Sure Partners Limited

ARKLOW BANK WIND PARK PHASE 2
ONSHORE GRID INFRASTRUCTURE

VOLUME III
Chapter 12 APPENDICES

Appendix 12.8 Fishery Survey and Water Quality Assessment

ARUP

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Appendix 12.8

Fish Survey and Water Quality Assessment

Fish Survey and Water Quality Assessment for the Arklow Bank Wind Park Phase 2 Onshore Grid Infrastructure Arklow, Co. Wicklow

Arklow Bank Wind Park Phase 2 Onshore Cable Route

March 2021

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Project	**Fish survey and water quality assessment for the Arklow Bank Wind Park Phase 2 Onshore Grid Infrastructure Arklow, Co. Wicklow**
Client	**Arup**

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1. Introduction

Following initial site surveys and desktop review it was determined that three watercourses within the route corridor had permanent running water and were of sufficient size to support fish populations. These small watercourses were therefore selected to carry out fish stock assessments. The objectives of the study were to determine the presence/absence for all fish species, including Atlantic Salmonids, lamprey species and European Eel in watercourses potentially affected by site works. As part of this assessment a water quality survey of these watercourses was carried out using a standard EPA methodology.

2. Assessment methodology – fish stock assessment

A broad aquatic habitat assessment was conducted at each site based on the methodology provided in the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (EA, 2003). Where relevant, habitats were classified using the habitat classification scheme outlined in *A Guide to Habitats in Ireland* (Fossitt 2000).

Following the submission of an application, DixonBrosnan received a Section 14 licence from the Department of Communications, Climate Action and Environment (DCCAE) for an electro-fishing fish stock assessment. All bio-security protocols as submitted to and agreed with the DCCAE, were followed during surveying. Surveys were carried out using a Safari Backpack electrofishing unit.

The surveyed areas were chosen to provide representative examples of habitats within the relevant watercourses and incorporated areas of soft sediment potentially of value for juvenile lamprey. Equipment and PPE used was disinfected between watercourses to prevent the transfer of pathogens and/or invasive species between survey areas.

Captured fish were held in a large bin of oxygenated water after processing until they were fully recovered and were then returned to the water. The methodology utilised by Inland Fisheries Ireland (Central and Regional Fisheries Board, 2009) was followed. Surveying was carried by Carl Dixon M.Sc. Ecological and Andrew Swift on 25th of September, 2020.

3. Information received from Inland Fisheries Ireland

Inland Fisheries Ireland (IFI) emailed correspondence, Gretta Hanigan IFI (3/11/20) noted the following in relation to fish stocks in watercourses within and in proximity to the proposed works:

The Avoca River represents an important Atlantic Salmonid system with excellent populations of Atlantic Salmon, Sea trout and Brown Trout throughout. The Avoca also supports populations of eel, and all three species of lamprey listed under Annex II of the Habitats Directive. Estuaries serve as the natural linkage for migratory species such as Atlantic Salmon, Sea trout, Lamprey and Eels migrating between freshwater and ocean environments, providing the necessary habitat for their transition. Fish monitoring carried out by IFI under WFD in the Avoca Estuary in 2015 classifies the Avoca at "good ecological status" due to the presence of four indicator species Atlantic Salmon, Brown Trout, European Eel and River Lamprey. (www.wfdfish.ie) .

In addition, the IFI also noted the watercourses listed, namely Johnstown North and South, Ticknock, Coolboy and Templerainy, are all salmonid with populations of Brown Trout. Also, a small but significant population of Sea Trout has been recorded in the lower Templerainy Stream.

4. Watercourses potentially affected by the project

The largest watercourse within this area is the Avoca River, which as noted above, is considered a high value habitat due in particular to the presence of Atlantic Salmon, River Lamprey, Brook Lamprey and Sea Lamprey. These species are listed on Annex II of the Habitats Directive. While the conductors of the new overhead line connection to the NETN will cross the Avoca River, the pilot lines for stringing the new conductors will be taken across the river by boat or drone and therefore there will be no instream river crossing for the Avoca River. Given the availability of fisheries data this watercourse was not included in the current site surveys.

