60493
Photograph	10
Wet Width (m)	5
Sampling depth (m)	0.2
Flow Type	Riffle 100%
Velocity	Fast
Substratum (in order of occurrence)	Cobble Boulder Gravel Silt
Instream Vegetation	*Fontinalis antipyretica* 1% *Platyhypnidium riparoides* 10% *Vaucheria sp.* 5% *Spirogyra sp.* 15% *Ranunculus sp.* 3%
Shade	Mixed

Watercourse	Knockanpower Stream
Site Code	14
Exact Sample Location	ITM 62254 60038 Bridge c. 300m upstream of confluence with Colligan.
Photograph	14
Wet Width (m)	2.5
Sampling depth (m)	0.1
Flow Type	Riffle-Step-Pool. Sample in 100% Riffle
Velocity	Fast
Substratum (in order of occurrence)	Cobble Gravel Sand Silt
Instream Vegetation	None
Shade	Heavy

Watercourse	Colligan
Site Code	8
Exact Sample Location	Colligan Bridge ITM 62195 59806
Photograph	17
Wet Width (m)	5
Sampling depth (m)	0.25
Flow Type	Riffle 100%
Velocity	Fast
Substratum (in order of occurrence)	Cobble Boulder Gravel
Instream Vegetation	*Hygrohypnum sp.* 5%
Shade	Heavy

Watercourse	Colligan
Site Code	9
Exact Sample Location	Kildangan Bridge. ITM 62317 59516
Photograph	18
Wet Width (m)	10
Sampling depth (m)	0.2
Flow Type	Riffle 100%
Velocity	Fast
Substratum (in order of occurrence)	Gravel Cobble Sand
Instream Vegetation	*Spirogyra sp.* 5% *Ranunculus sp.* 10%
Shade	None

Watercourse	Glounmor Stream
Site Code	10
Exact Sample Location	Bridge at ITM 62305 61124
Photograph	20
Wet Width (m)	3
Sampling depth (m)	0.03
Flow Type	Riffle 100%
Velocity	Moderate
Substratum (in order of occurrence)	Cobble Silt Gravel
Instream Vegetation	None
Shade	Heavy

Watercourse	Nier
Site Code	11
Exact Sample Location	Downstream of Curraghteskin Stream confluence. ITM 61978 61287
Photograph	25
Wet Width (m)	12
Sampling depth (m)	0.35
Flow Type	Riffle 80% Glide 20%
Velocity	Fast
Substratum (in order of occurrence)	Cobble Boulder Gravel Bedrock
Instream Vegetation	*Fontinalis antipyretica* 5% *Platyhypnidium riparoides* 5% *Ranunculus sp.* 5%
Shade	Light

Watercourse	Finisk
Site Code	12
Exact Sample Location	Downstream of Millinacoorka Br. ITM 61853 60383
Photograph	31
Wet Width (m)	7
Sampling depth (m)	0.15
Flow Type	Riffle 100%
Velocity	Fast
Substratum (in order of occurrence)	Gravel Cobble Sand Silt
Instream Vegetation	*Platyhypnidium riparoides* 3% *Ranunculus sp.* 10% *Oenanthe crocata* 5%
Shade	Light

APPENDIX 3
Q-VALUE ASSESSMENT RESULTS

Relative abundance expressed as D: Dominant; N: Numerous; C: Common; F: Few; SS: Single Specimen

TAXON	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6	SITE 7	SITE 8	SITE 9	SITE 10	SITE 11	SITE 12
Group A (Pollution Sensitive)												
Taenopterygidae	F											
Chloroperla sp.		F	C	F	F					F	F	
Isoperla sp.		F										
Perla sp.												SS
Ecdyonurus sp.			F			F-C	F	N	N		C	F
Group B (Less Pollution Sensitive)												
Leuctra sp.	C	C	C	C		F		C	F	F	SS	C
Odontoceridae												SS
Sericostomatidae			F			F						F
Group C (Relatively Pollution Tolerant)												
Tricladida										F		
Lumbricidae								F	F			
Lumbriculidae			F						F			F
Ancylus fluviatilis			F			F	F		C		F	F
Gammarus sp.	F			C	D		N			F		C
Hydrachnidae				F	F		SS		F		C	
Baetis rhodani	D		D	D	C	D	N	N	N	C	N	
Caenis sp.						C						
Seratella ignita	C	C	C			C	F	F	C		N	D
Hydropsyche sp.						F		F			F	
Polycentropus sp.	SS	F									F	F
Rhyacophila sp.	C	F			F	F		C	C		F	F
Dytiscidae	C											F
Hydraenidae					F	F						
Elmis aenea	F					F		F	F			F
Limnius sp.		F		F		F	F					F
Dicranota sp.	F		F	F	F		SS		F	F		

TAXON	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6	SITE 7	SITE 8	SITE 9	SITE 10	SITE 11	SITE 12
Tipula sp.					SS							
Simuliidae	C			C			C	F	C	N	C	
Ceratopogonidae					SS					F		
Chironomidae	F		C			C		N			C	C
Group D (Very Pollution Tolerant)												
Naididae					F							
Enchytraeidae							SS		F			
Radix balthica									F			
Group E (Most Pollution Tolerant)												
Tubificidae												SS
Q-value	**Q4**	**Q4**	**Q4**	**Q3-4**	**Q3-4**	**Q4 Lower**	**Q3-4**	**Q4**	**Q4**	**Q3-4***	**Q4**	**Q3-4**

APPENDIX 4
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Fisheries assessment of Coumnagappul wind farm, Co. Waterford

Prepared by Triturus Environmental Ltd. for Fehily Timoney & Company

April 2021

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Table of contents

1. Introduction

1.1 Background

Triturus Environmental Ltd. were contracted by Fehily Timoney & Company to undertake a baseline fisheries assessment of numerous watercourses in the footprint of the proposed Coumnagappul wind farm in the Monavullagh Mountains near Ballymacarbry, Co. Waterford (**Figure 1.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed development, which includes a proposed wind turbine layout, turbine delivery route (TDR) and associated grid connection route (GCR) alignment (**Figure 2.1**). In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the footprint of the proposed development, a catchment-wide electro-fishing survey across *n*=23 sites was undertaken (**Table 2.1; Figure 2.1**). Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, lamprey and European eel (*Anguilla anguilla*), as well as other species, and helped to further inform impact assessment and any subsequent mitigation for the development.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the footprint of the proposed Coumnagappul wind farm. Permission was granted on Monday 21st September 2020 and the survey was undertaken on Wednesday 23rd to Saturday 26th September 2020.

1.2 Fisheries asset of the survey area

The proposed Coumnagappul wind farm development footprint encompasses numerous small streams and rivers within the Colligan_SC_010 and Finisk_SC_010 river sub-catchments near Ballymacarbry, Co. Waterford. Furthermore, several survey sites draining to the north of the proposed wind farm site were located within the Suir_SC_130 sub-catchment. These northernmost sites also overlapped with the Suir *Margaritifera* sensitive area and shared downstream hydrological connectivity with the Lower River Suir SAC (site code: 002137) (**Figure 1.1**). The survey sites within the Finisk-SC_010 sub-catchment shared downstream hydrological connectivity with the Blackwater River SAC (2170). The survey sites within the Colligan_SC_010 sub-catchment shared downstream hydrological connectivity with the Dungarvan Harbour SPA (004032).

Fisheries survey sites were located on the Shanballyanne River (EPA code 16S13), Kilkeany River (16K22), Reanadampaun Commons Stream (16R10), Skeheens Stream (17S01), Colligan River (17C01), Glennaneanemountain River (17G23), Knockacaharna Stream (17K54), Greenane Stream (17G05), Colligan More Stream (17C11), Ballynaguilkee Upper Stream (18B20), Tooraneena Stream (18T04), Clooncogaile Stream (18C13), Tinalira Stream (18T05), Ballynaguilkee Lower Stream (18B24) and several unnamed watercourses (**Table 2.1** below).

The Colligan River is a renowned Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*) recreational fishery (currently catch-and-release only). The good to high-status watercourse (i.e. Q4 or Q4-5; EPA data) ranks 74th nationally in terms of the fluvial habitat accessible to migrating salmon (McGinnity et al., 2003). The Colligan River is also known to support brown trout, European eel (*Anguilla anguilla*), lamprey (*Lampetra* spp.), three-spined stickleback (*Gasterosteus aculeatus*) and flounder (*Platichthys flesus*) (Kelly et al., 2009).

Of the available fisheries data for other rivers in the study area, the Finisk River is known to support brown trout, Atlantic salmon, lamprey (*Lampetra* spp.), stone loach (*Barbatula barbatula*), European eel and three-spined stickleback (Matson et al., 2018). Fisheries data for the remaining watercourses within the survey area was not available at the time of reporting.

2. Methodology

2.1 Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on both named and unnamed watercourses in the footprint of the proposed Coumnagappul wind farm over the course of Wednesday 23rd to Saturday 26th September 2020, following notification to Inland Fisheries Ireland (Clonmel) and under the conditions of a Department of Communications, Climate Action & Environment (DCCAE) license. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank.

Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

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

The catchment-wide electro-fishing (CWEF) survey was undertaken across *n*=23 sites (see **Table 2.1, Figure 2.1**). Length frequency graphs and species composition graphs for all species with numbers captured are illustrated in the Results section.

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). At more minor watercourse sites or sites with limited access, it was more feasible to undertake electro-fishing for a 5-minute CPUE. Discrepancies in fishing effort (CPUE) between sites are accounted for in the subsequent results section (**Table 3.1**).

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate conductivity waters of the sites (most draining sandstone geologies) a voltage of 220-280, frequency of 40Hz and pulse duration of 3.5ms was utilised to draw fish to the anode without causing physical damage.

2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted box quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, approx. 10–15 cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

Table 2.1 *n*=23 electro-fishing survey site locations in the footprint of the proposed Coumnagappul wind farm development, Co. Waterford.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Shanballyanne River	16S13	Knockavannia	623899	611637
A2	Kilkeany River	16K22	Kilkeany	622889	611517
A3	Reanadampaun Commons Stream	16R10	Curraghnagree	622323	611575
A4	Shanballyanne River	16S13	Graignagower	621864	613351
A5	Unnamed stream	n/a	Knockavannia	625824	611293
B1	Skeheens Stream	17S01	Reanadampaun Commons	622549	609483
B2	Unnamed stream	n/a	Reanadampaun Commons	621198	608421
B3	Skeheens Stream	17S01	Lagg Bridge	621895	606497
B4	Colligan River	17C01	Coumnagappul	624276	608932
B5	Glennaneanemountain River	17G23	Carrickbrack	624984	607579
B6	Colligan River	17C01	Scart Bridge	622924	604925
B7	Knockacaharna Stream	17K54	R672 crossing	621227	601612
B8	Greenane Stream	17G05	R672 crossing	620751	600491
B9	Colligan More Stream	17C11	R672 crossing	620912	599354
B10	Colligan River	17C01	Currabaha	621976	598017
B11	Colligan River	17C01	Kildangan Bridge	623167	595182
C1	Unnamed stream	n/a	R672 crossing, Cahernaleague	620013	606645
C2	Ballynaguilkee Upper Stream	18B20	R672 crossing, Powers Cross Roads	620145	606453

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
C3	Tooraneena Stream	18T04	R672 crossing, Tooraneena	620318	606003
C4	Clooncogaile Stream	18C13	R672 crossing, Clooncogaile	620482	605316
C5	Clooncogaile Stream	18C13	Clooncogaile	619925	605273
C6	Tinalira Stream	18T05	R672 crossing, Kilcooney	620636	604571
C7	Ballynaguilkee Lower Stream	18B24	Tinalira	619692	603984

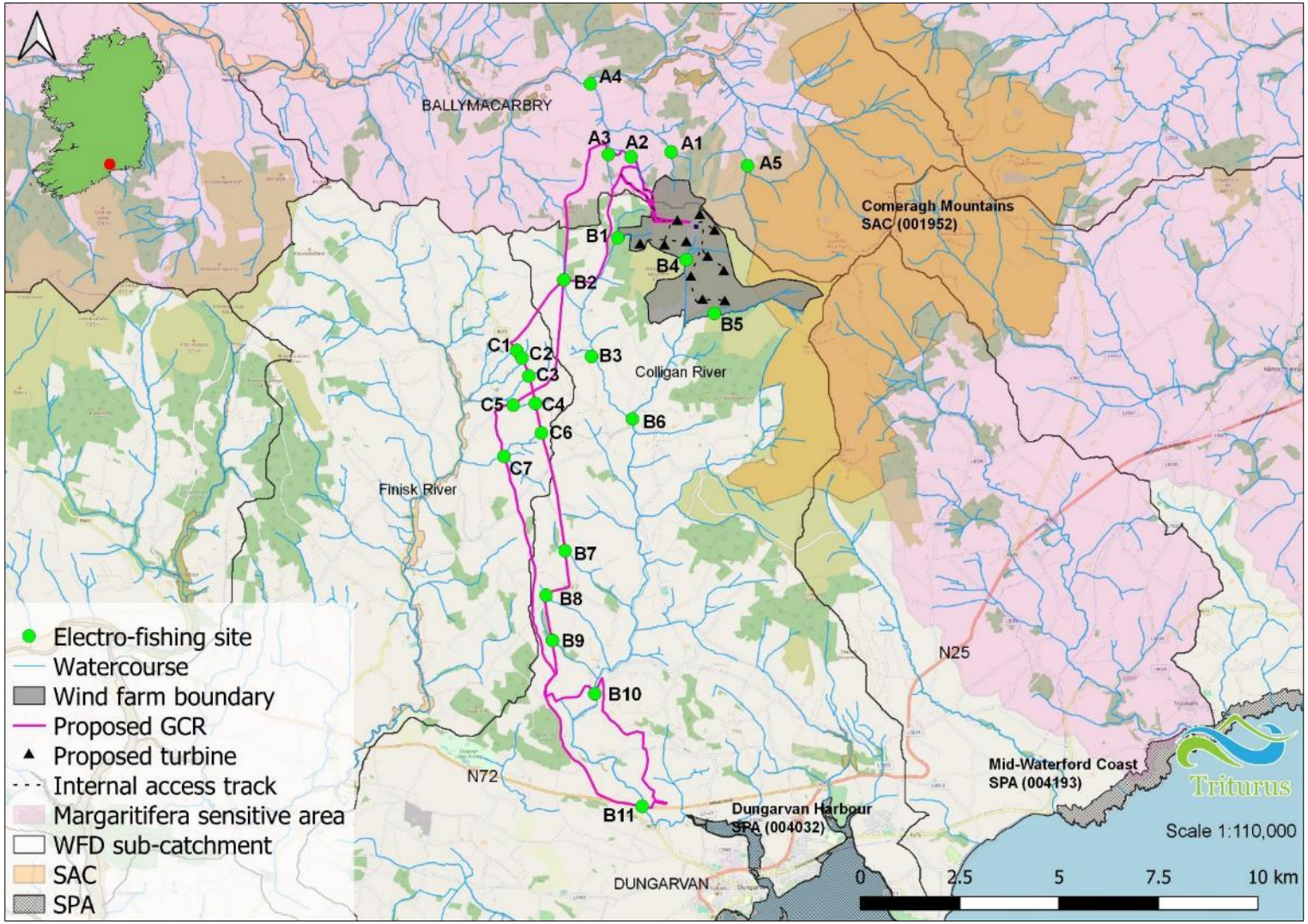

Figure 2.1 Location overview of the *n*=23 electro-fishing sites in vicinity of the proposed Coumnagappul wind farm, Co. Waterford.

