



Technical Appendix 6.4: Fish Population and Habitat Assessment

Dalfad Wind Farm

Brockwell Energy Limited

The Eagle Building, Third Floor, 19 Rose Street, Edinburgh, EH2 2PR

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Ayrshire Rivers Trust

Dalfad Wind Farm

Fish Population and Fish Habitat Assessment 2025

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Ayrshire Rivers Trust,
2 Crosshill Cottage,
Mauchline,
KA5 5HJ
T: 01290 518130
E: info@ayrshirerivertrust.org
W: www.ayrshirerivertrust.org
Scottish Registered Charity 030426

Revision	Purpose Description	Originated	Checked	Approved for submission
1.0	Draft	C. Watson	C. Bryce	S. Candlish

Summary

Ayrshire Rivers Trust (ART) completed eight electrofishing surveys on six watercourses and undertook fish habitat suitability surveys within the upper River Ayr catchment to support an Environmental Impact Assessment for a potential development near Cumnock. The results generated from these surveys will be used to assess the potential risk of the development to freshwater fish populations and produce site-specific mitigation recommendations.

The key findings of the surveys were:

- Atlantic salmon *Salmo salar* were recorded in high numbers in the Glenmuir Water and low numbers in the Glenmuir Burn.
- Brown trout *Salmo trutta* were recorded in the Glenmuir Water, Glenmuir Burn, Boghead Burn and Gass Water.
- No lamprey species *Lampetra* spp. or *Petromyzon marinus* were recorded or witnessed during the surveys, and there are no historic records of lamprey species within the Site.
- Habitat suitable for Lamprey ammocoetes was rare across all six watercourses.
- No European eels *Anguilla anguilla* were recorded or witnessed during the surveys; however historic records indicate that European eels are present in the River Ayr and Lugar Water.
- Pollution and historic mining practices impact the condition of the habitat within the Gass Water and Duncanzemere Burn.
- The upper reaches of the six watercourses suffer from a lack of riparian tree cover.
- A natural barrier limits or restricts Atlantic salmon access to the Bellow Water, of which the Gass Water and Boghead Burn are tributaries.

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1. Introduction

Ayrshire Rivers Trust (ART) was commissioned by SLR Consulting Ltd (SLR) to survey for freshwater fish populations and assess the suitability of habitats for fish species on watercourses within and around the Site of the proposed Dalfad Wind Farm (hereby referred to as the 'Site' or 'Proposed Development') in East Ayrshire. In total, six watercourses that are situated within and around and drain the Proposed Development were surveyed. These watercourses include the Glenmuir Water, Small Burn, Glenmuir Burn, Duncanzemere Burn, Boghead Burn and Gass Water. The purpose of these surveys is to help inform an Environmental Impact Assessment Report (EIA Report) for the Proposed Development and establish an ecological baseline to assess risks and potential associated with the Proposed Development. These surveys also follow guidance by the Scottish Government in relation to monitoring watercourses for onshore wind farm developments (Marine Scotland, 2021) where possible.

1.1 Salmonid Fish and Fisheries

Migratory salmonids; Atlantic salmon and brown/sea trout and other native fish populations use freshwater habitats for breeding and development of early life-stages. Typically, juvenile salmon spend between one and three years in freshwater before migrating to sea as smolts. Salmon may then spend between one and three years in the Atlantic Ocean before returning as mature fish to spawn within their natal river, at or close to their original hatching site. Sea trout differ from salmon in that they are part of a resident brown trout population and may spend less time at sea and, unlike salmon, remain in nearby inshore marine waters to feed. The use of both marine and freshwater habitats during their life-cycle makes migratory salmonids vulnerable to deterioration or loss of accessibility across a wide range of habitats. Factors influencing survival may be extremely varied or river-specific, for example physical obstructions to upstream migration, in-river or estuarine predation and water quality issues. Migratory fish species and resident populations are vulnerable throughout their range and during their transition between habitats.

Isolated resident brown trout populations are potentially present upstream of waterfalls and manmade barriers that prevent access from the sea. These populations form an important part of biodiversity as they are present in most catchments and may contribute to downstream populations through downstream migration.

1.2 Biodiversity

Other than Atlantic salmon and brown trout, native fish species such as brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus*, three-spined stickleback *Gasterosteus aculeatus*, European eel and other species may also utilise freshwater habitats in and/or downstream of the survey areas. Other species have been introduced to River Ayr catchments, many of which survive and can threaten native species, such as stone-loach *Barbatula barbatula*. Fish and freshwater habitats also support a range of native flora and fauna and consequently mitigation to protect water resources for fish species is likely to benefit other biodiversity and conservation objectives.

1.3 Survey Catchment

The proposed development lies to the northeast of Cumnock in East Ayrshire. All watercourses pertinent to this Proposed Development and report fall within the River Ayr catchment. The River Ayr is the largest river in Ayrshire. It's true source is the Stottencleugh Burn upstream of Glenbuck Reservoir, on the boundary of Ayrshire and Lanarkshire, from where it flows westwards for 65 km to its estuary at Ayr on the Firth of Clyde. It has a catchment area of 574 km² with principal tributaries including the Greenock Water, the Garpel Burn, the Water of Fail, Lugar Water and Water of Coyle.

2. Methods

2.1 Fish Monitoring

2.1.1 Background

ART is a full member of the Scottish Fisheries Coordination Centre (SFCC), which is an association of Scottish fisheries management organisations including Fisheries Management Scotland (FMS), Marine Directorate (formerly Marine Scotland Science), and the local District Salmon Fishery Boards. The SFCC provide electrofishing training to its members, and ART are qualified to lead and design electrofishing surveys to SFCC protocols. ART have three members of staff who have a current and in-date SFCC electrofishing team leader qualification. Each team leader has over 10 years of electrofishing experience and they have participated and contributed to the Scottish Government's National Electrofishing Programme for Scotland. All staff involved in survey delivery have their SFCC Level 2 'Introduction to Electrofishing' qualification as a minimum. ART's surveys are therefore carried out to the standards required by the SFCC, and data are recorded using the agreed format. ART are licensed by Marine Directorate to undertake electrofishing in all the freshwaters including rivers and coastal burns throughout Ayrshire.

2.1.2 Techniques

Fish populations at each site were assessed using electrofishing. This is a widely used technique to examine freshwater fish communities. The method uses electricity to attract and stun fish, which allows operators to remove them from the water. The fish are transferred to a holding container until they have recovered and then anaesthetised using a mild solution of MS222 (Tricaine Methane Sulphonate). Individuals are then identified, measured and returned unharmed to the area from where they were captured.

Battery-powered backpack equipment (Hans Grassl model # IG600) was used to carry out each survey. Smooth DC was used at all sites, to maximise catch efficiency, while minimising potential damage to fish and other wildlife. A minimum voltage of 150V was used, to ensure efficient fish capture.

In small watercourses, it is possible to cover the entire survey area accurately, and the number of fish captured can therefore be related to the wetted area of the site. All survey protocols were followed to SFCC standards.

2.1.3 Quantitative Sites

All sites were sampled using an area-delimited survey, thus allowing fish densities to be calculated. To ensure that all fish have an equal chance of being caught, each survey run began at the downstream end of the section and moved back and forth across the wetted channel in an upstream direction ensuring every part of the bed was covered. This approach was carried out three times (where fish numbers allowed), with a break in between each run to protect fish welfare and to standardise the potential of capture on subsequent survey runs. This electrofishing technique is referred to as a quantitative 3-run depletion, and ART followed all SFCC protocols for this technique.

From the results, salmon and trout were separated into year classes based on length frequency histograms. As fish grow at different rates between sites, this was repeated for each site individually. Where age classifications were unclear, they can be checked by examining the number of annual rings on scales taken from fish of a range

of sizes. Fish densities were separated into fry and parr for the presentation of the results. Throughout this report the following notation has been used to distinguish fish year classes: salmonid fish less than one year old are recorded as 0+ year class or fry, whilst fish one year or older are recorded as 1+ or parr. Other fish species were counted and recorded. If there were sufficient fish present, absolute fish densities were calculated, together with a measure of statistical confidence, otherwise a minimum density estimate was used.

2.1.4 Electrofishing Habitat Surveys

General habitat assessments that accompanied each electrofishing survey followed SFCC electrofishing methodology (2024) (**Annex F**). These differ in their definition and use of terminology compared to the Fish Habitat Walkover Survey based on the Hendry and Cragg-Hine method (1997) and align with the SFCC Walkover Habitat survey (SFCC, 2007). A modified approach was used to make notes of key and distinctive habitats within the watercourses out with of the surveyed sections. Habitat definitions are provided in **Annex G**.

2.1.5 Frequency and Timing of Sampling

The optimum season for catching juvenile salmonids in Scotland is from July to September. It is recognised that capture probability, especially for salmonid fry, may drop significantly outside of this window. Should annual surveys be required, it is recommended that they take place at the same time of year.

Annual fish surveys should be undertaken prior to the commencement of the development, during the construction phase and for at least one year during the post-construction restoration period to comply with guidance provided by Marine Scotland (2021).

2.1.6 Electrofishing Survey Limitations

Electrofishing is a common means of obtaining data on fish populations (SEERAD, 2007). The electrofishing techniques used by ART are specifically designed for assessing juvenile salmonid populations, therefore fish from other groups may not be quantified effectively.

The survey sites chosen were selected to be representative of the general habitat type present in the relevant sub-catchments and to include a range of flow and substrate types (if appropriate). If the site selected is representative of the local habitat, the survey should provide a robust estimate of local populations. However, it is possible that if fish populations are low or have clumped distribution, the survey data may not sample the full fish population in that area. It is considered impossible to capture all fish present within a site; therefore, whilst the failure to capture fish at a site may indicate that the population is absent, it cannot be assumed that they are not present elsewhere in the watercourse or catchment. For the purposes of this report and the classification tables, where a fish species has not been recorded at an electrofishing site, they will be classified as absent.

Depletion sampling, where fish are removed from a site in a series of successive electrofishing runs, are used to provide an estimate of the total fish population present. The rate of decline in each run and the total number of fish captured are used to estimate fish stocks. However, if fish numbers are low (less than 40 per site) the confidence limits will be large, and the depletion estimates will be unreliable (Schnute, 1983). In instances where absolute densities cannot be calculated, the 1-run minimum density estimate will be provided.

2.1.7 Monitoring Sites

Details and coordinates of electrofishing sites are displayed in **Table 2-1**. The locations of the electrofishing sites are shown on Figure 1, below, in relation to the Application Site boundary of the Proposed Development. All electrofishing survey sites lie within, or immediately downstream of, the Site.

The Glenmuir Water runs along the southern boundary of the Proposed Development. Two electrofishing sites were allocated to this watercourse. Site GLM1 is the further upstream of these, located near the south-eastern end of the Proposed Development. Site GLM4 is located downstream of several small tributaries that drain the south of the Proposed Development.