Three watercourses the Templerainy, Kilbride and Johnstown North Stream which will be crossed by the proposed cable route, were assessed. The location of the surveyed watercourses is detailed below in **Figure 1**.

Figure 1. Sampled watercourses within the study area

5 Description of watercourses

5.1 Templerainy Stream

The Templerainy Stream is a moderate sized watercourse and with the exception of the Avoca River is most significant watercourse within the study area. In the upper catchment north of the M11 motorway, the catchment is dominated by a mixture of pasture and tillage land with areas of riparian woodland in the lower catchment south of the M11 motorway. Ultimately this watercourse discharges to the sea northeast of Arklow town.

5.2 Kilbride Stream

The Kilbride Stream is the most significant tributary of the Templerainy Stream and drains a similar catchment of mixed tillage and pasture. It is of limited size and like the Templerainy Stream, passes under the M11 motorway. There are areas of riparian trees along the banks of this watercourse at several locations which creates a high level of shade.

5.3. Johnstown North Stream

The Johnstown North Stream is a small watercourse of limited size and fisheries potential. It drains intensively managed pasture and tillage land. The Johnstown North Stream is of insufficient size to be of significant value for fish in the upper reaches, and discharges to the sea approximately 1.3km northeast of Arklow town. There is some woodland habitat in the lower catchment.

6. Species of conservation value potentially affected.

6.1 Atlantic Salmon, Sea trout and Brown Trout.

Brown Trout (*Salmo trutta*) and Atlantic Salmon (*Salmo salar*) generally require similar environmental conditions including clean gravels of a suitable size for spawning, nursery habitat with suitable cover and deeper pools for older fish. Important environmental variables include flows, depth, geology, land use, riparian cover, shade, macrophyte development, oxygen levels, degree of organic enrichment, obstacles to migration, habitat heterogeneity and temperature. Seasonal factors may also be relevant; for example, low summer flows and high temperatures may impact on nursery habitat whereas scouring winter floods may impact on spawning success. Seasonal land use may also have impacts; for example, cattle drinking points on small tributaries in summer can cause localised nutrient enrichment and, due to low flows, wastewater discharges can increase levels of key nutrients. River drainage can significantly impact on river ecology by clearing bankside vegetation and by impacting on riffle/glide/pool sequences and spawning habitat. (O'Grady & Gargan, 1993).

Both salmon and trout are affected by these complex patterns of physical variables and biotic factors which determines the carrying capacity of a given area of channel. The significance of these factors will vary for different stages of the lifecycle and factors will interact with each other to varying degrees. It can therefore be difficult to determine or predict patterns in fish distribution and number, and bottlenecks may occur which may not be immediately discernible but which nonetheless impact significantly on fish

stocks. For Atlantic Salmon in particular access to sections of watercourses may require specific flow conditions; it has been reported that if parr numbers regularly exceed fry numbers, or vice versa, this may be indicative of intermittent access. Sea trout may be adept at successfully navigating past obstacles that prevent Atlantic Salmon from moving upstream.

6.2 European Eel

Current evidence supports the view that recruiting eel to European continental waters originate from a single spawning stock in the Atlantic Ocean, presumably in the Sargasso Sea area, where the smallest larvae have been found. In Ireland, glass eel migrate into coastal waters and estuaries between October and March/April, before migrating, as pigmented elvers, on into rivers and eventually into lakes and streams between May and September. Following immigration into continental waters, the prolonged yellow eel stage (known as brown eel in Ireland) begins, which lasts for up to 20 or more years. During this stage, the eels may occupy fresh water or inshore marine and estuarine areas, where they grow, feeding on a wide range of insects, worms, molluscs, crustaceans and fish. Sexual differentiation occurs when the eels are partly grown, though the mechanism is not fully understood and probably depends on local stock density. At the end of the continental growing period, the eels mature and return from the coast to the Atlantic Ocean; this stage is known as the silver eel. Female silver eels grow larger and may be twice as old as males. The biology of the returning silver eel in ocean waters is almost completely unknown. (National Report for Ireland on Eel Stock Recovery Plan, Department of Communications, Energy and Natural Resources 2008).