2.2 Fisheries habitat

2.2.1 Salmonid habitat

Fisheries habitat quality for salmonids was assessed using the Life Cycle Unit method (Kennedy, 1984; O'Connor & Kennedy, 2002) to map the *n*=23 riverine sites as nursery, spawning and holding habitat, by assigning quality scores to each type of habitat. Those habitats with poor quality substrata, shallow depth and a poorly defined river profile receive a higher score. Higher scores in the Life Cycle Unit method of fisheries quantification are representative of poorer value, with lower scores being more optimal despite this appearing counter-intuitive.

Table 2.1 Life Cycle Unit scoring system for salmonid nursery, spawning and holding habitat value (as per Kennedy, 1984 & O'Connor & Kennedy, 2002)

Habitat quality	Habitat score	Total score (three components)
Poor	4	12
Moderate	3	9-11
Good	2	6-8
Excellent	1	3-5

2.2.2 Lamprey habitat

Lamprey habitat evaluation for each survey site was undertaken using the Lamprey Habitat Quality Index (LHQI) scoring system, as devised by Macklin et al. (2018). The LHQI broadly follows a similar rationale as the Life Cycle Unit score for salmonids. Those habitats with a lack of soft, largely organic sediment areas for ammocoete burrowing, shallow sediment depth (<10cm) or compacted sediment nature receive a higher score. Higher scores in this index are thus of poorer value (in a similar fashion to the salmonid Life Cycle Unit Index), with lower scores being more optimal. Overall scores are calculated as a simple function of the sum of individual habitat scores.

Larval lamprey habitat quality as well as the suitability of adult spawning habitat is assessed based on the information provided in Maitland (2003) and other relevant literature (e.g. Gardiner, 2003). Unlike the salmonid Life Cycle Unit index, holding habitat for adult lamprey is not assessed owing to their different migratory and life history strategies, and that electro-fishing surveys routinely only sample larval lamprey.

The LHQI scoring system provides additional information compared to the habitat classification based on the observations of Applegate (1950) and Slade et al. (2003), which deals specifically with larval (sea) lamprey settlement habitat. Under this scheme, habitat is classified into three different types: preferred (Type 1), acceptable (Type 2), and not acceptable for larvae (Type 3) (Slade et al. 2003). Type 1 habitat is characterized by soft substrate materials usually consisting of a mixture of sand and fine organic matter, often with some cover over the top such as detritus

or twigs in areas of deposition. Type 2 habitat is characterized by substrates consisting of shifting sand with little if any organic matter and may also contain some gravel and cobble (lamprey may be present but at much lower densities than Type 1). Type 3 habitat consists of materials too hard for larvae to burrow including bedrock and highly compacted sediment. This classification can also be broadly applied to other lamprey species ammocoetes, including *Lampetra* species.

Table 2.2 Lamprey Habitat Quality Index (LHQI) scoring system for lamprey spawning and nursery habitat value (Macklin et al., 2018).

Habitat quality	Habitat score	Total score (two components)
Poor	4	8
Moderate	3	6-7
Good	2	3-5
Excellent	1	2

2.2.3 General fisheries habitat

A broad appraisal / overview of the upstream and downstream habitat at each site was also undertaken to evaluate the wider contribution to salmonid and lamprey spawning and general fisheries habitat. River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the river sites (i.e. channel profiles, substrata etc.).

2.3 Biosecurity

A strict biosecurity protocol following the Check-Clean-Dry approach was employed during the survey. Equipment and PPE used was disinfected with Virkon® between survey sites to prevent the transfer of pathogens and/or invasive species between survey areas. Where feasible, equipment was also be thoroughly dried (through UV exposure) between survey areas. As per best practice, surveys were undertaken at sites in a downstream order (i.e. uppermost site surveyed first etc.) to prevent the upstream mobilisation of invasive propagules and pathogens. Any invasive species recorded within or adjoining the survey area were geo-referenced.

3. Results

A catchment-wide electro-fishing survey of *n*=23 sites in the footprint of the proposed Coumnagappul wind farm was conducted over Wednesday 23rd to Saturday 26th September 2020 following notification to Inland Fisheries Ireland (Clonmel). Due to low water levels during the survey period, it was not possible to electro-fish site C6 (Tinalira Stream) (i.e. site 100% dry). Sites B4 (Colligan River) and B5 (Glennaneanemountain River) were not accessible due to land ownership issues. Thus, a total of *n*=20 sites were surveyed via electro-fishing. The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery and spawning habitat for salmonids, European eel and lamprey species. Scientific names are provided at first mention only. Site characteristics are summarised in **Appendix A**. Additional site and survey images are provided in **Appendix B**.

3.1 Fish stock assessment (electro-fishing)

3.1.1 Site A1 – Shanballyanne River, Knockavannia

Brown trout was the only fish species recorded via electro-fishing at site A1, located on the upper reaches of the Shanballyanne River at a local ford crossing (**Figure 3.1**). A low density of small adults and a heathy number of juveniles were present (*n*=21 total).

The diminutive stream site provided moderate quality salmonid habitat. Fish were highly localised given the nature of the site (i.e. shallow ford crossing with very few deeper pool areas). Spawning habitat was good overall (relatively clean, unbedded, mobile substrata) with localised deeper areas evidently of value as a brown trout nursery. However, holding habitat for adults was limited given the presence of small, shallow pools only (typical of a small upland stream). The ford crossing was a significant migration barrier to fish, with fisheries habitat superior downstream of this feature. The site was considered too high energy for lamprey (no larval habitat present) and European eel were not recorded (sub-optimal habitat given upland nature and lack of refugia).

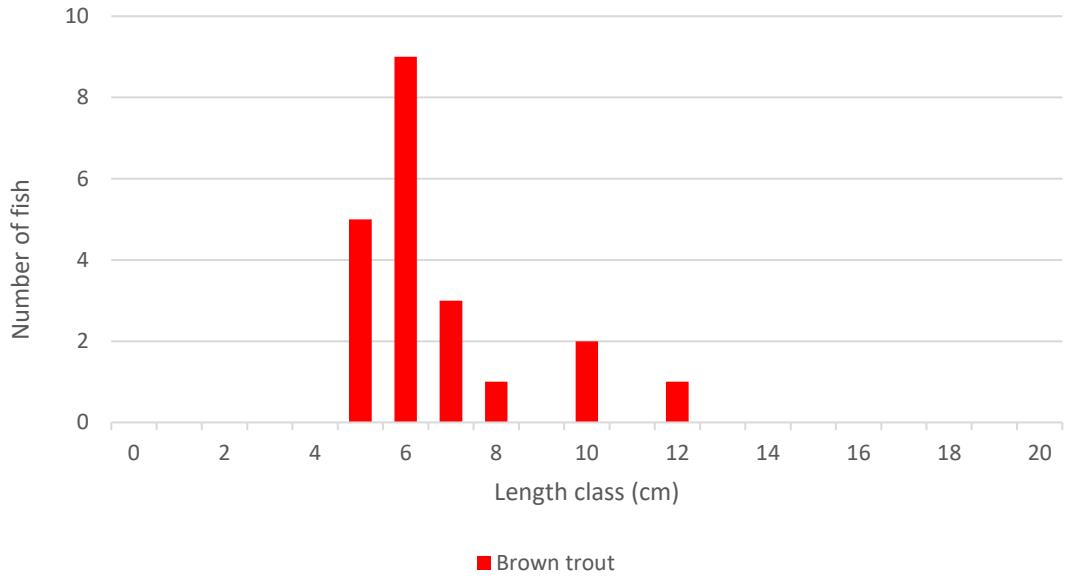

Figure 3.1 Fish stock length distribution recorded via electro-fishing at site A1 on the Shanballyanne River, September 2020.

Plate 3.1 Representative image of site A1 on Shanballyanne River (upstream of ford crossing).

3.1.2 Site A2 – Kilkeany River, Kilkeany

Brown trout was the only fish species recorded via electro-fishing at site A2, located on the upper reaches of the Kilkeany River at a local road and proposed GCR crossing (**Figure 3.2**). A low density of juveniles was present with the high energy site dominated by adults (*n*=17 total).

The site was a good salmonid habitat overall (**Table 3.2**). Spawning habitat was of good quality (relatively clean, unbedded, mobile substrata) with some moderate value as a nursery. Holding habitat for adults was limited (small shallow pools only given small upland nature of stream). The twin pipe culvert under the road was a migration barrier to fish. The site was considered too high energy for lamprey (no larval habitat present) and eel were not recorded (sub-optimal habitat given upland nature and lack of refugia).

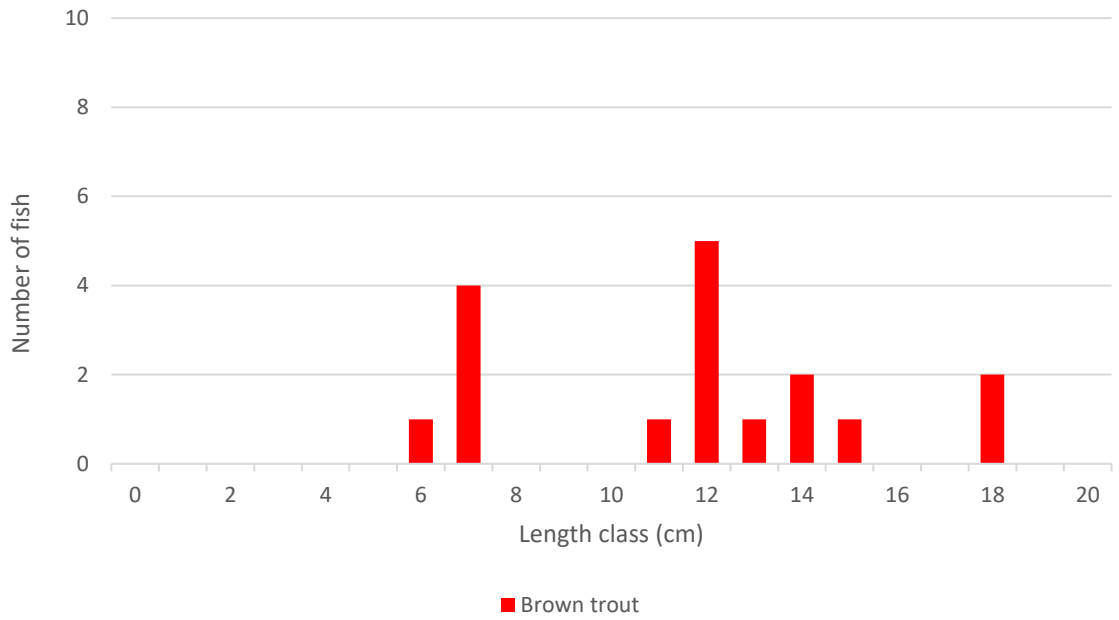

Figure 3.2 Fish stock length distribution recorded via electro-fishing at site A2 on the Kilkeany River, September 2020.

Plate 3.2 Representative image of site A2 on the Kilkeany River.

3.1.3 Site A3 – Reanadampaun Commons Stream, Curraghnagree

Brown trout was the only fish species recorded via electro-fishing at site A3, located on the Reanadampaun Commons Stream approx. 150m upstream of the Kilkeany River confluence, at a proposed GCR crossing (**Figure 3.3**). Juvenile trout dominated the site (*n*=26) with only a single, small adult recorded.

The site was evidently a good brown trout nursery with a moderate density of juveniles recorded. However, the number of adults in the small, shallow upland stream was low. Spawning habitat was good overall (clean, unbedded, mobile substrata). Holding habitat for adults was limited (small shallow pools only). The site was considered too high energy for lamprey (no larval habitat present) and eel were not recorded (sub-optimal habitat given upland nature and lack of refugia).