The Small Burn is a small tributary of the Glenmuir Water that drains the southeast of the Proposed Development. Site GLM2 is situated immediately before it joins the Glenmuir Water.

Site GLM3 is located at the bottom of the Glenmuir Burn, before it joins the Glenmuir Water. This watercourse flows through an area of forestry to the east of the site before running in a southwest direction directly through the Proposed Development.

The Duncanzemere Burn runs southwest along the western boundary of the development. The watercourse flows past a large artificial pond that was historically an opencast mine. Site GLM5 is located below the outfall for this artificial pond.

The Boghead Burn flows through the very northern end of the development. Site GLM6 is located immediately before its confluence with the Gass Water.

The Gass Water itself also flows through the north of the development and has two electrofishing sites: site GLM7 is the downstream site and site GLM8 is the upstream site on this watercourse.

Table 2-1: Details of electrofishing survey sites

Site code	Purpose	Location	Grid ref (Easting)	Grid ref (Northing)
GLM1	Baseline Monitoring	Glenmuir Water	262820	619462
GLM2	Baseline Monitoring	Small Burn	262579	619686
GLM3	Baseline Monitoring	Glenmuir Burn	262034	620249
GLM4	Baseline Monitoring	Glenmuir Water	261313	620290
GLM5	Baseline Monitoring	Duncanzemere Burn	260870	621483
GLM6	Baseline Monitoring	Boghead Burn	262900	624271
GLM7	Baseline Monitoring	Gass Water	262763	623690
GLM8	Baseline Monitoring	Gass Water	263050	623134

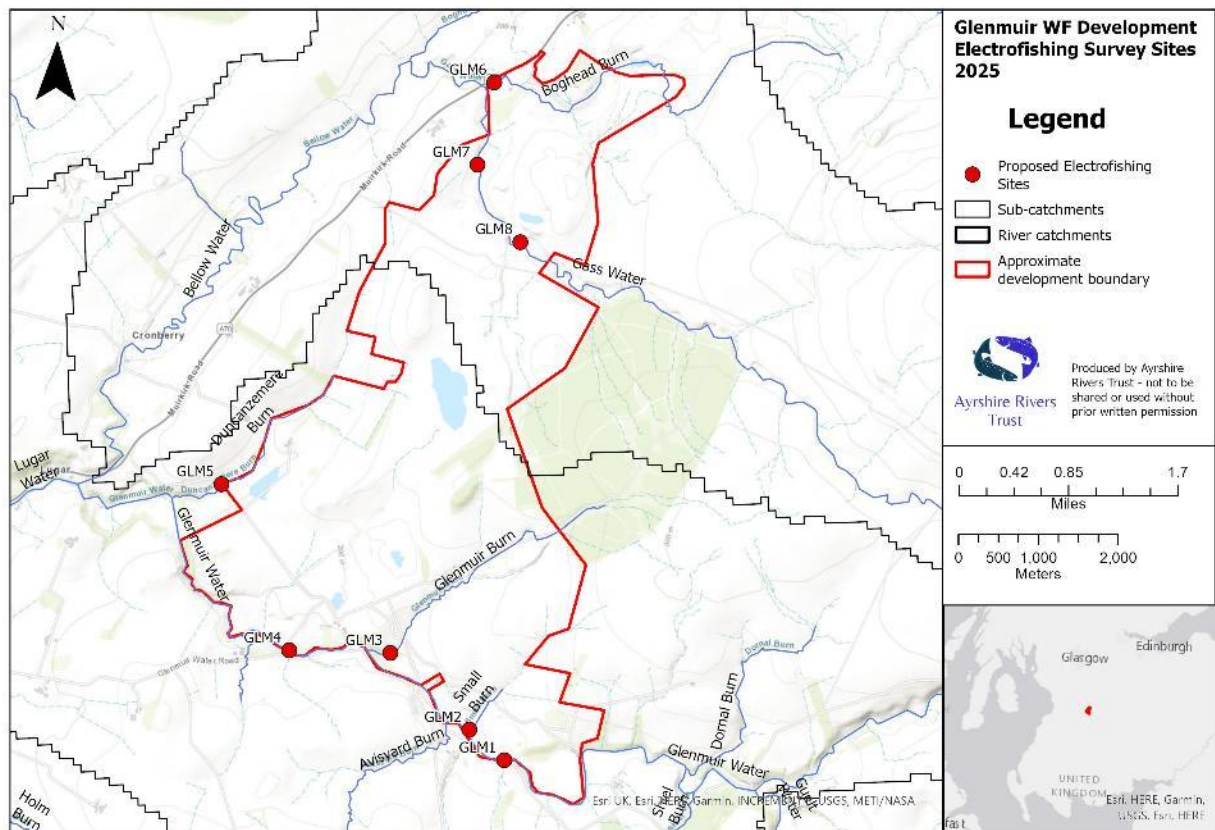


Figure 1: Overview of the electrofishing survey sites in relation to the Proposed Development

2.2 Fish Habitat Survey

A walkover fish habitat survey was undertaken along four watercourses recording instream, bankside and riparian habitat features. A modified Hendry and Cragg-Hine walkover survey was used to collect both general and detailed information on the status of instream and bankside features and habitats. Habitat classifications and general target notes will follow Hendry and Cragg-Hine and SFCC habitat definitions (**Table 2-2**). ART's team leaders are qualified to carry out SFCC habitat walkover surveys and the Hendry & Cragg-Hine walk-over method.

Table 2-2: Fish Suitability Habitat Classifications

Habitat type	Characteristics and definition
Salmonid spawning habitat including silted spawning habitat	Stable gravel up to 30 cm in depth that is not compacted or contains excessive silts. Substrate size of 80 mm to 100 mm is optimal. Silted spawning habitats are compacted and contain excess silt preventing easy movement of substrate.
Fry (0+) habitat	Shallow (<20 cm) fast flowing water associated with riffle-run habitats with substrates dominated by pebble (16-64 mm) and cobble (64-256 mm).
Parr (1+) habitat	Deeper (20-40 cm) fast flowing water associated with riffle-run habitats with substrates composed of pebble (16-64 mm), cobble (64-256 mm) and boulder (>256 mm).
Mixed juvenile salmonid habitat	A mix of fry and parr habitat, suited to both age classes in combination. Deeper, faster, larger substrate areas used by parr, and the shallower, slower, smaller substrate areas used by fry.
Glides	Smooth laminar flow with little surface turbulence and generally greater than 30 cm in depth.
Pools	No perceptible flow and usually greater than 1 m deep.
Flow constriction	Where physical features provide a narrowing of the channel resulting in increased velocity and depth (often combined with a localised increase in gradient and bedrock substrates).
Obstacles to fish migration	A structure or item identified as a potential obstruction to fish passage at certain water heights (e.g. waterfalls, weirs, bridge aprons, shallow braided river sections preventing upstream migration during low flows, culverts).
Lamprey spawning habitat	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt. Moderate to fast flowing water.
Ammocoete habitat	Areas of stable silt and sand (>20 cm depth), shallow with low velocity and organic detritus (twigs, leaf litter) present, SFCC (2007).

3. Results

3.1 Results Classification

The results from surveys where fish densities are obtained are now classified according to the SFCC Scottish national classification scheme which was derived using data from over 1600 Scottish sites covering the period 1997-2002, (Godfrey. 2005). This allows ART and the reader to interpret local fish populations in a Scotland-wide context. The national classes should be periodically revised as fish populations will inevitably change over time, even on a national scale.

Table 3-1: SFCC classification salmon fry and parr breakpoints

Salmon fry (no/100 m ²)	Classification	Salmon parr (no/100 m ²)
0.0	Absent	0.0
< 4.7	E – Very Poor	< 2.6
4.7 - < 10.3	D – Poor	2.6 - < 5.1
10.3 - < 20.3	C – Moderate	5.1 - < 9.1
20.3 - < 42.1	B – Good	9.1 - < 15.8
> 42.1	A – Excellent	> 15.8

Table 3-2: SFCC classification trout fry and parr density breakpoints

Trout fry (no/100 m ²)	Classification	Trout parr (no/100 m ²)
0.0	Absent	0.0
< 2.5	E – Very Poor	< 1.6
2.5 - < 5.3	D – Poor	1.6 - < 3.1
5.3 - < 12.4	C – Moderate	3.1 - < 5.6
12.4 - < 30.3	B – Good	5.6 - < 10.4
> 30.3	A – Excellent	> 10.4

3.2 Fish Survey Results

Details of the 2025 electrofishing sites are shown below in **Table 3-3** below. All surveys were completed in low-medium water level conditions during daylight hours.

Table3-3: Results from electrofishing surveys including SFCC classifications for the Proposed Development

Site code	Watercourse	Survey Date	Fish densities (Number/100 m ²)				Other fish species**
			Salmon*		Trout*		
			0+	1++	0+	1++	
GLM1	Glenmuir Water	07/08/2025	232.5 +/- 9.8	12.3 +/- 1.1	10.2 +/- 1.5	0	SL (11-100)
GLM2	Small Burn	08/08/2025	0	0	0	0	M (1-10), SL (1-10)
GLM3	Glenmuir Burn	30/07/2025	1.6#	0	8#	1.6#	-
GLM4	Glenmuir Water	07/08/2025	140 +/- 6.9	14.9 +/- 2.5	2.2 +/- 0.5	0.7#	SL (11-100)
GLM5	Duncanzemere Burn	30/07/2025	0	0	0	0	-
GLM6	Boghead Burn	06/08/2025	0	0	7.7#	0	SL (1-10)
GLM7	Gass Water	06/08/2025	0	0	6.4#	2.6#	SL (1-10)
GLM8	Gass Water	06/08/2025	0	0	1.3#	6.3#	SL (1-10)

Where available, calculations of absolute densities are given, along with confidence limits (in brackets), otherwise minimum densities are supplied and denoted by #.

* Codes for salmon and trout 0+ = fry, 1++ = parr (one year and older fish).

** Codes for other fish species are, E = European eel, M = Minnow, SL= Stoneloach, SB = 3-spined stickleback, L = Lamprey species. Numbers in brackets indicate number category for each species.

3.3 Results & Discussion

Photographs relating to each watercourse are provided in **Annex A**. Notes on obstacles to fish migration are provided in **Annex B**. Information on known absence/presence and distribution of key freshwater fish species in the relevant sub-catchments is available in **Annex C**.

Glenmuir Water

The Glenmuir Water is the principal tributary of the Lugar Water. The Scottish Environment Protection Agency (SEPA) group both watercourses together under their water classification assessments. The most recent assessment is from 2024 and classifies these water bodies as 'Good', an improvement from 'Moderate' in 2016. Overall ecology and hydro-morphology parameters downgrade the water bodies from high to good. The classification assessment includes biological parameters and measurements of chemistry, hydrology, morphology and invasive non-native species (INNS). The classification is a measure of how much the condition of the water bodies differ from near natural conditions. Waterbodies close to natural conditions are given a 'High' status whereas those severely degraded are given a 'Bad' status. The overall classification status is determined by the lowest scoring parameter.