European Eel is listed by the International Union for Conservation of Nature (IUCN) as a critically endangered species, with numbers in catastrophic decline. This is seen in the fisheries for yellow and silver eels, as well as in surveys of the number of glass eels that are returning to Europe. The decline can be tracked back to the early 1980s and considerable effort is now needed to reverse the situation.

6.3 Lamprey species

Lamprey species are of high conservation value and threes species occur in Ireland namely Sea Lamprey, *Petromyzon marinus*, River Lamprey *Lampetra fluviatilis* and Brook Lamprey, *Lampetra planeri*. Lamprey are protected under Annex II of the EU Habitats Directive 79/409/EEC. The habitat required for lamprey spawning (gravel or cobble river bed substrate) is very different to that required by juvenile ammocoete lamprey (sandy substrates that are rich in organic sediment).

Sea Lamprey

Important locations include the River Shannon, River Suir in Clonmel, the River Nore in Kilkenny, the River Moy in Ballina and the River Corrib in Galway. Many of these locations are along main river channels immediately downstream of weirs, where sea lamprey can be found spawning at high densities and are easily observed. (Kurz and Costello, 1999)

River Lamprey

Due to their smaller size, adult River Lamprey are less obvious than sea lamprey to the naked eye and subsequently less information is available on their distribution in Ireland. Their range appears to overlap with that of the sea lamprey. Important populations occur in the rivers Slaney, Mulkear, Barrow, Nore, Blackwater (Co. Cork), Laune and Bonet (Kurz and Costello, 1999). It is likely that they occur in most rivers that allow access to spawning and nursery areas from the sea.

Brook Lamprey

Brook Lamprey are the smallest lamprey species in Ireland. They are non-anadromous and can complete their entire life cycle above physical barriers that impede upstream migration of anadromous lamprey. However, they may undergo migrations over considerable distances to reach their spawning beds (Hardisty and Potter 1971). Brook Lamprey are the most widespread of the three species and are regularly captured during electro-fishing surveys and kick sampling for macroinvertebrates.

7. Results fish survey

Results for each watercourse are detailed below including characteristics of the survey locations and tabulated results. The survey locations are shown in **Figure 2**. The sampling locations included the watercourse crossing locations on the Johnstown North Stream and the Kilbride Stream. On the Templerainy Stream the sampling locations were located approximately 330m downstream of the watercourse crossing location. However, it is noted that the Templerainy Stream will be crossed by horizontal directional drilling (HDD) and therefore there will be no direct impact on this watercourse.

