Aultmore Forest Wind Farm

Technical Appendix 8.5: Fish Habitat Assessment and Fully Quantitative Electrofishing Surveys

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
V01	29 August 2023	Amy Green	Nicola Tyrrell	Nicola Tyrrell
V02	3 October 2023	Amy Green	Nicola Tyrrell	Nicola Tyrrell
V03	16 November 2023	Amy Green	Nicola Tyrrell	Nicola Tyrrell

Basis of Report

Executive Summary

SLR Consulting ('SLR') was appointed by Vattenfall Wind Power Ltd ('the Client') to undertake surveys including fish habitat assessment (including salmonid spawning suitability) and fully quantitative electrofishing surveys to determine the presence of fish species at the proposed sixteen turbine wind farm development at Aultmore Forest ('the Development'). The proposed Development is located within central Ordnance Survey (OS) grid reference NJ424580 and is within the Spey and Deveron catchment. The proposed Development Layout can be found in **Figure 8.5.2**.

Mhor Environmental Ltd (2022) conducted baseline fish habitat assessments, though no assessments within the redline boundary were made. No survey locations from the August 2023 fish habitat assessments within the redline boundary were suitable for further investigation using electrofishing methods. AM9 located south of the development in the Burn of Aultmore was recommended for further investigation. The report is included as **Appendix C** to this Report.

Using previous data and report from Mhor Environmental Ltd (2022), recommendations for electrofishing sites were used and full quantitative electrofishing surveys were undertaken in August 2023. Fish habitat quality ranged from: Good (AM07, AM08, AM16, AM9, CS); Moderate (AM02, AM12, AM21) and Poor (AM01, AM06). No habitat identified at the time were deemed to be High or Low. Salmonid spawning potential ranged from: Optimal (AM07, AM12, AM9); Sub-Optimal (AM02, AM08, CS) and Not Suitable (AM01, AM06, AM16, AM21). No redds were identified.

Atlantic salmon fry (0+) and parr (1++) were not recorded at any of the surveyed locations; although, that is not to say salmon are not present across the main tributaries surrounding the proposed Development. Trout parr (1++) were present across all electrofishing surveyed locations; although, fry (0+) were absent from several locations (AM06, AM08, AM01) where undercutting of the banks was found to be limited and wet width was particularly narrow.

Eel habitat was found at AM16 where rocks along the left bank were found to provide substantial cover for both eel and trout parr (1++). No other site was found to have great rock formation which would provide substantial cover for eels.

Based on the results of this report it is recommended that:

- The proposed development has been designed to minimise the number of watercourse crossing points and that site infrastructure is sufficiently distant (>50m) from watercourses.
- Pollution prevention measures should be employed during the construction process and a suitable water quality programme established to ensure that the construction phase does not impact on the fish habitats.
- Construction and post-construction fish fauna monitoring programme is carried out utilising the same ten (control site included) fish fauna sites as part of an ongoing assessment of potential impacts which may occur due to the proposed development. The suggested monitoring schedules are as follows: Fish fauna surveys annually during construction (summer/early autumn) and post-construction Year 1 (summer/early autumn) and Year 2 (summer/early autumn).
- Macroinvertebrate sampling is recommended to be conducted at all ten survey locations. The purpose of this macroinvertebrate data is to provide a longer-term water quality monitoring that can be compared and monitored over the duration of the project and to demonstrate biodiversity recovery post construction. Baseline ecological condition for watercourses will be used as an indicator of overall watercourse health over time.
- A pre-construction, construction and post-construction water quality monitoring programme is carried out as part of an ongoing assessment of potential impacts, which may occur due to the proposed development. This will help to protect the proposed development in the long term and provide evidence of scale of impact on the surrounding watercourses from any pollution incidents which may or may not be directly related to the proposed development.

- A suitably qualified / experienced Aquatic Ecological Clerk of Works (ECoW) should be on site, periodically, for the construction phase of the proposed development, in tune with the locations of works and project programme.
- Reconstruction of the river corridors are advised; options include blocking of the drainage within the forestry rides in order to maintain flow of the watercourses, removing conifer plantation species along the corridor route to reduce water transportation from the soil.

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Acronyms and Abbreviations

FWPM	Freshwater Pearl Mussel
SEPA	Scottish Environment Protection Agency
SFCC	Scottish Fisheries Coordination Centre
OS	Ordnance Survey
SEW	Scotlands Environmental Web
FLS	Forestry and Land Scotland
RBMP	River Basin Management Plan
FHQ	Fish Habitat Quality
SSP	Salmonid Spawning Potential

1.0 Introduction

1.1 Background

SLR Consulting ('SLR') was appointed by Vattenfall Wind Power Ltd ('the Client') to undertake surveys including fish habitat assessment (including salmonid spawning suitability) and fully quantitative electrofishing surveys to determine the presence of fish species at the proposed sixteen turbine wind farm development at Aultmore forest ('the proposed development').

The proposed development is located approximately 6 km north of Keith and approximately distance 7 km south of Buckie, within Banffshire. The Site is managed on behalf of Scottish Ministers by Forestry and Land Scotland (FLS) and is defined by the red line boundary in **Figure 8.5.1.** The proposed development is located within central Ordnance Survey (OS) grid reference NJ424580 and is within the Banff Coastal and River Deveron hydrological catchments, and the Spey Foundation and Deveron, Bogie and Isla River Trust areas. The proposed development layout can be found in **Figure 8.5.2**.

1.2 River Basin Management Plan

The European Union's Water Framework Directive (WFD) requires all inland and coastal waters within defined river basin districts to reach at least 'good' ecological status/potential by a set deadline[1]. The Scottish Government committed to continued alignment with European Union (EU) standards and laws following EU exit[2]. SEPA is the lead authority to ensure compliance with WFD requirements. With input from responsible authorities and other stakeholders, SEPA has coordinated the production of the Scotland River Basin Management Plan (RBMP) to ensure the protection, improvement and sustainable use of the water environment for future generations. The overall aim is for 98% of Scotland's waters to be in a good condition by 2027, to be progressively implemented through three RBMP cycles (2009-2015; 2015-2021 and 2021-2027)[3].

The RBMP has identified the following key pressures on the water environment in Scotland:

- Morphological alterations (e.g., modifications to beds, banks and shores as the result of historical engineering and urban development)
- Diffuse source pollution (e.g., agriculture, urban development)
- Point source pollution (e.g., the discharge of sewage, manufacturing and quarrying)
- Abstraction and flow regulation (e.g., alterations to water flows and levels as the result of electricity generation and public water supplies)
- Invasive non-native species RBMPs set out how organisations, stakeholders and communities will work together to improve the water environment.

1.3 Study Objectives

The objectives of this report were to:

- Undertake baseline fish habitat assessments within/out with the proposed development area where there is potential for impact on the aquatic environment during construction and operation to identify potential important ecological features;
- To put watercourses into context to that of the wider riverine environment;

[1] EU Water Framework Directive (2000) - Directive 2000/60/EC (Accessed online – 29/08/2023)

[2] UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021 (legislation.gov.uk)

[3] https://www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf (Accessed online – 29/08/2023)

- Identify potential spawning areas for salmonids (Atlantic salmon (*Salmo salar*)/ sea trout/ brown trout (*Salmo trutta*) and lamprey (*Lampetra fluviatilis/ Lampetra planeri*);
- Identify the potential presence of protected such as Freshwater Pearl Mussels (FWPM)/ notable/ invasive species;
- Use the baseline information for future comparison studies, potentially required during the Development construction and post-construction phases;
- Undertake fully quantitative electrofishing assessments of moderate to good habitat; and
- To provide recommendations/ mitigation measures for the proposed development.

1.4 Salmonids

Habitat requirements differ across salmonid species life stages (Atlantic salmon and brown/sea trout), which has been subjected to considerable research[4][5][6][7]. Salmonids return to their natural rivers and spawn in late autumn and early winter, depositing eggs in redds which females excavate in gravel and pebble substrate. Spawning depths range from 5 – 90cm[8], though the selected habitat is based on flow type and substrate composition as opposed to depth. Areas of riffle, run and glides where accelerated flow is present is where eggs are often deposited, where high amounts of O_2 is supplied, essential of egg development. Fine sediment such as silt and fine sand reduces water flow and O_2 supply, resulting in egg mortality. Egg survival is also affected by redd 'washouts' during winter spates – the direct, physical, scouring out of eggs from the gravel. Substrate stability, the dynamics of water flow and the weather all determine the extent of siltation and washouts. Over the course of three/four months (385 – 545 degree days) the eggs hatch into alevins, though, this time frame is highly dependent on environmental factors such as temperature. Alevins emerge from the gravel redds (often in March to early May) to feed on macro-invertebrates, they are then referred to as "fry", where they passively drift downstream or remain in the vicinity of the redd. Salmon fry prefer fast flowing waters i.e. riffles (>20cm/s) with surface turbulence, requiring pebble, cobble and gravel substrate. However, trout prefer low velocity water, near the stream bed with slower flow rates. Cover from stones, plants or debris is required and good cover is essential for maintaining high fry densities.

Usually by the second year in streams, fry develop into "parr", becoming much larger over time after utilizing feeding opportunities in the stream. Environmental factors such as water temperature and food availability determine the temporal variability in which individuals remain in the parr phase. Parr are found to prefer deeper water (approximately 15 -40cm) and coarser substrate, consisting of pebbles, cobbles, and boulders. Trout parr prefer low water velocity areas where cover is available, often being found alongside the banks, in undercut banks and amongst margin vegetation and exposed tree roots.

1.5 Lamprey

In April to May, adult lamprey migrate upstream, often during night hours to spawn, extruding their eggs into a redd (nest) in the riverbed, consisting of pebble and gravel substrate, though substrate densities and types have been found to vary between species. Brooke lamprey (*Lampetra planeri*)

[4] Crisp, D.T. 1993. The environmental requirements of salmon and trout in fresh water. *Freshwater Forum*, 3(3): 176-201.

[5] Hendry, K & Cragg-Hine, D. 2003. *Ecology of the Atlantic Salmon*. Conserving Natura 2000 Rivers Ecology Series No. 7, English Nature, Peterborough.

[6] Klemetsen, A., Amundsen, P-A, Dempson, J.B., Jonsson, B., Jonsson, N., O'Connell, M.F. and Mortensen, E. 2003. Atlantic salmon Salmo salar L., brown trout Salmo trutta L. and Arctic charr Salvelinus alpinus (L.): a review of aspects of their life histories. *Ecology of Freshwater Fish*, 12, 1-19.

[7] Youngson, A & Hay, D. 1996 *The Lives of Atlantic Salmon. An illustrated account of the life-history of Atlantic salmon*. Swan Hill Press, Shrewsbury.

[8] Neary, J.P. 2006. *Use of Physical Habitat Structure to Assess Stream Suitability Upland Scottish Streams*. Ph.D. Thesis, University of Stirling, October 2006.

have been found to spawn in areas of coarse sand and gravel whilst river lamprey (*Lampetra fluviatilis*) selects sites with larger substrate types (gravel, pebble and cobble). The eggs hatch into young larvae, known as ammocoetes and drift downstream from the redd, utilising the current to settle in nursey habitat which consists of fine, soft substrate (mud/sand) in well oxygenated, slow flowing waters. Ammocoetes feed on fine particulate matter such as diatoms, algae and bacteria, spending several years before metamorphosing from larval to adult form. At larvae stage, Brooke and river lamprey are not distinguishable, though once transformed it becomes possible to distinguish between them on the basis of morphology and colouration[9].

Both species of lamprey are known to be poor swimmers, so when migrate upstream for spawning it can be easily disrupted by relatively low vertical barriers.

1.6 European Eel

Eels migrate from saltwater to freshwater environments (catadromous freshwater fish) though spawn in saltwater, taking place in the Sargasso Sea, but the exact location has never been found. The fertile eggs float with the oceanic currents before developing into leptocephali. The migration back to Europe utilising only oceanic currents can take up to two years allowing for morphological changes to occur to pre-adapt juvenile eels for freshwater environments, developing into the glass eel stage.

Glass eels use tides to carry themselves upstream once the coastline is reached. At around 8cm juvenile eels migrate upstream in-search for suitable residing habitat (coarse substrate and gravel, undercutting banks, tree roots). Once within the freshwater environment, glass eels transition into yellow eels, which is the longest life stage ranging from 5 – 20 years, though dependent of sex, recourses and temperature. Upon reach adequate size and fat storage, yellow eels transform into silver eels. The morphological changes (change colour, pectoral fins widen, digestive tract shut down, eyes grow up to 10 times their original size and muscle mass increase) pre-adapts the silver eel to return to the Sargasso Sea to start the cycle again.

1.7 Freshwater Pearl Mussel

Freshwater pearl mussels (FWPM) are found in fast flowing river systems (optimal velocity of 0.25 – 0.75 $m.s^{-1}$), with an optimal depth of 30 – 40 cm[10]. FWPM prefer stable, though non compact substrate such as cobble and boulder with patches of fine substrates which allow for individuals to burrow[11].

Juvenile mussels require fine stable substrate, particularly clean gravel, living buried in clean, fast-flowing unpolluted riverine environments and survive by inhaling and filtering for the minute organic particles on which they feed[9]. Adult and juvenile mussels tend to have similar habitat 'preferences', although adults are found over a wider range of physical conditions and juveniles appear to be more exacting in their requirements and sensitivity to environmental disturbance[12].

Freshwater pearl mussels have a short parasitic larval phase on the gills of suitable host fish. The larvae (glochidia) of freshwater pearl mussels are host-specific and can only complete their development on Atlantic salmon or brown trout, with the preferred host being juvenile fish (fry and parr) of these species[13].

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[9] Gardiner, R. 2003. *Identifying Lamprey. A field key for Sea, River and Brook lamprey*. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

[10] Hastie, L.C., Boon, P.J. and Young, M.R. 2000. Physical microhabitat requirements of freshwater pearl mussels M. margaritifera (L). *Hydrobiologia* 429: 59-71.

[11] Cosgrove, P.J. Hastie, L.C. and Young, M.R. 2000. *Freshwater pearl mussels in peril*. British Wildlife 11: 340-347.

[12] Maitland, P.S. 2003. Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

[13] Young, M.R. & Williams, J.C., 1984. The reproductive biology of the freshwater pearl mussel Margaritifera margaritifera (Linn.) in Scotland I. Field Studies. *Archive für Hydrobiologie* 99: 405-422.

The presence of freshwater pearl mussels in any river therefore depends on salmonid host fish availability. It is usually considered necessary for migratory salmonids to be present within a catchment for freshwater pearl mussels to be present. This is typically the case, however occasionally, where historical river captures have occurred, freshwater pearl mussel populations are sometimes isolated from present day migratory salmonids (e.g., by impassable waterfalls and have survived this isolation by utilising host resident brown trout). Thus, all sites capable of containing native salmonids can potentially hold freshwater pearl mussel populations[14].

2.0 Methodology

2.1 Project Personnel

Table 1 details all personnel involved in aquatic assessments of the proposed development of Aultmore Forest wind farm.

Table 1. Project Personnel

Personnel	Role
Amy Green	Project Ecologist
Niamh Ni Nagy	Assistant Ecologist
Leigh Kelly	Mhor Environmental Ltd (subcontractor) - Director

2.2 Desk Study

A desk study was carried out at the start of the commission and ahead of field surveys. Information sources used for this study are described below:

- Bing Maps[15] – to obtain aerial imagery to inform field surveys and access suitability to survey along steep slope;
- Ordnance Survey Map[16] – to obtain maps for the area covered by the proposed Development and to inform survey location and gradient limitations;
- Scotland's Environment Web (SEW)[17] – to obtain data on obstacles to fish migration on affected watercourses and to determine expected species within the surrounding location (~2 km area boundary);
- Scottish Environment Protection Agency (SEPA)[18] – to review information on the SEPA Water Classification Hub regarding the classification status of watercourses with potential to be affected by the Development; and
- NatureScot[19] – to perform a search to identify survey locations with relevant qualifying interests within 2 km of the proposed Development.