The Glenmuir Water and the Guelt Water, a tributary of the Glenmuir Water, originates from Auchtitench Hill. Downstream of the confluence with the Guelt Water, the surrounding land is used primarily for sheep grazing. Upstream of the confluence the land use is predominately moorland, rough pasture and forestry. The lower Glenmuir Water flows through a wider valley and has characteristics associated with a wandering channel river type, such as extensive gravel bars and the occasional island. The river has been subjected to gravel extraction and riverbank modifications to protect the road on the left-hand bank. The substrate composition is made up of clean gravel, pebble, cobble and boulder with cobble making up a higher proportion throughout this middle section. Flow type is diverse and transitions between glides and pools to shallow riffles and run creating nursery and spawning habitats for salmonids. A river habitat assessment of the Glenmuir Water by Ayrshire Rivers Trust in 2004 calculated that juvenile and spawning salmonid habitat formed over 75 % of the total habitat. As the Glenmuir Water progresses downstream towards the Lugar Water between Dornal and Dalblair, the valley becomes more confined, the gradient increases and bedrock becomes more prominent. As a result, small cascades and step pools become the predominant habitat features. These are deemed as passable and should not hinder upstream migration of salmonids.

The river has cut a channel through deep, sandy topsoil leaving high, steep riverbanks with a tendency for landslips where riparian trees and diverse vegetation is absent. Erosion and a lack of protected riparian zones has resulted in very little bankside fish cover along some stretches of the Glenmuir Water.

Site GLM1 is the furthest upstream of the two Glenmuir Water electrofishing sites and is located on the southeastern boundary of the Development. This was the most productive site of the surveys for salmon with excellent salmon fry numbers (232.5 per 100 m²) and good salmon parr numbers (12.3 per 100 m²). Trout fry were recorded in moderate numbers at this site (10.2 per 100 m²), however no trout parr were recorded.

The electrofishing site is located within a wide channel in a fenced off section of the Glenmuir Water. As such, there is little riverbank erosion and some shade is provided by willow on the left-hand bank. As the channel is

wide, the overall depth is shallow, with around 80 % of the site estimated to be 20 cm deep or shallower (**Photo 1, Annex A**). This would explain why the fry classifications of both salmon and trout were considerably better than parr classifications, as parr prefer deeper water. Substrate at the site is predominantly cobble (50 %) with a good mix of gravel, pebble and boulder also being present. Around 70 % of the site was estimated to be fast flowing run and riffle and this faster flowing water tends to suit salmon more than trout, as is reflected in the results (Louhi *et al.* 2008).

Site GLM4 is located further downstream on the Glenmuir Water and there are several small watercourses that feed into it between the two sites. Site GLM4 also recorded salmon fry in excellent numbers (140 per 100 m²) and salmon parr in good numbers (14.9 per 100 m²). Trout fry numbers were considerably lower than at the upstream site, with a very poor number recorded (2.2 per 100 m²). However, trout parr were recorded at this site, albeit in very poor numbers (0.7 per 100 m²), whereas they were absent at the upstream site.

This electrofishing site is located within a narrower and deeper channel that is more suited to mixed juvenile salmonids (**Photo 2 and 3, Annex A**). This would explain the higher proportion of salmon parr when compared to the upstream site (**Photo 4, Annex A**). Again, the site is predominantly cobble (45 %) with a good mix of clean gravel, pebble and boulder as well. Water flow was estimated as being around 85 % run/riffle and faster flowing than the upstream site.

Small Burn

The Small Burn joins the Glenmuir Water between sites GLM1 and GLM4 (**Photo 5, Annex A**). Site GLM2 is located on this tributary immediately upstream of the confluence. No salmonids were recorded, and minnows and stone loach were the only fish species recorded. These species are far more tolerant of more polluted watercourses and their habitat requirements differ from salmonids. Both species utilise shallow marginal gravel for spawning and shelter from predators in draped and marginal vegetation.

The Small Burn is a small watercourse approximately 2,200 m in length. In the lower reaches the wet width ranges between 0.5 m and 1.3 m. The Small Burn is relatively shallow with approximately 70 % of the electrofishing site estimated as being 10 cm deep or shallower. However, there are deeper pools (>0.3 m) present, with 15 % of the electrofishing site estimated to be between 41 cm and 50 cm deep. The site was noted as being silted, though not to the point of substrate compaction. Silt is likely deposited within the pool habitats due to the lack of flow. Upstream of the electrofishing site to the road bridge, livestock regularly access the watercourse and there is evidence of livestock-driven riverbank erosion. Within the electrofishing site, there is good bankside cover for fish, with 60 % of the left bank and 40 % of the right bank assessed as undercut. Draped riverbank vegetation and rock also provide cover.

Upstream of the electrofishing site, the Small Burn shows evidence of historical straightening, resulting in limited habitat diversity and poor suitability for salmonids. While there are small pools present, for most of its length, the Small Burn is shallow (<0.3 m). Substrate is predominately cobble with some pebble and boulder present. There is a road bridge that crosses the Small Burn (262736, 619892). The bridge apron forms a migration barrier due to a 0.5 m elevation difference between the apron and the riverbed and the absence of a deep pool below the structure (**Photo 8, Annex A**). There is moss growth on the substrate upstream of the bridge that points to some level of nutrient enrichment. There is a lack of riparian cover along the entire burn.

Glenmuir Burn

Site GLM3 is located at the bottom of the Glenmuir Burn, before it joins the Glenmuir Water. The survey at this site recorded very poor numbers of salmon fry (1.6 per 100 m²) and did not record any salmon parr. The absence of salmon parr is attributed to the proximity of high quality parr habitat within the Glenmuir Water. Trout fry were recorded in moderate numbers (8 per 100 m²) and trout parr were recorded in poor numbers (1.6 per 100 m²) (**Photo 10, Annex A**).

The electrofishing survey was undertaken in an incised channel with steep banks. Bankside cover for fish at the site is therefore poor, with the entirety of the left bank and 90 % of the right bank assessed as bare. The site is shallow, with approximately 80 % of the survey site estimated to be 10 cm deep or less and around 50 % estimated to be riffle/run habitat (**Photo 9, Annex A**). The channel is silted, with silt making up approximately 15 % of the substrates. Cobble substrates constituted around 50% of the substrates, with boulder making up around 25%, but much of this also had a fine layer of silt over it. The survey site is in an area of woodland which runs from the Glenmuir Burn's confluence with the Glenmuir Water up to the road bridge. Within this section there are areas of good fry and mixed juvenile habitat due to the shallow riffle/run habitat and tree cover (**Photo 11, Annex A**). Potential eel habitat was also identified in this section of the watercourse, with two pools having good root and boulder cover that could be utilised by eels, despite none being found on the survey (**Photo 12, Annex A**). One small section of ammocete habitat was also identified, where silt deposits appeared to be natural and stable. At the road crossing there is a culvert estimated to be approximately 20 m long (**Photo 13, Annex A**). Water flow was very shallow at the time of the survey and the water depth through the culvert was too shallow for fish to swim through. It was assessed that this culvert would only be passable under certain higher flow conditions.

Upstream of the road culvert the landscape is utilised for rough grazing. The riparian zone is fenced off initially which protects the riparian habitat. The watercourse itself shows evidence of historic modification and straightening and flows through what appears to be an old dump site within the fenced off wooded area. There is significant bank erosion present here. Upstream of this, however, there are several pools and areas deemed suitable for salmonid parr due to the deeper water and larger boulder substrate.

Upstream of the fenced area, riparian tree cover is absent, and livestock regularly access the watercourse (**Photo 14, Annex A**). Where livestock cannot access the watercourse, potential spawning areas were identified. The substrate size and water depth in this area would suit trout spawning over salmon spawning (Eklöv *et al.* 1999). Where the land-use changes from cattle grazing to sheep grazing, the condition of the substrate improves. Substrate composition is predominately gravel, pebble and cobble and instream cover is provided by undercut banks and draped vegetation. Boulders are infrequent and typically found in small pools which provide excellent cover for parr and adult trout. This stretch of the Glenmuir Burn is typified by long stretches of glide habitat that are interspersed by small stretches of run/riffle that would be used by salmonid fry.

Moving towards the upper reaches of the Glenmuir Burn, the river valley becomes more confined resulting in high and steep riverbanks. Both natural and man-made migration obstacles become more frequent and include crossing fords, culverts and waterfalls. In the upper reaches of the watercourse, bedrock outcrops become more prominent and the gradient increases, creating narrow step-pool habitats. The upper limit of the survey area

coincides with the forestry coup. There is some pollution here in the way of silt deposition and significant algae growth, potentially as a result of forestry operations (Neal *et al.* 2004).

Duncanzemere Burn

The Duncanzemere Burn runs southwest along the western boundary of the Proposed Development, with site GLM5 located downstream of a flooded opencast mining void. The survey at this site recorded no fish of any species, making it the worst performing of the eight electrofishing survey sites.

The channel at the electrofishing site is very narrow, with wet width ranging between 0.3 m and 0.6 m. The channel is also shallow, with around 80 % of the survey area estimated to be 20 cm deep or less. The channel is heavily silted, with silt comprising around 40 % of the substrate. The other 60 % of the substrate were covered in algae and weeds. This points to a heavily enriched watercourse, likely due to inputs from the opencast void upstream of the survey site. The conductivity of the site is very high, with a reading of 1100 μ S/cm⁻¹ recorded.

Habitat upstream of the electrofishing site is a mixture of constricted flows and some areas of sub-par juvenile salmonid habitat, though the condition was adversely impacted by high siltation and algae growth. A small area of potential eel habitat was also identified; however, this was also impacted by algae growth. An otter *Lutra lutra* spraint was found nearby which does imply there is a potential food source from the Duncanzemere Burn, though they may be feeding on prey other than fish and are more likely to utilise the nearby Glenmuir Water a short distance downstream. There was some potential salmonid parr habitat noted at the reservoir outfall where the input of water has artificially deepened the watercourse.

Downstream of the electrofishing site, the watercourse is severely degraded because of livestock poaching (**Photo 17 and 18, Annex A**). Despite the watercourse being surrounded by riparian woodland, there is no livestock exclusion, and the riverbed is compacted and silted. Algae growth covering the substrate is likely due to nutrient enrichment. Trout were present in the Duncanziemere Burn prior to the upper reaches being modified for opencast mining and mining discharges entering the watercourse.

Boghead Burn

Site GLM6 on the Boghead Burn is the most northern survey site. No salmon fry or parr and no trout parr were recorded during the survey here. Trout fry were recorded in moderate numbers (7.7 per 100 m²).