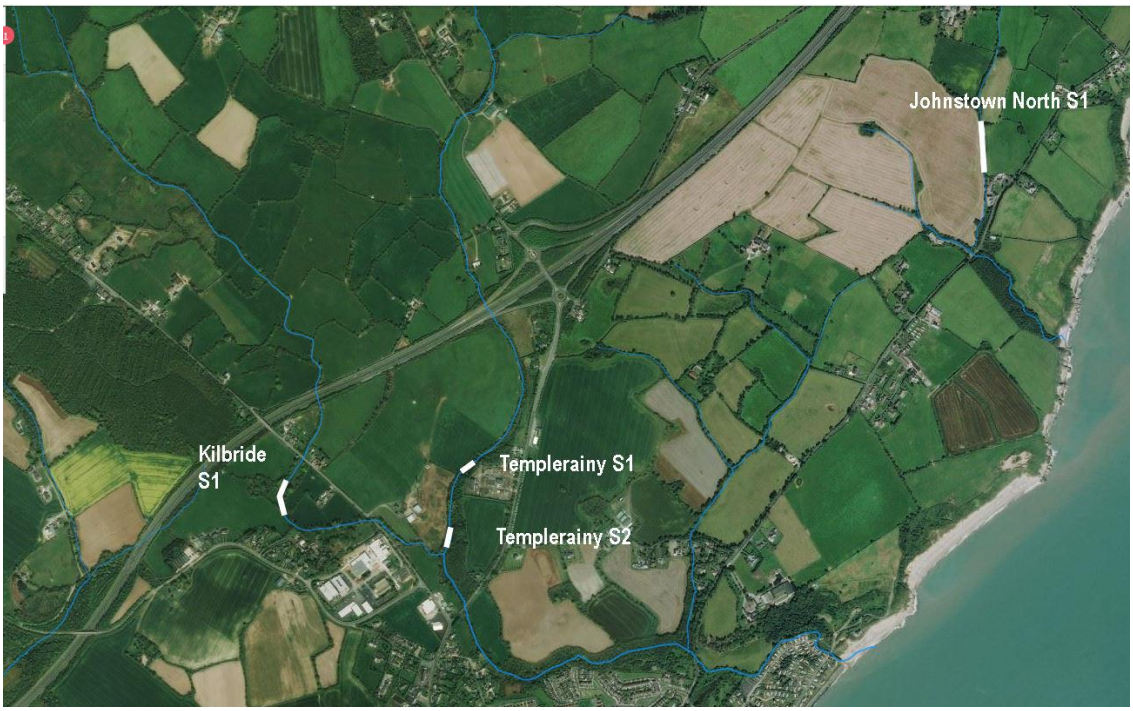

Figure 2. Fish survey locations (highlighted in white).

7.1 Templerainy Stream - Results

Two sections of the Templerainy Stream were surveyed. These sections of the stream are wooded to the east and adjoin intensively grazed pasture to the west. The eastern bank of the stream is heavily vegetated.

S1 is the most upstream section and the stream bed is characterised by a mixture of boulders, rocks and small patches of gravel. Silt levels are moderate and areas of sediment suitable for lamprey are nearly entirely absent. At this point the stream is approximately 4m wide, 20cm deep, 80% glide and 20% riffle. Shade of approximately 40% is from trees along the eastern bank from Ash, Willow, Gorse, Rowan and Holly. Cover for Atlantic Salmonids is provided by dense beds of Fools Watercress and Woody Nightshade. This site is considered of moderate to high value for Atlantic Salmonids and of low to negligible value for lamprey.

S2 is located further downstream and upstream of the confluence of the Templerainy and Kilbride Streams. It is broadly similar to S1 with intensive pasture to the west and trees including Alder and Holly along the eastern bank. Cattle are able to access the stream leading to some ground damage and localised enrichment. Morphologically the stream is primarily glide (85%) with 15% riffle and with a substrate of rocks and gravel. Silt levels are moderate and there are pockets of sediment suitable for juvenile lamprey. Width is approximately 2.5m with an average depth of approximately 25cm. This site provides high value Atlantic Salmonid habitat with small pockets of moderate lamprey habitat.

Table 1. Survey results Templerainy Stream

Templerainy	Brown Trout	Atlantic Salmon	Eel	Brook/River Lamprey
Site 1	28	0	0	0
Site 2	56	0	0	3

7.2 Kilbride Stream - Results

The Kilbride is a small stream and an initial site inspection indicated that sections of the stream are small and lack cover for fish species. A small wooded area provided better quality cover for Atlantic Salmonids and small areas of sediment potentially suitable for lamprey species and this section was surveyed. This site (S1-Kilbride) is characterised by steep banks with sections of mature Oak, Ash and Beech with Hogweed, Fools Watercress, Rosebay Willowherb and Bramble also recorded. Shade levels were 60%. The survey area consists of 80% riffle, 20% glide with an approximate depth of 15cm and width of 2m. Silt levels were moderate and there were some areas of soft sediment which could potentially support juvenile lamprey. The under-cut banks with mature roots and overhanging brambles provide niches for trout. The site provides moderate quality habitat for Brown Trout.

Table 2. Survey results Kilbride Stream

Kilbride	Brown Trout	Atlantic Salmon	Eel	Brook/River Lamprey
Site 1	11	0	3	0

7.3 Johnstown North Stream

This is a small stream which supported running water but has little fish potential in the upper reaches due to its limited size. Small pockets of deeper water within the survey area were surveyed. The survey area adjoins tillage land to the west with a treeline to the east with Sycamore, Willow, Privet and Bramble. The channel is also heavily shaded (90%) by riparian vegetation including Nettle, Hogweed and Bush Vetch. This watercourse is characterised by low flows. The flow pattern is dominated by glide (90%) with smaller areas of riffle (10%). The upper reaches, within which the survey was carried out, are considered to be of negligible fish value and no fish were recorded during the survey. Small populations of fish such as European Eel and trout could potentially occur in deeper pockets of water in the lower reaches.