[14] www.gateway.snh.gov.uk (accessed online 29/08/2023)

[15] Bing Maps. (2022). Search. [Online] Available at: https://www.bing.com/maps/

[16] Ordnance Survey Maps. (2023). Maps. [Online] Available at: https://shop.ordnancesurvey.co.uk/maps/ [Accessed 29/08/2023]

[17] Scotland's Environment Web. (2022). Search Scotland's Environment Map. [Online] Available at: https://map.environment.gov.scot/sewebmap/ [Accessed 29/08/2023]

[18] Scottish Environment Protection Agency. (2022). SEPA Water Classification Hub. [Online] Available at: https://www.sepa.org.uk/data-visualisation/water-classification-hub/ [Accessed 29/08/2023]

[19] NatureScot. (2022). Map Search. [Online] Available at: https://sitelink.nature.scot/map [Accessed 29/08/2023]

2.3 Survey Locations

Table 2 provides a list of all survey locations for fish habitat assessments in 2023 conducted by SLR Project Ecologists and provide justification for site allocation.

Table 2. Survey locations for 2023 aquatic assessments of Aultmore Forest wind farm conducted by SLR Consulting.

Waterbody	Survey Location	Upstream	Downstream	Justification for Surveying
Corsekell Burn	AM1.a	NJ409576	NJ409575	Within the redline boundary. Potential impact from Turbine T1 and T2.
Corsekell Burn	AM1.b	NJ410574	NJ409574	Within the redline boundary. Potential impact from Turbine T1, T2.
Stripe of Gateside	AM2	NJ426576	NJ428575	Within the redline boundary. Potential impact from Turbine T3 and construction compound CC1.
Burn of Fernking	AM3	NJ430580	NJ432580	Within the redline boundary. Watercourse crossing
Burn of Aultmore	AM4	NJ456591	NJ457589	Within the redline boundary. Watercourse crossing
Milk Burn	AM6	NJ474579	NJ472579	Within the redline boundary. Potential impact from easterly turbines T14 -T 16 and SS2.
Stripe of Gateside	AM7	NJ442568	NJ444567	Outside the redline boundary. Potential impact from Turbine T3, construction compound CC1 and batching compound.
Burn of Fernking	AM8	NJ443569	NJ446568	Outside the redline boundary. Watercourse crossing.
Burn of Aultmore	AM9	NJ455557	NJ454556	Outside the red line boundary. Downstream of all northern points.

Table 3. Provides a list of all survey locations for fully quantitative electrofishing assessments in 2023 and justification. Mhor Environment Ltd (2022)[20], provided proposed suitable electrofishing survey locations for the 2023 survey. The 2023 fish habitat assessment conducted by SLR ruled out all but one survey location (AM9) which required further investigation. No survey locations within the redline boundary of the proposed development support suitable habitat quality or spawning potential for salmonids or lamprey.

Table 3. Survey locations for 2023 electrofishing assessments of Aultmore Forest wind farm conducted by SLR Consulting and Mhor Environmental Ltd (see Figure 8.5.3 for locations).

Waterbody	Survey Location	Upstream	Downstream	Justification for Surveying
Burn of Ryeriggs	AM01	NJ401558	NJ401557	Outside of redline boundary. Potential impact within the lower catchment area.
Burn of Tynet	AM02	NJ399596	NJ399596	Outside of redline boundary. Potential impact within the lower catchment area.
Ault Kittoch	AM06	NJ438601	NJ438602	Outside of redline boundary. Potential impact within the lower catchment area.
Burn of Letterfourie	AM07	NJ440620	NJ440620	Outside of redline boundary. Potential impact within the lower catchment area.
Burn of Whitefield	AM08	NJ444611	NJ445612	Outside of redline boundary. Potential impact within the lower catchment area.

[20] Mhor Environmental Ltd (2022) *Aultmore Wind Farm – Fish Habitat Survey*. rep. SLR Consulting .

Waterbody	Survey Location	Upstream	Downstream	Justification for Surveying
Tack Burn	AM12	NJ496593	NJ496593	Outside of redline boundary. Potential impact within the lower catchment area.
Burn of Aultmore	AM16	NJ456562	NJ455561	Outside the red line boundary. Downstream of all northern points.
Garral Burn	AM21	NJ440555	NJ440554	Outside of redline boundary. Potential impact within the lower catchment area.
Burn of Aultmore	AM9	NJ455557	NJ454556	Outside the red line boundary. Downstream of all northern points.
Burn of Curlusk	CS	NJ372497	NJ371498	Control Site.

2.4 Fish Habitat Assessments

Fieldwork for the 2023 survey locations was conducted over one day on 14th August 2023 by two experienced surveyors. Weather conditions on the day of sampling were clear and bright with an ambient temperature of 18°C. Survey locations were determined prior to visiting the Development during the desk study using the latest design freeze (**Figure 8.5.1**). Watercourses visible at the 1:25,000 scale (OS map) within the Development red line boundary were considered for survey where there was a potential impact from the Development. The methodology for habitat assessment employed for the fieldwork was conducted under a modified version of the Scottish Fisheries Coordination Centre (SFCC)[21] outlined in the Environment Agency document 'Restoration of Riverine Salmon Habitats: A guidance Manual'[5] . This focuses on the assessment of salmonid fish habitat and lamprey habitat, and the suitability of these respective areas to act as spawning areas. Predominant habitat was recorded within specific stretches, and the habitat classified employing the criteria in **Table 4**. The habitats outlined form definable sections of a wider spectrum of habitats commonly found in watercourses. Where spawning gravels were present and accessible, an assessment of their quality in terms of stability, compaction and siltation was made. In addition, the bankside structure and surrounding land use was also described where appropriate. Areas surveyed included 100m^2 sections with target notes recorded up to 250 m upstream and downstream of the survey locations, given in **Table 2**. In survey locations where the watercourses ceased to have definable features and/or were determined unsuitable to support any fish species the survey was not continued upstream of this point.

Table 4. Fish habitat classifications

Habitat Type	Classification
Salmon spawning gravel	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt. Substrate size predominantly pebbles and smaller cobbles depending on fish size.
Trout spawning gravel	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt. Substrate size varies from gravels, pebbles and smaller cobbles depending on fish size.
Salmon fry habitat	Shallow (<0.2 m) and fast flowing water indicative of riffles and runs with a substrate dominated by pebbles and smaller cobbles.
Salmon parr habitat	Riffle/run habitat that is generally faster and deeper than fry habitat (0.2 - 0.4 m). Substrate size* from large pebbles/smaller cobbles to boulder.
Trout fry habitat	Slow to medium flowing shallow water with a substrate dominated by pebbles and smaller cobbles, often concentrated at stream margins.
Trout parr habitat	Variety of substrate sizes; undercut banks, tree roots, big rocks; deeper, slower water.
Lamprey spawning habitat	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt (but may contain some sand). Substrate size varies from gravels to pebbles.

[21] Scottish Fisheries Co-ordination Centre. (2007). *Habitat Surveys Training Course Manual*. pp. 1-64

Habitat Type	Classification
Juvenile lamprey habitat	Optimal: Stable fine sediment or sand ≥15cm deep with low water velocity and the presence of organic detritus/plant material. Sub-optimal: Shallow sediment (<15cm deep), often patchy and interspersed among coarser substrates.
Eel habitat	Frequently burrow into mud and utilise cover from larger instream substrate and bankside crevices (e.g., gaps in bank modifications such as walls and log revetments).
Glides	Smooth laminar flow with little surface turbulence. Shallow glide ≤ 0.3m, deep glide > 0.3m.
Pools	No perceptible flow. Shallow pool ≤ 0.3m, deep pool > 0.3m.
Flow constriction	Where flows are accelerated between narrow banksides (usually combined with deep fast flows and bedrock substrates).
*Gravel (2-16mm), pebble (16-64mm), cobble (64-256mm), boulder (>256mm) ** If significant amounts of different habitat types were found to co-exist in the same section, these habitat classifications were adequately described. For example, in the case of salmonids, fry and parr habitat is classified as juvenile habitat. Where parr habitat is mentioned, this refers to habitat that has principally been identified as habitat more suited to parr than fry, however, habitually contains a lower quantity of fry habitat than habitat which is suited to both fry and parr. Salmonid definitions in Table 4 are adapted from SFCC Habitat Manual[5,21,,12].	

Predominant substrate and flow types was categorised according to SFCC[21] definitions outlined in **Table 5**.

Table 5.Substrate and flow type categorisation[21]

Substrate	Definition	Flow Types	Definitions
SA	Sand: Fine, inorganic particles, <2mm diameter, individual particles visible	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.
GR	Gravel: Inorganic particles 2-16 mm diameter	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
PE	Pebble: Inorganic particles 16-64 mm diameter	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.
CO	Cobble: Inorganic particles 64-256mm diameter	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.
BO	Boulder: Inorganic particles >256mm diameter	RU	Run: water flow fast, unbroken standing waves at surface; water flow is silent.
BE	Bedrock: Continuous Rock Surface	RI	Riffle: water flows fast, broken standing waves at surface; water flow is audible.
OB	Obstruction: Roots, wood, sheets of iron, barrels etc.	TO	Torrent: white water, chaotic and turbulent flow, water flow is noisy, difficult to distinguish substrate.

2.4.1 Fish Habitat Assessment Analysis

During the fish habitat survey for numerous species, observations and target notes were recorded to identify optimal habitat, including channel width; channel depth; flow type; substrate composition; instream and bankside cover; riparian canopy cover; fish spawning potential; riparian land uses; and

associated limiting factors. From this, further analysis was undertaken, and evaluations were made for suitable spawning potential and fish habitat quality along the watercourse. Each survey location was then given a rating for fish habitat quality (**High**, **Good**, **Moderate**, **Low** or **Poor**) described in **Table 6**.

Table 6. Fish habitat suitability grades

Grade	Conditions
High	All desirable habitat conditions are met.
Good	Most of desirable habitat requirements met with few adverse conditions present.
Moderate	Habitat displays a mixture of both desirable and adverse conditions.
Poor	Habitat primarily consists of adverse conditions with few desirable conditions present.
Low	Little/no desirable habitat conditions present.

Salmonid spawning potential was assessed via the SFCC Walkover Habitat Survey Protocol and Habitat Surveys Training Course Manual[21]. Survey locations were graded as having **Optimal**, **Sub-Optimal** or **Not Suitable** salmonid spawning potential. Spawning potential is considered optimal if an area greater than 10m^2 is present with clean and suitable substrate likely suitable to all salmonids. Spawning potential is considered sub-optimal if spawning area is <10m^2 with a mix of suitable and unsuitable substrate types. Not suitable spawning habitat contains no suitable spawning habitat. Additional assessment of spawning potential was taken to provide additional information on the categories assessed: substrate type, substrate compaction, river depth, flow type, and siltation[22]. Spawning habitat potential assessment criteria is shown in **Table 7**.

Table 7. Suitable Atlantic salmon and brown/Sea trout spawning habitat taken from SFCC[21] and Louhi et al. (2003)[22]

Species	Substrate	Substrate Compaction	Depth (cm)	Flow Type	Siltation
Salmon	Gravel, Pebble, Cobble	Uncompacted	20-50	Swift velocities	No siltation
Trout	Gravel, Pebble, Cobble	Uncompacted	15-45	Slower flow	No siltation

2.5 Fully Quantitative Electrofishing Assessments

Electrofishing surveys were conducted across three days from 21st to 23rd August 2023 by two experienced and SFCC qualified team leads (Leigh Kelly and Amy Green) using an EF-500B-SYS Electric Fishing Backpack System and single anode. Electrofishing surveys were led by Leigh Kelly BA MRes (licence holder - CMS-18-102) and in full accordance with SFCC protocols. Weather conditions on the day of sampling were clear and bright with an ambient temperature of 18°C. Survey locations were determined prior to revisiting the Development using data collected and reported by Mhor Environmental Ltd (2022)[20].

Fully quantitative methods were adopted. Fully quantitative surveys use a multiple run approach (3 runs) and estimates of fish abundance were based on fish depletion during successive runs. Fully quantitative surveys are area based and calculate the number of fish per 100m² as per SFCC guidelines[21], the data collected can then be compared to other data collected year on year. For example; before, during and after construction. Both upstream and downstream stop nets were deployed to avoid fish emigration and/or migration from the survey location. All fish caught were anaesthetised for processing, identified (species) and measured (fork length). Other non-salmonid species were recorded but not measured.

[22] Louhi, P., Mäki-Petäys, A. and Erkinaro, J. (2008). Spawning habitat of Atlantic Salmon and brown trout: general criteria and intergravel factors. *River Research and Applications*. 24(3). pp. 330-339

2.5.1 Fish Habitat Assessment

At each electrofishing survey location, a repeated habitat assessment using the protocol outline in section 2.4 were used to assess the instream habitat available for juvenile and adult fish. This was conducted to assess annual differences and potential bottleneck zones in areas which demonstrate fluctuating flow regimes.

2.5.2 Electrofishing Analysis

Densities of fish were calculated separately for fry (young of the year) and parr for both salmon and trout. Estimates of minimum density were calculated by dividing the number of fish caught by the area of habitat surveyed. Zippin corrections were applied where appropriate using the Removal Sampling II software (Pisces conservation)[23]. To provide a guide to the relative abundance of salmonid fish sampled during the survey, fish densities were classified per the SFCC classifications scheme Outer Hebrides region[24]. Godfrey's classification scheme is area based and calculated on a one-run approach, therefore classification for this survey is based only on the first pass of the multi-run approach. Grading from very poor through to excellent are given for abundance within each quintile range and absent for no fish caught.

2.6 Freshwater Pearl Mussels

The surveys were conducted across the same 100m^2 section to which electrofishing surveys were conducted in August 2023, based on the methodology and guidance of NatureScot's 'Freshwater Pearl Mussel Survey Protocol'[25]. Where substrate was assessed to be Moderate to High, transect searches for FWPM were carried out using a bathyscope in areas which had potential to support this species. FWPM's found are to be measured, before being returned to the same location found.

2.7 Limitations to Survey

During the fish habitat assessments (14.08.2023) forest works were under way making it difficult to gain access to water courses. Two water courses within the redline boundary contained water, the rest were dry or no defined watercourses were present.

During the electrofishing assessments site visit (21.08.2023-23.08.2023) watercourses identified by Mhor Environmental Ltd (2022)[20] such as AM05, AM09, AM10, AM11, AM13 and AM14 were reassessed in 2023 and deemed not suitable for electrofishing due to the dense vegetation and in some circumstances limited to no water available. More appropriate sites downstream of these points were investigated and electrofished if appropriate.

3.0 Results

3.1 Desk Study

3.1.1 Watercourse Classification

Six classified watercourses were identified 2 km from the proposed development within the SEPA (2022) Water Classification Hub.

[23] Seaby, R.M.H. & Henderson, P.A. (2008) Population Estimation by Removal Sampling. Version 2.2.2.22, *Pisces Conservation*, Hampshire.

[24] Godfrey (2005) *Site Condition Monitoring of Atlantic Salmon SACs*. SFCC to Scottish Natural Heritage, Contract F02AC608.

