FEARNA STORAGE

Fearna Pumped Storage Hydro Scheme
EIA Report

Appendix 11.1 – Main PSH Site Aquatic Ecology Surveys

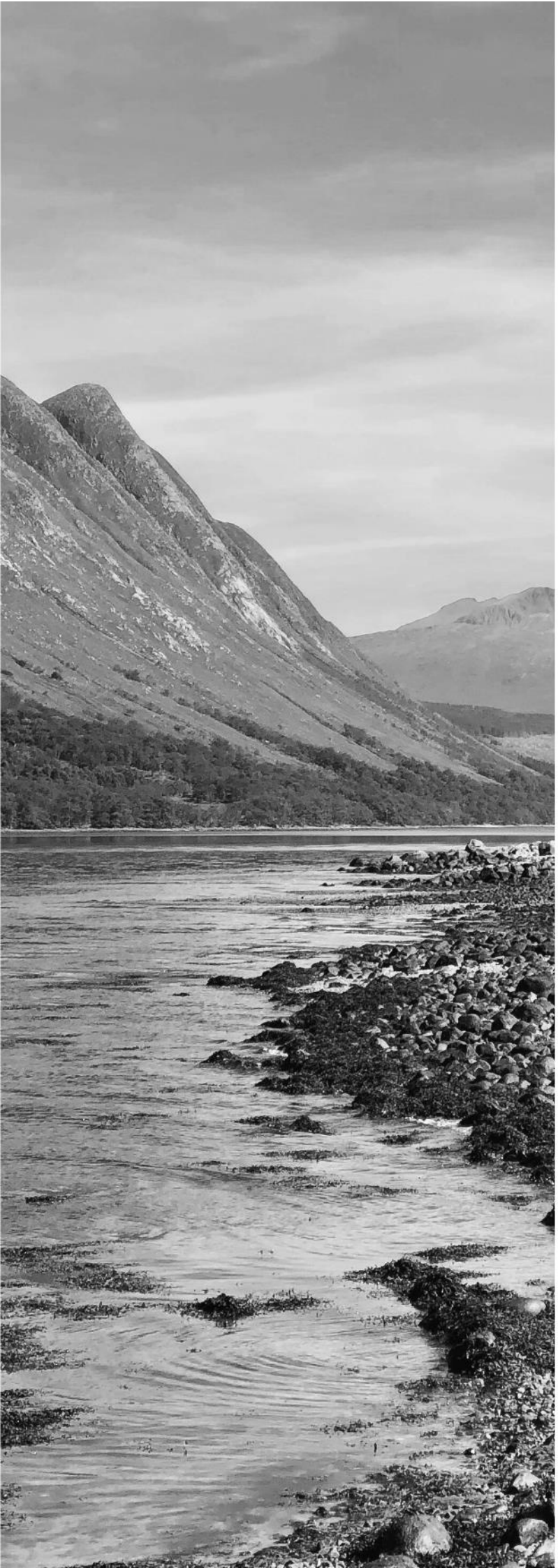
February 2025

Quality Information

Prepared by	Checked by	Approved by
Gavia	Chris Pasteur	Fraser Allison

Revision History

Revision	Revision Date	Details	Authorised
01	February 2025	Issue to ECU	Fraser Allison



APPENDIX 11.1: FEARNA PSH AQUATIC ECOLOGY SURVEYS

FEARNA PUMPED STORAGE

FEARNA PSH LTD.

28/02/2025

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Revision History

Revision	Date	Prepared By	Reviewed By	Approved By	Comments
V1.0	05/11/2024	JP	DM	MA	Initial issue
V1.1	28/02/2024	JP / JMc	DM	MA	Client comments addressed

Quality assurance

This report has been prepared according to Gavia Environmental Ltd. Quality Management Process. Gavia Environmental Ltd. employs consultant scientists who are members of appropriate professional institutions and adhere to professional codes of conduct.

Disclaimer

This report is presented to Fearna PSH Ltd. in respect of Appendix 11.1: Fearna PSH Aquatic Ecology Surveys, and may not be used or relied on by any other person or by the client in relation to other matters not covered specifically by the scope of this report.