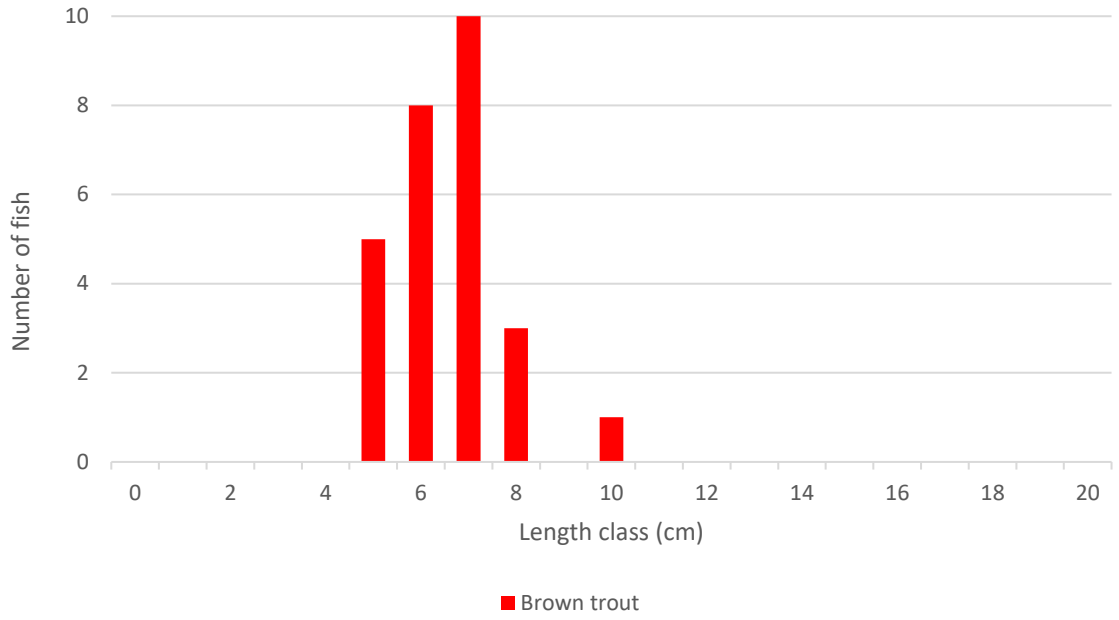

Figure 3.3 Fish stock length distribution recorded via electro-fishing at site A3 on the Reanadampaun Commons Stream., September 2020.

Plate 3.3 Representative image of site A3 on the Reanadampaun Commons Stream.

3.1.4 Site A4 – Shanballyanne River, Graignagower

Brown trout and Atlantic salmon (*Salmo salar*) were the only two fish species recorded via electro-fishing at site A4, located on the lower reaches of the Shanballyanne River immediately upstream of the River Nier confluence (**Figure 3.4**). Atlantic salmon were the most numerous species (*n*=24) with two distinct size classes recorded. Both juvenile and small adult brown trout were also present.

The high-energy site was evidently an excellent salmonid nursery, particularly for Atlantic salmon (less so for trout given the high flows/cascading nature). Spawning habitat was good overall (clean, unbedded, mobile substrata), again being more suited to larger Atlantic salmon due to average size of the substrata present. Holding habitat for adults was limited and improved downstream in the main River Nier channel (also an excellent salmonid habitat). The site was considered too high energy for lamprey (no larval habitat present) and eel were not recorded (sub-optimal habitat given high flow rates).

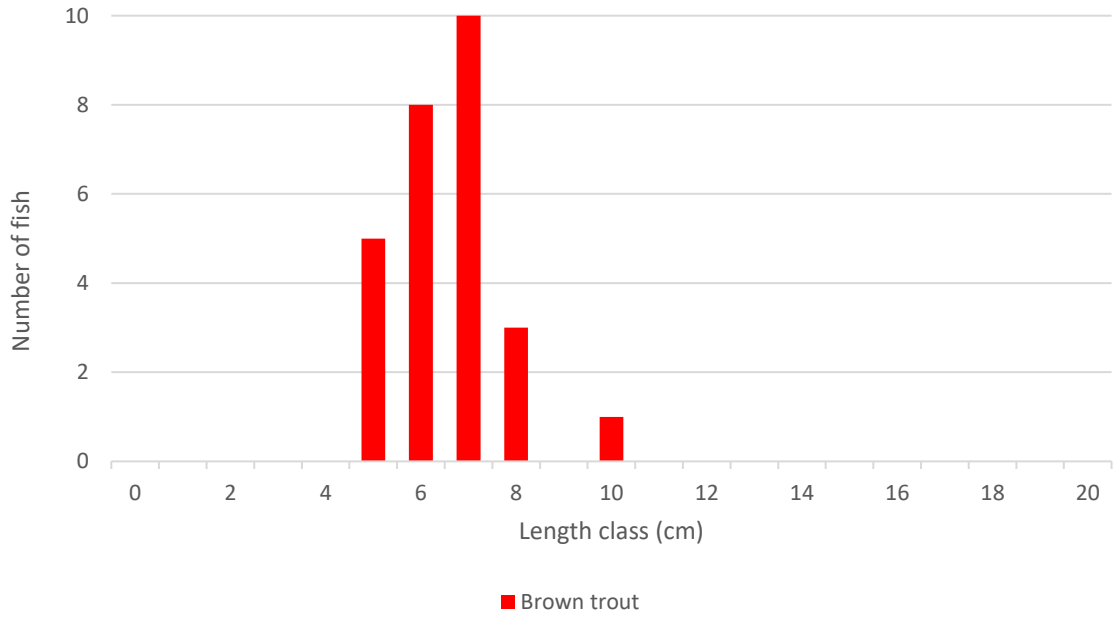

Figure 3.4 Fish stock length distribution recorded via electro-fishing at site A4 on the lower Shanballyanne River, September 2020.

Plate 3.4 Representative image of juvenile Atlantic salmon (second from top & bottom) and brown trout (first & third from top) recorded from site A4 on the lower Shanballyanne River.

3.1.5 Site A5 – unnamed stream, Knockavannia

Brown trout and Atlantic salmon were the only two fish species recorded via electro-fishing at site A5 (**Figure 3.5**), located on the upper reaches of an unnamed Nier tributary immediately downstream of the Lyremountain Stream confluence. Atlantic salmon were the most numerous species (*n*=29) with a range of juvenile size classes recorded (suggesting multiple spawning events). Both juvenile and small adult brown trout were also present in moderate numbers.

The upland, high-energy site was an excellent salmonid habitat (**Table 3.2**), especially for Atlantic salmon, with a relatively high density of juveniles recorded. Brown trout were frequent although the number of adults was low. Salmonid spawning habitat was good overall, although better suited to Atlantic salmon given the higher energy nature and prominence of larger gravel and cobble substrata. The site was evidently an excellent salmonid nursery. Holding habitat was good locally (cascading/plunge pools) although the site lacked deeper holding pools. The upland site was not suitable for lamprey and eel habitat was sub-optimal given the high flow rates.

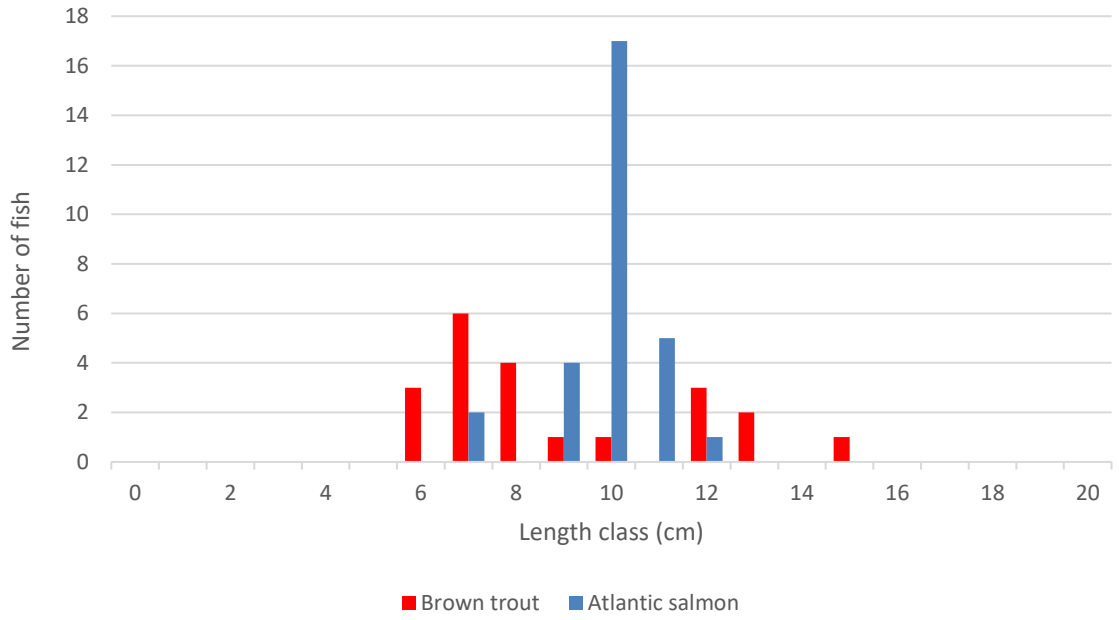

Figure 3.5 Fish stock length distribution recorded via electro-fishing at site A5 on an unnamed River Nier tributary, September 2020.

Plate 3.5 Juvenile Atlantic salmon (top and bottom) and brown trout (middle) recorded from site A5.

3.1.6 Site B1 – Skeheens Stream, Reanadampaun Commons

Brown trout was the only fish species recorded via electro-fishing at site B1 (**Figure 3.6**), located on the upper reaches of the Skeheens Stream adjoining the proposed wind farm boundary. Low numbers of both juveniles and adults were recorded.

The shallow upland eroding site was a moderate salmonid habitat (**Table 3.2**) with a low density of fish recorded. Spawning and nursery habitat were moderate overall, with holding habitat generally lacking. The value of the site was compromised by heavy tunnelling and moderate to heavy siltation (gravel and cobble substrata partially bedded). Water quality impacts from upstream and adjoining coniferous afforestation were evident (iron oxide deposits on substrata). The site provided poor eel habitat and none were recorded. The upland eroding site was not suitable for lamprey.

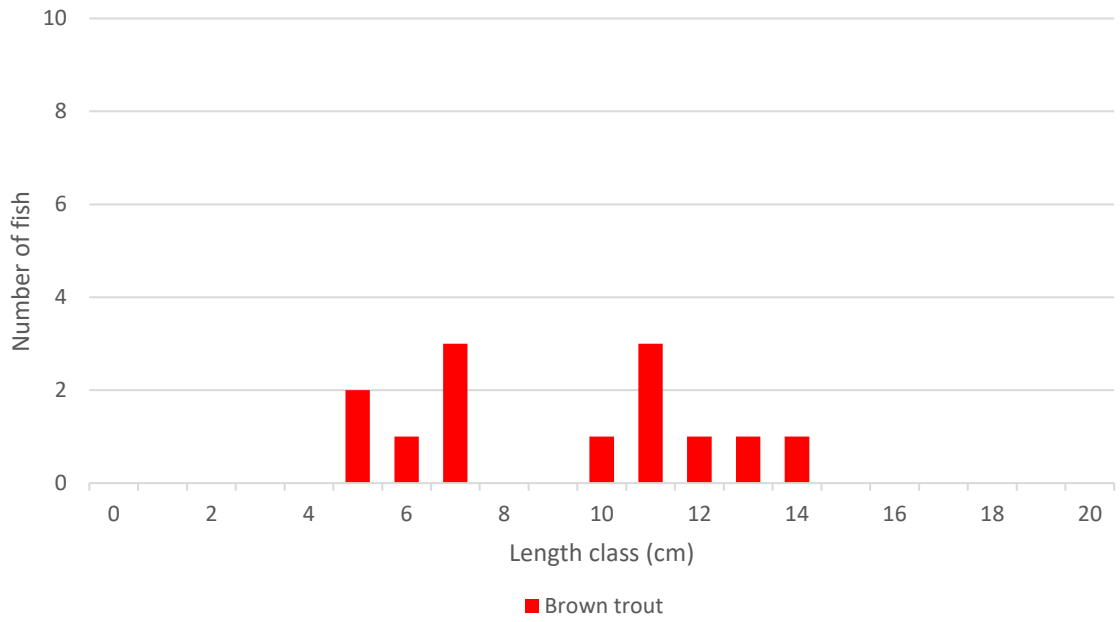

Figure 3.6 Fish stock length distribution recorded via electro-fishing at site B1 on the Skeheens Stream, September 2020.

Plate 3.6 Representative image of site B1 on the upper reaches of the Skeheens Stream.

3.1.7 Site B2 – unnamed stream, Reanadampaun Commons (Bryan's Cross roads)

Brown trout was the only fish species recorded via electro-fishing at site B2 (**Figure 3.7**), located on a small unnamed stream at a local road and proposed GCR crossing at Bryan's Cross roads. Juvenile trout dominated the site (*n*=26) with only a single, small adult recorded.

The site was a moderate salmonid habitat overall (**Table 3.2**) with a very low density of small adults and moderate numbers of juvenile brown trout recorded. The spawning value of the historically-straightened site was compromised by moderate to heavy siltation, with a general lack of deeper holding pools for adults. Water quality impacts from upstream afforestation were also evident (sedimentation and iron oxide deposits on substrata). However, despite these pressures, the site was of good value as a brown trout nursery. The site provided poor eel habitat and none were recorded (shallow, lack of instream refugia) The upland eroding site was not suitable for lamprey.