Between 2019 and 2021, the lower 280 m of the Boghead Burn was moved from its original channel to its present channel as part of a protection scheme for the A70 road. A series of step-pools have been built using large boulders to address the elevation change (**Photo 23, Annex A**). During low to medium flows some of the step-pools may act as a barrier to local migrations, limiting fish from accessing different habitats during their life cycle. The substrate throughout this section does not appear natural and has likely been brought in during the realignment of this watercourse. Boulders have been used to protect the toe of the riverbank, providing some fish cover, however there are no other features that provide instream cover. The riparian zone has been regraded and planted with broadleaf tree species, however as livestock has access to the site, very few trees have survived.

This stretch of the watercourse has been impacted by siltation resulting in the substrates being partly compacted and significant silt disturbance during the survey. Around 20 % of the electrofishing site's substrates were

estimated as being silt as silt drops out of the water column in the pools. Around 75 % of the survey site was assessed as being pool habitat. Clay comprised a proportion of the substrate which was likely brought in to create an impermeable liner for the new channel.

Upstream of the realigned section, the Boghead Burn runs through an incised channel. Habitat type is more diverse with fry, mixed and parr habitat present (**Photo 25, Annex A**). The substrate is primarily gravel, pebble and cobble with some boulder and bedrock present. Deeper pools with boulders and tree roots create refuges for parr and adult trout. Potential spawning habitat was also identified within this stretch of the Boghead Burn and juvenile salmonids from this stretch likely disperse downstream into the new channel. The riparian zone has established broadleaf tree cover which becomes sparser as you move upstream. Approximately 1,300 m upstream from the confluence with the Gass Water, there are settlement ponds from the opencast mining that discharge into a small tributary of the Boghead Burn.

Gass Water

The Gass Water is the primary tributary of the Bellow Water. The SEPA groups the Bellow Water and Gass Water together during their annual water environment classification assessment. The Bellow Water and Gass Water received an overall classification status of 'high' in 2024, an improvement from 'good' in 2018.

The Gass Water crosses the development and flows from east to north-west through a gently confined river valley (**Photo 26 and 27, Annex A**). The Gass Water is a typical plane-bed river type characterised by clean cobble and boulder dominated substrate (**Photo 28, Annex A**). The substrate and river channel is stable with little evidence of lateral channel movement. There is little habitat variation as it alternates between run and shallow glide however there are good examples of spawning and nursery (fry and parr) habitats throughout. The surrounding riparian zone is used for rough pasture and subsequently lacks tree cover or plant species diversity. There was no evidence of accelerated riverbank erosion indicating moderate river energy flow. Where the underlying geology changes, the Gass Water becomes more confined, bedrock becomes the dominate substrate type, the gradient increases and the habitat type change to cascades and pools (**Photos 30 and 31, Annex A**). Remnants of a historic weir are still present within the watercourse; however, the structure does not impede migration.

As the watercourse progresses downstream towards the confluence with the Bellow water, it shifts from a plane-bed river type to a plane-riffle channel as mesohabitat type diversifies (**Photo 32, Annex A**). This lower reach provides a wider range of habitat types available to salmonids and the electrofishing results support this conclusion.

Two electrofishing surveys were conducted on the Gass Water: site GLM7, the furthest downstream (**Photo 29, Annex A**), and site GLM8, the furthest upstream. Two surveys were included due to the presence of a natural waterfall and a historic weir.

No salmon were recorded at either electrofishing site as they are located upstream of the Bellow Water waterfall which is considered the upper limit to Atlantic salmon migration (**Photo 37, Annex A**). At site GLM7 trout fry were recorded in moderate numbers (6.4 per 100 m²) and trout parr were recorded in poor numbers (2.6 per 100 m²). Water depth at site GLM7 was estimated as 30 cm or less, with 70 % of the site being estimated as 11-20 cm deep. Substrate composition is dominated by cobble (45 %) and boulder (35 %), with some bedrock present as well. The mesohabitat or flow type is predominantly run (75 %) with riffle and shallow glide making up a small proportion

of the site. Instream cover was assessed as good due to the presence of boulders. The habitat conditions at this survey site are more suited to trout fry than parr. The riverbanks are relatively shallow and do not provide any bankside cover in the form of undercut banks or draped vegetation. The riparian zone is absent of trees, and the surrounding land use is rough pasture. Water conductivity is high (405 $\mu\text{S}/\text{cm}$) when compared to the conductivity at site GLM8 (86 $\mu\text{S}/\text{cm}$) approximately 950 m upstream.

Downstream of site GLM7 there is a settlement pond outfall. As is the case at the Duncanzemere Burn, this will contribute to the high conductivity of the watercourse. Areas of mixed juvenile salmonid habitat were identified, as were some areas of salmonid parr habitat where the water is deeper. A large area of spawning potential was identified where a pool/glide turns into run habitat.

Between sites GLM7 and GLM8 the watercourse features a higher proportion of bedrock, with chutes sometimes being formed. Alternating pools and bedrock constrictions are common. Immediately upstream of site GLM7 is a road crossing with a culvert that is passable to salmonids. Further upstream from this road crossing the watercourse forms a braided channel below an old collapsed weir. This collapsed weir was deemed passable to salmonids by surveyors. Unrestricted livestock access has created some areas of siltation and also means that there has been no opportunity for riparian woodland development. As such the watercourse is very exposed.

Site GLM8 is the upstream site on the Gass Water. Again, no salmon were recorded during the survey here, however trout fry were recorded in very poor numbers (1.3 per 100 m^2) and trout parr were recorded in good numbers (6.3 per 100 m^2).

Water flow at site GLM8 is predominantly run (60 %) and shallow glide (30 %). Substrates are dominated by boulder (60 %) which provides good cover for juvenile salmonids, particularly parr, as is reflected by the results. Bankside cover is poor with no draped vegetation or trees. Immediately upstream of the electrofishing site there are several areas that were identified as being suitable mixed juvenile salmonid, with a good variety of substrates and depths as well as spawning habitat.

Discussion

The surveys highlight the importance of these watercourses in the context of the River Ayr catchment. As this development is in the upper reaches of the catchment, any impacts here will have repercussions downstream on this river. Furthermore, any impacts on the fish populations within these waters will have knock on effects on the wildlife that depends on them.

Salmon were recorded on two of the six watercourses surveyed, with encouraging numbers in the Glenmuir Water and very poor numbers in the Glenmuir Burn. Despite this, all watercourses surveyed flow into watercourses that are known to support Atlantic salmon, trout and European eels. Salmonid spawning and juvenile habitat are particularly susceptible to the impacts of diffuse and point source pollution from upstream sources. As such, the watercourses within the Site should be managed accordingly to protect water quality, instream habitats and fish species within and downstream of the Proposed Development. Given the conservation status of these fish and the historical and current significance of the River Ayr as a productive salmon fishery, it is important to mitigate against potential impacts that this Proposed Development may have on these species.

Trout were present in four of the six watercourses that were surveyed. While Atlantic salmon require access from the sea to rivers to complete their life cycles, trout do not and can form resident populations upstream of migration barriers. The absence of both Atlantic salmon and trout in the Duncanzemere Burn and the Small Burn imply that it is not barriers to migration that are the issue here but rather poor conditions and unsuitable habitat. The Gass Water and Boghead Burn are both tributaries of the Bellow Water. The lack of salmon in these watercourses is attributed to a large impassable waterfall immediately upstream of the Bellow Water's confluence with the Glenmuir Water.

Fish populations are naturally variable over time and resident populations, such as the trout recorded in the Gass Water and Boghead Burn, are particularly susceptible to anthropogenic degradation and natural environmental events. For example, extreme flows may cause redd washout and it therefore can take a population several years to fully recover due to a lack of fish immigrating into the inaccessible section of the watercourse.

The habitat surveys of these watercourses generally found that they have stretches that can support salmonids but are hindered overall by pollution, channel realignment and historic land use issues. The impact of historic land usage, particularly mining, is evident and the watercourses, particularly the Duncanzemere Burn, are less suitable to salmonids due to these historic inputs and enrichment. All watercourses surveyed lack riparian tree cover in their upper reaches, reducing the suitability of these areas for fry and parr of the species surveyed. With the increased effects of climate change, the warming of rivers and burns will become an increasingly important factor influencing the survival of fish populations. Riparian woodland also benefits bank stability and provides habitat for other wildlife.

4. Recommendations

Without appropriate mitigation and pollution control measures, the development has the potential to adversely affect the fish habitat and fish populations within and downstream of the Proposed Development. It is recommended that good practice guidelines are strictly adhered to for each component of the development (forestry felling, infrastructure construction, new water crossings, water management). The recommendations provided below are not exhaustive and it is the responsibility of the developer and contractor to ensure that they comply with legislation (**Annex C**) and conditions provided by the planning authority, SEPA, NatureScot and any other statutory consultee.

- All instream work must be scheduled to avoid the migration, spawning, egg incubation and emergence period of salmonids. The exclusion period is October to May inclusive (SEPA).
- Following approval by the planning authority an ecological baseline should be established which includes aquatic fish, macroinvertebrate and water quality sampling to comply with Marine Directorate (formerly Marine Scotland) (2021) 'Monitoring watercourses in relation to onshore wind farm development: generic monitoring programme'.
- Immediately prior to any new water crossings being installed or upgraded, fish rescues should be scheduled in and conducted regardless of the size of watercourse.
- New or upgraded water crossings should follow SEPA's 'Engineering in the water environment: good practice guide. River Crossings' guidance and ensure that new water crossing do not become an obstacle to fish migration. Perched outfalls, insufficient water depth and/or high-water velocities through culverts are common problems that can cause habitat fragmentation. This is of particular importance for resident brown trout who carry out local migrations to access different habitats for refuge and as part of their life cycle.
- Visual assessments of the watercourse (downstream of on-Site works) should be carried out daily to ensure pollution is not entering the watercourses. Silt protection measures should be regularly checked for their effectiveness, especially in advance of forecasted heavy rain and following periods of heavy rain. Recent pollution incidents in Ayrshire have been caused due to irregular checks and failed silt protection following heavy rain.
- Water management plans should consider all potential avenues for pollution to enter watercourses and have appropriate pollution controls and silt mitigation measures in place prior to commencement of works.
- The EIAR should consider the cumulative impact of existing developments in the surrounding area on the fish populations, habitat quality and water availability. Historic land use, such as the mining practices referred to throughout the report, should also be taken into account.
- Any biodiversity enhancements required by the National Planning Framework 4 (NPF4) should consider creating protected riparian buffers and planting riparian trees within the surveyed sub-catchments. ART can provide additional recommendations that would support the biodiversity policy criteria should the Proposed Development be consented.
- Biosecurity protocols should be established to ensure that INNS are not introduced or spread within the catchment. This is particularly pertinent as the development lies in the upper reaches of the Lugar Water and Ayr catchment. Monthly checks during the growing season of Japanese knotweed *Reynoutria japonica*, giant hogweed *Heracleum mantegazzianum*, Himalayan balsam *Impatiens glandulifera* and American skunk cabbage *Lysichiton americanus* should be carried out within the Site.