[25] NatureScot, 2012. Information on freshwater pearl mussel survey protocols [Online] Available: https://www.nature.scot/sites/default/files/2018-10/Freshwater%20pearl%20mussel%20survey%20-%20protocol%20for%20use%20in%20site%20specific%20projects.pdf Last accessed: 29/08/2023

SEPA[26] Water Classification Hub identified **Burn of Aultmore (ID: 23176)** which runs through the River Deveron catchment of the Scotland river basin district and through the Development redline boundary. The Burn of Aultmore is considered to be of Good overall status and ecological status since 2019, though barrier to fish migration was deemed High since 2012. The main stem is approximately 10.1 km in length. The waterbody has been designated as heavily modified on account of physical alterations that cannot be addressed without a significant impact on the drainage of agricultural land.

Similarly, the **Burn of Paithnick (ID: 23175)** which runs southeast of the proposed development, and out with the redline boundary is considered to be of Good overall status and ecological status since 2019, though barrier to fish migration was deemed High since 2012 and the watercourse has been designated as a heavily modified. The main stem is approximately 7.6 km in length.

The final watercourse to be classified as Good overall status is the **Burn of Tynet (ID: 23047)** which runs through the Banff Coastal catchment of the Scotland river basin district and is 11.0 km in length. This Burn has been classified as having Moderate ecological status, though fish status remains High.

Both **Deskford Burn (ID: 23050)** and **Crooksmill Burn / Haughs Burn (ID: 23180)** have been considered to be of Moderate overall status and ecological status. The Deskford Burn runs through the Banff Coastal catchment of the Scotland river basin district with a main stem length of approximately 14.8 kilometres. Fish ecology remains moderate with this burn and has had a moderate overall status since 2013. The Crooksmill Burn / Haughs Burn runs through the River Deveron catchment of the Scotland river basin district. The main stem of Crooksmill Burn / Haughs Burn is approximately 13.3 km in length, though ecology status along the burn remains bad (status since 2012). However, the Crooksmill Burn / Haughs Burn has a moderate overall status.

The ecological status is **Buckie Burn (ID: 23048)**, which runs through the Banff Coastal catchment of the Scotland river basin district, is Poor. The main stem is approximately 8.6 km in length. Fish ecology depleted from High to Moderate in 2013 and has remained of Moderate status since.

3.1.2 Barriers to Migration

No barriers to migration were identified using Scotland's Environment Web[17] within any tributary within the redline boundary and 2 km outside of the redline boundary line.

3.1.3 Protected Areas

Currently there are no conservation designations, with relevance to fish, within a 2 km buffer of the proposed development redline boundary[19].

3.2 Fish Habitat Assessment

3.2.1 Fish Habitat Quality

Results of the fish habitat quality (FHQ) surveys conducted in 2023 are presented in **Table 8** and **Figure 8.5.3**.

Fish habitat quality ranged from: Good (AM9); Low (AM1.2); and Poor (AM1.1, AM2, AM3, AM4, AM5, AM6, AM7, AM8). No habitat identified at the time were deemed to be High or Moderate. No survey locations within the redline boundary of the proposed development support suitable habitat for salmonids or lamprey. Survey location AM9 was the only site outside of the redline boundary.

3.2.2 Salmonid Spawning Potential

Results of the salmonid spawning potential (SSP) surveys are presented in **Table 8.**

[26] Scottish Environment Protection Agency. (2022). *SEPA Water Classification Hub.* [Online] Available at: https://www.sepa.org.uk/data-visualisation/water-classification-hub/ [Accessed 29/08/2023].

No survey locations within the redline boundary of the proposed Development support suitable spawning habitat for salmonids or lamprey. Salmonid spawning potential ranged from: Optimal (AM9); and Not Suitable AM1.1, AM1.2, AM2, AM3, AM4, AM5, AM6, AM7, AM8). No habitat was identified at the time were deemed to be Sub-Optimal spawning habitat. Survey location AM9 was the only site outside of the redline boundary. No redds were identified.

Please note 250 m both upstream and downstream were investigated at each survey location for additional target notes. There were no additional points of interest noted.

Table 8. Fish habitat assessment results.

Survey Location	Fish Habitat Quality	Reach Description and Limiting Factors	Salmonid Spawning Suitability	Reach Description and Limiting Factors
AM1.1	**Poor**	Wet width ranged from 0.65 – 0.2 m. Flow type was dominated by SM (85%) with RI (10%) and RU (5%) also present throughout. Watercourse depth was 100% <10cm. Substrate was varied with SI (75%), GR (15%) and PE (10%) present, providing very poor instream cover. The flow types and substrates made this watercourse poor for salmonids at a range of life stages. Land use is predominately moorland/ heath and conifer plantation. Limiting factors within this section are low water levels during summer months and steep gradients downstream creating a potential barrier for migrating fish.	**Not Suitable**	Due to low flow, substrate composition narrow passage and lack of flow, this location was deemed unsuitable.
AM1.2	**Poor**	Wet width ranged from 0.47 – 1.54 m. Flow type was dominated by faster moving RI (50%)/ RU (35%) sequences with SM (5%), DG (10%) and SG (5%) also present in small areas. Watercourse depth ranged from <10 - 40 cm but with water predominately being 11 -20 cm deep (45%). Substrate was varied with SI (50%) GR (10%), PE (10%) CO (20%), and BO (10%) present throughout. Fish cover was moderate throughout with 50-60 % undercutting, The flow types and substrates made this watercourse unsuitable for salmonids at a range of life stages. Land use is predominately moorland/ heath and conifer plantation. Limiting factors within this section are low water levels during summer months and steep gradients downstream creating a potential barrier for migrating fish.	**Not suitable**	Due to low flow, substrate composition narrow passage and lack of flow, this location was deemed unsuitable.
AM2	**Low**	Upon assessment, the watercourse was completely dry.	**Not suitable**	No water was present deeming this site unsuitable.

Survey Location	Fish Habitat Quality	Reach Description and Limiting Factors	Salmonid Spawning Suitability	Reach Description and Limiting Factors
AM3	**Low**	Upon assessment, the watercourse was completely dry.	**Not suitable**	No water was present deeming this site unsuitable.
AM4	**Low**	Upon assessment, water could be heard in small amounts running underground, but no defined watercourse was seen.	**Not suitable**	Lack of water and no defined watercourse allow for this location to be classified as unsuitable.
AM5	**Low**	Upon assessment, there was no defined watercourse (bog) with thick, soft rush.	**Not suitable**	Lack of water and no defined watercourse allow for this location to be classified as unsuitable.
AM6	**Low**	Upon assessment, there was no defined watercourse (bog) with thick, soft rush.	**Not suitable**	Lack of water and no defined watercourse allow for this location to be classified as unsuitable.
AM7	**Low**	Upon assessment, water could be heard in small amounts running underground, but no defined watercourse was seen.	**Not suitable**	Lack of water and no defined watercourse allow for this location to be classified as unsuitable.
AM8	**Low**	Upon assessment, water could be heard in small amounts running underground, but no defined watercourse was seen.	**Not suitable**	Lack of water and no defined watercourse allow for this location to be classified as unsuitable.
AM9	**Good**	Wet width ranged from 3 – 4 m. Flow type was dominated by DG (50%) with sections of SG (10%) RI (15%) and RU (25%) also present throughout. Watercourse depth ranged from <10 – 50cm but was predominately 41 – 50cm (40%). Substrate was varied with SA (5%), GR (20%), (PE 50%) and CO (25%) present, providing moderate to good instream cover. The flow types and substrates made this watercourse good for salmonids at a range of life stages. Land use is predominately broadleaf and road. Limiting factors within this section are low water levels during summer months and potential pollution impact from the road.	**Optimal**	Optimal substrate and flow types were present, where large patches of cobbles, pebbles and gravels were present and flow velocity was high. Classifying this location as optimal spawning habitat for both salmon and trout.

No survey locations within the red line boundary were deemed to have suitable salmonid or lamprey habitat. Sites suggested by Mhor Environmental Ltd (2022)[20] and survey location AM9 required further investigation.

3.3 Fully Quantitative Electrofishing Assessment

3.3.1 Fish Fauna

Table 9 presents fish fauna data for August 2023, minimum density classification per the SFCC classifications scheme[23], and population estimate using Zippin[24] where possible. Please refer to **Appendix A, Table A-1** for raw data collected.

Table 9. Fish fauna results, classification and population estimates

Site Code	*Grid Reference	Fish Densities & Species	Length (mm)	Classification (*based on 1st pass*[24])	Population Estimate
AM01	NJ401558	Trout fry: 0 Trout Parr: 1	Trout fry: n/a Trout Parr: 113	Trout fry: n/a Trout Parr: Very Poor	Trout fry: 0 Trout Parr: 1.0
AM02	NJ399596	Trout fry: 9 Trout Parr: 7	Trout fry: 61- 72 Trout Parr: 105-136	Trout fry: Moderate Trout Parr: Moderate	Trout fry: 9.01 Trout Parr: 7.02
AM06	NJ438601	Trout fry: 0 Trout Parr: 2	Trout fry: n/a Trout Parr: 110 - 127	Trout fry: n/a Trout Parr: Poor	Trout fry: 0 Trout Parr: 2.0
AM07	NJ440620	Trout fry: 24 Trout Parr: 37	Trout fry: 47 - 69 Trout Parr: 80 - 157	Trout fry: Excellent Trout Parr: Excellent	Trout fry: 30.33 Trout Parr: 39.05
AM08	NJ444611	Trout fry: 0 Trout Parr: 6	Trout fry: n/a Trout Parr: 99 - 166	Trout fry: n/a Trout Parr: Moderate	Trout fry: 0 Trout Parr: 6.15
AM12	NJ496593	Trout fry: 10 Trout Parr: 2	Trout fry: 54 - 68 Trout Parr: 94 - 126	Trout fry: Good Trout Parr: Poor	Trout fry: 10.06 Trout Parr: 2.0
AM16	NJ456562	Trout fry: 16 Trout Parr: 17	Trout fry: 58 - 74 Trout Parr: 111 - 187	Trout fry: Excellent Trout Parr: Excellent	Trout fry: 16.33 Trout Parr: 18.85
AM21	NJ440555	Trout fry: 14 Trout Parr: 9	Trout fry: 58 - 67 Trout Parr: 110 - 194	Trout fry: Excellent Trout Parr: Good	Trout fry: 14.43 Trout Parr: 9.54
AM9	NJ455557	Trout fry: 18 Trout Parr: 12	Trout fry: 44 - 73 Trout Parr: 88 - 199	Trout fry: Excellent Trout Parr: Good	Trout fry: 20.32 Trout Parr: 12.59
CS	NJ401558	Trout fry: 10 Trout Parr: 8	Trout fry: 49 - 63 Trout Parr: 94 - 150	Trout fry: Good Trout Parr: Good	Trout fry: 10.43 Trout Parr: 8.01

Site 1: AM01 (Deveron Catchment):

Trout parr were recorded in a very poor density and no trout fry were recorded. No salmon parr or fry were recorded. No other species were recorded.

Site 2: AM02 (Deveron Catchment):

Juvenile trout were recorded in a moderate density. No salmon parr or fry were recorded. No other species were recorded.

Site 3: AM06 (Deveron Catchment):

Trout fry were absent but trout parr were recorded in poor density. No salmon parr or fry were recorded. No non-salmonid fish species were recorded.

Site 4: AM07 (Deveron Catchment):

Both trout fry and parr were recorded in an excellent density. No non-salmonid fish species were recorded.

Site 5: AM08 (Deveron Catchment):

Trout parr were recorded in a moderate density, however, trout fry was absent from this site. No salmon parr or fry were recorded. No non-salmonid fish species were recorded.

Site 6: AM12 (Deveron Catchment):

Trout fry were recorded in a good density together with a poor density of trout parr. No salmon parr or fry were recorded. No non-salmonid fish species were recorded.

Site 7: AM16 (Deveron Catchment):

Both trout fry and parr were recorded in an excellent density. No salmon parr or fry were recorded. one eel (212 mm) and a single minnow were recorded. Additionally, eggs were found, though due to the colouration they were deemed to be at the early stages of spawning. No redds were identified.

Site 8: AM21 (Deveron Catchment):

Juvenile salmon were absent from this site. Trout fry were recorded in an excellent density together with a good density of trout parr. No non-salmonid fish species were recorded.

Site 9: AM9 (Deveron Catchment):

Juvenile salmon were absent from this site. Trout fry were recorded in an excellent density together with a good density of trout parr. No non-salmonid fish species were recorded.

Site 10: CS (Deveron Catchment):

Trout fry were recorded in a good density together with a poor density of trout parr. No salmon parr or fry were recorded. No non-salmonid fish species were recorded.

3.3.2 Fish Habitat Assessment (post-electrofishing)

Table 10 provides summary data of FHQ and SSP ratings, post electrofishing assessments conducted in August 2023, which is also shown on **Figure 8.5.4**.

Please note sites AM04, AM05, AM09, AM11, AM13, AM14 reported by Mhor Environmental Ltd (2022)[20] were re-evaluated during the August 2023 surveys and were deemed unsuitable for electrofishing surveys to be conducted due to access issues, lack of water or overgrown vegetation caused by farm run off and filamentous algae growth.

Table 10. Post electrofishing fish habitat Assessment results

Survey Location	Fish Habitat Quality	Reach Description and Limiting Factors	Salmonid Spawning Suitability	Reach Description and Limiting Factors
AM01	**Poor**	Wet width ranged from 1 – 1.4 m. Flow type was dominated by faster moving RU (70%) with RI (20%) and DP (10%) also present throughout. Watercourse depth ranged from <10 to 40cm and was predominately 11 – 20cm (60%). Substrate was varied with SI (10%), PE (60%) and CO (30%) present, providing poor instream cover. The flow types and substrates made this watercourse moderate for fry, though limiting factors such as the impassable raised culvert, presence of silt and limited instream cover for parr allow for site classification to be deemed poor. Land use is predominately road and conifer plantation. Limiting factors within this section are low water levels during summer months and steep gradients and raised culvert upstream creating a potential barrier for migrating fish.	**Not Suitable**	No continuous patches of gravels and pebbles were present. Silt present will be an issue for oxygen supply to the redds.