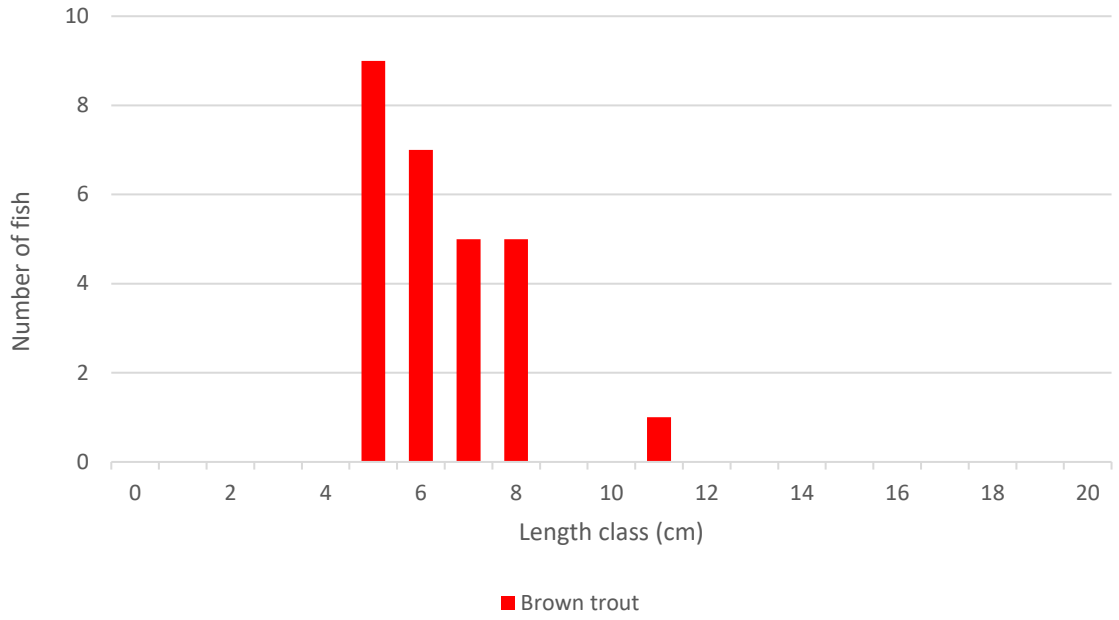

Figure 3.7 Fish stock length distribution recorded via electro-fishing at site B2 on an unnamed stream at Reanadampaun Commons, September 2020.

Plate 3.7 Juvenile brown trout recorded from site B2 on an unnamed stream at Reanadampaun Commons, September 2020.

3.1.8 Site B3 – Skeheens Stream, Lagg Bridge

Brown trout and Atlantic salmon were the only two fish species recorded via electro-fishing at B3 on the Skeheens Stream at Lagg Bridge (**Figure 3.8**). Brown trout were present in relatively high numbers and dominated the site (*n*=61), with a wide range of juvenile and adult cohorts present. Three Atlantic salmon parr were also recorded.

The site was a good salmonid habitat overall (**Table 3.2**), with a range of brown trout and Atlantic salmon size classes recorded. Nursery habitat was good overall, although this was superior upstream of the bridge given an increased coverage of *Ranunculus* sp. vegetation. Holding habitat was good overall with frequent, albeit small, deeper pools scattered throughout (mostly downstream of the bridge). A single large pool at the bridge (c.1.8m deep) offered excellent holding habitat for larger adults, however (especially Atlantic salmon). Spawning was good locally (smaller cobble and coarse gravels). Undercut banks, naturally scoured by the high energy flow, also offered good holding habitat along the west bank downstream of the bridge. Despite some good suitability in terms of instream refugia, no European eel were recorded. The site was not suitable for lamprey given the high energy nature and lack of soft sediment accumulations (sand-dominated where present).

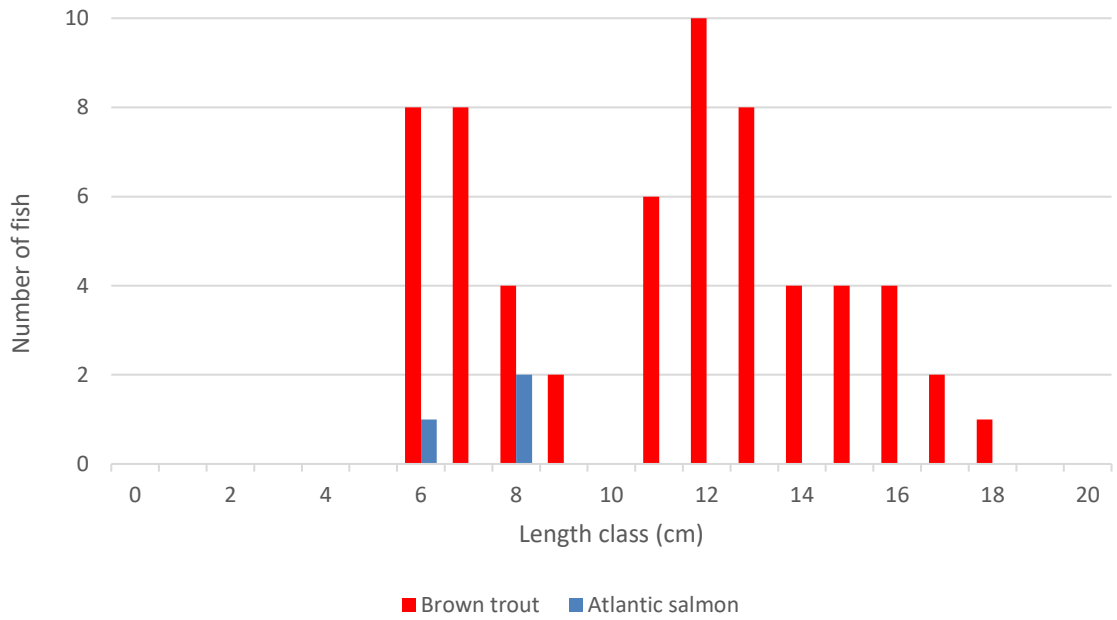

Figure 3.8 Fish stock length distribution recorded via electro-fishing at site B3 on the Skeheens Stream at Lagg Bridge, September 2020.

Plate 3.8 Mixed cohort brown trout and Atlantic salmon parr (right foreground) recorded from site B3 on the Skeheens Stream, September 2020.

3.1.9 Site B6 – Colligan River, Scart Bridge

Brown trout and Atlantic salmon were the only two fish species recorded via electro-fishing at B6 on the Colligan River at Scart Bridge (**Figure 3.9**). Brown trout were present in high numbers and dominated the site (*n*=70), with a wide range of adult and mostly juvenile cohorts present. A low density of Atlantic salmon parr were also recorded (*n*=10).

The medium-sized, historically-straightened river site was a good salmonid habitat overall (**Table 3.2)** and was evidently an excellent nursery with a particularly high density of juvenile brown trout and Atlantic salmon recorded. Holding habitat was sparse (shallow glide and riffle dominated) and the site was better suited to juveniles (abundant cobble refugia plus localised *Ranunculus* sp. beds). Spawning habitat was good (more so for larger fish) although impacted by filamentous algal cover (indicating enrichment). European eel habitat was sub-optimal given high flow rates and general lack of instream refugia favoured by the species (i.e. deeper pools, undercut banks, large boulder zones etc.). The site was not suitable for lamprey given the upland nature and absence of sediment accumulations.

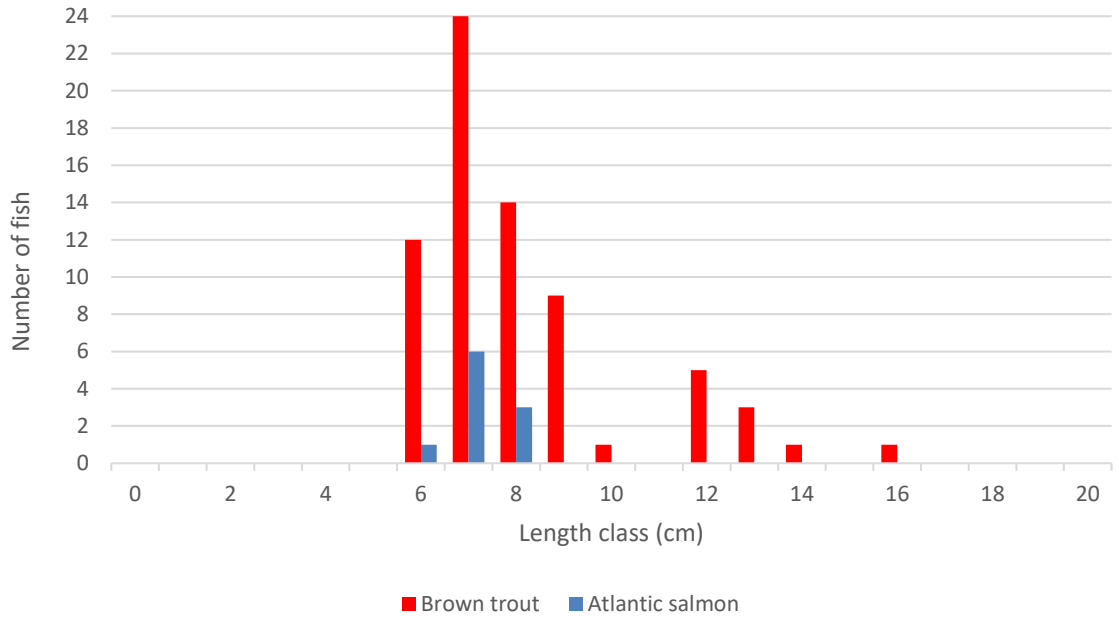

Figure 3.9 Fish stock length distribution recorded via electro-fishing at site B6 on the Colligan River at Scart Bridge, September 2020.

Plate 3.9 Mixed cohort brown trout and Atlantic salmon recorded from site B6 on the Colligan River at Scart Bridge, September 2020.

3.1.10 Site B7 – Knockacaharna Stream, Knockanpower Bridge

Three-spined stickleback (*Gasterosteus aculeatus*) was the only fish species recorded via electro-fishing at site B7 (**Figure 3.10**), located on the Knockacaharna Stream at Knockanpower Bridge on the R672 road, a proposed GCR crossing.

The historically straightened and deepened drainage channel site was heavily-vegetated at the time of survey and offered poor fisheries value overall. A low density of three-spined stickleback was present. The site featured low flows (stagnant water) and was not of suitability for salmonids, European eel or lamprey. The fisheries value of the stream likely improved much further downstream nearer the Colligan River.

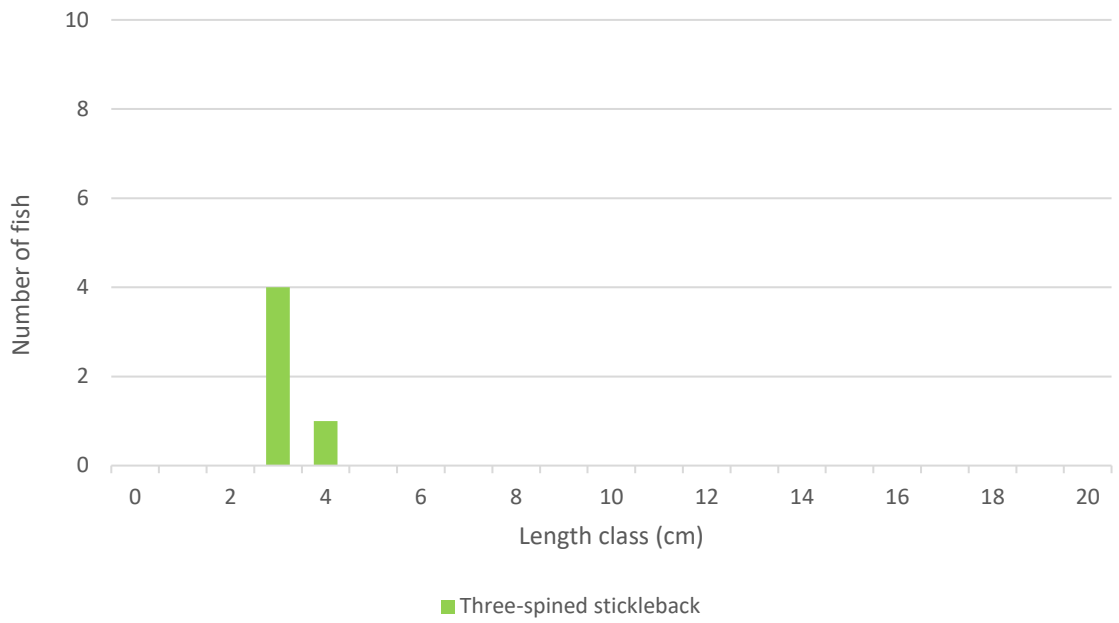

Figure 3.10 Fish stock length distribution recorded via electro-fishing at B7 on the Knockacaharna Stream at Knockanpower Bridge, September 2020.