- In accordance with Marine Directorate electrofishing license requirements, local District Salmon Fishery Boards and Fisheries/Rivers Trusts (should they exist) should be informed at least one week in advance of any activity covered by the license.

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Annex A – Site Photographs



Photo 1: Site GLM1 - The Glenmuir Water looking upstream



Photo 2: Site GLM4 - The Glenmuir Water looking downstream



Photo 3: Site GLM4 - The Glenmuir Water looking upstream



Photo 4: Site GLM4 - Atlantic salmon parr recorded during the electrofishing survey



Photo 5: Confluence of the Small Burn with the Glenmuir Water



Photo 6: Small Burn - looking upstream



Photo 7: Small Burn - Looking upstream



Photo 8: Small Burn - Road bridge apron preventing upstream migration



Photo 9: Site GLM3 - Glenmuir Burn electrofishing site looking upstream



Photo 10: Site GLM3 - Atlantic salmon and trout fry



Photo 11: Glenmuir Burn - Looking downstream – fry habitat



Photo 12: Glenmuir Burn - Large pool and area of natural silt deposition



Photo 13: Glenmuir Burn - Large culvert



Photo 14: Glenmuir Burn - Evidence of cattle poaching looking upstream



Photo 15: Glenmuir Burn - Looking upstream towards step-pool habitat



Photo 16: Glenmuir Burn - Algae growth in the upper reaches of the Glenmuir Burn

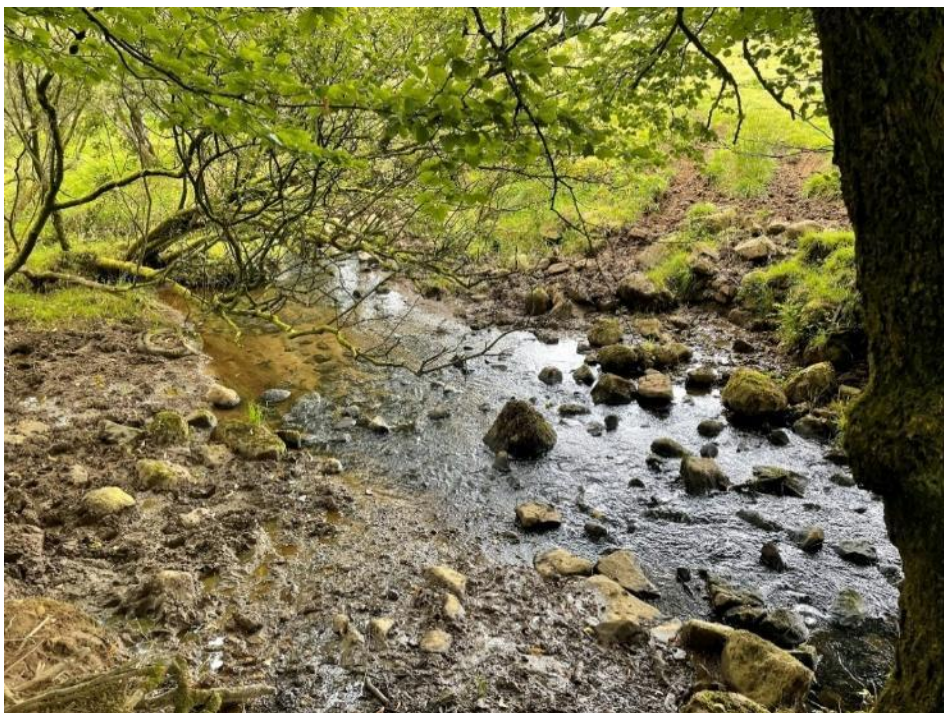


Photo 17: Duncanzemere Burn - Downstream of electrofishing site, evidence of significant livestock poaching



Photo 18: Duncanzemere Burn - Downstream of electrofishing site, another area of livestock poaching



Photo 19: Site GLM5 - Electrofishing site looking upstream



Photo 20: Site GLM5 - Looking upstream



Photo 21: Duncanzemere Burn - Quarry Pond in the upper reaches



Photo 22: Boghead Burn - Confluence with the Gass Water, looking upstream



Photo 23: Boghead Burn - Looking upstream to the realigned river channel



Photo 24: Site GLM6 - The Boghead Burn electrofishing site



Photo 25: Boghead Burn - Looking upstream above the realigned channel



Photo 26: Gass Water - Looking upstream beyond the development boundary



Photo 27: Gass Water - Looking downstream from the upper limit of the habitat survey



Photo 28: Gass Water - Representative substrate composition



Photo 29: Gass Water - Mixed juvenile habitat



Photo 30: Gass Water - Remnants of the historic weir



Photo 31: Gass Water – Natural migration obstacle



Photo 32: Gass Water - Mixed juvenile habitat



Photo 33: Gass Water - Road culvert - Partial barrier to fish migration



Photo 34: Site GLM7 - Lower limit of the electrofishing site



Photo 35: Gass Water - Parr habitat and cover provided by undercut banks and tree roots



Photo 36: Gass Water - Lower limit of the habitat survey, confluence with the Boghead Burn and passable road culvert



Photo 37: Bellow Water Waterfalls - Upper limit to Atlantic salmon migration

Annex B – Obstacles to Fish Migration

There are several barriers downstream of the development that were all deemed passable under certain flow conditions. Details relating to these known obstacles to fish migration within the River Ayr catchment which are relevant to the development are presented within **Table 6**.

Table B-1: Known obstacles to fish migration in the River Ayr catchment that are pertinent to the development

Barrier Type	Location	Grid ref (Easting)	Grid ref (Northing)	Permeability	Notes
Weir	River Ayr	234291	621518	Passable	Fish pass installed.
Weir	River Ayr	243717	623649	Passable	No fish pass.
Weir	Lugar Water	251101	621262	Passable	Fish pass installed.
Waterfall	Bellow Water	259969	621563	Impassable	-
Bedrock Chute	Gass Water	262953	623266	Impassable	Natural bedrock chute. Impassable.
Weir	Gass Water	262835	624204	Passable	Partially collapsed. No fish pass.

Sources: Obstacles to Fish Passage (SEPA WMS)

<https://marinescotland.atkinsgeospatial.com/nmpi/default.aspx?layers=1746>

Annex C – Freshwater Species Information and Distribution

Ayrshire Rivers Trust conducted a desk-based review of the known presence/absence and distribution of the following fish species within the River Ayr catchment and Glenmuir Development watercourses: Atlantic salmon *Salmo salar*, Brown/Sea trout *Salmo trutta*, European eel *Anguilla anguilla*, Brook lamprey *Lampetra planeri*, River Lamprey *Lampetra fluviatilis* and Sea Lamprey *Petromyzon marinus*.

This data has been drawn from Ayrshire Rivers Trust’s electrofishing database, and pre-existing habitat and fisheries reports. Data provided here is for the Glenmuir development only and not to be used, shared, replicated or sold without prior written permission from Ayrshire Rivers Trust.

Table C-1: Fish species presence and distribution information

Watercourse and catchment	Fish Species Presence / Absence					
	Atlantic salmon	Brown trout	European eel	Brook Lamprey	River Lamprey	Lamprey spp (undefined)
Glenmuir Water	Present	Present	Absent	Absent	Absent	Absent
Small Burn	Absent	Absent	Absent	Absent	Absent	Absent
Glenmuir Burn	Present	Present	Absent	Absent	Absent	Absent
Duncanzemere Burn	Absent	Present	Absent	Absent	Absent	Absent
Boghead Burn	Absent	Present	Absent	Absent	Absent	Absent
Gass Water	Present	Present	Absent	Absent	Absent	Absent

Though Atlantic salmon are shown here as being ‘present’ in the Gass Water, the lone 2002 survey that recorded them has a note that these were likely stocked fish.

It is considered impossible to capture all fish present within a site therefore, whilst the failure to capture fish at a site may indicate that the population is absent, it cannot be assumed that they are not present elsewhere in the watercourse or catchment. For the purposes of this section of the report, ‘absent’ means that Ayrshire Rivers Trust have no records of this fish species within the specified section. Restoration projects, the removal of barriers and/or restoration stocking programmes may result in native fish species becoming established in catchments where they are currently recorded as ‘absent’. Mitigation measures should consider this when being implemented.

Atlantic salmon

Salmon populations in Great Britain have declined between 30-50% since 2005 and are expected to fall 50-80% between 2010-2015 (IUCN Red List, 2023). As such Atlantic salmon in Great Britain were reassessed by the IUCN Red List of Threatened Species in December 2023 and reclassified from ‘Least Concern’ to Endangered’.

The management of existing and emerging pressures to improve the status of wild salmon has been identified as a priority action under Objective 4 of the Scottish Biodiversity Delivery Plan 2024-2030. Encompassed within this plan is the Scottish Wild Salmon Strategy which sets out the vision, objectives and priority themes for action to protect and support the recovery of wild Atlantic salmon populations in Scotland (Marine Directorate, 2022). Atlantic salmon is protected under Annex II (animal and plant species of community interest whose conservation requires the designation of special areas of conservation) and Annex V (animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures) of the Habitats Directive.

Atlantic salmon is protected under the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003.

Under section 23, sub-section 1, Paragraph (a) it is an offence to:

- Knowingly take, injure or destroy young salmon (alevin, fry, parr or smolt) and spawning beds

Under section 23, sub-section 2, paragraph (a) and (b) it is an offence to:

- Knowingly injure or disturb any salmon spawn; or
- Disturb any spawning bed or any bank or shallow in which the spawn of salmon may be.

Under section 23, sub-section 3 it is an offence to:

- Obstruct or impede salmon in their passage to any such bed, bank or shallow during the annual close time

Brown/Sea trout (*Salmo trutta*)

While Brown trout and Sea trout are the same species (*Salmo trutta*), they differ in their life history strategies. Brown trout complete their entire life cycle in freshwater whereas sea trout are anadromous and migrate to sea to mature. Due to this difference, the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003 applies to each form differently. The sea trout populations across Scotland have declined dramatically, with rod catches in 2023 being the fifth lowest since 1952 (Marine Directorate, 2024). Trout is a UK Biodiversity Action Plan priority fish species.

European eel (*Anguilla anguilla*)

European eels are classified as 'Critically endangered' by the IUCN Red List of Threatened Species following significant declines since the early 1980s (Jacoby and Gollock, 2014). In the North Sea, the recruitment index series for glass eels (a life stage of European eels) fell to 0.5% in 2023 and 1.1% in 2024 of the recruitment between 1960-1979 (ICES, 2024). Similarly, the data series for yellow eels (a life stage of European eels) showed a recruitment level of just 11.4% in 2023.

In European Union waters, European eel stocks, fisheries and pressures are regulated under Council Regulation (EC) No 1100/2007, which sets out measures for the recovery of European eels (ICES, 2024). In Scotland, fishing for eels is prohibited without license under the Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008. European eels are a UK Biodiversity Action Plan priority fish species.