Survey Location	Fish Habitat Quality	Reach Description and Limiting Factors	Salmonid Spawning Suitability	Reach Description and Limiting Factors
AM02	**Moderate**	Wet width ranged from 1.9 – 2.4 m. Flow type was equally dominated by RI (30%), RU (30%) and SG (40%) sequences. Watercourse depth ranged from <10 - 30 cm but with water predominately being 21 -30 cm deep (40%). Substrate was varied with GR (40%), PE (10%), CO (40%), and small patches of SI (5%) and SA (5%) present throughout. Instream fish cover was moderate throughout, though banks were predominantly bare (95%) providing no fish cover for fry and parr, giving the classification of moderate habitat quality. Land use is predominately road and broadleaf. Limiting factors within this section are low water levels during summer months and continuous erosion of the bank faces.	**Sub-Optimal**	Substrate within the survey location would deem this site as suboptimal due to continuous gravel patches though there is lack of coarser substrate such as pebbles making this a sub-optimal spawning potential. Flow rates in summer months could be a limiting factor to facilitate egg development.
AM06	**Poor**	Wet width ranged from 0.6 – 1.3 m. Flow type was equally dominated by RI (70%) and RU (30%). Watercourse depth was 100% <10 cm. Substrate was varied with GR (30%) and CO (30%), though predominately SI (40%). Instream fish cover was poor throughout, and fish cover was only generated from draping grasses along the bank face. Substrate present is not ideal for salmonids across any life stage due to high SI. Land use is predominately road and arable. Limiting factors within this section are low water levels during summer months, potential agricultural runoff and the upstream in river barrier limiting migration.	**Not suitable**	Due to the high silt present the site is deemed not suitable due to the potential for silt to suffocate eggs and reduce potential development.
AM07	**Good**	Wet width ranged from 2.4 – 6 m. Flow type was dominated by RU (40%) with sections of SG (30%) and RI (20%) present throughout. Watercourse depth ranged from <10 – 50cm but was predominately 21 – 30cm (40%). Substrate was varied with GR (20%), (PE 30%), CO (40%) and BO (10%) providing good instream cover for a range of salmonid life stages. Only the left bank provided substantial fish cover (50%) at low water levels. Land use is predominately broadleaf and woodland. Limiting factors within this section are low water levels during summer months and potential pollution impact from the road.	**Optimal**	Particular sections within the survey location provided optimal spawning habitat where riffle and run were dominant across gravel and pebble substrate. Limiting factors could be lowering water levels during summer months.
AM08	**Good**	Wet width ranged from 1.2 – 2.2 m. Flow type was equally dominated by RU (40%) and RI (40%) with sections of SG (20%). Watercourse depth ranged from <10 – 30cm but was predominately 11 – 21cm (60%). Substrate was varied with GR (35%), (PE 35%), CO (20%) and patches of SI (5%) and SA (5%) providing moderate to good instream cover for a range of salmonid life stages. Draping along both banks provide good cover for fry. Land use is predominately broadleaf and woodland. Limiting	**Sub-Optimal**	Particular sections within the survey location provided optimal spawning habitat where riffle and run were dominant across gravel and pebble substrate. Though due to the presence of silt and low water levels this is sub-optimal due to the potential impact of egg development. Limiting factors could be lowering

Survey Location	Fish Habitat Quality	Reach Description and Limiting Factors	Salmonid Spawning Suitability	Reach Description and Limiting Factors
		factors within this section are low water levels during summer months.		water levels during summer months.
AM12	**Moderate**	Wet width ranged from 2.4 – 3.2 m. Flow type was dominated by RU (55%) with sections of RI (30%), SP (10%) and SG (5%). Watercourse depth ranged from <10 - 30 cm but with water predominately being 21 -30 cm deep (40%). Substrate was varied with GR (35%), PE (25%), CO (35%), and small patches of BO (5%) present throughout. Instream fish cover was good, though lack of bankside cover for fry classify this location as moderate overall. Land use is predominately road and broadleaf. Limiting factors within this section are low water levels during summer months .	**Optimal**	Particular sections within the survey location provided optimal spawning habitat where riffle and run were dominant across gravel and pebble substrate. Limiting factors could be lowering water levels during summer months.
AM16	**Good**	Wet width ranged from 2.6 – 4.3 m. Flow type was dominated by RU (60%) and DG (30%) with sections of RI (10%). Watercourse depth ranged from <10 – >50cm. Substrate was varied with SA (10%), GR (5%), (PE 10%), CO (60%), BO (10%) and patches of BE (5%), providing good instream cover for a range of salmonid life stages. Rocks along the bank faces provided good coverage for fry and resident trout. Land use is predominately broadleaf and road. Limiting factors within this section are low water levels during summer months and agricultural runoff causes filamentous algae growth.	**Not Suitable**	Due to the lack of continuous gravel and pebble this area is deemed not suitable. Limiting factors could also be reduced water flow in summer months and increase filamentous algae within the river which could reduce the oxygen cycling though the water system.
AM21	**Moderate**	Wet width ranged from 0.5 – 2.1 m. Flow type was dominated by RU (60%) with sections of RI (25%) and SG (15%). Watercourse depth ranged from <10 - 50 cm but with water predominately being 21 -30 cm deep (50%). Substrate was varied with HO (5%), SI (10%), SA (5%), GR (5%), PE (15%), BO (10%) but the site was dominated by CO (60%), provide moderate instream cover. Bankside undercutting on both left and right banks provide good coverage for fry. Land use is predominately road and arable. Limiting factors within this section are low water levels during summer months which can impact migration downstream due to culvert which is deemed passable under certain flow conditions.	**Not suitable**	Due to the lack of continuous gravel and pebble this area is deemed not suitable. Limiting factors could also be reduced water flow in summer months and increase filamentous algae within the river which could reduce the oxygen cycling though the water system.
AM9	**Good**	Wet width ranged from 3.2 – 4.1m. Flow type was dominated by DG (50%) with sections of RI (35%) and RU (15%) also present throughout. Watercourse depth ranged from <10 – 50cm but was predominately 41 – 50cm (40%). Substrate was varied with SA (5%), GR (20%), (PE 50%) and CO (25%) present, providing moderate to good instream cover. The flow types and substrates made this watercourse good for	**Optimal**	Optimal substrate and flow types were present, where large patches of cobbles, pebbles and gravels were present and flow velocity was high. Classifying this location as optimal spawning habitat for trout.

Survey Location	Fish Habitat Quality	Reach Description and Limiting Factors	Salmonid Spawning Suitability	Reach Description and Limiting Factors
		salmonids at a range of life stages. Land use is predominately broadleaf and road. Limiting factors within this section are low water levels during summer months and potential pollution impact from the road.		
CS	**Good**	Wet width ranged from 2.1 – 2.6 m. Flow type was dominated by RU (60%) with sections of SG (30%) and limited RI (10%). Watercourse depth ranged from <10 – 30cm but was predominately 11 – 20cm (50%). Substrate was varied with CO (40%), GR (15%), (PE 40%) and BO (5%) present, providing moderate to good instream cover. The flow types and substrates made this watercourse good for salmonids at a range of life stages. Land use is predominately broadleaf and road. Limiting factors within this section are low water levels during summer months and potential pollution impact from the road.	**Sub-Optimal**	Small sections within the survey location provided optimal spawning habitat where riffle and run were dominant across patches gravel and pebble substrate. Though due to the limited continuous gravel/ pebble substrate this is survey location is classified as sub-optimal spawning habitat. Limiting factors could be lowering water levels during summer months.

3.3.3 Fish Habitat Quality

Results of the FHQ surveys conducted post fully quantitative electrofishing assessments in 2023 are presented in **Table 10**.

FHQ ranged from: Good (AM07, AM08, AM16, AM9, CS); Moderate (AM02, AM12, AM21) and Poor (AM01, AM06). No habitat identified at the time were deemed to be High or Low.

3.3.4 Salmonid Spawning Potential

Results of the SSP surveys conducted post fully quantitative electrofishing assessments in 2023 are presented in **Table 10**.

SSP ranged from: Optimal (AM07, AM12, AM9); Sub-Optimal (AM02, AM08, CS) and Not Suitable (AM01, AM06, AM16, AM21). No redds were identified.

Please note 250 m both upstream and downstream were investigated at each survey location for additional target notes but there was no extra information required to inform the report.

3.4 Freshwater Pearl Mussel Results

No survey locations within the redline boundary were suitable to support FWPM. Survey locations AM02, AM07, AM08, AM12, AM16, AM21 and AM9 were investigated for FWPM presence. No FWPM were identified during the 2023 survey.

4.0 Discussion

4.1 Fish Fauna and Habitat Quality Survey Summary

4.1.1 On Site

No survey locations within the redline boundary of the proposed development support SSP habitat for salmonids or lamprey and FHQ was deemed significantly low. Surveys conducted within the redline boundary were limited due to the dense forestry, steep gradients and limited/ no water present at the time of surveying. It is likely due to the nature of the site being predominately conifer plantation,

water transpiration from the soil is occurring at a greater rate therefore, the Sites watercourses are limited/ absent and unlikely to change seasonally or under high rainfall pressures. Due to the limited water and lack of concluding evidence regarding the substrates and flow types which would promote moderate+ FHQ and sub-optimal+ SSP, electrofishing surveys were conducted downstream of intended survey locations investigated in August 2023, beyond the redline boundary.

4.1.2 Connected to Site

Using Mhor Environmental Ltd (2022) referenced survey locations, electrofishing was conducted across ten suitable locations out-side of the redline boundary, downstream of all investigated survey locations from the August 2023 survey.

Both Atlantic salmon fry (0+) and parr (1++) were not recorded at any of the surveyed locations, though that is not to say salmon are not present across the main tributaries surrounding the proposed Development. Trout parr (1++) were present across all electrofishing surveyed locations, though fry (0+) were absent from several locations (AM06, AM08, AM01) where undercutting of the banks was found to be limited and wet width was particularly narrow. Eel habitat was found at AM16, where rocks along the left bank were found to provide substantial cover for both eel and trout parr (1++). No other site was found to have great rock formation which would provide substantial cover for eels.

Based on the substrate and flow regimes found during the 2023 electrofishing surveys, three sites were deemed to be of optimal SSP (AM07, AM12, AM9), though, eggs were found during the netting of trout at AM16 (deemed not suitable) which were deemed to be of the early spawning period due to the colouration of the eggs, though the species of the eggs were not identifiable. Additionally, across several survey locations, trout parr (1++) were found to have lateral spawning pigmentation. No redds were identified during the 2023 surveys.

Furthermore, no substantial lamprey habitat was found across any of the survey locations, though sand and shallow gravel bed were present in sections at AM02, AM08, AM16, AM21, AM9, though no lamprey were recorded at the time of the 2023 surveys.

Survey locations outside of the redline boundary consisted of broadleaf which has the potential to slow down water transpiration from the soil and based on substrates and flows presents, survey locations AM2, AM07, AM08, AM12, AM16, AM21, AM9 were all likely to support moderate+ FHQ and sub-optimal+ SSP across all seasons and not be largely impacted by dry summer months.

5.0 Conclusion and Recommendations

Instream barriers faced by salmonids and lamprey were not identified with a review of SEW[17]. The physical access limitations of dense forestry, gradient scale and limited/ no water did limit surveys across various locations within the redline boundary. This acted to surmount surveys being conducted downstream of intended survey locations, beyond the redline boundary. The results of off-site habitat assessment and electro-fishing surveys provide a baseline to indicate the potential impact of the Development on these freshwater systems within the Deveron Catchment and to conclude impacts would be greater during higher rainfall periods when the watercourses on Site would be flowing into the catchment.

Results from the off-site fish surveys in August 2023 indicate that salmon were absent across all surveyed sites. Previous electrofishing data along the Burn of Aultmore has highlighted both fry (0+) and parr (1++) classifications to be of either very low- moderate (near Keith) or absent when recorded in 2021, thus it is unsurprising no salmon were recorded in August 2023 electrofishing surveys.

In addition, the absence of salmon across the surveyed locations in August 2023 could be attributed to the various well documented factors[27] including (but not limited to):

- Biological characteristics (e.g., size) of salmon smolts;

[27] http://www.nasco.int/pdf/reports_other/Salmon_at_sea.pdf (Accessed August 2023)

- Physical factors in fresh water (water flow and temperature);
- Freshwater contaminants;
- Predation; and
- Salmon aquaculture.

Trout populations in the off-site survey locations ranged from very poor to Excellent and were present at all of the surveyed sites in August 2023, though trout fry (0+) were absent from AM01, AM06 and AM08. However, historical data regarding trout within the catchment is limited.

The possible impacts that any land-based wind farm development and its associated infrastructure could have on surrounding fish populations are well documented. The potential for fish species and their habitats to be affected by the proposed development mainly occurs during the construction and decommissioning phases of the development.

During the construction phase potential impacts include siltation from ground disturbance, accelerated or exacerbated erosion, hydrological changes, pollution, and the blocking or hindering of the upstream/downstream migration of fish. During the operational phase, concerns include the effects of poor road drainage, accelerated levels of erosion, fish access, and the maintenance of silt traps and road crossings. Potential risks during the decommissioning phase are broadly similar to those in the construction phase. These potential effects could all impact on the surrounding fish populations by causing direct mortality of juveniles and adults, direct habitat loss (damage of instream and riparian habitats), direct and indirect habitat severance (emanating from fish avoidance behaviour and blocking of migration routes to spawning beds resulting in unused habitat), direct and indirect habitat degradation (for example, resulting from pollution impacts) and indirect effects via changes in food availability (from the above pressures).

Based on the results of this report it is noted/recommended that:

- The proposed development has been designed to minimise the number of watercourse crossing points and that other site infrastructure is sufficiently distant (>50m) from watercourses.
- Pollution prevention measures should be employed during the construction process and a suitable water quality programme established to ensure that the construction phase does not impact on the fish habitats.
- Construction and post-construction fish fauna monitoring programme is carried out utilising the same ten (control site included) fish fauna sites as part of an ongoing assessment of potential impacts which may occur due to the proposed development. The suggested monitoring schedules are as follows: Fish fauna surveys annually during construction (summer/early autumn) and post-construction Year 1 (summer/early autumn) and Year 2 (summer/early autumn).
- Macroinvertebrate sampling is recommended to be conducted at all ten survey locations. The purpose of this macroinvertebrate data is to provide a longer-term water quality monitoring that can be compared and monitored over the duration of the project and to demonstrate biodiversity recovery post construction. Baseline ecological condition for watercourses will be used as an indicator of overall watercourse health over time.
- A pre-construction, construction and post-construction water quality monitoring programme is carried out as part of an ongoing assessment of potential impacts, which may occur due to the proposed Development. This will help to protect the aquatic assemblage throughout the Development and in the long term, highlighting where impacts may be occurring, and mitigation can be designed to address accordingly. It will also provide evidence of the scale of impact on the surrounding watercourses from any pollution incidents which may or may not be directly related to the Development.
- A suitably qualified / experienced Aquatic Ecological Clerk of Works (ECoW) should be on site, periodically, for the construction phase of the Development.

- Reconstruction of the river corridors are advised; options include blocking of a proportion of man-made land/forestry drainage channels within the forestry rides (not the watercourses) in order to encourage water retention on site for longer periods, water reaching the watercourses identified on the Figures and maintain flow of the watercourses for longer-periods. Selection of locations of conifer plantation to replace/ allow natural managed regeneration with broadleaved or alternative native floral species along the corridor route has the potential to reduce and slow down water transpiration from the soil.