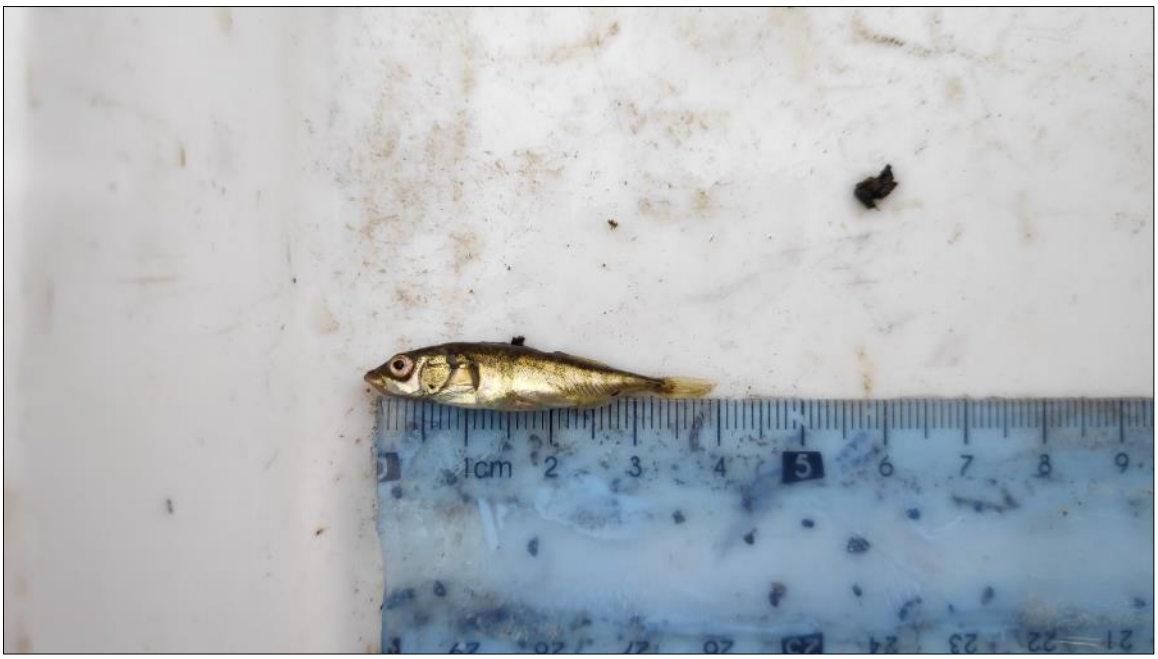

Plate 3.10 Three-spined stickleback recorded from site B7 on the Knockacaharna Stream at Knockanpower Bridge, September 2020.

3.1.11 Site B8 – Greenane Stream, R672 road crossing

No fish were recorded via electro-fishing at site B8, located on the Greenane Stream at the R672 road and proposed GCR crossing (**Plate 3.11**). The site was semi-dry at the time of survey and evidently seasonal, with standing water present near the road culvert only. The heavily-tunnelled site was of no fisheries value in the vicinity of the road crossing. The fisheries value of the stream likely improved further downstream nearer the Colligan River confluence.

Plate 3.11 Representative image of site B8 on the Knockacaharna Stream.

3.1.12 Site B9 – Colligan More Stream, R672 road crossing, Garryclone

European eel was the only fish species recorded via electro-fishing at site B9 (**Figure 3.10**), located on the Colligan More Stream approx. 1.5km upstream of the Colligan River confluence, at a proposed GCR crossing. Juvenile eel (elvers) and small adults were both present at low densities.

The historically-straightened and deepened site was evidently of no value for salmonids given the absence of brown trout or Atlantic salmon. However, despite heavy siltation the site was of value as a European eel nursery, with a low density of eel present in marginal silt beds. The general lack of instream refugia (e.g. boulders/cobble) reduced eel value overall. Despite some physical suitability, the site did not support lamprey ammocoetes with the silt accumulations invariably very shallow (<2cm) and flocculent in nature. The observed low flows also likely reduced lamprey value of the site.

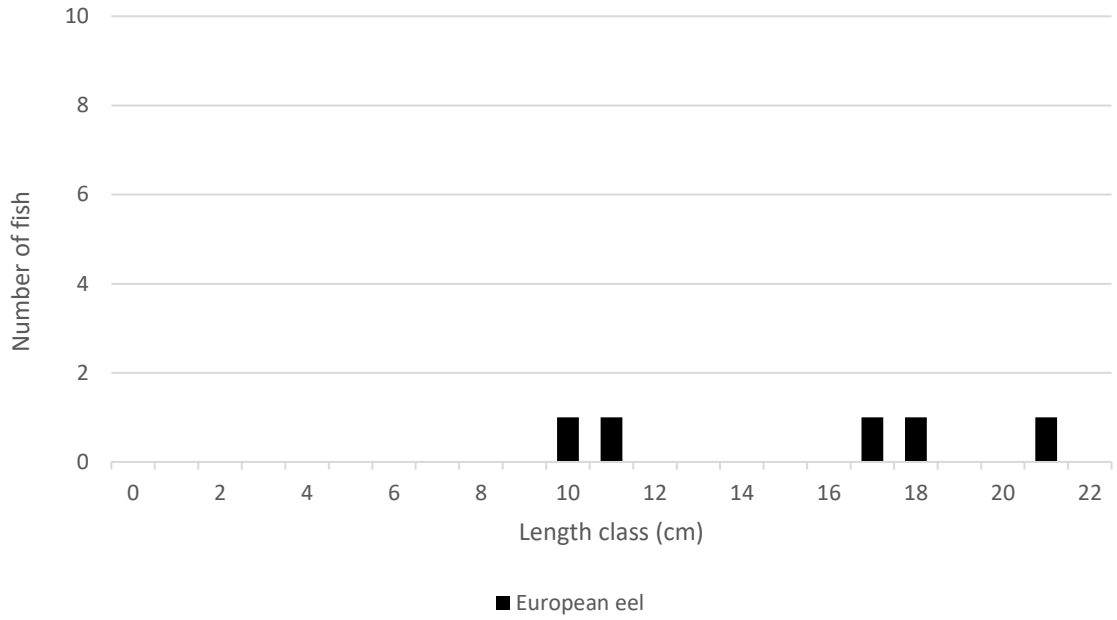

Figure 3.11 Fish stock length distribution recorded via electro-fishing at site B9 on the Colligan More Stream, September 2020.

Plate 3.12 European eel recorded from site B9 on the Colligan More Stream, September 2020.

3.1.13 Site B10 – Colligan River, Colligan Bridge

A total of three fish species were recorded from site B10 on the River Colligan at Colligan Bridge (**Figure 3.12**), located at a proposed GCR crossing. Brown trout were most numerous (*n*=10), with low densities of both juvenile and adults present. A low density of Atlantic salmon parr were captured (two size cohorts). Four large adult sea trout (all >26cm FL) were also recorded.

The site was evidently an excellent salmonid habitat, with excellent quality spawning substrata, particularly for Atlantic salmon and sea trout (**Table 3.2**). Holding habitat was also of excellent quality, with frequent deep pools and undercut banks offering refugia for sea trout (particularly along the west bank). Salmonid nursery habitat was reduced to good given the general lack of instream refugia outside boulder and cobble – overall, the site was a good Atlantic salmon nursery but only a moderate brown trout nursery. Despite some suitability for European eel (i.e. cobble refugia, deep pools) none were recorded although the species was likely present in low densities in deeper pools (beyond the reach of electro-fishing backpack equipment).

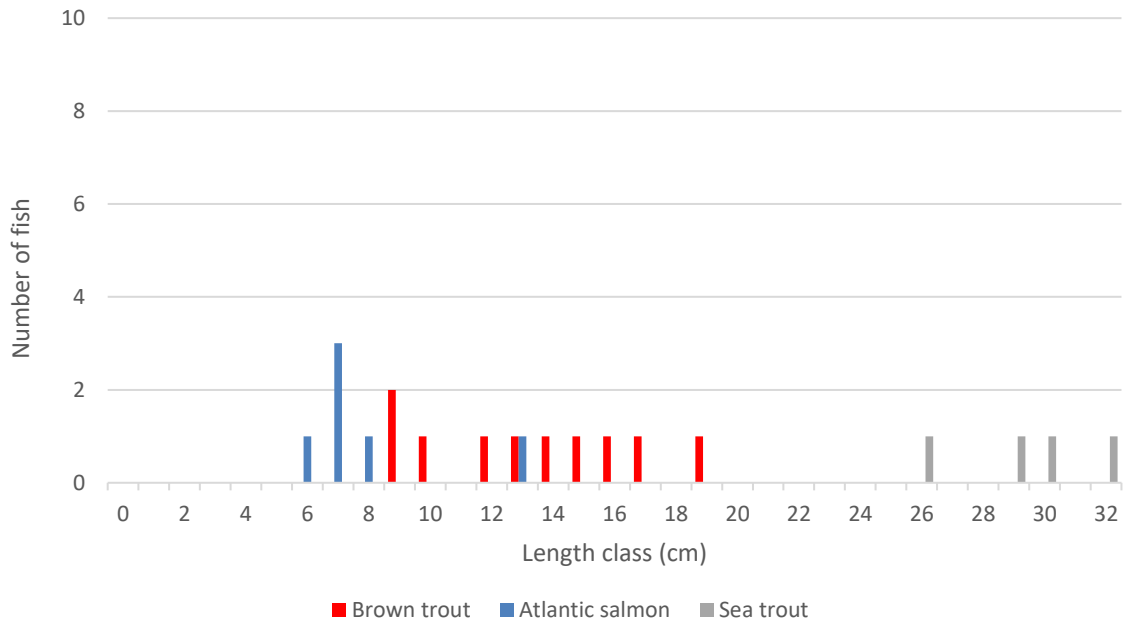

Figure 3.12 Fish stock length distribution recorded via electro-fishing at site B10 on the Colligan River at Colligan Bridge, September 2020.

Plate 3.13 Adult sea trout recorded from site B10 on the Colligan River at Colligan Bridge, September 2020.

3.1.14 Site B11 – Colligan River, Kildangan Bridge

A total of five fish species were recorded via electro-fishing from site B11 on the lower reaches of the Colligan River at Kildangan Bridge, the highest of any site surveyed (**Figure 3.13**). Atlantic salmon dominated the site (*n*=30), with a range of size cohorts present. Brown trout and European eel were also recorded in moderate densities; both were represented by a range of adult and juvenile size classes. A low density of lamprey ammocoetes (*Lampetra* sp.) were recorded. Low numbers of flounder were also captured.

The site was evidently an excellent salmonid habitat (**Table 3.2**), with combinations of excellent spawning (unbedded gravels and cobbles), excellent nursery (*Ranunculus* sp. zones and glides) and excellent holding habitat (downstream of the bridge in particular). The site was also an excellent European eel nursery, with cobble-dominated glides upstream of the bridge providing excellent refugia in addition to macrophyte beds. Whilst some suitability existed for lamprey spawning (fine gravels in association with slower glides and *Ranunculus* beds), sediment accumulations were largely absent and sand-dominated where present. However, low densities of *Lampetra* sp. ammocoetes were recorded (only survey site to support the species).

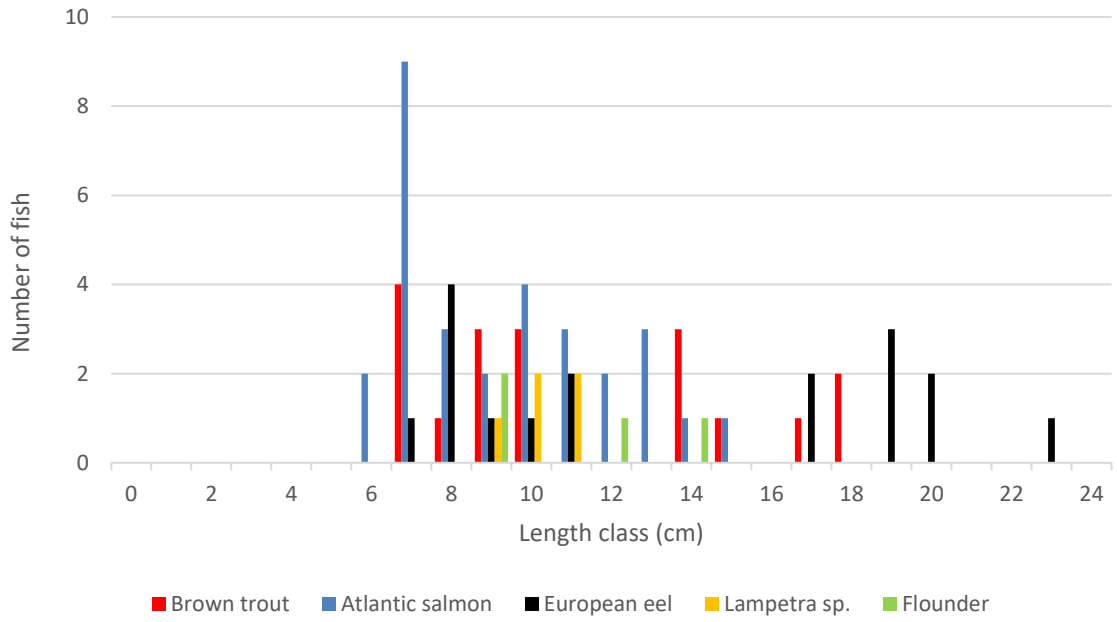

Figure 3.13 Fish stock length distribution recorded via electro-fishing at site B11 on the Colligan River at Kildangan Bridge, September 2020.

Plate 3.14 Mixed cohort brown trout and Atlantic salmon parr recorded from site B11 on the Colligan River at Kildangan Bridge, September 2020.

3.1.15 Site C1 – unnamed stream, R672 crossing, Cahernaleague

No fish were recorded via electro-fishing at site C1, located on the uppermost reaches of an unnamed stream at the R672 road and proposed GCR crossing (**Plate 3.15**). The semi-spate channel suffered from low flows at the time of survey, with water depths of <0.1m (often less). The heavily-tunnelled site was of no fisheries value in the vicinity of the road crossing and was considered unlikely to support resident fish given evident seasonality.

Plate 3.15 Representative image of site C1 on an unnamed stream, September 2020.

3.1.16 Site C2 – Ballynaguilkee Upper Stream, R672 crossing, Powers Cross Roads

No fish were recorded via electro-fishing at site C1, located on the upper reaches of the Ballynaguilkee Stream at the R672 road and proposed GCR crossing (**Plate 3.15**). The narrow, historically-straightened stream suffered from very low flows at the time of survey and was representative of a heavily-vegetated drainage ditch habitat. Although some gravel substrata was present underneath excessive macrophyte vegetation (>95% cover) and terrestrial grass encroachment, the very shallow water depths (<0.05m) precluded resident fish and the channel was considered likely to be seasonal at this location.