8. Water Quality Assessment

8.1. Introduction

DixonBrosnan carried out biological analyses at six sampling stations to assess the current water quality of the watercourses at these stations on the 25th of September 2020. The monitoring stations which were utilised for the survey are indicated below in **Figure 3**. Two samples were taken from each location.

Figure 3. Biological monitoring locations

8.2 EPA Q values

The Templerainy Stream is of sufficient size to be included in the EPA standard monitoring programme (**Figure 4**). One EPA monitoring site is located upstream of the proposed works area and was last monitored in 2003. A Q value of 3 was recorded which is indicative of a degree of water quality impairment. The second EPA monitoring site at Porter's Bridge, which is located downstream of the proposed works, was assigned a Q value of 4 in 2018 which is indicative of 'good' water quality.

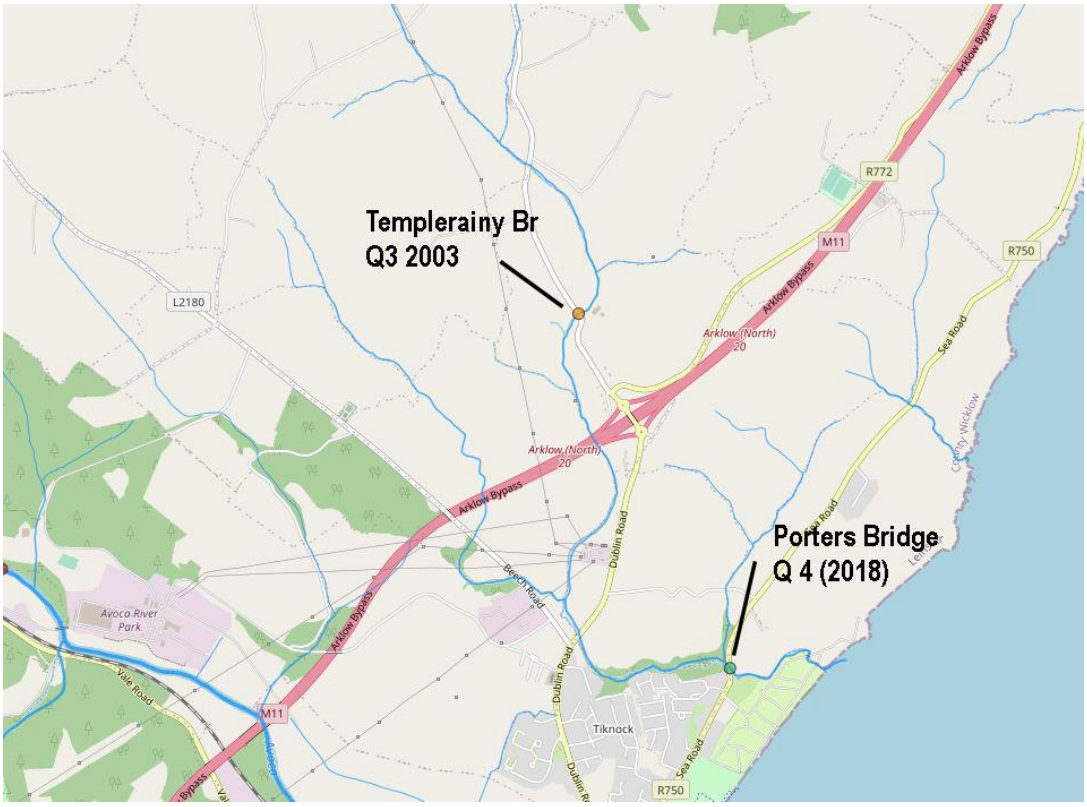

Figure 4. EPA monitoring stations in the vicinity of the proposed development site

There are no recent EPA monitoring sites on the Avoca River in proximity to the proposed works. The closest monitoring site upstream of the proposed development at Avoca Bridge was assigned a Q value of 2-3 in 2019. It is noted that the Avoca River has historically suffered from toxic impacts including high levels of metals associated with mining activity within its catchment.