Figures

Aultmore Forest Wind Farm

Technical Appendix 8.5: Fish Habitat Assessment and Fully Quantitative Electrofishing Surveys

Vattenfall Wind Power Ltd

SLR Project No.: 404.03640.00016

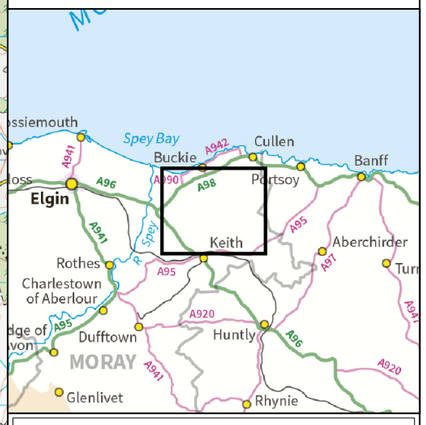
16 November 2023

340000 345000 350000

865000 860000 855000

LEGEND

Site Boundary



VATTENFALL

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AULTMORE WIND FARM REDESIGN

HABITAT SURVEY REPORT

SITE LOCATION

Figure 8.5.1

Scale 1:50,000 @ A3

Date AUGUST 2023

0 1 2 3 4 Kilometres

03640.00016.0032.1 Site Location

340000 342000 344000 346000 348000

862000 860000 858000

LEGEND

- Site Boundary
- Turbine Location
- Permanent Hardstanding
- Temporary Hardstanding
- Upgraded Existing Track
- New Track
- Substation Location
- Temporary Construction Compound Location
- Borrow Pit Search Area

N

0 0.5 1 Kilometres

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AULTMORE WIND FARM REDESIGN

TECHNICAL APPENDIX 8.5

FISHERY ASSESSMENT

SITE LAYOUT

FIGURE 8.5.2

Scale 1:30,000 @ A3

Date SEPTEMBER 2023

03640.00016.0141.0 Site Layout

339000 342000 345000 348000 351000

862000 859000 856000

LEGEND

- Site Boundary
- Turbine Location
- Permanent Hardstanding
- Temporary Hardstanding
- Substation Location
- Temporary Construction Compound Location
- Borrow Pit Search Area
- Upgraded Existing Track
- New Track
- Watercourse
- Fish Additional Survey Location

Fish Habitat Quality

- Good
- Moderate
- Poor
- Low

N

Kilometers 0 1 2

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TA 8.5 - FISHERY REPORT

FISH HABITAT SUITABILITY

FIGURE 8.5.3

Scale 1:40,000 @ A3

Date NOVEMBER 2023

03640.00016.0199.0 Fish Habitat Suitability

339000 342000 345000 348000 351000

862000 859000 856000

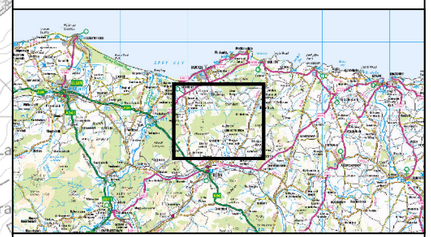
N

LEGEND

- Site Boundary
- Turbine Location
- Permanent Hardstanding
- Temporary Hardstanding
- Substation Location
- Temporary Construction Compound Location
- Borrow Pit Search Area
- Upgraded Existing Track
- New Track
- Watercourse
- Fish Additional Survey Location

Salmonoid Spawning Suitability

- Optimal
- Sub-optimal
- Not Suitable



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AULTMORE WIND FARM REDESIGN

TA 8.5 - FISHERY REPORT

SALMONOID SPAWNING SUITABILITY

FIGURE 8.5.4

Scale 1:40,000 @ A3

Date NOVEMBER 2023

0 1 2 Kilometers

03640.00016.0200.0 Salmonid Spawning Suitability

Appendix A Raw Data

Table A1: Electrofishing results, Zippin estimates site dimensions, fish density and minimum estimate.

Survey Location	Age Class/ Species	2023 Actual Catch	Lower 95% confidence interval	Upper 95% confidence interval	Site Length (m)	Avg. width (m)	Area Covered m² (Min Est.)	Minimum Est.
AM01	Trout Fry (0+) Trout Parr (1++)	0 1	0 1.00	0 1.00	60	1.3	78	- 0.1
AM02	Trout Fry (0+) Trout Parr (1++)	9 7	9.00 7.00	9.21 7.27	60	2.1	126	9.01 7.02
AM06	Trout Fry (0+) Trout Parr (1++)	0 2	0 2.00	0 2.00	100	1	100	- 2.0
AM07	Trout Fry (0+) Trout Parr (1++)	24 37	24.00 37.00	44.05 43.35	25	4	100	30.33 39.05
AM08	Trout Fry (0+) Trout Parr (1++)	0 6	0 6.00	0 7.14	68	1.7	115.6	- 6.15
AM12	Trout Fry (0+) Trout Parr (1++)	10 2	10.00 2.00	10.58 2.00	35	3.7	129.5	10.06 2.0
AM16	Trout Fry (0+) Trout Parr (1++)	16 17	16.00 17.00	17.76 23.83	25	4	100	16.33 18.85
AM21	Trout Fry (0+) Trout Parr (1++)	14 9	14.00 9.00	16.17 11.81	55	2.3	126.5	14.43 9.54
AM9	Trout Fry (0+) Trout Parr (1++)	18 12	18.00 12.00	26.27 14.84	35	3.5	122.5	20.32 12.59
CS	Trout Fry (0+) Trout Parr (1++)	10 8	10.00 8.00	12.30 8.24	47	2.3	108.1	10.43 8.01

Appendix B Site Photos

Plate 1: AM01: Dense Vegetation and narrow water course.

Plate 2. AM01: Raised culvert upstream.

Plate 3. AM02: Dense foliage upstream.

Plate 4. AM02:

Plate 5 AM06

Plate 6: AM07: Downstream

Plate 7: AM08: Upsteam

Plate 8: AM12

Plate 9: AM16: Downstream

Plate 10: AM21

Plate 11: AM9

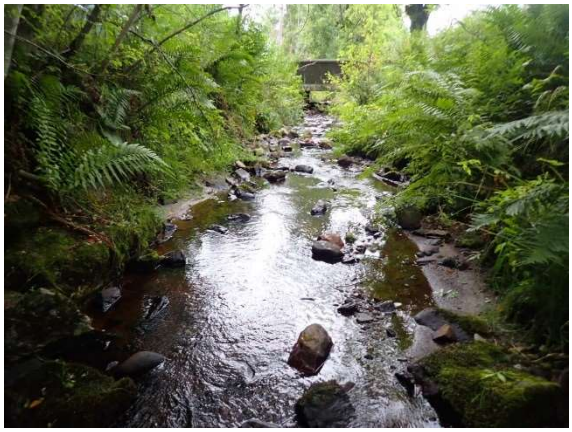
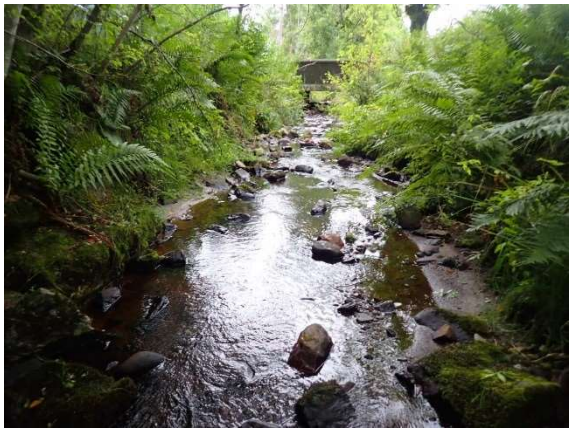


Plate 12. CS:Control Site Downstream



Appendix C Fishery Habitat Assessment

AULTMORE WIND FARM

FISH HABITAT SURVEY

JULY 2022

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QA	Name	Date	Signature
Author	Leigh Kelly, Mhor Environmental Ltd	28.10.2021 02.08.2022	By email
Reviewer	Shauun Plenty, Principal Aquatic Ecologist & Nicola Tyrrell, Principal Ecologist (SLR)	08.12.21 & 21.12.21 02.08.2022	By email

Revision	Description	Date of Issue
1	First Issue for Client Review	21.12.2021
2	Updated for proposed access track	02.08.2022
3	Final Issue	

TABLE OF CONTENTS

1 INTRODUCTION

This report presents the methods and results of Fish Habitat Surveys (FHS) undertaken to obtain the baseline ecological information required to inform the Environmental Impact Assessment (EIA) of the proposed Aultmore Wind Farm, hereafter referred to as the 'Development'.

Mhor Environmental Ltd was commissioned by SLR Consulting Limited (SLR) to undertake a FHS in September 2021 on their behalf, for Vattenfall Wind Power Ltd. (hereafter referred to as 'the Developer').

The following terminology is used throughout this technical report:

- The Development: the whole physical process involved in the development of land at Aultmore Wind Farm, including wind farm construction, operation and decommissioning (not a piece of land or an area); and
- Development Site Boundary (hereafter referred to as 'the Site'): the proposed area of land, provided by the Developer, within which all development works for the wind farm will take place (shown as the red-line boundary in Appendix A, Figure 1). Fish Habitat Surveys were undertaken within and in close proximity to the Development Site Boundary.

1.1 Site Description

The Site is situated approximately 7.5km south of Buckie in Banffshire adjacent to the Moray Firth coast of Scotland. Five main watercourses – the Burn of Aultmore, Milk Burn, Burn of Fernking, Burn of Thievesbush and the Burn of Tynet (Corsekell Burn) – flow through the site. Various other watercourses are present close to the Site which have the potential to be impacted by the proposed Development. Four of these watercourses are within the River Deveron catchment; the River Deveron has been renowned as an Atlantic salmon (*Salmo Salar*) and sea/brown trout (*Salmo trutta*) river for many years[1].

The landscape in the wider area around the Site is dominated by forestry plantation, moorland and farmland.

1.2 River Basin Management Plan

The European Union's Water Framework Directive (WFD) requires all inland and coastal waters within defined river basin districts to reach at least 'good' ecological status/potential by a set deadline[2]. The Scottish Government committed to continued alignment with European Union (EU) standards and laws following EU exit[3]. SEPA is the lead authority to ensure compliance with WFD requirements. With input from responsible authorities and other stakeholders, SEPA has coordinated the production of the Scotland River Basin Management Plan (RBMP) to ensure the protection, improvement and sustainable use of the water environment for future generations. The overall aim is for 98% of Scotland's waters to be in a good condition by 2027, to be progressively implemented through three RBMP cycles (2009-2015; 2015-2021 and 2021-2027)[4].

[1] https://deveron.org/ (Accessed online – 23/11/2021)

[2] EU Water Framework Directive (2000) - Directive 2000/60/EC (Accessed online – 21/12/2021)

[3] UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021 (legislation.gov.uk)

[4] https://www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf (Accessed online – 23/11/2021)

The RBMP has identified the following key pressures on the water environment in Scotland:

- Morphological alterations (e.g., modifications to beds, banks and shores as the result of historical engineering and urban development)
- Diffuse source pollution (e.g., agriculture, urban development)
- Point source pollution (e.g., the discharge of sewage, manufacturing and quarrying)
- Abstraction and flow regulation (e.g., alterations to water flows and levels as the result of electricity generation and public water supplies)
- Invasive non-native species

RBMPs set out how organisations, stakeholders and communities will work together to improve the water environment.

1.3 Objectives

The aim of the FHS were to undertake a detailed assessment of watercourse bankside and habitat quality along the main watercourse and various tributaries within and in close proximity to the Site, to obtain detailed information regarding the suitability of watercourses for fish species within the Development Site Boundary. Detailed information obtained from the fish habitat surveys will provide an accurate and robust baseline on which to base the Environmental Impact Assessment (EIA).

The purpose of the FHS were to:

- Provide a baseline fisheries habitat report to assess Fish Utilisation Potential (FUP) and Fish Habitat Quality (FHQ) of watercourses within the Site, including an assessment and searches for lamprey and freshwater pearl mussel (*Margaritifera margaritifera)* habitat (assessment criteria is based on various characteristics recorded within surrounding habitats detailed in section 3.3);
- Determine the requirement for further surveys (including targeted electrofishing surveys); and
- Use the baseline information for future comparison studies, potentially required during the Development construction and post-construction phases.

2 HABITAT REQUIREMENTS

Habitat requirements of species covered within this report are presented below.

2.1 Salmonids

The physical habitat requirements of juvenile salmonids (Atlantic salmon and brown trout) have been subject to a considerable amount of detailed study[5,6,7,8]. Atlantic salmon and brown trout spawn in late autumn and early winter, depositing their eggs in redds which they excavate in gravel and pebble substrates. Spawning depth can range from 5 cm to 90

[5] Crisp, D.T. 1993. The environmental requirements of salmon and trout in fresh water. Freshwater Forum, 3(3): 176-201.

[6] Hendry, K & Cragg-Hine, D. 2003. Ecology of the Atlantic Salmon. Conserving Natura 2000 Rivers Ecology Series No. 7, English Nature, Peterborough.

[7] Klemetsen, A., Amundsen, P-A, Dempson, J.B., Jonsson, B., Jonsson, N., O'Connell, M.F. and Mortensen, E. 2003. Atlantic salmon Salmo salar L., brown trout Salmo trutta L. and Arctic charr Salvelinus alpinus (L.): a review of aspects of their life histories. Ecology of Freshwater Fish, 12, 1-19.

[8] Youngson, A & Hay, D. 1996 The Lives of Atlantic Salmon. An illustrated account of the life-history of Atlantic salmon. Swan Hill Press, Shrewsbury.

cm[9], but it is likely that habitat is selected on the basis of suitable substrate and flow rather than depth per se.

Eggs are often deposited in areas of accelerating flow, such as the tails of pools and glides, upstream from riffles. However, in upland streams eggs may be deposited in any areas of gravel that can be physically moved. A good supply of oxygen is essential for eggs to develop and this is facilitated by a flow of water through the gravel. Clogging with fine sediment such as silt and fine sand reduces water flow resulting in egg mortality due to lack of oxygen.

Egg survival is also affected by redd 'washouts' during winter spates – the direct, physical, scouring out of eggs from the gravel. Substrate stability, the dynamics of water flow and the weather all determine the extent of siltation and washouts.

After hatching the young fry remain in the gravel as alevins, absorbing nutrient from the remaining yolk sac. On emergence, usually between March and early May, young fry disperse from the redds and set up territories which they defend aggressively. Salmon fry prefer fast flows (>20 cm/s) and favour areas with surface turbulence (riffle habitat). They require a rough bed of pebble, cobble and gravel.

Brown trout fry prefer areas of relatively low velocity water near the streambed and often inhabit slower flows than salmon fry. Cover from stones, plants or debris is required and good cover is essential for maintaining high fry densities.

Atlantic salmon that have survived their first winter (parr) prefer deeper water than fry (typically 15-40 cm) and a coarser substrate often consisting of pebbles, cobbles and boulders. Brown trout parr generally favour areas of relatively low current speed where cover is available. Juvenile brown trout are often to be found in cover alongside the banks, in undercuts, among tree roots or in marginal vegetation. Cover remains important for adult trout and salmon particularly in smaller streams. In larger rivers and lochs this may be less important, as deep water provides refuge.

2.2 Lamprey

A recent review of lamprey ecology is provided by a study by Maitland in 2003[10]. Adult lamprey aggregate to spawn and extrude their eggs into 'nests' excavated in the riverbed. Suitable spawning substrate varies between species. Brook lamprey spawn in areas of coarse sand and gravel while the larger species select areas of gravel, pebble and cobble. After hatching the young lamprey larvae, known as ammocoetes, drift downstream with the current. They settle in nursery habitat consisting of fine, soft substrate in well oxygenated, slow flowing water. The ammocoetes are blind and feed on fine particulate matter such as diatoms, algae and bacteria. Ammocoetes spend several years in this muddy nursery habitat before metamorphosing (or transforming) from larval to adult form. The larvae of river and brook lamprey are indistinguishable from one another. Following transformation, it becomes possible to distinguish between them on the basis of morphology and colouration[11]. Upstream migrating lamprey may be prevented from reaching spawning grounds by both natural and man-made barriers. They are poor swimmers, so can be prevented from moving upstream by relatively low vertical barriers.

[9] Neary, J.P. 2006. Use of Physical Habitat Structure to Assess Stream Suitability for Brown Trout: A Case Study of Three Upland Scottish Streams. Ph.D. Thesis, University of Stirling, October 2006.

[10] Maitland, P.S. 2003. Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

[11] Gardiner, R. 2003. Identifying Lamprey. A field key for Sea, River and Brook lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

2.3 Freshwater Pearl Mussel

Freshwater pearl mussels are found in fast flowing rivers, with detailed studies on Scottish freshwater pearl mussel populations suggesting that optimum water depths of 30-40 cm and optimum current velocities of 0.25-0.75ms^{-1} at intermediate water levels are most suitable[12].