Lamprey Species – Brook Lamprey, River Lamprey & Sea Lamprey

All three species of Lamprey native to the UK are protected under Annex II of the EU Habitats Directive, Appendix III of the Bern Convention and are a UK Biodiversity Action Plan priority fish species. Brook Lamprey are afforded further protection under Annex V of the EU Habitats Directive. All three species migrate within the freshwater environment however Brook Lamprey are the only species to complete their lifecycle entirely in freshwater. Both River lamprey and Sea Lamprey spend a portion of their lifecycle at sea before returning to freshwater to spawn. All three species spawn in spring to early summer.

Freshwater pearl mussel (Margaritifera margaritifera)

There are no records of freshwater pearl mussels in the River Ayr catchment.

Annex D – Invasive Non-Native Species Distribution

Invasive Non-Native Species (INNS) are considered one of the biggest threats to biodiversity worldwide after habitat destruction. INNS are species that have been introduced and can cause harm or damage to local biodiversity, natural environments, our health, the economy or the way we live. Invasive non-native plant species commonly found in Scotland are Japanese knotweed *Fallopia japonica*, Giant hogweed *Heracleum mantegazzianum*, Himalayan balsam *Impatiens glandulifera* and American skunk cabbage (*Lysichiton americanus*).

Under the Wildlife and Countryside Act 1981, section 14 it is an offence to:

- plant, or otherwise cause to grow, any plant in the wild at a place out with its native range.

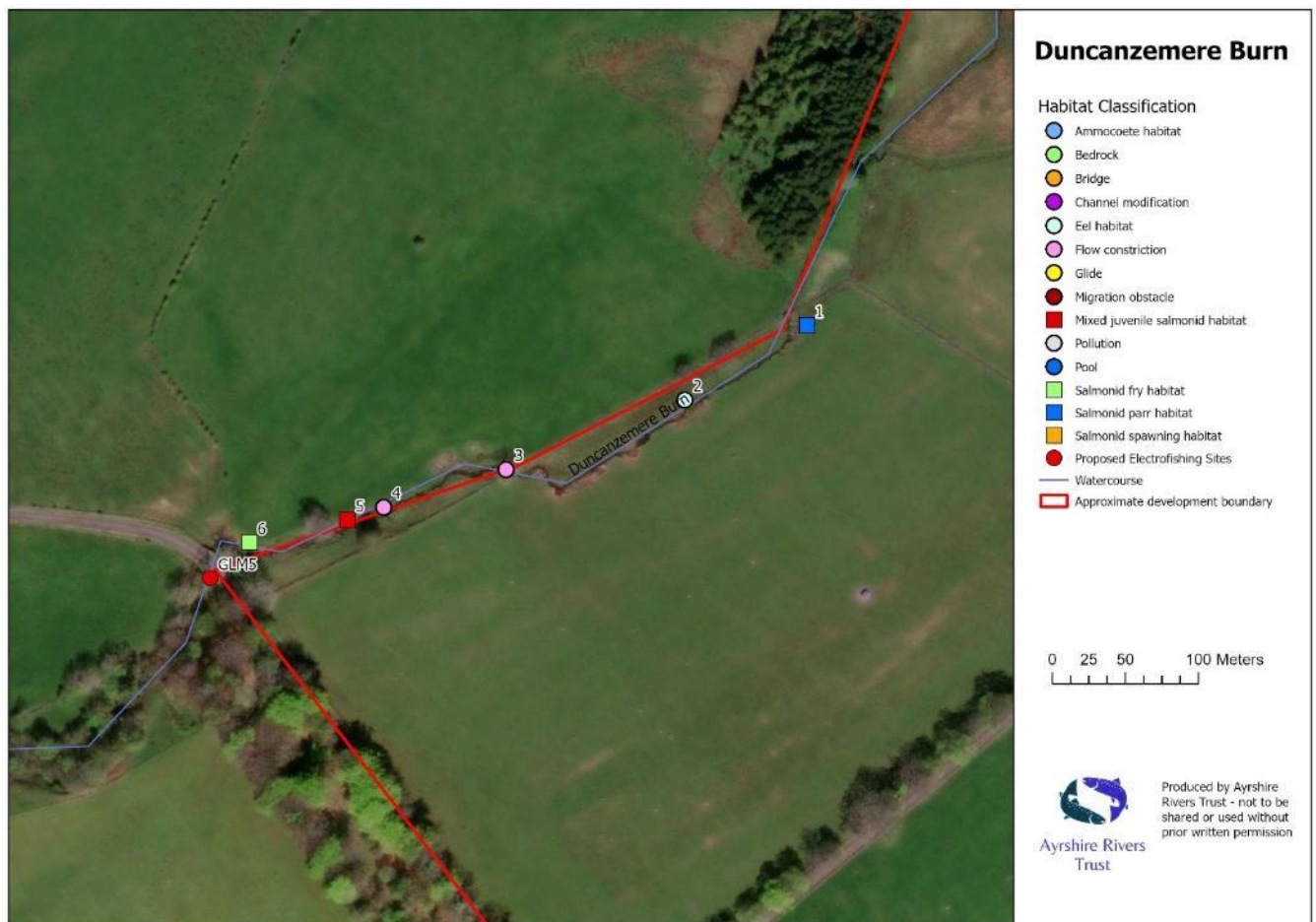
Under the Wildlife and Countryside Act, native range is defined as ‘the locality to which the animal or plant of that type is indigenous and does not refer to any locality to which that type of animal or plant has been imported (whether intentionally or otherwise) by any person’.

Ayrshire Rivers Trust carry out INNS control and management of all four species and as such are experienced in identifying and surveying for these species. During the electrofishing and fish habitat surveys, our staff made additional notes on the presence/absence of INNS. Within the development boundary, ART identified areas of Himalayan balsam and Japanese knotweed. These are displayed in **Table D-1** below.

Table D-1: Invasive Non-Native Species

Species	Location	Grid ref (Easting)	Grid ref (Northing)	Notes
Himalayan Balsam	Lugar Water, upstream of Mill Affleck	252801	620864	Himalayan balsam is prevalent on the Lugar Water and downstream of its confluence with the River Ayr.
Japanese Knotweed	Cumnock	256627	619984	Japanese Knotweed is present on the Lugar Water from Cumnock down. There may be small pockets upstream.
Giant Hogweed	Glaisnock Water	257712	618037	Giant Hogweed is found throughout the Ayr catchment. Ayr tackle this plant annually, starting from the Glaisnock Water.

Annex E – Fish Habitat Survey Maps



FigureE-1: Duncanzemere Burn - General target notes

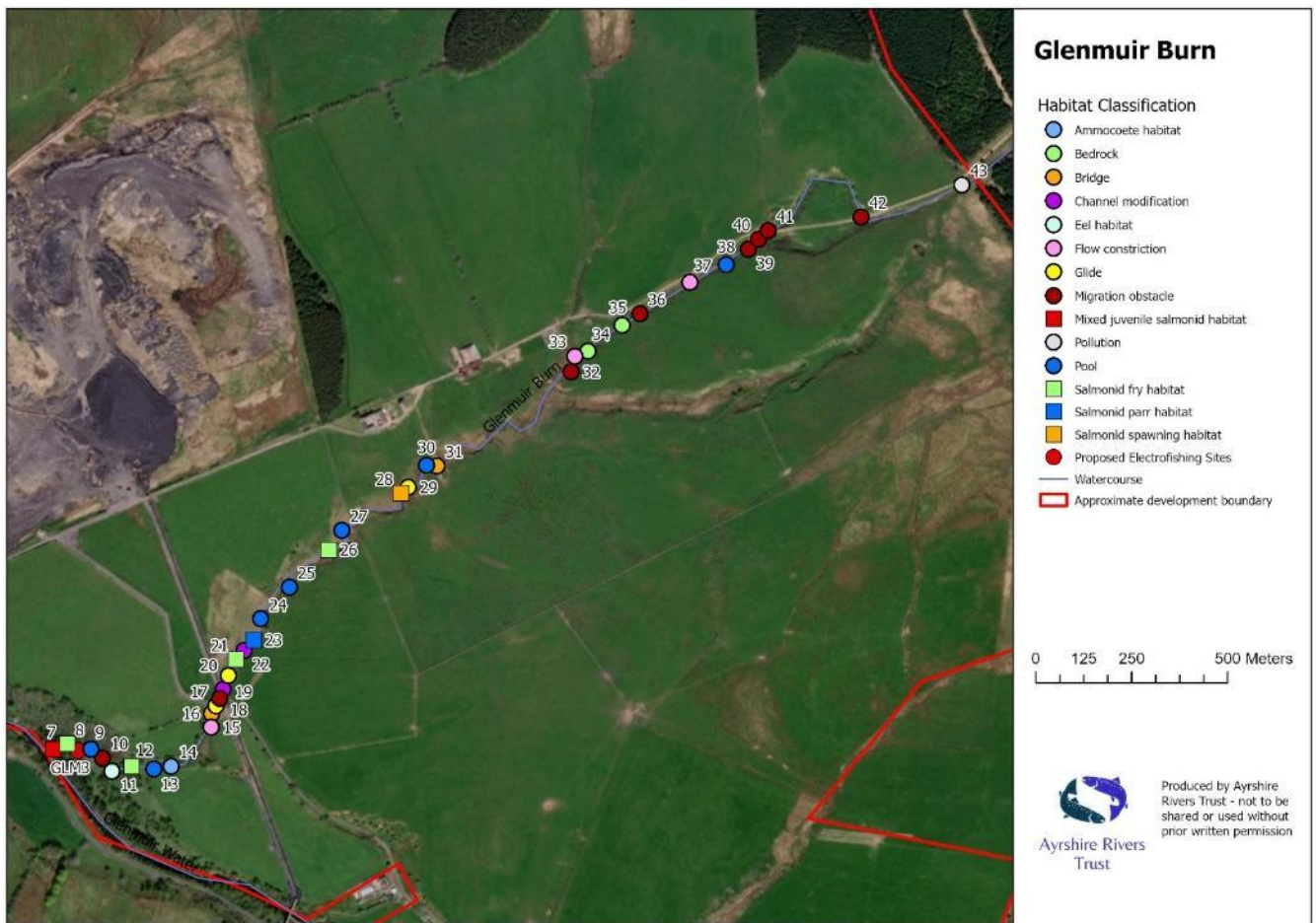
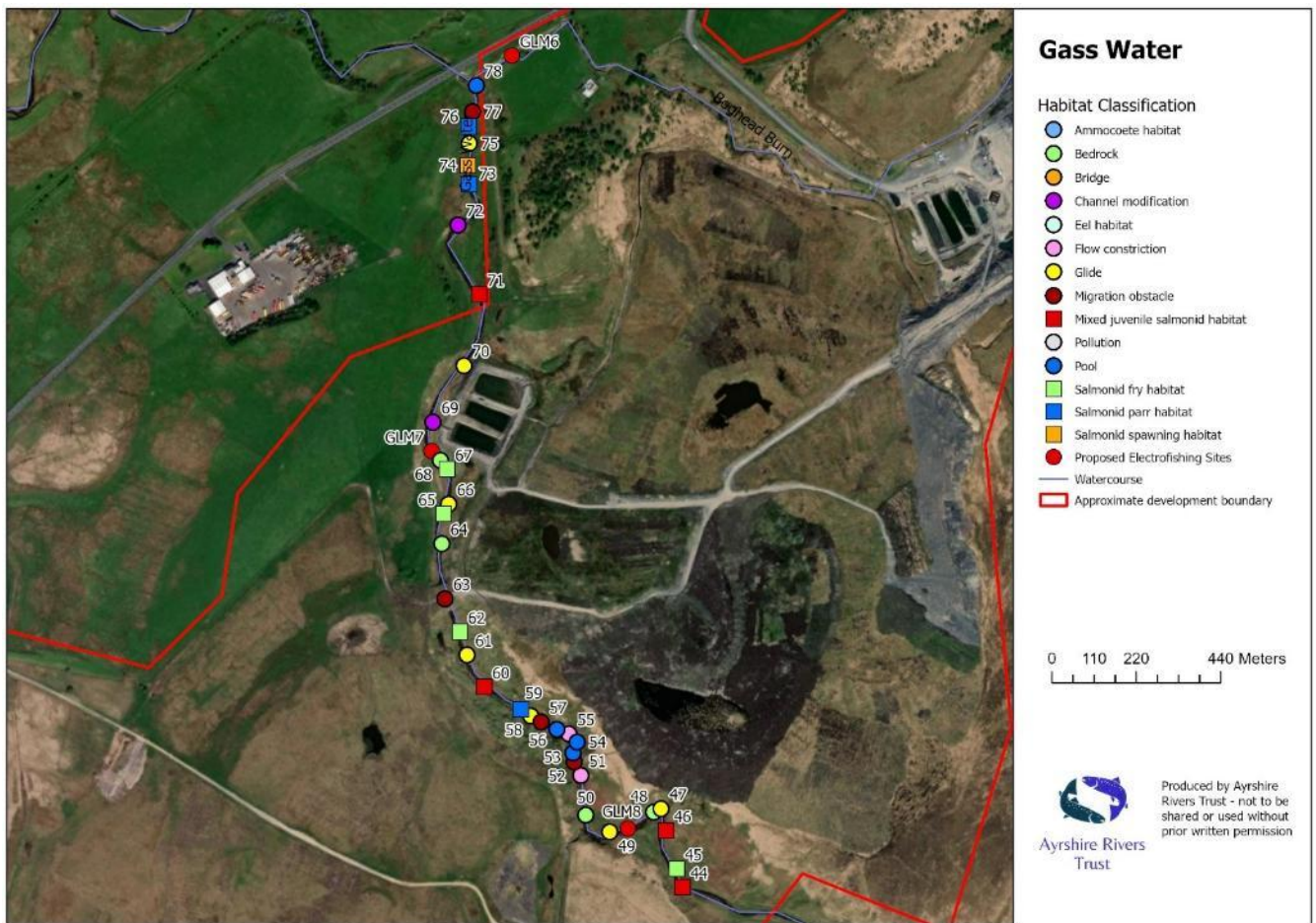