8.3. Survey methodology

The field survey was undertaken on the 25th of September 2020. Biological sampling was carried out at each station using the kick-sampling technique as described by the EPA (1999). The kick-sampling technique involved using a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged in a fast-flowing area of the river bed with its mouth directed upstream. Where available, riffle habitat is utilised. The substrate immediately upstream of the net was kicked for two minutes to dislodge invertebrates. Stone washings were also undertaken to ensure a representative sample of the fauna present at each site is collected. Samples are transferred to plastic containers and preserved using 70% alcohol. Samples are subsequently sieved and sorted using a white sorting tray. Identification was undertaken in the laboratory using a high-powered binocular microscope and using standard identification keys.

To establish the water quality of the two samples the EPA protocol for calculating Q values was utilised (Toner *et al*, 2005). This biotic index is used by the EPA and allows river quality to be compared under standardized guidelines. This method divides macro-invertebrates into five groups, depending on their sensitivity to pollution as presented in **Table 3**.

Table 3. Macroinvertebrate sensitivity classes.

Group	Sensitivity
A	Sensitive
B	Less Sensitive
C	Tolerant
D	Very tolerant
E	Most tolerant

Having determined the relative proportions of the various organisms in a sample, water quality can be inferred by a comparison of this data with that which might be expected from unpolluted habitats of the type under investigation. The Q-value determined using the fauna collected at each station therefore provides an indication of the quality of the water at that station. The relationship between Q values and water quality is set out in **Table 4** below. The relationship between the Q-rating system and the Water Framework Directive classification as defined by the Surface Waters) Regulations 2009 (S.I. 272 of 2009) is shown in **Table 5.**

Table 4. Q-value and water quality.

Q-value	Water quality	Status
5	Good	Satisfactory
4	Fair	Satisfactory
3	Doubtful	Unsatisfactory
2	Poor	Unsatisfactory
1	Bad	Unsatisfactory

Table 5. Correlation between the WFD classification and Q values

Ecological status WFD	Q Values
High	Q5, Q4-5
Good	Q4
Moderate	Q3-4
Poor	Q3, Q2-3
Bad	Q2, Q1

8.4 Characteristics of sampling stations

General descriptions of each sampling location are outlined in **Table 6**.

Table 6. **Characteristic of sampling locations**

Site	Stream name	Stream characteristics at monitoring location	Instream vegetation	Riparian vegetation	Flow type	Flow width m	Channel depth cm	% Shade
KS1	Kilbride Stream	40% cobbles, 60% gravel	None	Oak (*Quercus* sp.) Beech (*Fagus sylvatica*)	Riffle	2m	15	65
KS2	Kilbride Stream	20% cobbles,50% gravel,30% sand	None	Willow (*Salix* sp.*)* Bramble (*Rubus fruticosus* agg.) Nettle (*Urtica dioica*)	Riffle	2m	15	55
TS1	Templerainy Stream	10% boulders,40% cobbles,40% gravel;10% sand	Brooklime (*Veronica beccabunga*) Fool's Watercress (*Apium nodiflorum*)	Ash(*Fraxinus excelsior*) Willow, Gorse (*Ulex europeas*) Rowan (Sorbus aucuparia) Holly (*Ilex aquifolium*)Woody Nightshade (*Solanum dulcamara*)	Riffle	4m	20	40
TS2	Templerainy Stream	5% cobbles, 55% gravel,40% sand	Brooklime, Fool's Watercress	Sycamore, Holly, Oak, Nettle, Montbretia.	Riffle	2m	25	40
JNS1	Johnstown North Stream	30% cobbles,65% gravel,5% sand & mud	Limited amount of Fool's watercress	Sycamore (*Acer pseudoplatanus*) Willow, Hogweed (*Heracleum sphondylium*) and Bramble.	Glide	1	10	85
JNS2	Johnstown North Stream	20% cobbles,35% gravel,40% sand & mud,5% boulders	Fools Watercress and Common Water-Starwort (*Callitriche stagnalis*)	Sycamore, Willow, Bramble, Hogweed	Riffle	1	10	90

8.5. Results- Biological survey

Macro-invertebrates found at each site were identified down to the lowest taxon required for the determination of Q value, using the rating systems described in **section 8.3.** The results of the biological survey are presented in **Table 7**.