Plate 3.16 Representative image of site C2 on the Ballynaguilkee Stream, September 2020.

3.1.17 Site C3 – Tooraneena Stream, R672 crossing, Tooraneena

Brown trout was the only fish species recorded via electro-fishing at site C3, located on the Tooraneena Stream at the R672 road and proposed GCR crossing (**Figure 3.14**). Juvenile trout dominated the site with only a low number of small adults recorded (total *n*=17).

The moderate-energy, upland site was evidently a good nursery for brown trout (**Table 3.2**) with some localised good-quality spawning substrata for smaller adults (fine to coarse gravels). Holding habitat was poor with only occasional, small, shallow pools present. The cobbled bridge apron (moderate gradient) was a barrier to upstream salmonid passage. Eel habitat was poor overall given the shallow, upland nature of the site in addition to a lack of refugia (none recorded). Lamprey habitat was unsuitable overall given the upland site characteristics (no ammocoete habitat present).

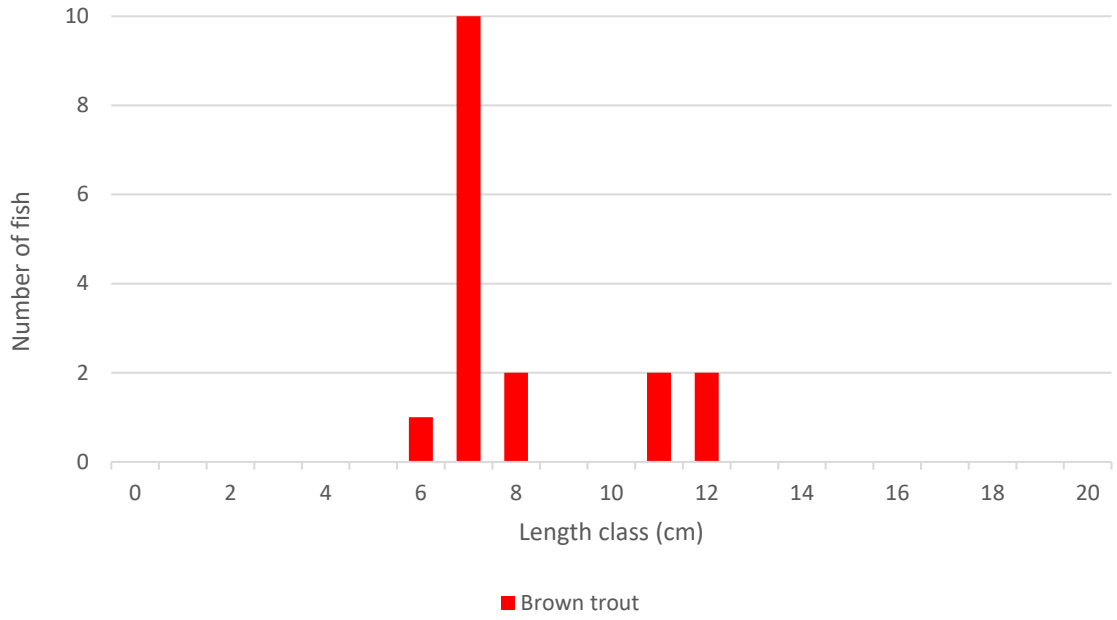

Figure 3.14 Fish stock length distribution recorded via electro-fishing at site C3 on the Tooraneena Stream at the R67 road crossing, September 2020.

Plate 3.17 Juvenile and small adult brown trout recorded from site C3 on the Tooraneena Stream at the R67 road crossing, September 2020.

3.1.18 Site C4 – Clooncogaile Stream, R672 crossing, Clooncogaile

Brown trout was the only fish species recorded via electro-fishing at site C4, located on the Clooncogaile Stream at the R672 road and proposed GCR crossing (**Figure 3.15**). A low number of juvenile trout were recorded (total *n*=8).

The historically-straightened and deepened site was a moderate brown trout nursery, with a low number of juveniles recorded (no adults). Siltation and recent channel modifications had evidently reduced the overall value of the site (shallow channel, poor habitat heterogeneity throughout). No European eel were recorded and the overall habitat was poor given lack of instream refugia and deeper pool areas. The upland, higher-energy site was unsuitable for lamprey (none recorded).

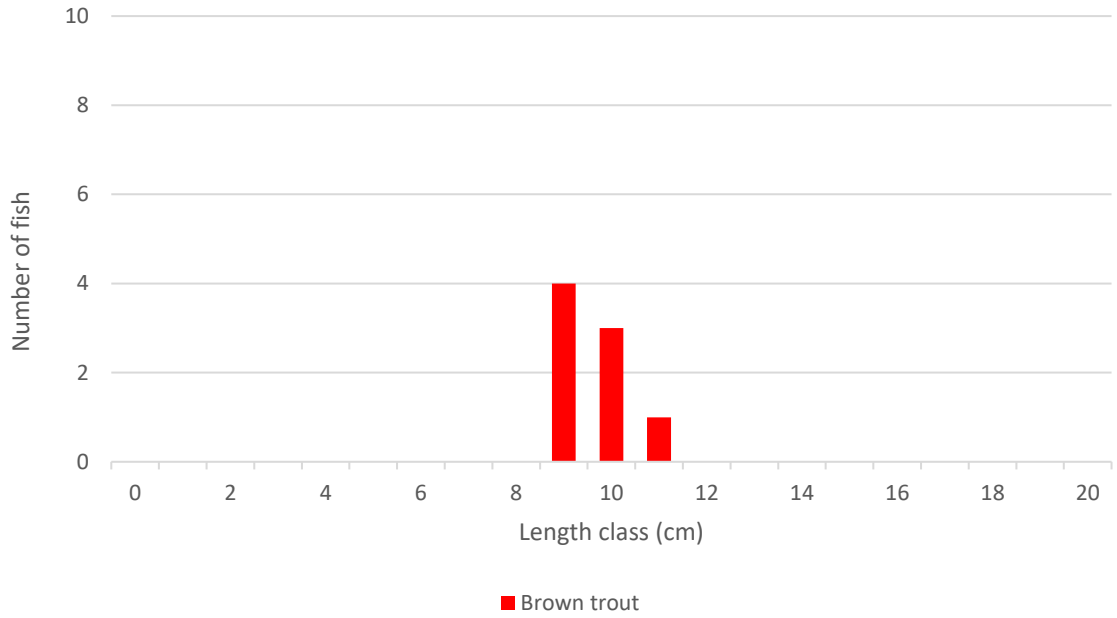

Figure 3.15 Fish stock length distribution recorded via electro-fishing at site C4 on the Clooncogaile Stream at the R672 road crossing, September 2020.

Plate 3.18 Representative image of site C4 on the Clooncogaile Stream at the R672 road crossing, September 2020.

3.1.19 Site C5 – Clooncogaile Stream, Clooncogaile

Brown trout and European eel were the only two fish species recorded via electro-fishing at site C5 (**Figure 3.16**), located on the Clooncogaile Stream at a proposed GCR crossing approx. 0.5km downstream from site C4. Brown trout dominated (*n*=45) with a relatively high abundance of juveniles recorded in addition to a low number of small adults. A single adult European eel was also captured.

The natural, upland eroding site was evidently a good brown trout nursery. However, the number of adults was low, likely reflecting the general paucity of deeper holding pools (some present, nevertheless). Siltation pressures had reduced the overall value of the site with only moderate spawning habitat was present. European eel habitat was moderate given the higher energy nature of the site although a single eel was recorded. The upland, higher-energy site was unsuitable for lamprey (none recorded).

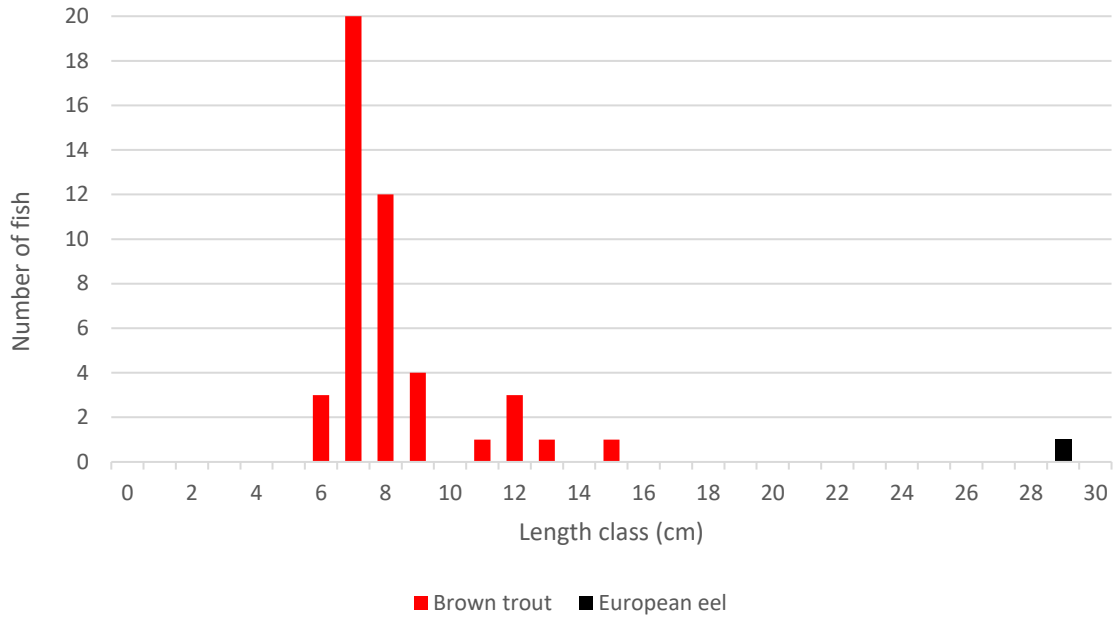

Figure 3.16 Fish stock length distribution recorded via electro-fishing at site C5 on the Clooncogaile Stream, September 2020.

Plate 3.19 Representative image of site C5 on the Clooncogaile Stream at a local road crossing, September 2020.

3.1.20 Site C6 – Tinalira Stream, R672 crossing, Kilcooney

No fish were recorded via electro-fishing at site C6, located on the Tinalira Stream at the R672 road and proposed GCR crossing (**Plate 3.20**). The site was 100% dry at the time of survey and evidently seasonal. The historically-straightened and over-deepened site was of no fisheries value in the vicinity of the road crossing. The fisheries value of the stream likely improved much further downstream nearer the Ballynaguilkee Lower Stream confluence.

Plate 3.20 Representative image of site C6 on the Tinalira Stream, September 2020 (100% dry at the time of survey and buried in a hedgerow).

3.1.21 Site C7 – Ballynaguilkee Lower Stream, Tinalira

A total of three fish species were recorded via electro-fishing from site C7 on the Ballynaguilkee Lower Stream, located at a local road and proposed GCR crossing (**Figure 3.17**). Brown trout dominated the site (*n*=64), with a relatively high number of juveniles present. A single Atlantic salmon parr and a single adult European eel were also recorded.

The site on the River Finisk tributary was evidently an excellent nursery for brown trout and Atlantic salmon (**Table 3.2**). The number of adults was low, however and limited to the deep pool near the bridge culvert (moderate holding habitat, lack of deeper pools elsewhere). Spawning habitat quality was good overall, with fast flows reducing overall siltation levels (i.e. clean well mixed gravels frequent amongst cobble & boulder). European eel habitat was moderate at best given the higher energy nature of the site, although a single eel was recorded. The high-energy, upland nature of the site precluded the presence of lamprey ammocoetes.

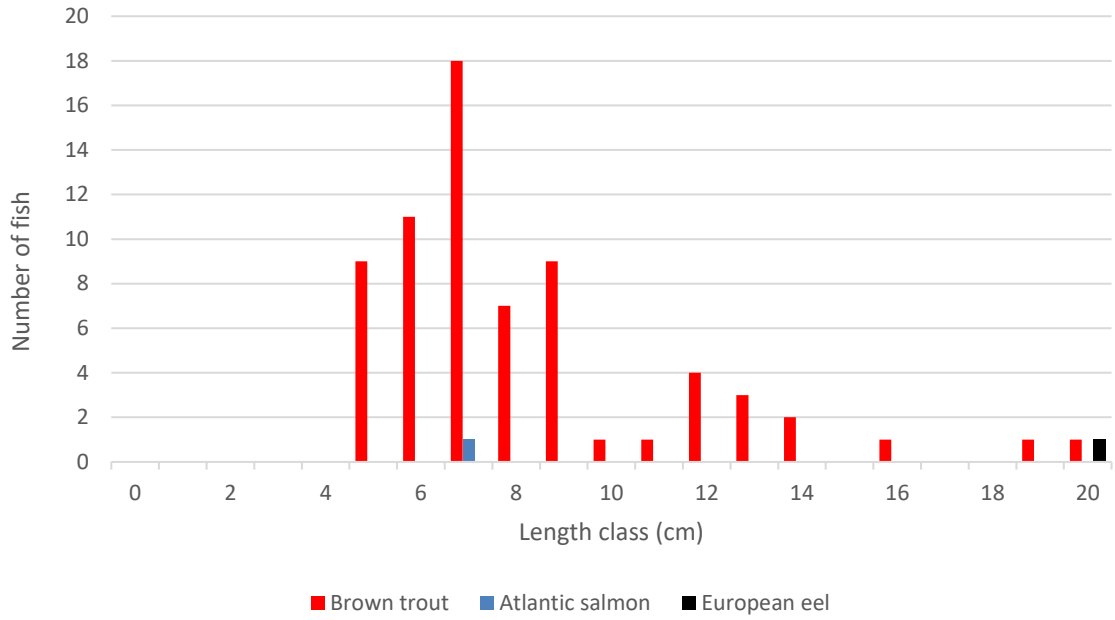

Figure 3.17 Fish stock length distribution recorded via electro-fishing at site C7 on the Ballynaguilkee Lower Stream, September 2020.