Riverbed substrate characteristics are considered to be the best physical parameters for describing freshwater pearl mussel habitat[13]. Freshwater pearl mussels prefer stable cobble/boulder dominated substrate with some fine substrate that allows the mussels to burrow[14]. Adult and juvenile mussels tend to have similar habitat 'preferences', although adults are found over a wider range of physical conditions and juveniles appear to be more exacting in their requirements and sensitivity to environmental disturbance[10]. Juvenile mussels require fine stable sediments, particularly clean sand and gravel.

Freshwater pearl mussels live buried or partly buried in the beds of clean, fast-flowing unpolluted streams and rivers and subsist by inhaling and filtering for the minute organic particles on which they feed[11]. Of specific importance to freshwater pearl mussel survival are levels of silt, suspended solids, calcium and chemical compounds generally associated with enrichment (eutrophication) (i.e., nitrate, phosphate)[15].

Freshwater pearl mussels have a short parasitic larval phase on the gills of suitable host fish. The larvae (glochidia) of freshwater pearl mussels are host-specific and can only complete their development on Atlantic salmon or brown trout, with the preferred host being juvenile fish (fry and parr) of these species[16]. The presence of freshwater pearl mussels in any river therefore depends on salmonid host fish availability. It is usually considered necessary for migratory salmonids to be present within a catchment for freshwater pearl mussels to be present. This is typically the case, however occasionally, where historical river captures have occurred, freshwater pearl mussel populations are sometimes isolated from present day migratory salmonids (e.g., by impassable waterfalls and have survived this isolation by utilising host resident brown trout). Thus, all sites capable of containing native salmonids can potentially hold freshwater pearl mussel populations[14].

3 METHODS

3.1 Desktop Study

A detailed desktop study was undertaken to identify watercourses, watercourse classifications, the presence of aquatic species, and statutory, non-statutory or designated/classified sites relevant to the aquatic environment, within 2km of the Site.

The following web-based sources were utilised for this:

- Scottish Natural Heritage (SNH) website[17] - information provided covered the location of any designated sites, statutorily protected species or habitats

[12] Hastie, L.C., Boon, P.J. and Young, M.R. 2000. Physical microhabitat requirements of freshwater pearl mussels M. margaritifera (L). Hydrobiologia 429: 59-71.

[13] Cosgrove, P.J. Hastie, L.C. 2000. Conservation of threatened freshwater pearl mussel populations: river management, mussel translocation and conflict resolution.

[14] Cosgrove, P.J. Hastie, L.C. and Young, M.R. 2000. Freshwater pearl mussels in peril. British Wildlife 11: 340-347.

[15] Bauer, G. 1983. Age structure, age specific mortality rates and population trend of the freshwater pearl mussel (M. margaritifera) in North Bavaria. Archiv für Hydrobiologie 98: 523-532.

[16] Young, M.R. & Williams, J.C., 1984. The reproductive biology of the freshwater pearl mussel Margaritifera margaritifera (Linn.) in Scotland I. Field Studies. Archive für Hydrobiologie 99: 405-422.

[17] www.gateway.snh.gov.uk (accessed online 23/11/2019)

- Scottish Environment Protection Agency (SEPA) website[18] - information provided covered classified and designated waterbodies under the Water Framework Directive (WFD) and Freshwater Fish Directive (FFD)
- National Biodiversity Network (NBN)[19] – information provided covered localised species records, and focused on legally protected and ecologically significant species
- Scotland's Environmental Web[20] - managed by the SEPA, information provided covered environmental information and data on Scotland's environment
- Marine Scotland[21] – National Marine Plan Interactive - Obstacles to Fish Passage (SEPA WMS)
- Google earth[22] – satellite imagery provided detailed maps used during fieldwork

3.2 Dates and Survey Conditions

FHS were conducted between the 13th and 16th of September 2021 (survey locations AM01 to AM22), the 24th July 2022 (survey locations AM23 to AM26). Survey weather conditions were good, with moderate water levels and good water clarity.

3.3 Survey Locations

A total of twenty-six survey locations were assessed for fish habitat potential based on professional judgment and potential impact zones within the catchment. Survey locations were selected using a combination of desktop study and onsite observations. During the walkover, habitats were characterised and split into sections detailing specific fish habitat suitability and fish utilisation potential.

Survey locations are presented in Table 1 (below).

Table 1: Fisheries Habitat Survey Locations

Watercourse	Survey Location ID	Downstream Limit	Upstream Limit	Tributary / Catchment
Burn of Ryeriggs	AM01	NJ 40172 55874	NJ 40196 55914	Flows into Burn of Crooksmill to River Isla
Burn of Tynet	AM02	NJ 40033 59550	NJ 40010 59524	Flows into Moray Firth. Moray Coast catchment
Small Burn	AM03	NJ 40521 59428	NJ 40544 59346	Flows into Ardmachie Burn to Burn of Tynet (AM02). Moray Coast catchment
Ardmachie Burn	AM04	NJ 41339 59024	NJ 41393 58973	Flows into Burn of Tynet (AM02). Moray Coast catchment
Buinnach Burn	AM05	NJ 42044 60476	NJ 41964 60418	Below confluence with Allobane Burn and flows into Burn of Cairnfield. Moray Coast catchment
Core Burn	AM06			Below confluence with Addie Burn & Ault Kittoch. Flows into the

[18] www.sepa.org.uk (accessed online 20/11/2021)
[19] www.searchnbn.net (accessed online 20/11/2021)
[20] https://map.environment.gov.scot/sewebmap/ (accessed online 20/11/2021)
[21] https://marinescotland.atkinsgeospatial.com/nmpi/ (accessed online 23/11/2021)
[22] http://earth.google.co.uk (accessed online 20/11/2021)

Watercourse	Survey Location ID	Downstream Limit	Upstream Limit	Tributary / Catchment
		NJ 43881 60212	NJ 43876 60163	Burn of Buckie at the confluence with Burn of Letterfourie.
Burn of Letterfourie	AM07	NJ 44101 62069	NJ 44060 62075	Flows into Burn of Buckie. Moray Coast catchment
Burn of Whitefield	AM08	NJ 44395 60977	NJ 44375 60917	Flows into Burn of Letterfourie then into Burn of Buckie. Moray Coast catchment
Shiel Burn	AM09	NJ 46094 61285	NJ 46164 61303	Flows into Burn of Letterfourie then into Burn of Buckie. Moray Coast catchment
Back Burn	AM10	NJ 46901 61662	NJ 46934 61577	Flows into Burn of Darbreich to Glen Burn into Burn of Cullen. Moray Coast catchment
Lornach Burn	AM11	NJ 48389 61004	NJ 48306 60948	Flows into Ha' Burn to Burn of Deskford then to Burn of Cullen. Moray Coast catchment
Tack Burn	AM12	NJ 49651 59397	NJ 49635 59390	Flows into Burn of Deskford then to Burn of Cullen. Moray Coast catchment
Langland Burn	AM13	NJ 49321 58422	NJ 49237 58442	Flows into Burn of Deskford then to Burn of Cullen. Moray Coast catchment
Balnamoon Burn	AM14	NJ 48381 55329	NJ 48313 55399	Flows into Bowie Burn, Burn of Paithnick to River Isla. Deveron catchment
Tarryfeuch Burn	AM15	NJ 46556 56073	NJ 46550 56164	Flows into Burn of Aultmore to River Isla. Deveron catchment
Burn of Aultmore	AM16	NJ 45577 56197	NJ 45608 56207	Flows into River Isla to Deveron. Deveron catchment
Milk Burn	AM17	NJ 45704 57464	NJ 45767 57471	Flows into Burn of Aultmore to River Isla. Deveron catchment
Rumbling Burn	AM18	NJ 45421 57643	NJ 45392 57715	Flows into Burn of Aultmore to River Isla. Deveron catchment
Burn of Fernking	AM19	NJ 44163 57216	NJ 44136 57288	Flows into Burn of Aultmore to River Isla. Deveron catchment
Stripe of Gateshead	AM20	NJ 44046 56894	NJ 43954 56929	Flows into Burn of Thievesbush to Burn of Aultmore. Deveron catchment
Garral Burn	AM21	NJ 44051 55465	NJ 44017 55504	Flows into Burn of Aultmore to River Isla. Deveron catchment
				Upstream of Burn of Ryeriggs - AM01 flows

Watercourse	Survey Location ID	Downstream Limit	Upstream Limit	Tributary / Catchment
White Stripe	AM22	NJ 40472 56188	NJ 40562 56179	into Burn of Forgie / Crooksmill. Moray Coast catchment
Burn of Ryeriggs	AM23	NJ 40449 56294	NJ 40456 56460	Flows into Burn of Crooksmill to River Isla
Burn of Ryeriggs	AM24	NJ 40457 56565	NJ 40449 56662	Flows into Burn of Crooksmill to River Isla
Tributary of Burn of Ryeriggs	AM25	NJ 40421 56601	NJ 40428 56669	Flows into Burn of Ryeriggs, then Burn of Crooksmill to River Isla
Burn of Tynet	AM26	NJ 39955 59643	NJ 39983 59614	Flows into Moray Firth. Moray Coast catchment

See Figure 1 (Appendix A) for a map showing the survey locations and Appendix B for photographs.

3.4 Fisheries Habitat Survey Methods

A FHS was carried out by Leigh Kelly BA MRes MIFM (Member of the Institute of Fisheries Management) of Mhor Environmental Ltd (Scottish Fisheries Co-Ordination Centre (SFCC) Qualified Electrofishing Team Lead and Salmonid Habitat Surveyor). Monitoring information collected following field surveys was used to undertake a detailed assessment of fish habitat quality and utilisation potential, for each survey location (Table 1).

A combination of methods developed by Hendry and Cragg-Hine[23] and those developed for the river/fisheries habitat surveying[24],[25] were adopted. During the field survey, each watercourse and surrounding habitats were characterised and assessed according to the following criteria:

- Predominant channel substrate and flow-types
- Habitat features
- Modifications to the channel and banks
- Channel vegetation types
- Vegetation structure of the banks and banktop
- Land-use

The habitat was then defined as described in Table 2 below.

Table 2: Fisheries Habitat Classification

Habitat Type*	Classification
Spawning habitat	Stable gravel approx. 20 cm deep (up to 90 cm deep[7]) that is not compacted or contains excessive silt. Substrate size with a diameter of 1.3 to 10.2 cm.
Salmon Fry (0+) habitat	Shallow (<20 cm) and fast flowing water indicative of riffles and runs with a substrate dominated by gravel and cobbles.

[23] Hendry K, Cragg-Hine D (1997) - A Guidance Manual. APEM Ltd, Fisheries Technical Manual 4, R & D Technical Report W44, Version 1.0/07-97. R & D Project 603.
[24] Environment Agency (2003) - River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual: Environment Agency, Bristol.
[25] SFCC (2007) - Fisheries Management SVQ – Habitat Surveys Training Course Manual.

Habitat Type*	Classification
Salmon Parr (1+) habitat	Riffle-run habitat that is generally faster and deeper than fry habitat (15-40 cm). Substrate consists of boulder, cobbles and gravels.
Trout Fry (0+) habitat	Slow to medium flowing shallow water with a substrate dominated by pebbles and smaller cobbles, often concentrated at stream margins.
Trout Parr (1+) habitat	Variety of substrate sizes; undercut banks, tree roots, big rocks; deeper, slower water.
Lamprey spawning habitat	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt (but may contain some sand). Substrate size varies from gravels to pebbles.
Juvenile lamprey habitat	Optimal: Stable fine sediment or sand ≥15 cm deep with low water velocity and the presence of organic detritus/plant material. Sub-optimal: Shallow sediment (<15 cm deep), often patchy and interspersed among coarser substrate.
Eel Habitat	Variety of habitats including streams, rivers, and muddy or silt-bottomed lakes during their freshwater stage.
Freshwater Pearl Mussel	Small sand patches stabilised amongst large stones or boulders in fast-flowing streams and rivers.
Riffle	Fast flow with significant turbulence and generally less than 10 cm deep, broken standing waves at surface and audible.
Run	Fast flow with limited turbulence and generally less than 30 cm deep, unbroken standing waves at surface and silent.
Glides	Smooth laminar flow with little surface turbulence and generally greater than 30 cm deep.
Pool	No perceptible flow. Shallow pool ≤0.3 m – Deep pool >0.3 m
Flow constrictions	Physical features providing a narrowing of the channel resulting in increased velocity and depth.
Obstructions to migration	Impassable falls, weirs, bridge sills etc. shallow braided river sections preventing upstream migration during low flows.

** If significant amounts of different habitat types were found to co-exist in the same section, these habitat classifications were adequately described. For example, in the case of salmonids, fry and parr habitat is classified as juvenile habitat. Where parr habitat is mentioned this refers to habitat that has principally been identified as habitat more suited to parr than fry, however habitually contains a lower quantity of fry habitat and habitat which is suited to both fry and parr. Habitat characteristics for Lamprey adopted Maitland (2003)[26]. Habitat characteristics for freshwater pearl mussel were also recorded adopting methods by Hastie (2003)[27].*

4 RESULTS

4.1 Desktop Study

4.1.1 *Designated Sites*

From SNHs Sitelink and Scotland's environmental web, no designation or non-designated sites associated to the aquatic environment were recorded within 2km of the Site.

Other sites not directly linked to the aquatic environment within 2 km of the Site include various ancient woodland areas.

[26] Maitland, PS (2003). Ecology of the River, Brook and Sea Lamprey. Conserving

[27] Skinner, A, Young M & Hastie L (2003). Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2 English Nature, Peterborough.

4.1.2 *Waterbody Classification*

Seven watercourses within and in close proximity to the Site are classified and designated under the Water Framework. The latest available information is detailed below and presented in Table 3:

- **Burn of Tynet** is a river (ID: 23047) in the Banff Coastal catchment of the Scotland River basin district. The main stem is approximately 10.97 kilometres in length. The water body has been designated as not heavily modified, lowland, small and calcareous in nature. The pressure associated with this water body are Diffuse Source Pollution. Associated protected areas Tynet Burn – SSSI, Spey Bay – SSSI and Moray / Aberdeenshire / Banff / Buchan – Nitrate Vulnerable Zone.
- **Buckie Burn** is a river (ID: 23048) in the Banff Coastal catchment of the Scotland River basin district. The main stem is approximately 8.62 kilometres in length. The water body has been designated as not heavily modified, lowland, small and Siliceous in nature. The pressure associated with this water body are Diffuse Source Pollution – mixed farming and Abstraction – whiskey production. Associated protected areas Moray / Aberdeenshire / Banff / Buchan – Nitrate Vulnerable Zone.
- **Burn of Aultmore** is a river (ID: 23176) in the River Deveron catchment of the Scotland River basin district. The main stem is approximately 10.08 kilometres in length. The water body has been designated as not heavily modified, mid-altitude, small and Siliceous in nature. The pressure associated with this water body are Diffuse Source Pollution – forestry and livestock farming. Associated protected areas River Deveron – Freshwater Fish (Existing).
- **Deskford Burn** is a river (ID: 23050) in the Banff Coastal catchment of the Scotland River basin district. The main stem is approximately 14.80 kilometres in length. The water body has been designated as not heavily modified, lowland, small and Siliceous in nature. The pressure associated with this water body are Diffuse Source Pollution. Associated protected areas Cullen, Seatown Access & water contact – Recreational Water, Moray / Aberdeenshire / Banff / Buchan - Nitrate Vulnerable Zone and Cullen to Stakeness Coast – SSSI.
- **Burn of Paithnick** is a river (ID: 23175) in the River Deveron catchment of the Scotland River basin district. The main stem is approximately 7.61 kilometres in length. The water body has been designated as not heavily modified, mid-altitude, small and Siliceous in nature. There are currently no pressures identified on this water body. Associated protected areas River Deveron – Freshwater Fish (Existing).
- **Crooksmill Burn / Haughs Burn** is a river (ID: 23180) in the River Deveron catchment of the Scotland River basin district. The main stem is approximately 13.26 kilometres in length. The water body has been designated as not heavily modified, mid-altitude, small and Siliceous in nature. The pressure associated with this water body are Morphological Alterations – various, Diffuse Source Pollution – mixed farming and Abstraction – whiskey production. Associated protected areas River Deveron – Freshwater Fish (Existing).