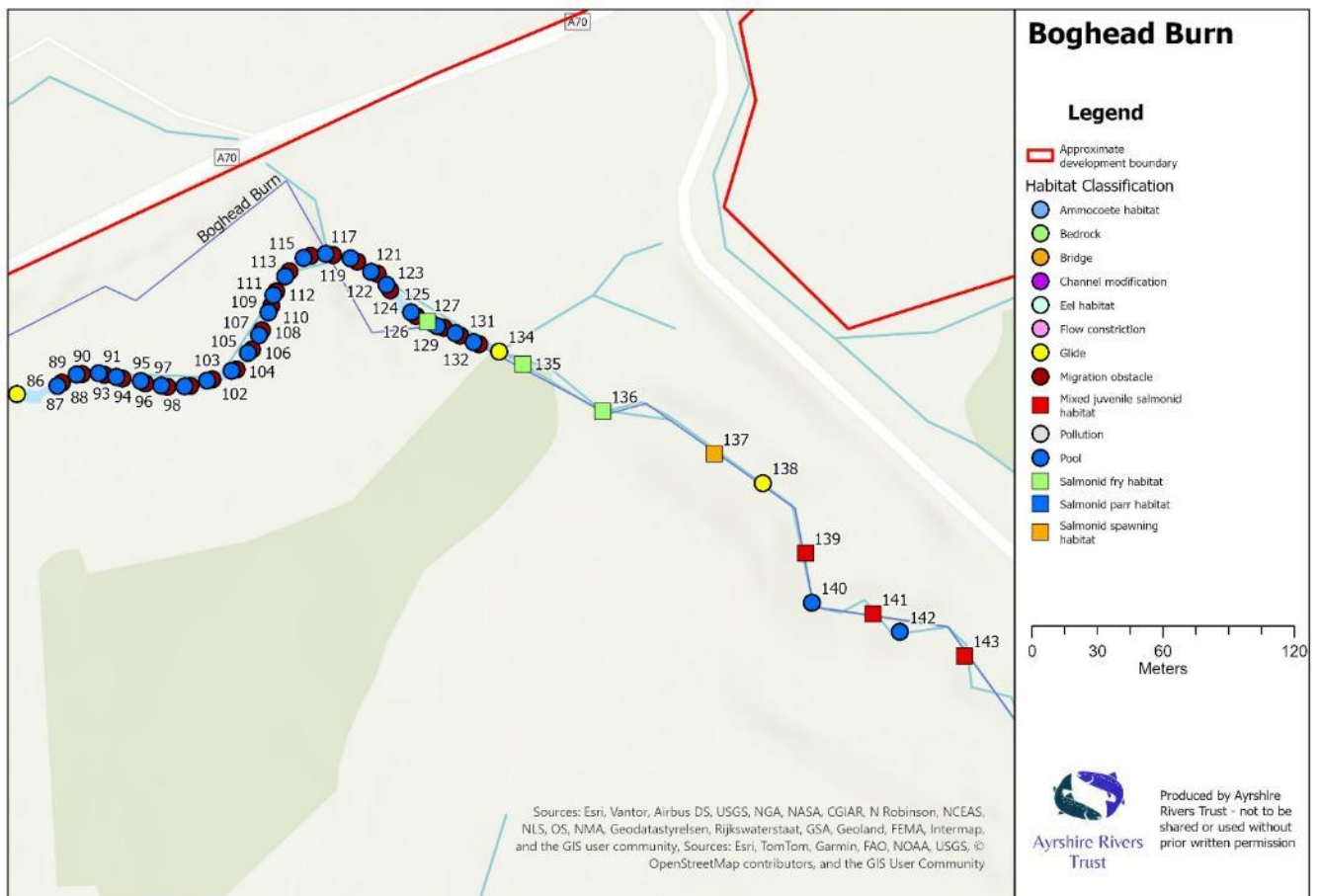
Figure E-2: Glenmuir Burn - General target notes



FigureE-3: Gass Water - General target notes



FigureE-4: Small Burn - General target notes



FigureE-5: Boghead Burn - General Target Notes

Annex F – Fish Habitat Survey Field Notes

Point	Coordinates	Habitat Classification	Habitat Notes
1	NS 61106 21574	Salmonid parr habitat	Reservoir outfall joins Duncanzemere Burn. Some deeper parr habitat.
2	NS 61057 21547	Eel habitat	Wider area. Very enriched. Covered in algae.
3	NS 60987 21522	Flow constriction	Increase gradient due to narrowing and boulder cascade. Significant algae growth
4	NS 60939 21509	Flow constriction	Increase gradient due to narrowing and boulder cascade. Significant algae growth
5	NS 60925 21504	Mixed juvenile salmonid habitat	A mix of substrate sizes suitable to both fry and parr however the substrate is compacted and covered in significant algae growth
6	NS 60887 21497	Salmonid fry habitat	Water depth and substrate size suitable for Salmonid fry however due to livestock poaching, algae growth and substrate compaction it is in a very poor condition.

Table F-1: Duncanzemere Burn Habitat Survey Field Notes

Table F-2: Glenmuir Burn Habitat Survey Field Notes

Point	Coordinates	Habitat Classification	Habitat Notes
7	NS 61879 20277	Mixed juvenile salmonid habitat	Good mix of substrate sizes at the mouth of the Glenmuir burn. No issues with access to the Glenmuir burn from the Glenmuir Water. Some natural erosion present.
8	NS 61897 20282	Salmonid fry habitat	Shallow riffle run habitat with good native riparian tree cover
9	NS 61924 20278	Pool	Shallow pool (<0.30m) with woody debris present
10	NS 61949 20260	Migration obstacle	Migration obstacle created by man-made debris such as corrugated iron sheets

Point	Coordinates	Habitat Classification	Habitat Notes
11	NS 61954 20246	Eel habitat	Substrate consists of cobble and boulder with tree roots present for shelter
12	NS 61987 20249	Salmonid fry habitat	Immediately downstream of a crossing ford.
13	NS 62024 20241	Pool	Shallow pool (<0.30m)
14	NS 62036 20248	Ammocoete habitat	Small area of stable silt/sand
15	NS 62111 20301	Flow constriction	Small stepped boulder cascade
16	NS 62118 20328	Bridge	Bridge footing is passable as the substrate throughout is natural
17	NS 62123 20336	Glide	Smooth flow in deeper water and area of silt deposition due to modifications to channel and culvert upstream
18	NS 62124 20340	Migration obstacle	Approximately 15m long culvert with shallow water flowing through. Passability will depend on water depth and velocity through this culvert
19	NS 62130 20356	Channel modification	Artificial bank on the left bank and channel has been straightened
20	NS 62139 20376	Glide	Shallow glide (<0.3m)
21	NS 62151 20399	Salmonid fry habitat	
22	NS 62163 20412	Channel modification	Area of significant bank erosion. Watercourse is running through an old dump site
23	NS 62178 20427	Salmonid parr habitat	Narrows and boulders provide good cover
24	NS 62189 20458	Pool	Shallow pool (<0.3m)
25	NS 62233 20503	Pool	Shallow pool (<0.3m) present upstream of watergate. Area of livestock poaching on the left bank. No riparian cover