Plate 3.21 Mixed cohorts of brown trout recorded from site C7 on the Ballynaguilkee Lower Stream, September 2020.

Table 3.1 Fish species densities per m^2 recorded at sites in the vicinity of Coumnagappul wind farm via electro-fishing in September 2020. Values in **bold** represent the highest densities recorded for each species, respectively. * density of ammocoetes per targeted m^2 of habitat, † semi-dry site

Site	Watercourse	CPUE (elapsed fishing time)	Approx. area fished (m^2)	Fish density (number fish per m^2)						
				Brown trout	Atlantic salmon	Sea trout	European eel	*Lampetra* sp.	Three-spined stickleback	Flounder
A1	Shanballyanne River	5	35	**0.600**	0.000	0.000	0.000	0.000	0.000	0.000
A2	Kilkeany River	5	45	0.378	0.000	0.000	0.000	0.000	0.000	0.000
A3	Reanadampaun Commons Stream	5	48	0.563	0.000	0.000	0.000	0.000	0.000	0.000
A4	Shanballyanne River	10	180	0.078	0.133	0.000	0.000	0.000	0.000	0.000
A5	Unnamed stream	10	150	0.140	**0.193**	0.000	0.000	0.000	0.000	0.000
B1	Skeheens Stream	5	90	0.144	0.000	0.000	0.000	0.000	0.000	0.000
B2	Unnamed stream	10	105	0.257	0.000	0.000	0.000	0.000	0.000	0.000
B3	Skeheens Stream	10	150	0.407	0.020	0.000	0.000	0.000	0.000	0.000
B4	Colligan River	n/a - not accessible due to land owner								
B5	Glennaneanemountain River	n/a - not accessible due to land owner								
B6	Colligan River	10	240	0.292	0.042	0.000	0.000	0.000	0.000	0.000
B7	Knockacaharna Stream	5	45	0.000	0.000	0.000	0.000	0.000	**0.111**	0.000
B8	Greenane Stream	5	†5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B9	Colligan More Stream	5	60	0.000	0.000	0.000	**0.083**	0.000	0.000	0.000
B10	Colligan River	10	350	0.029	0.017	**0.011**	0.000	0.000	0.000	0.000

Site	Watercourse	CPUE (elapsed fishing time)	Approx. area fished (m^2)	Fish density (number fish per m^2)						
				Brown trout	Atlantic salmon	Sea trout	European eel	*Lampetra* sp.	Three-spined stickleback	Flounder
B11	Colligan River	10	375	0.048	0.080	0.000	0.048	**2.5***	0.000	**0.011**
C1	Unnamed stream	5	35	0.000	0.000	0.000	0.000	0.400	0.000	0.000
C2	Ballynaguilkee Upper Stream	5	80	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C3	Tooraneena Stream	10	82.5	0.206	0.000	0.000	0.000	0.000	0.000	0.000
C4	Clooncogaile Stream	10	150	0.053	0.000	0.000	0.000	0.000	0.000	0.000
C5	Clooncogaile Stream	10	135	0.333	0.000	0.000	0.007	0.000	0.000	0.000
C6	Tinalira Stream	Site 100% dry at time of survey								
C7	Ballynaguilkee Lower Stream	10	200	0.320	0.005	0.000	0.005	0.000	0.000	0.000

3.2 Fisheries habitat

3.2.1 Salmonid habitat

The quality of salmonid habitat ranged from poor to excellent across the survey sites (**Table 3.2**). Of the *n*=20 sites assessed, three offered excellent quality salmonid habitat according to Life Cycle Unit scores. These were sites B3 (Skeheens Stream) and B10 and B11 (Colligan River).

A total of eight sites offered good quality salmonids habitat (i.e. sites A1, A2, A3, A4, B6, C3, C5 & C7). Sites B1, B2 and C4 offered moderate quality salmonid habitat, with these sites featuring moderate to heavy siltation or a paucity of deeper areas, thus reducing overall scores. Sites B7, B8, B9, C1 and C2 offered little or no value for salmonids and scored as 'poor' in terms of salmonid habitat.

Site C6 (Tinalira Stream) was 100% dry at the time of survey and thus a Life Cycle Unit score was not applicable (i.e. no fisheries habitat present). Sites B4 (Colligan River) and B5 (Glennaneanemountain River) were not accessible during the survey period (both likely supported salmonids based on known fish communities at downstream sites).

Table 3.2 Life Cycle Unit scores for salmonid habitat at the sites surveyed in the vicinity of the proposed Coumnagappul wind farm, September 2020 (lower scores = superior habitat).

Site no.	Salmonid habitat value	Spawning	Nursery	Holding	Total score	Salmonids recorded
A1	Good	3	2	3	**8**	**Yes**
A2	Good	2	3	3	**8**	**Yes**
A3	Good	2	2	3	**7**	**Yes**
A4	Good	2	1	3	**6**	**Yes**
A5	Excellent	2	1	2	**5**	**Yes**
B1	Moderate	3	3	4	**10**	**Yes**
B2	Moderate	3	2	4	**9**	**Yes**
B3	Excellent	2	1	2	**5**	**Yes**
B4	n/a – site not accessible due to land owner					
B5	n/a – site not accessible due to land owner					
B6	Good	2	1	4	**7**	**Yes**
B7	Poor	4	4	4	**12**	No
B8	Poor	4	4	4	**12**	No
B9	Poor	4	4	4	**12**	No
B10	Excellent	1	2	1	**4**	**Yes**

Site no.	Salmonid habitat value	Spawning	Nursery	Holding	Total score	Salmonids recorded
B11	Excellent	1	1	1	**3**	**Yes**
C1	Poor	4	4	4	**12**	No
C2	Poor	4	4	4	**12**	No
C3	Good	2	2	3	**7**	**Yes**
C4	Moderate	3	3	4	**10**	**Yes**
C5	Good	3	2	2	**7**	**Yes**
C6	n/a – site 100% dry at time of survey					
C7	Good	2	1	3	**6**	**Yes**

3.2.2 Lamprey habitat

Lamprey ammocoetes (*Lampetra* sp.) were only recorded at a single site (i.e. site B11 on the Colligan River at Kildangan Bridge). The majority of the survey sites were not physically suitable for lamprey given their upland, eroding/cascading/high-energy nature and, thus, Lamprey Habitat Quality Index was not applicable at sites A1, A2, A3, A4, A5, B1, B2, B3, B6, B7, B8, C1, C3, C5 or C7 (**Table 3.3**).

Good quality lamprey habitat was present at sites B9 (Colligan More Stream) and B11 (Colligan River). Sites B10 (Colligan River) and C4 (Clooncogaile Stream) offered some moderate quality lamprey habitat overall but none were recorded via electro-fishing. Site C2 on the Ballynaguilkee Upper Streamoffered poor quality lamprey habitat and none were recorded (no fish were recorded at this site).

Site C6 (Tinalira Stream) was 100% dry at the time of survey and thus a LHQI score was not applicable (i.e. no fisheries habitat present). Sites B4 (Colligan River) and B5 (Glennaneanemountain River) were not accessible during the survey period; both sites were unlikely to support likely lamprey ammocoetes based on their upland/eroding nature.

3.2.3 European eel habitat

European eel were recorded from a total of four sites; B9 (Colligan More Stream), B11 (Colligan River), C5 (Clooncogaile Stream) and C7 (Ballynaguilkee Lower Stream). Eel habitat was generally sub-optimal across the survey area given the upland eroding, high-energy nature of most sites.

Table 3.3 Lamprey Habitat Quality Index (LHQI) scores for lamprey habitat at the sites surveyed in the vicinity of the proposed Coumnagappul wind farm, September 2020 (lower scores = superior habitat).

Site no.	Lamprey habitat value	Spawning	Nursery	Total score	Lamprey recorded
A1	n/a – upland/eroding site unsuitable for lamprey				
A2	n/a – upland/eroding site unsuitable for lamprey				
A3	n/a – upland/eroding site unsuitable for lamprey				
A4	n/a – upland/eroding site unsuitable for lamprey				
A5	n/a – upland/eroding site unsuitable for lamprey				
B1	n/a – upland/eroding site unsuitable for lamprey				
B2	n/a – upland/eroding site unsuitable for lamprey				
B3	n/a – upland/eroding site unsuitable for lamprey				
B4	n/a – site not accessible due to land owner				
B5	n/a – site not accessible due to land owner				
B6	n/a – upland/eroding site unsuitable for lamprey				
B7	n/a – upland/eroding site unsuitable for lamprey				
B8	n/a – upland/eroding site unsuitable for lamprey				
B9	Good	3	2	**5**	No
B10	Moderate	3	3	**6**	No
B11	Good	2	3	**5**	**Yes**
C1	n/a – upland/eroding site unsuitable for lamprey				
C2	Poor	4	4	**8**	**No**
C3	n/a – upland/eroding site unsuitable for lamprey				
C4	Moderate	3	4	**7**	**No**
C5	n/a – upland/eroding site unsuitable for lamprey				
C6	n/a – site 100% dry at time of survey				
C7	n/a – upland/eroding site unsuitable for lamprey				

4. Discussion

4.1 Most valuable sites

4.1.1 Salmonids

Salmonids were recorded from a total of fourteen of the *n*=20 survey sites sampled via electro-fishing undertaken in September 2020 (**Table 4.1**). At the sites supporting salmonids, all contained brown trout and seven sites supported Atlantic salmon (i.e. sites A4, A5, B3, B6, B10, B11 and C7). Atlantic salmon density (number fish per m^2 electro-fished) was highest at sites A5 (unnamed Nier tributary) and A4 (Shanballyanne River) (**Table 3.1**), both draining to the north of the proposed wind farm (within the Suir_SC_130 sub-catchment). The three sites with the highest density of brown trout were all located within the Suir_SC_130 sub-catchment (i.e. sites A1, A2 and A3), although sites B3 (Skeheens Stream) and C5 (Clooncogaile River), draining to the south of the wind farm site, supported a comparably high trout density.

The majority of the survey sites provided good or better salmonid habitat based on Life Cycle Unit scores (**Table 3.2**) although, of the *n*=20 sites assessed, only three offered excellent quality salmonid habitat, i.e. sites B3 (Skeheens Stream) and B10 and B11 (Colligan River). The Colligan River at site B10 (Colligan Bridge) also supported adult sea trout, where excellent quality holding habitat for migrating fish was present. In its lower reaches (including survey site B11 at Kildangan Bridge), the Colligan is a recognised as a regionally important sea trout river. As evident in the study area, Atlantic salmon are more likely to migrate to the upper catchment to spawn, thus displaying a greater longitudinal distribution along river catchments than anadromous sea trout, which prefer the lower reaches of rivers (Harris & Milner, 2008).

4.1.2 Lamprey

Lamprey ammocoetes (*Lampetra* sp.) were only recorded at a single site (i.e. site B11) on the Colligan River at Kildangan Bridge (**Table 4.1**), where highly localised ammocoete burial habitat was present in association with instream macrophyte beds (primarily *Ranunculus* subsp. *Batrachion* agg. vegetation). The majority of the survey sites within the vicinity of the proposed Coumnagappul wind farm were not physically suitable for lamprey given their upland, eroding/cascading and or high-energy nature (**Table 3.3**). Naturally such sites do not encourage the deposition of fine, organic rich sediment required by larval lamprey and the predominance of larger substrata reduces the spawning value for the species (Goodwin et al., 2008; Aronsuu & Virkkala, 2014).

4.1.3 European eel

On both a global and Irish scale, the European eel is listed as 'critically endangered' (Pike et al., 2020; King et al., 2011). European eel were recorded from a total of four sites; B9 (Colligan More Stream), B11 (Colligan River), C5 (Clooncogaile Stream) and C7 (Ballynaguilkee Lower Stream) (**Table 4.1**). Eel habitat was generally sub-optimal across the survey area given the upland eroding, high-energy nature of most sites. Consequentially, the majority of sites featured a

paucity of suitable instream refugia, deeper pool areas and or were too shallow/high energy to be considered of good value to eel. Nonetheless, smaller, shallower channels, and even those with poor or little overall fisheries value, offer value as potential European eel migratory pathways, provided they maintain downstream connectivity to larger channels or waterbodies (e.g. adult migration seawards, usually from September/October onwards).