Table 3: Water Classification Data (2021 data) [28]

2021 Parameters	Burn of Tynet (ID: 23047)	Buckie Burn (ID: 23048)	Burn of Aultmore (ID: 23176)	Deskford Burn (ID: 23050	Burn of Paithnick (ID: 23175)	Crooksmill Burn / Haughs Burn (ID: 23180)
Overall status	Good	Poor	Poor	Good	Bad	Bad

[28] https://www.sepa.org.uk/data-visualisation/water-environment-hub (Accessed online – 26/11/2021)

2021 Parameters	Burn of Tynet (ID: 23047)	Buckie Burn (ID: 23048)	Burn of Aultmore (ID: 23176)	Deskford Burn (ID: 23050	Burn of Paithnick (ID: 23175)	Crooksmill Burn / Haughs Burn (ID: 23180)
Access for fish migration	High	High	High	High	High	High
Water flows and levels	Good	Poor	High	High	High	Moderate
Physical condition	Good	Good	Poor	Good	Bad	Bad
Freedom from invasive species	High	High	High	High	High	High
Water Quality	High	Moderate	Good	High	Good	Good

4.1.3 *Species Records*

Fish species records available from NBN Gateway were limited for this area. The desk study returned two records of Atlantic salmon, two records of brown/sea trout and a single record of European eel (*Anguilla anguilla*). All records were recorded on the Burn of Aultmore at Garralburn and dated back to 1985.

Marine Scotland's National Marine Plan Interactive tool verified that Atlantic salmon are present within the Burn of Aultmore (downstream of Garralburn) near AM16, Garral Burn downstream of AM19 (proposed new location) and Burn of Paithnick downstream of AM14.

No available records for freshwater pearl mussel were identified within 2km of the Site.

4.1.4 *Marine Scotland – Obstacles to Fish Passage*

Three waterfalls identified during the desktop study are considered potential barriers to fish migration. Potential barrier No.1 is downstream of AM03 (grid reference NJ 40217 59485), No.2 is downstream of AM04 (grid reference NJ 40598 59398) and No.3 is downstream of AM05 (grid reference NJ 42079 61351).

4.1.5 *Aerial Photography/Habitats*

From the aerial photography, it is clear that a range of habitat types are adjacent to the proposed works area. These range from extensive forestry, farmland, moorland, woodland, road, bridges and areas of peatland.

4.2 Fisheries Habitat Survey Results

Table 4 presents a summary of the prominent habitat characteristics recorded during the FHS (September 2021). Full results of the FHS are presented in Appendix A (Figure 1), which displays the FUP and FHQ and each survey site.

Table 4: Fisheries Habitat Survey Results

Survey Location ID	Fish Utilisation Potential	Fish Habitat Quality	Characteristics
AM1	Moderate	Moderate/Poor	**Salmonid parr habitat**. Flow type predominantly run while section of glide. Average wet width ranging between 0.5-1 m. Depth ranging from <10-30 cm. Pebble/cobble substrate with gravel/silt in places. Poor instream cover. Culvert within survey section – considered passable. Upstream section is considered poor habitat quality due to narrowing of channel and silt deposits. Land use is grazing and scrub adjacent to watercourse. Suitable lamprey and eel habitat present. Freshwater pearl mussel habitat not recorded
AM2	High	Good	**Juvenile salmonid habitat**. Flow type predominantly run/riffle/glide sequences. Average wet width ~2.5 m. Depth ranging from <10-40 cm. Cobble substrate with areas of pebble/gravel. Area of potential spawning habitat recorded left bank. Moderate instream cover. Land use is moorland and road. Limited lamprey and eel habitat present. Freshwater pearl mussel habitat not recorded
AM3	Low	Poor	**Limited salmonid habitat**. Flow type predominantly run with step pool in places. Average wet width ~1 m. Depth ranging from 10-50 cm. Cobble/pebble substrate with accumulation of silt throughout. Areas of silt/ organic matter covering substrate. Poor instream cover. Watercourse blocked with debris, considered impassable for migratory fish. Steep embankment and considered heavily modified channel. Land use is woodland and road. Not considered suitable for salmonid populations, however if present, considered likely to be low population density. No eel, lamprey or freshwater pearl mussel habitat recorded. Potential barrier to fish migration identified downstream of survey location.
AM4	Low/Moderate	Poor	**Salmonid parr habitat**. Flow type predominantly run with step pools. Average wet width ranging between 1.5-2 m. Depth ranging from <10-30 cm. Bedrock throughout with section of cobble/pebble/gravel substrate. Poor instream cover. Downstream section is considered moderate habitat quality however access is difficult. Land use is forestry plantation with stone bridge downstream. Limited eel habitat present. Freshwater pearl mussel and lamprey habitat not recorded. Potential barrier to fish migration identified downstream of survey location.
AM5	Low/Moderate	Poor/Moderate	**Salmonid parr habitat**. Flow type predominantly run with riffle at bridge. Average wet width ranging between 0.5-1 m. Depth ranging from 30-50 cm. Cobble/pebble/gravel substrate with accumulation of silt in places. Poor instream cover. Falls downstream of survey reach considered impassable. Land use is scrub and grazing adjacent. Limited eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded. Channel considered to have been modified / straightened. Resident brown trout considered

Survey Location ID	Fish Utilisation Potential	Fish Habitat Quality	Characteristics
			likely to be present. Water running discoloured during survey. Potential barrier to fish migration identified downstream of survey location.
AM6	Moderate	Moderate	**Juvenile salmonid habitat**. Flow type predominantly run/riffle sequences. Average wet ranging between 1-1.75 m. Depth ranging from 10-25 cm. Cobble/pebble substrate with gravel in places. Moderate instream cover. Triple culvert considered impassable to migratory fish. Land use is farmland/ grazing with scrub throughout. Limited eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded. Resident brown trout considered likely to be present.
AM7	High	Good	**Juvenile salmonid habitat.** Flow type predominantly run/glide sequences with area of riffle. Average wet width ~3.5 m. Depth ranging from <10-50 cm. Cobble/pebble substrate with boulder and gravel in places. Good instream cover. Potential spawning habitat within survey section. Left bank 100% undercut providing good habitat for brown trout. Land use is woodland. Suitable eel and limited lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM8	Moderate/ High	Moderate	**Juvenile salmonid habitat.** Flow type predominantly run/glide sequences with small area of riffle downstream. Average wet width ~2.5 m. Depth ranging from <10-30 cm. Predominantly cobble substrate with pebble and gravel throughout margins. Moderate instream cover. Potential spawning habitat within survey section. Land use is woodland. Suitable eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM9	Low/Moderate	Moderate	**Salmonid parr habitat.** Flow type predominantly run with area of glide upstream. Average wet width ~1 m. Depth ranging from <10-20 cm. Cobble/pebble substrate with gravel in places. Moderate instream cover. Impassable culvert downstream. Watercourse likely to support low population of brown trout. Land use is farm access track and grazing. Dense scrub along bank. Limited eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM10	Low	Poor	**Limited salmonid habitat**. Flow type predominantly run. Average wet width ~0.75 m. Depth ranging from <20-30 cm. Gravel/silt substrate with cobble in places. Poor instream cover. Watercourse likely to support low population of brown trout. Land use is farm access track and grazing. Dense vegetation obscured habitat characteristics. No eel, lamprey or freshwater pearl mussel habitat recorded.
AM11	Low	Poor	**Limited salmonid habitat**. Flow type predominantly run. Average wet width ~0.5 m with areas of the channel partially covered. Depth ranging from <10-30 cm. Gravel/silt substrate

Survey Location ID	Fish Utilisation Potential	Fish Habitat Quality	Characteristics
			throughout. Poor instream cover. Field drain flowing into watercourse. Watercourse likely to support low population of brown trout. Land use is road and grazing. Dense vegetation obscured habitat characteristics. No eel, lamprey or freshwater pearl mussel habitat recorded.
AM12	High	Good	**Juvenile salmonid habitat.** Flow type predominantly run/riffle/glide sequences. Average wet width ~3.5 m. Depth ranging from <10-40 cm. Predominantly cobble substrate with pebble/gravel and boulder in places. Good instream cover. Potential spawning habitat within survey section. Land use is woodland. Suitable eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM13	Low/Moderate	Poor/Moderate	**Salmonid parr habitat.** Flow type predominantly glide/run sequences with area of step pools / cascade and small 1m bedrock falls upstream. Average wet width ~1 m. Depth ranging from 20-50 cm. Cobble/pebble with boulder substrate downstream and bedrock throughout upstream section. Moderate to poor instream cover. Land use is woodland. No eel, lamprey or freshwater pearl mussel habitat recorded.
AM14	Low/Moderate	Poor/Moderate	**Salmonid parr habitat.** Flow type predominantly run. Average wet width ~0.5 m. Depth ranging from <10-40 cm. Gravel/pebble/silt substrate with cobble in places. Poor instream cover. Watercourse likely to support low population of brown trout. Land use is road and commercial unit. Dense vegetation. Channel considered to have been modified. Water running discoloured during survey. Limited eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM15	Low	Poor	**Limited salmonid habitat**. Flow type predominantly run. Average wet width ~0.5 m. Depth ranging from <10-50 cm. silt substrate with pebble/gravel in places. Poor instream cover. Watercourse likely to support low population of brown trout. Land use is road and grazing. Dense vegetation. Limited eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM16	High	Good	**Adult/juvenile salmonid habitat with patches of potential spawning habitat.** Flow type predominantly run/riffle sequences with deep glide upstream. Wet width ranging from 3.5-5.5 m. Depth ranging from <10-75 cm. Cobble/pebble substrate with boulder in places. Good instream cover. Adult holding area recorded upstream section. Land use is grazing and access to farm via ford downstream. Water colour opaque considered due to peatland upstream. Suitable eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM17	Low/Moderate	Poor/Moderate	**Salmonid parr habitat.** Flow type predominantly glide with run where channel narrows. Average wet

Survey Location ID	Fish Utilisation Potential	Fish Habitat Quality	Characteristics
			width ~1 m with a 2.5 m pool at the downstream section. Depth ranging from 20-60 cm. Cobble/pebble substrate with silt accumulation in places. Poor instream cover. Land use grazing. Dense vegetation upstream. Water colour opaque considered due to peatland upstream. Suitable eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM18	Low/Moderate	Poor/Moderate	**Salmonid parr habitat**. Flow type predominantly run with step pool. Average wet width <0.5 m. Depth ranging from <20-50 cm. Heavily silted throughout. Poor instream cover. Dense vegetation and unstable embankment both banks due to poaching. Land use is grazing and scrub adjacent to watercourse. Limited eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM19	Low	Poor	**Not considered suitable for migratory fish.** Flow type predominantly run. Wet width approx. <0.5 m. Depth ranging from <10- 30 cm. Predominately peat substrate with gravel/pebble downstream. Poor instream cover. Recommended survey location is moved downstream above confluence with Burn of Aultmore (AM16).
AM20	Low	Poor	**Not considered suitable for fish.** Undefined channel and considered unlikely to support fish populations.
AM21	High	Good	**Juvenile salmonid habitat.** Flow type predominantly run/riffle/glide sequences. Average wet width ~1.5 m. Depth ranging from 20-40 cm. Predominantly cobble/pebble substrate with boulder in places. Good instream cover. Land use is grazing right bank and road left bank. Suitable eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.
AM22	Low	Poor	**Salmonid parr habitat**. Flow type predominantly run throughout. Average wet width <0.5 m. Depth ranging from <10-30 cm. Gravel substrate with limited cobble and boulder in places. Poor instream cover. Culvert downstream end – considered passable. Dense vegetation throughout section. Land use is grazing and scrub adjacent to watercourse.
AM23	Low/Moderate	Poor/Moderate	**Limited salmonid habitat**. Flow type predominantly run with shallow glide in places. Average wet width ~0.75 m. Depth ranging from <10-30 cm. Coble substrate with pebble/gravel in places. Poor instream cover. Watercourse likely to support low population of brown trout. Land use is grazing. Dense vegetation throughout both banks. Limited eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.

Survey Location ID	Fish Utilisation Potential	Fish Habitat Quality	Characteristics
AM24	Low	Poor	**Not considered suitable for fish.** Undefined channel and considered unlikely to support fish populations.
AM25	Low	Poor	**Not considered suitable for fish.** Undefined channel and considered unlikely to support fish populations.
AM26	High	Good	**Juvenile salmonid habitat.** Flow type predominantly run/riffle/glide sequences will pool at the downstream end. Average wet width ~2.2 m. Depth ranging from 10-40 cm. Predominantly cobble/pebble substrate with boulder and small accumulation of sand/gravel in places. Moderate instream cover. Land use is grassland right bank and path left bank. Woodland throughout. Suitable eel and lamprey habitat present. Freshwater pearl mussel habitat not recorded.

5 EVALUATION OF RESULTS

5.1 Fisheries Habitat Survey (Salmonid Fish)

The habitat quality of the sampling locations was variable in terms of supporting salmonid populations. The majority of sampling locations afforded combinations of flow types, depths and variable substrates that provided moderate to good habitat for juvenile salmonids. Eight sampling locations were poorer in quality and considered to be unsuitable in terms of fish utilisation potential and fisheries habitat (AM03, AM10, AM11, AM15, AM20, AM22, AM24 and AM25).

Seventeen out of twenty-six sampling locations were identified as being suitable to hold salmonid populations. These watercourses are predominantly of a size more likely to support brown/sea trout populations. In some instances, these are likely to be residential brown trout populations due to habitat characteristics. The exception may be in the following watercourse (AM02, AM07, AM12, AM16, AM17 and AM26), which are more substantial watercourses with direct connectivity to either the Moray Firth coast or the River Isla (a tributary of the River Deveron), containing habitat considered suitable to support Atlantic salmon populations.

It is considered possible that there may be a small population of European eel and cyprinids (such as common minnow (*Phoxinus phoxinus*)), across the sampling locations within the Site.

5.2 Lamprey Suitability

Within the selected sampling locations, there were few areas of suitable habitat for juvenile lamprey (i.e., fine, soft substrate in well oxygenated, slow flowing water). Although not pristine, the watercourses sampled represent an important part of their respective catchment areas. Therefore, should the Development progress, due care should be taken to ensure no damage is done to fish populations or to fish habitat (including water quality). Also, due to the lack of information obtained during the desktop study lamprey cannot be scoped out.

5.3 Freshwater Pearl Mussel Suitability

Limited suitable habitat for freshwater pearl mussel was identified during the habitat survey of sampled watercourses (i.e., discrete sand patches stabilised amongst large stones or boulders in fast-flowing streams and rivers). It is considered unlikely that freshwater pearl mussel are present.

5.4 Potential for Impact to Fish Populations

The possible impacts that land-based wind farm developments and associated infrastructure could have on surrounding fish populations are well known. The potential for fish species and their habitats to be affected by the Development would mainly occur during the construction and decommissioning phases.

During the construction phase potential impacts may include siltation from ground disturbance, accelerated or exacerbated erosion, hydrological changes, accidental pollution and the inadvertent obstruction or hindering of the upstream/downstream passage of migratory fish.