Point	Coordinates	Habitat Classification	Habitat Notes
26	NS 62293 20557	Salmonid fry habitat	Partly compacted substrate due to significant livestock poaching. No riparian cover
27	NS 62314 20585	Pool	Shallow pool (<0.3m). Bedrock outcrops
28	NS 62402 20637	Salmonid spawning habitat	Shallow glide into riffle/run. Substrate size more suitable for trout spawning.
29	NS 62413 20646	Glide	Shallow glide (<0.3m)
30	NS 62442 20678	Pool	Shallow pool (<0.3m)
31	NS 62457 20676	Bridge	Passable bridge
32	NS 62660 20809	Migration obstacle	Passable crossing ford
33	NS 62666 20832	Flow constriction	Boulder cascade
34	NS 62686 20839	Bedrock	Bedrock outcrops become prominent and dominate substrate feature
35	NS 62737 20875	Bedrock	Bedrock cascade with substrate on top
36	NS 62764 20892	Migration obstacle	Crossing ford
37	NS 62839 20936	Flow constriction	Pipe crossing burn and a livestock feeder blocking and backing up substrate
38	NS 62894 20960	Pool	Shallow pool (0.3m)
39	NS 62927 20982	Migration obstacle	Bedrock falls approximately 0.5m in height
40	NS 62943 20996	Migration obstacle	Livestock crossing ford

Point	Coordinates	Habitat Classification	Habitat Notes
41	NS 62958 21008	Migration obstacle	Culvert with perched entrance and broken culvert pipe blocking entrance. Fungus below the culvert and significant enrichment upstream.
42	NS 63096 21024	Migration obstacle	Culvert and pollution present. Possible source is the forestry.
43	NS 63246 21067	Pollution	Silt deposition potentially from forestry

Table F-3: Gass Water Habitat Survey Field Notes

Point	Coordinates	Habitat Classification	Habitat Notes
44	NS 63114 23035	Mixed juvenile salmonid habitat	Glide <30cm. Mixed habitat with compacted substrates.
45	NS 63106 23062	Salmonid fry habitat	Shallower. Less coarse substrates but more cobble.
46	NS 63092 23119	Mixed juvenile salmonid habitat	Good variety of substrates and depths.
47	NS 63086 23152	Glide	Glide/run.
48	NS 63053 23134	Bedrock	Bedrock becoming prominent.
49	NS 63009 23120	Glide	Glide and run
50	NS 62974 23146	Bedrock	Bedrock with substrates on top. Possible fry habitat.
51	NS 62969 23204	Flow constriction	Flow constriction due to old collapsed weir (passable).
52	NS 62959 23225	Migration obstacle	Natural waterfall. Passable.
53	NS 62960 23234	Pool	Downstream of waterfall.

Point	Coordinates	Habitat Classification	Habitat Notes
54	NS 62963 23263	Pool	Deep pool above bedrock chute.
55	NS 62953 23266	Migration Obstacle	Natural bedrock chute. Impassable.
56	NS 62938 23266	Pool	Braided channel. Pool and island below chute. Water very peaty. No riparian cover. Livestock sheep access. Stable substrates.
57	NS 62913 23285	Migration obstacle	Bedrock cascade.
58	NS 62898 23295	Glide	Deep glide. Downstream of bedrock cascade and riffle.
59	NS 62883 23305	Salmonid parr habitat	Boulder/cobble and gets deeper fast.
60	NS 62830 23340	Mixed juvenile salmonid habitat	Areas of slower flow
61	NS 62806 23388	Glide	
62	NS 62797 23422	Salmonid fry habitat	Shallower and smaller substrates.
63	NS 62776 23472	Migration obstacle	Passable culvert.
64	NS 62774 23553	Bedrock	Natural straight bedrock ridge. Forms a chute.
65	NS 62787 23607	Salmonid fry habitat	Shallow and smaller substrates. Settlement pond leaching/leaking.
66	NS 62786 23611	Glide	Algae growth on substrate
67	NS 62780 23672	Salmonid fry habitat	
68	NS 62775 23683	Bedrock	
69	NS 62767 23733	Channel modification	Settlement pond outfall

Point	Coordinates	Habitat Classification	Habitat Notes
70	NS 62815 23815	Glide	
71	NS 62848 23921	Mixed juvenile salmonid habitat	Middle island. Sheep driven erosion and riffle/run.
72	NS 62825 24005	Channel modification	
73	NS 62833 24099	Salmonid parr habitat	Riparian tree cover present.
74	NS 62833 24108	Salmonid spawning habitat	Pool/glide into run.
75	NS 62840 24150	Glide	Riparian tree cover present.
76	NS 62839 24168	Salmonid parr habitat	
77	NS 62843 24187	Migration obstacle	Unnatural. Passable.
78	NS 62846 24229	Pool	Upstream of Boghead confluence.

Table F-4: Small Burn Habitat Survey Field Notes

Point	Coordinates	Habitat Classification	Habitat Notes
79	NS 62566 19678	Glide	Deep glide > 0.3m. Minnow habitat. Cattle poaching present.
80	NS 62615 19710	Pool	Shallow pool created by field drain.
81	NS 62625 19726	Pollution	Iron leaching. Very narrow. Silted and shallow. Mixed substrate and undercut.
82	NS 62740 19879	Migration obstacle	~0.5m jump up to bridge footing. Moss growth on substrate upstream of bridge – may suggest that substrate becomes exposed during dry periods.

Point	Coordinates	Habitat Classification	Habitat Notes
83	NS 62762 19891	Pool	Shallow pool
84	NS 62766 19896	Flow constriction	Narrows and boulder steps
85	NS 62778 19912	Pool	Shallow pool then narrowing. Draped vegetation 100% over burn. Dark/peaty. Low density grazing.

Table F-5: Boghead Burn Habitat Survey Field Notes

Point	Coordinates	Habitat Classification	Habitat Notes
86	NS 624221 262860	Glide	
87	NS 624225 262879	Pool	
88	NS 624226 262881	Migration obstacle	
89	NS 624230 262888	Pool	
90	NS 624230 262890	Migration obstacle	
91	NS 624231 262898	Pool	
92	NS 624230 262901	Migration obstacle	
93	NS 624229 262906	Pool	
94	NS 624228 262909	Migration obstacle	
95	NS 624227 262917	Pool	
96	NS 624226 262919	Migration obstacle	
97	NS 624225 262927	Pool	
98	NS 624225 262929	Migration obstacle	
99	NS 624225 262937	Pool	
100	NS 624225 262940	Migration obstacle	
101	NS 624228 262948	Pool	
102	NS 624228 262950	Migration obstacle	
103	NS 624232 262959	Pool	
104	NS 624233 262961	Migration obstacle	
105	NS 624240 262966	Pool	
106	NS 624242 262968	Migration obstacle	
107	NS 624248 262971	Pool	

Point	Coordinates	Habitat Classification	Habitat Notes
108	NS 624250 262973	Migration obstacle	
109	NS 624259 262975	Pool	
110	NS 624262 262977	Migration obstacle	
111	NS 624267 262978	Pool	
112	NS 624268 262979	Migration obstacle	
113	NS 624275 262983	Pool	
114	NS 624277 262985	Migration obstacle	
115	NS 624284 262992	Pool	
116	NS 624285 262995	Migration obstacle	
117	NS 624285 263002	Pool	
118	NS 624285 263005	Migration obstacle	
119	NS 624283 263013	Pool	
120	NS 624282 263016	Migration obstacle	
121	NS 624277 263023	Pool	
122	NS 624276 263025	Migration obstacle	
123	NS 624271 263030	Pool	
124	NS 624269 263031	Migration obstacle	
125	NS 624259 263041	Pool	
126	NS 624257 263043	Migration obstacle	
127	NS 624254 263048	Salmonid fry habitat	
128	NS 624252 263053	Pool	
129	NS 624252 263056	Migration obstacle	
130	NS 624249 263061	Pool	

Point	Coordinates	Habitat Classification	Habitat Notes
131	NS 624248 263063	Migration obstacle	
132	NS 624245 263069	Pool	
133	NS 624244 263072	Migration obstacle	
134	NS 624241 263081	Glide	
135	NS 624235 263092	Salmonid fry habitat	
136	NS 624213 263129	Salmonid fry habitat	
137	NS 624194 263180	Salmonid spawning habitat	
138	NS 624180 263202	Glide	
139	NS 624149 263221	Mixed juvenile salmonid habitat	
140	NS 624126 263224	Pool	
141	NS 624121 263252	Mixed juvenile salmonid habitat	
142	NS 624113 263265	Pool	
143	NS 624101 263294	Mixed juvenile salmonid habitat	
144	NS 624221 262860	Glide	

Annex G – General Habitat Survey Definitions

Habitat and site data collection follows the SFCC team leader electrofishing general method guidelines. Relevant components and definitions from the SFCC Electrofishing Team Leader manual have been provided below.

Left and Right bank are determined when facing downstream.

Instream Cover

Instream cover for salmonids aged one year or older:

None – No over – Stream bed composed entirely of fine uniform particles (silt, sand, gravel, pebbles) or continuous hard surfaces (bedrock or concrete).

Poor – Little cover - Stream bed composed predominantly of fine to medium particles (gravel, pebbles and cobbles), little or no cover from aquatic vegetation.

Moderate – Moderate cover - Stream composed of a mix of particle sizes (gravel to boulders) and/or with some areas of Good cover substrate (pebbles, cobbles and boulders), which may or may not have some aquatic vegetation cover.

Good – Good cover - Stream composed mainly of medium to large size substrate (pebbles, cobbles and boulders) and/or with some aquatic vegetation cover.

Excellent – Excellent cover - Stream composed predominantly of large size substrate (cobbles and boulders) and/or with extensive aquatic vegetation cover.

Substrate type

Table G-1: SFCC Substrate type definitions

High Organic	Very fine organic matter, include peat substrate and thick leaf cover on stream bed in this category.
Silt	Fine, sticky, mostly inorganic material, individual particles invisible.
Sand	Fine, inorganic particles, <2mm diameter, individual particles visible
Gravel	2-16mm diameter
Pebble	16-64mm diameter
Cobble	64-256mm diameter
Boulder	>256mm diameter
Bedrock	Continuous rock surface
Obscured	Anything that can obscure the riverbed and cannot be moved for inspection. Include areas that cannot be seen because of water depth or colour

Compacted substrates

Compaction of the substrate is evaluated by digging into the riverbed using your foot. If it freely moves, it is considered uncompacted. A compacted substrate is when the riverbed is cemented by fine particles and very difficult or impossible to move with your foot.

Flow types

Table 1: SFCC Flow type definitions

SM	Still marginal	<10cm deep, water still or eddying, no waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent.
DP	Deep pool	≥30 cm deep, water flow slow, eddying, no waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent.
SP	Shallow pool	<30cm deep, water flow slow, eddying, no waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent
DG	Deep glide	≥30 cm deep, water flow moderate/fast; waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent.
SG	Shallow glide	<30 cm deep, water flow moderate/fast; waves form behind a 2-3 cm wide rule is placed in the current, smooth surface appearance, water flow is silent.
RU	Run	Water flow fast, unbroken standing waves at surface; water flow is silent.
RI	Riffle	Water flow fast, broken standing waves at surface; water flow is audible.
TO	Torrent	White water, water flow noisy, difficult to distinguish substrate, associated with steep gradient.

Scottish Fisheries Coordination Centre (2024). Training Manual, Team Leader Electrofishing