Table 7. Results of Biological Monitoring

Taxa	KS1	KS2	TS1	TS2	JNS1	JNS2
GROUP A						
GROUP B						
Leutricidae		P	F	P		
Limnephilidae		P			P	P
GROUP C						
Baetis rhodani	P		P			
Rhyacophila dorsalis				P		
Hydropsyche sp.	P		P	P		P
Polycentropus sp.		P			P	
Elminthidae	F		P	P	P	
Dytiscidae	P	P				
Gammarus duebeni	C	N	C	C	C	
Potamopyrgus jenkinsi	p					
Tipulidae/Tabanidae				P		P
Chironomidae	P					
GROUP D						
Hirudinea	F	P		P	P	
Lymnea peregra						
Asellus aquaticus	F			P	P	P
GROUP E						
OTHER						
Oligochaeta	P					
Q values	Q3	Q3	Q3	Q3	Q3	Q3
P=Present, F=Frequent, C=Common, N=Numerous, D=Dominant						

8.6 Water Quality Results summary

A summation of the of Q value assessment is given in **Table 8**.

Table 8. 2019 Q Values

	KS1	KS2	TS1	TS2	JNS1	JNS2
Q-value	Q3	Q3	Q3	Q3	Q3	Q3
Rating	Moderately Polluted	Moderately Polluted	Moderately Polluted	Moderately Polluted	Moderately Polluted	Moderately Polluted
WFD status	Poor	Poor	Poor	Poor	Poor	Poor

9. Conclusions

9.1 Fish

Results indicate that the upper reaches of the Johnstown North Stream, which will be crossed by the proposed route corridor, are characterised by a narrow channel, low flows and high shade levels. No fish were recorded, and the upper reaches of this stream are considered of negligible value for fish. IFI have noted that Brown Trout do occur within the Johnstown North Stream, however such populations are likely to occur downstream of the planning boundary where flows are greater.

The Kilbride Stream is a small watercourse but is of sufficient size to support Brown Trout and eel where conditions are suitable. At the survey site there was cover provided by undercut banks and dense overhanging bramble which provided suitable conditions for Brown Trout and small numbers of European Eel were also recorded. No lamprey were recorded and it is considered unlikely that they are present due to the limited size of the watercourse. Although susceptible to localised pollution impacts due to its limited size, this stream is considered of moderate local value.

The Templerainy Stream was found to support substantial populations of Brown Trout, however no Atlantic Salmon were recorded. Three Brook/River Lamprey, which are listed on Annex II of the Habitats Directive were also recorded. Some ground damage and localised nutrient enrichment was recorded. Overall, this river is considered of high local value for brown/seatrout and of county importance due to the presence of lamprey.

9.2 Water Quality

The Johnstown North in a very small watercourse in its upper reaches and may dry out partially during extended dry periods. Such streams tend to have limited biodiversity and are susceptible to relatively small pollution events. The Kilbride Stream is a larger watercourse but is still relatively small and susceptible to nutrient inputs. Relatively small nutrient inputs can impact on the density and diversity of macroinvertebrates, with the effect being more profound for smaller watercourses.

The Templerainy is a larger watercourse but adjoins improved agricultural pasture with a number of drinking points for cattle along this section of the stream. Under such circumstances, localised nutrient enrichment is likely to occur and there may also be nutrient inputs further upstream.

Group A species were absent from all surveyed sites. In general Group B species were limited in extent although small numbers of stoneflies (Leutricidae) and caddis fly (Limniphilidae) were recorded. Group C species were the most dominant species with high numbers of freshwater shrimp (*Gammerus duebeni)* recorded at sites KS1, KS2, TS1, TS2 and JNS1. Smaller numbers were recorded at JNS2. A Q value of 3 was assigned to all of the survey sites which is indicative of a degree of water quality impairment. This is probable due to localised agricultural effects.

10. References

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