The associated construction activities with building a wind farm, such as ground disturbance, deforestation and flocculant use could reduce water quality further.

During the operational phase, concerns for the aquatic environment may include the effects of poor road drainage, accelerated levels of erosion, fish access and the maintenance of silt traps and road crossings.

Potential risks during the decommissioning phase are considered as likely to be broadly similar to those in the construction phase.

6 RECOMMENDATIONS

The watercourses surveyed form part of the classified River Deveron and the Moray Coast RBMP site for its importance to freshwater fish and is protected through local planning policy and in part national law. Both catchments offer areas of suitable habitat for a number of important fish species (Atlantic salmon, brown trout, European eel and lamprey).

The Development may potentially affect fish populations by inadvertently causing direct mortality of juveniles and adults, changes in food availability, avoidance behaviour resulting in unused habitat, blocking of migration routes to spawning beds, or the accidental damage of instream and riparian habitats.

To ensure compliance with relevant environmental legislation and implementation of good working practices, the following recommendations are provided.

6.1 Avoidance

Avoidance measures should include (all sites):

- Fish rescue – removal of fish from any in-river working areas; and
- Work must not be carried out when fish are likely to be spawning in the affected surface water, or in the period between spawning and the subsequent emergence of juvenile fish (catchment specific – consult with local District Salmon Fisheries Board).

6.2 Mitigation

Mitigation measures should include (all sites):

- Adopting SEPA guidelines on construction in or near rivers and relevant 'Guidance for Pollution Prevention' documents;

- In-river works to be completed within dry channel where possible (full isolation over pumping method);
- Minimising the length of in-river works; and
- Consultation with NatureScot on how best to deal with potentially affected protected species and gain licences as required.

6.3 Fully Quantitative Electrofishing Surveys

To provide baseline data for future monitoring, it is recommended that fully-quantitative electrofishing surveys are completed at survey locations (including but not limited to – AM01, AM02, AM04, AM05, AM06, AM07, AM08, AM09, AM12, AM13, AM14, AM16, AM17, AM19 (move to grid ref: NJ 45404 56405), AM21, AM23 and AM26 (plus an additional two survey locations to be used as control sites).

Change in fish numbers alone may not provide compelling evidence of development impacts without corroborating evidence from control sites, monitoring of freshwater invertebrates or hydrochemistry, and/or direct observations of pollution incidents e.g., by an Ecological/Aquatic Clerks of Works. Nevertheless, the inclusion of fish as part of a spatially harmonised aquatic monitoring programme remains worthwhile, as salmonid species sensitive to water quality changes are present in most streams within the Site.

6.4 Construction and Post-Construction Monitoring of Aquatic Ecology

As part of an ongoing monitoring assessment of potential impacts which may occur as a result of the Development, it is recommended that a fish fauna and aquatic invertebrate monitoring plan is produced (utilising suitable survey sites plus two control sites). The monitoring plan should include pre-construction (baseline) fish fauna and aquatic invertebrate surveys. Should results of the baseline surveys indicate salmonid populations, it is recommended that construction and post-construction fish fauna and aquatic invertebrate monitoring is undertaken.

The suggested monitoring schedule would include the following:

- Fish fauna – annually during construction (summer) and post-construction Year 1 (summer) and Year 2 (summer); and
- Aquatic invertebrates – annually during construction (spring/autumn) and post-construction during Year 1 (spring/autumn) and Year 2 (spring/autumn).
- Assuming fish are present, mitigation would include ensuring access track crossings (culvert installation) do not impede fish access (even if only brown trout are present), also timing engineering works to avoid the period of October-June to avoid spawning and egg/ alevin incubation times in sensitive watercourses (catchment specific – consult with local District Salmon Fisheries Board).

It is also recommended that the Ecological/ Aquatic Clerk of Works with knowledge of the water environment is appointed during works. The Ecological/ Aquatic Clerk of Works should undertake water quality monitoring as part of their role.

APPENDIX A: FIGURES

Figure 1: Survey Locations (See attachments - 03640.00016.0042.1 Aultmore Fish Habitat Survey Results)

340000 342000 344000 346000 348000

862000

860000

858000

LEGEND

- Site Boundary
- Turbine Location
- Watercourse
- Waterbody
- Upstream Survey Location
- Downstream Survey Location
- Adult/Juvenile Salmonid Habitat With Patches of Potential Spawning Habitat
- Juvenile Salmonid Habitat
- Limited Salmonid Habitat
- Salmonid Parr Habitat
- Not Considered Suitable for Fish

N

0 0.5 1 Kilometres

VATTENFALL

SLR
4/5 LOCHSIDE VIEW
EDINBURGH PARK
EDINBURGH
EH12 9DH
T: +44 (0)131 335 6830
www.slrconsulting.com

AULTMORE WIND FARM

ECOLOGY

FISH HABITAT SURVEY

FIGURE 1 - OVERVIEW

Scale 1:30,000 @ A3

Date JANUARY 2022

03640.00016.0042.0 Aultmore Fish Habitat Survey Results

340000 342000 344000

862000 860000

LEGEND

- Site Boundary
- Watercourse
- Waterbody
- Upstream Survey Location
- Downstream Survey Location
- Juvenile Salmonid Habitat
- Limited Salmonid Habitat
- Salmonid Parr Habitat

N

AM02 AM03 AM04 AM05 AM06 AM07 AM08

0 0.5 1 Kilometres

VATTENFALL

SLR
4/5 LOCHSIDE VIEW
EDINBURGH PARK
EDINBURGH
EH12 9DH

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AULTMORE WIND FARM

ECOLOGY

FISH HABITAT SURVEY

FIGURE 1 - MAP 1

Scale 1:15,000 @ A3

Date JANUARY 2022

03640.00016.0042.0 Aultmore Fish Habitat Survey Results

346000

348000

862000

860000

LEGEND

- Site Boundary
- Turbine Location
- Watercourse
- Waterbody
- Upstream Survey Location
- Downstream Survey Location
- Juvenile Salmonid Habitat
- Limited Salmonid Habitat
- Salmonid Parr Habitat

N

AM09

AM10

AM11

AM12

0 0.5 1 Kilometres

VATTENFALL

SLR
4/5 LOCHSIDE VIEW
EDINBURGH PARK
EDINBURGH
EH12 9DH
T: +44 (0)131 335 6830
www.slrconsulting.com

AULTMORE WIND FARM

ECOLOGY

FISH HABITAT SURVEY

FIGURE 1 - MAP 2

Scale 1:15,000 @ A3

Date JANUARY 2022

03640.00016.0042.0 Aultmore Fish Habitat Survey Results

340000 342000 344000

858000 856000

LEGEND

- Site Boundary
- Turbine Location
- Watercourse
- Waterbody
- Upstream Survey Location
- Downstream Survey Location
- Juvenile Salmonid Habitat
- Salmonid Parr Habitat
- Not Considered Suitable for Fish

N

0 0.5 1 Kilometres

VATTENFALL

SLR
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AULTMORE WIND FARM

ECOLOGY

FISH HABITAT SURVEY

FIGURE 1 - MAP 3

Scale 1:15,000 @ A3

Date JANUARY 2022

03640.00016.0042.0 Aultmore Fish Habitat Survey Results

346000

348000

858000

856000

03640.00016.0042.0 Aultmore Fish Habitat Survey Results

Aultmorehill Wood
Milkwell Moss
Leomond Hill
Cranloch Moss
Milk Burn
Black Hill
Aultmore
Pit
Plaiding Knowe
Deerhill Moss
Bogan Curr
Balnamoon Moss
Deerhill Croft
Deerhill
Tarryfeuch
Tarryfeuch Burn
Horsebog
Kilbady
Whippingstone
Starhill
Roehill
Chapelhill
Greenbog
Grange
Bridge of Croftgibb
Croftgibb
Balnamoonhill
West Balnamoon
Bowie Burn
Mains of Balnamoon
Balnamoon Burn
Balnamoon
Bridge of Balnamoon
Aultown of Balnamoon
Burnside
Muirtown
Bridge of Goukstone
Goukstone
Quarry
Bridge of Burnend
Burnend
Euchries
Marchbank
Queans Strip
Myreside
Wester Windyhills
Bossy Hillocks
Nethertown
Drum Toul
Windy Hills
Windyhills Wood
Over Windyhills
Langlanburn
Clochmacreich
Milkburn
Drodland
Garralhill
Garralburn
Burn of Aultmore
Ford
FB
Spr
AM13
AM14
AM15
AM16
AM17
AM18
1
2
3
4
7
8
N
0
0.5
1
Kilometres

LEGEND

- Site Boundary
- Turbine Location
- Watercourse
- Waterbody
- Upstream Survey Location
- Downstream Survey Location
- Adult/Juvenile Salmonid Habitat With Patches of Potential Spawning Habitat
- Limited Salmonid Habitat
- Salmonid Parr Habitat

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FISH HABITAT SURVEY

FIGURE 1 - MAP 4

Scale 1:15,000 @ A3

Date JANUARY 2022

APPENDIX B: PHOTOGRAPHS

Plate 1 – AM1 (facing upstream)

Plate 2 – AM1 (culvert)

Plate 3 – AM2 (facing upstream)

Plate 4 – AM2 (facing downstream / bridge)

Plate 5 – AM3 (mid-section / blockage)

Plate 6 – AM3 (facing upstream)

	
Plate 7 – AM4 (facing upstream / step pool)	**Plate 8 – AM4 (facing downstream)**
	
Plate 9 – AM5 (facing upstream)	**Plate 10 – AM5 (facing upstream)**
	
Plate 11 – AM6 (facing upstream)	**Plate 12 – AM6 (triple culvert / impassable)**

	
Plate 13 – AM7 (facing upstream)	**Plate 14 – AM7 (facing downstream)**
	
Plate 15 – AM8 (facing upstream)	**Plate 16 – AM8 (upstream end)**
	
Plate 17 – AM9 (facing downstream / impassable culvert)	**Plate 18 – AM9 (facing upstream)**

	
Plate 19 – AM10 (dense vegetation)	**Plate 20 – AM10 (facing upstream)**
	
Plate 21 – AM11 (various field drains flowing into watercourse)	**Plate 22 – AM11 (facing upstream / channel partially covered)**
	
Plate 23 – AM12 (facing upstream)	**Plate 24 – AM12 (facing downstream)**

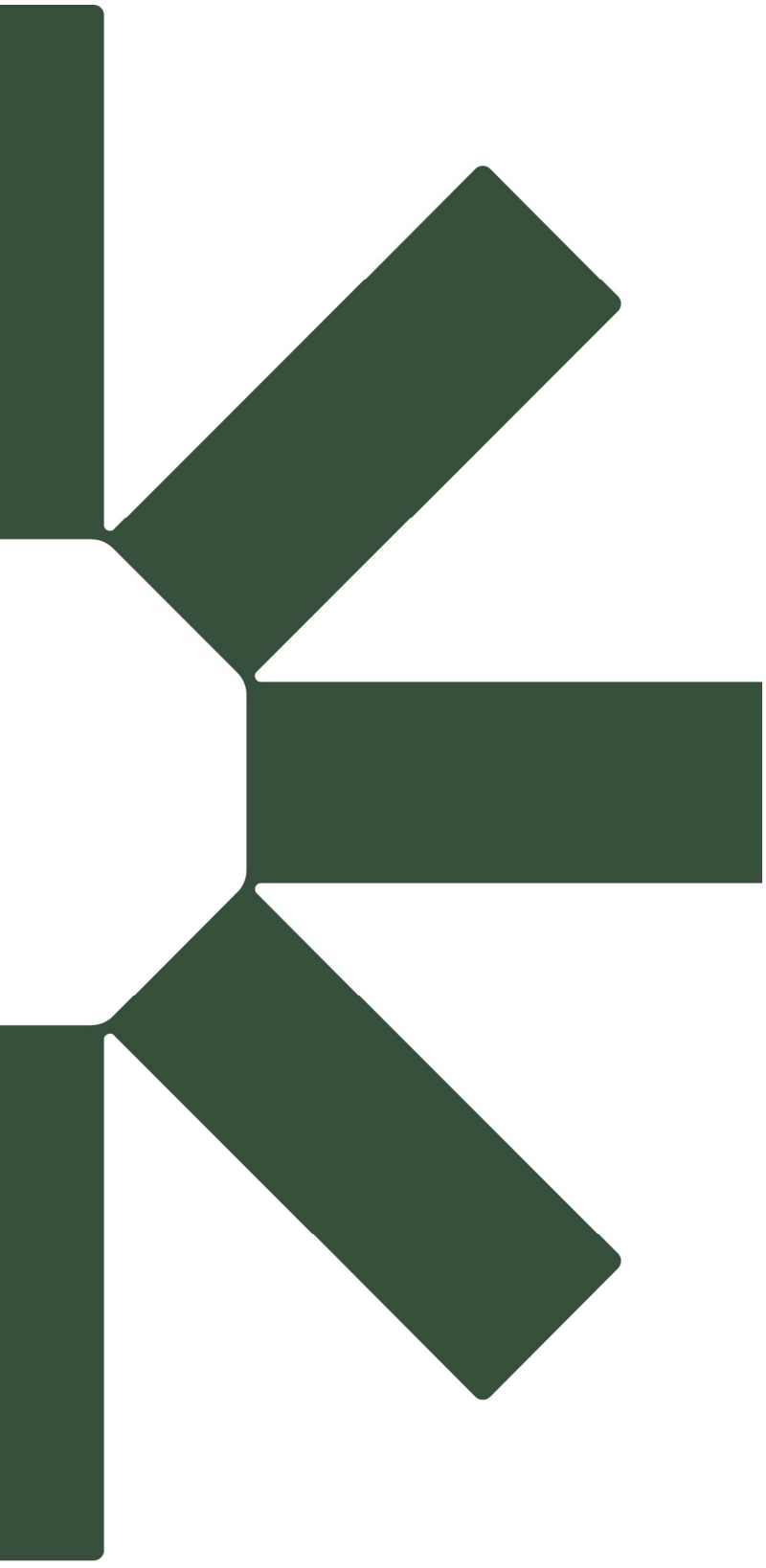
	
Plate 25 – AM13 (facing upstream)	**Plate 26 – AM13 (small bedrock falls)**
	
Plate 27 – AM14 (facing upstream)	**Plate 28 – AM14 (facing downstream)**
	
Plate 29 – AM15 (facing upstream)	**Plate 30 – AM15 (facing downstream)**

	
Plate 31 – AM16 (facing upstream)	**Plate 32 – AM16 (upstream end)**
	
Plate 33 – AM17 (facing upstream)	**Plate 34 – AM17 (facing downstream)**
	
Plate 35 – AM18 (facing upstream)	**Plate 36 – AM18 (facing downstream)**

	
Plate 37 – AM19 (facing upstream)	**Plate 38 – AM19 (facing downstream)**
	
Plate 39 – AM20 (facing upstream)	**Plate 40 – AM20 (facing downstream)**
	
Plate 41 – AM21 (facing upstream)	**Plate 42 – AM21 (upstream end)**

	
Plate 43 – AM22 (facing upstream)	**Plate 44 – AM22 (facing downstream)**
	
Plate 45 – AM23 (facing downstream)	**Plate 46 – AM23 (upstream end)**
	
Plate 47 – AM24 (downstream end)	**Plate 48 – AM24 (facing upstream)**

	
Plate 49 – AM25 (downstream end)	**Plate 50 – AM25 (facing upstream)**
	
Plate 51 – AM26 (facing downstream)	**Plate 42 – AM26 (facing upstream)**



Making Sustainability Happen