Table 4.1 Summary of fish species recorded by river survey site in the vicinity of the proposed Coumnagappul wind farm, September 2020

Site no.	Watercourse	Atlantic salmon	Brown trout	Sea trout	European eel	*Lampetra* sp.	Other species
A1	Shanballyanne River		✓				
A2	Kilkeany River		✓				
A3	Reanadampaun Commons Stream		✓				
A4	Shanballyanne River	✓	✓				
A5	Unnamed stream	✓	✓				
B1	Skeheens Stream		✓				
B2	Unnamed stream		✓				
B3	Skeheens Stream	✓	✓				
B4	Colligan River	**Not accessible due to landowner**					
B5	Glennaneanemountain River	**Not accessible due to landowner**					
B6	Colligan River	✓	✓				
B7	Knockacaharna Stream						Stickleback
B8	Greenane Stream						
B9	Colligan More Stream				✓		
B10	Colligan River	✓	✓	✓	✓		
B11	Colligan River	✓	✓		✓	✓	Flounder
C1	Unnamed stream						
C2	Ballynaguilkee Upper Stream						
C3	Tooraneena Stream		✓				
C4	Clooncogaile Stream		✓				
C5	Clooncogaile Stream		✓		✓	✓	
C6	Tinalira Stream	**Dry at time of survey**					
C7	Ballynaguilkee Lower Stream	✓			✓		

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6. Appendix A – survey site characteristics

Table A1 Summary characteristics of each fisheries survey site, September 2020

Site	Watercourse	River profile	Bordering land uses & riparian habitat (Fossitt, 2000)	Substrata	Riverbed condition & siltation	Macrophytes & bryophytes (DAFOR)	Fish species recorded	Threats & pressures
A1	Shanballyanne River, Knockavannia	Upland eroding watercourse (FW1), 1m wide (often <0.5m) & 0.05-0.1m deep (0.3m max.), bank heights 0-0.5m, shallow glide dominated, high shading downstream	GA1, WD4	40% medium-coarse gravels, 30% cobble, 20% sand, 10% boulder	Moderate siltation, partial bedding of substrata	*Chiloscyphus polyanthos* (O)	Brown trout	Upstream afforestation, siltation from agriculture, road culvert (migration barrier)
A2	Kilkeany River, KIlkeany	Upland eroding watercourse (FW1), 1-1.5m wide & 0.1-0.2m deep (0.3m max.), semi-cascading, frequent meanders, bank heights 1-2m, riffle & glide dominated, high shading	GA1, WD4, WS1	40% cobble, 30% boulder, 15% sand, 15% fine-medium gravels	Light siltation, mobile substrata	*Hygroamblystegium tenax* (O), *Racomitrium aciculare* (O)	Brown trout	Upstream afforestation, siltation from agriculture, road culvert (migration barrier)
A3	Reanadampaun Commons Stream, Curraghnagree	Upland eroding watercourse (FW1), 1.2-1.5m wide & 0.1-0.2m deep, deep U-shaped natural channel, bank heights 1-2.5m, fast glide dominated with frequent small pool to 0.3m, high shading	GA1, GS4	40% fine-medium gravels, 30% cobble, 20% sand, 10% boulder	Light siltation, mobile substrata	*Chiloscyphus polyanthos* (R)	Brown trout	Upstream afforestation, siltation from agriculture (livestock poaching)
A4	Shanballyanne River, Graignagower	Medium-sized upland eroding watercourse (FW1), 2.5-3m wide & 0.2-0.3m deep, pools to 0.6m, bank heights 1-2m, cascading & high-	GA1, WD1	50% cobble, 30% boulder, 15% medium-coarse gravels, 5% coarse sand	No siltation, mobile, clean substrata	*Fontinalis squamosa* (F), *Racomitrium aciculare* (O)	Atlantic salmon, brown trout	Upstream afforestation (site had very high-quality water)

Site	Watercourse	River profile	Bordering land uses & riparian habitat (Fossitt, 2000)	Substrata	Riverbed condition & siltation	Macrophytes & bryophytes (DAFOR)	Fish species recorded	Threats & pressures
		energy, fast glide dominated, moderate shading						
A5	Unnamed stream, Knockavannia	Medium-sized upland eroding watercourse (FW1), 3-4m wide & 0.2-0.3m deep, pools to 0.5m, cascading & high-energy, natural channel, bank heights <1.5m, fast glide & riffle dominated, low shading (open channel)	GA1, HH3, WS1	35% cobble, 35% boulder, 20% medium-coarse gravels, 10% sand	No siltation, mobile, clean substrata	*Fontinalis squamosa* (F), *Racomitrium aciculare* (F)	Atlantic salmon, brown trout	Agriculture (siltation & enrichment)
B1	Skeheens Stream, Reanadampaun Commons	Small upland eroding watercourse (FW1), moderate energy, 2m wide & 0.1-0.2m deep with pools to 0.3m max., bank heights <1m, shallow glide & riffle dominated, high shading	WS1, WD4, GA1	50% cobble, 30% boulder, 20% medium-coarse gravels	Moderate-heavy siltation, partially bedded substrata	*Hygroamblystegium tenax* (O), *Racomitrium aciculare* (O)	Brown trout	Upstream afforestation, agriculture (siltation & enrichment)
B2	Unnamed stream, Bryan's cross roads	Small upland eroding watercourse (FW1), moderate energy, 2m wide & 0.1-0.2m deep with pools to 0.3m max., bank heights 1m, shallow glide & riffle dominated, high shading	GS4, WD4	50% well-mixed gravels, 30% cobble, 10% boulder, 5% silt, 5% sand	Moderate siltation, partially bedded substrata	*Chiloscyphus polyanthos* (O), *Riccardia chamedryfolia* (O)	Brown trout	Upstream afforestation, agriculture (siltation & enrichment)
B3	Skeheens Stream, Lagg Bridge	Medium upland eroding watercourse (FW1 becoming FW2),	WD1, GA1	40% cobble, 30% boulder, 20% medium-coarse	Low siltation, unbedded substrata	*Ranunculus* subspecies *Batrachion* agg. (F), *Fontinalis squamosa*	Atlantic salmon, brown trout	Upstream afforestation,

Site	Watercourse	River profile	Bordering land uses & riparian habitat (Fossitt, 2000)	Substrata	Riverbed condition & siltation	Macrophytes & bryophytes (DAFOR)	Fish species recorded	Threats & pressures
		moderate energy, 5-6m wide & 0.2-0.6m deep with pool to >1.5m, bank heights 1-5m, fast glide & riffle dominated, low shading		gravels, 10% sand		(F), *Racomitrium aciculare* (F)		agriculture (siltation & enrichment)
B6	Colligan River	Medium upland eroding watercourse (FW1), high energy, 7-8m wide & 0.2-0.4m deep, historically straightened (upstream bridge), bank heights 1.5-1.8m, fast shallow glide & riffle dominated, low shading	GA1	40% cobble, 30% boulder, 20% medium-coarse gravels, 10% sand	Low siltation, unbedded substrata	*Ranunculus* subspecies *Batrachion* agg. (O), *Fontinalis antipyretica* (F), *Oenanthe crocata* (R)		Upstream afforestation, agriculture (siltation & enrichment – filamentous algae 5% cover)
B7	Knockacaharna Stream, Knockanpower Bridge	Small lowland depositing watercourse (FW2), very slow flowing, 1.5-2m wide & 0.05-0.1m deep, historically straightened, bank heights 1.5-2m, 100% slow glide heavily vegetated	GA1, GS2	60% silt, 30% fine-medium gravels, 10% cobble	Heavy siltation, bedded substrata	*Apium nodiflorum* (A)	Three-spined stickleback	Agriculture (siltation & enrichment)
B8	Greenane Stream, R672 road crossing	Small upland eroding watercourse (FW1), historically straightened & deepened, culverted under road,1-1.5m wide & <0.05m deep (semi dry site), ponding of water only, heavily tunnelled	GA1, WS1, BL3	50% fine-medium gravels, 30% silt, 20% cobble	Heavy siltation, bedded substrata	None recorded	None recorded	Surface water run-off, tunnelling, seasonality (low flows)

Site	Watercourse	River profile	Bordering land uses & riparian habitat (Fossitt, 2000)	Substrata	Riverbed condition & siltation	Macrophytes & bryophytes (DAFOR)	Fish species recorded	Threats & pressures
B9	Colligan More Stream, R672 road crossing, Garryclone	Small lowland depositing watercourse (FW2), historically straightened & deepened, culverted under road, 1-1.5m wide & <0.15m deep, heavily silted, high shading	GA2, GA1, WS1, WL2	70% silt, 20% cobble, 10% fine-medium gravels	Very heavy siltation, bedded substrata	None recorded	European eel	Siltation, upstream afforestation, agricultural enrichment
B10	Colligan River, Colligan Bridge	Large natural upland eroding watercourse (FW1), high energy, 10-12m wide & 0.5-1m deep with pools to >2m, bank heights 2-3m, deep glide dominated, moderate shading	WD1	30% cobble, 30% boulder, 20% medium-coarse gravels, 10% bedrock, 5% sand	No siltation, mobile substrata	*Hygroamblystegium tenax* (O)	Atlantic salmon, brown trout, sea trout	Agricultural enrichment, upstream afforestation, invasive species (cherry laurel)
B11	Colligan River, Kildangan Bridge	Large natural high-energy lowland depositing watercourse (FW2), 18-20m wide & 0.4-0.8m deep with pools to >2m, bank heights 0.5-1m, shallow glide and riffle dominated, low shading	GA1, BL3	40% cobble, 30% boulder, 20% fine-coarse gravel, 10% sand	No siltation, mobile substrata	*Ranunculus* subspecies *Batrachion* agg. (F), *Apium nodiflorum* (O), *Phalaris arundinacea* (O), *Oenanthe crocata* (R)	Atlantic salmon, brown trout, European eel, *Lampetra* sp., flounder	Agricultural enrichment, upstream afforestation, invasive species (Himalayan balsam, Japanese knotweed)
C1	Unnamed stream, R672 road crossing, Cahernaleague	Small upland eroding watercourse (FW1), historically straightened & deepened, spate channel with low flows at time of survey, <1m wide & 0.05-0.1m deep, deep U-shaped channel	GA1, WD4	50% medium-coarse gravels, 20% sand, 20% cobble, 10% boulder	Moderate siltation, partially-bedded substrata	*Veronica beccabunga* (O)	None recorded	Upstream afforestation, agriculture (siltation & enrichment)

Site	Watercourse	River profile	Bordering land uses & riparian habitat (Fossitt, 2000)	Substrata	Riverbed condition & siltation	Macrophytes & bryophytes (DAFOR)	Fish species recorded	Threats & pressures
		with 1-2m bank heights, shallow glide dominated, low shading						
C2	Ballynaguilkee Upper Stream, Power's cross roads	Small drainage channel (FW4), historically straightened, culverted under road, very low flows at time of survey, <1m wide & 0.05m deep, shallow U-shaped channel with 0.5m bank heights, shallow pool dominated, heavily vegetated	GA1, BL3	90% silt, 10% fine gravels	Moderate siltation, partially-bedded substrata	*Rorripa nasturtium-aquaticum* agg. (A)	None recorded	Surface water run-off, siltation, upstream afforestation
C3	Tooraneena Stream, R672 road crossing, Tooraneena	Small upland eroding watercourse (FW1), semi-natural, lower energy but some cascading, 1.5-2m wide & 0.1-0.2m deep, fast glide dominated with frequent riffle, high shading	WS1, GA1, WD4	40% medium-coarse gravels, 30% cobble, 20% boulder, 10% sand	Moderate siltation (more than expected for river type), partially-bedded substrata	*Rorripa nasturtium-aquaticum* agg. (O), *Hygroamblystegium tenax* (O), *Riccardia chamedryfolia* (R)	Brown trout	Upstream afforestation, agriculture (siltation & enrichment)
C4	Clooncogaile Stream, R672 road crossing, Clooncogaile	Small lower-energy upland eroding watercourse (FW1), straightened & deepened in recent past, 1.5-2m wide & 0.1m deep, slow shallow glide and riffle dominated, 2m bank heights, low shading	GA1, WL1, WS1	50% cobble, 20% boulder (small), 20% medium-coarse gravels, 10% sand	Moderate siltation, unbedded substrata	*Berula erecta* (O), *Rorripa nasturtium-aquaticum* agg. (O), *Mentha aquatica* (O), *Apium nodiflorum* (R)	Brown trout	Agriculture (siltation & enrichment)

Site	Watercourse	River profile	Bordering land uses & riparian habitat (Fossitt, 2000)	Substrata	Riverbed condition & siltation	Macrophytes & bryophytes (DAFOR)	Fish species recorded	Threats & pressures
C5	Clooncogaile Stream, Clooncogaile	Small high-energy upland eroding watercourse (FW1), natural channel, 2-2.5m wide & 0.1-0.3m deep, cascading riffle-glide-pool sequences, 3-4m high natural V-shaped valley moderate shading	WD1, GA1	40% cobble 30% boulder, 25% fine-medium gravels, 5% sand	Moderate siltation (higher than expected for river type), unbedded substrata	*Hygroamblystegium tenax* (O), *Racomitrium aciculare* (O)	Brown trout, European eel	Agriculture (siltation & enrichment)
C6	Tinalira Stream, R672 road crossing, KIlcooney	100% dry drainage channel (FW4), 1m wide, 2m bank heights, historically straightened & deepened, no fisheries value at time of survey, seasonal channel, heavily tunnelled by scrub	GA1, BC3, WS1	100% mud base	n/a – dry channel	None recorded	None recorded	Seasonality (low flows)
C7	Ballynaguilkee Lower Stream, Tinalira	Medium-sized upland eroding watercourse (FW1), semi-natural high-energy channel, 2-2.5m wide & 0.1-0.3m deep, fast glide & riffle dominated, 1-3m variable bank heights, moderate shading (higher downstream)	GA1, WD1, GS4, WD4, WS2	40% boulder, 30% cobble, 20% fine-coarse gravels, 10% sand	Light siltation, partial-bedding of substrata	*Hygroamblystegium tenax* (O), *Racomitrium aciculare* (O), *Riccardia chamedryfolia* (R)	Brown trout, Atlantic salmon, European eel	Upstream afforestation, agriculture (siltation & enrichment), livestock poaching, instream barrier (culvert at bridge)

7. Appendix B – additional site images

Plate B.1 Site A4 on the Shanballyanne River

Plate B.2 Site A5 on an unnamed stream, Knockavannia

Plate B.3 Site B2 on an unnamed stream at Bryan's cross raods, Reanadampaun Commons.

Plate B.4 Site B6 on the Colligan River at Scart Bridge

Plate B.5 Site B9 on the Colligan More Stream

Plate B.6 Site B10 on the Colligan River at Colligan Bridge

Plate B.7 Site B11 on the River Colligan at Kildangan Bridge

Plate B.8 Site C3 on the Tooraneena Stream, R672 road crossing

Plate B.9 Site C7 on the Ballynaguilkee Lower Stream, Tinalira

Plate B.10 European eel recorded from site B11 on the River Colligan at Kildangan Bridge

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