Notwithstanding anything to the contrary contained in the report, Gavia Environmental Ltd. is obliged to exercise reasonable skill, care, and diligence in the performance of the services required by Fearna PSH Ltd. and shall not be liable except to the extent that it has failed to exercise reasonable skill care and diligence, and this report shall be read and construed accordingly.

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Executive Summary

Gavia Environmental Ltd. was commissioned by Fearna PSH Ltd. to undertake an Aquatic Ecology Assessment in order to determine the status of fish and macroinvertebrate populations at the proposed Loch Fearna Pumped Storage Hydro scheme (the Proposed Development – National Grid Reference NH055030).

For the purposes this survey report, the '**Upper Area**' of the Proposed Development includes Loch Fearna, Coire Glas and Coire Dubh and the upper reaches of the Allt a' Mheil to immediately downstream of the existing hydroscheme. This area is affected by proposed dam infrastructure, proposed access tracks and inundation zones. The '**Lower Area**' of the Proposed Development includes areas of Loch Quoich within the construction footprint and watercourses potentially impacted by proposed access tracks and run off from construction activities taking place within the upper area.

The objectives of this study were to conduct a fish habitat assessment using an adapted SEPA methodology; a fully quantitative fish population assessment using SFCC electrofishing techniques; an in-situ water quality assessment; an aquatic macrophyte (aquatic plants) survey on Loch Fearna using JNCC methodologies; and a macroinvertebrate population assessment using standard kick EA/SEPA kick sampling methodology on watercourses and waterbodies potentially affected by the Proposed Development within the construction footprint. An eDNA assessment to inform on fish populations in Loch Fearna and Loch Quoich was also carried out.

A fish habitat assessment, to identify suitable habitat for salmonids, was conducted within the Upper and Lower Areas of the Proposed Development on the Loch Fearna and Allt a' Mheil catchments. The area (m^2) of watercourse considered as *Productive: Good* was approximately 1,462.50 m^2 (18.03 %) in total, whereas 1,184.00 m^2 (14.60%) were classified as *Productive: Moderate*. Unproductive sections, due to the presence of steep bedrock channel, were estimated to be 2,154.50 m^2 (26.57 %) and an area of 3,362 m^2 (40.78 %) was classified as Unproductive: Other due to obstacles to migration, steep gradients, underground sections, peat channels and watercourses considered minor in nature.

During electrofishing surveys, an absence of fish was confirmed within all of the Loch Fearna tributaries surveyed despite good brown trout spawning and juvenile habitat present in H_SL_4 and H_SL_5. This suggests that Loch Fearna is also fishless, further strengthened by eDNA results which detected no brown trout or Arctic charr. An absence of fish was also confirmed within the upper Allt a' Mheil catchment.

The presence of brown trout and common minnow was confirmed at one Survey Location (SL7 – Allt Fearna upstream of Loch Quoich) within the Lower Area of the Proposed Development, an area with fish access from Loch Quoich. Despite the low densities of brown trout at the *fry* stage it does support the fact of a recent recruitment in the population since the previous spawning season. Brown trout fry populations were classified as *Poor* and at parr stage, were classified as *Moderate* on the SFCC Regional Classifications.

Environmental DNA results confirmed no detection of Arctic charr or other fish species within the Loch Fearna samples via metabarcoding. qPCR (Quantitative Polymerase Chain Reaction) analysis could not determine presence / absence of Arctic charr within Loch Quoich due to being lower than the limit of detection/quantification as stated by the qPCR standard curve.

Water quality parameters presented optimal conditions for salmonid fish across all sampling locations.

The macroinvertebrate population was representative of good watercourse condition. No species of nature conservation interest were noted from the sampling conducted. Species recorded were dominated by common and widespread taxa, typical of a range of habitat

types. Within the samples collected, the species composition was that of marginal and lotic environments.

In total 11 species of aquatic macrophyte were identified throughout Loch Fearna: 9 submerged/floating; and 4 emergent/edge species (*Juncus bulbosus* & *Littorella uniflora were* identified in both submerged and emergent communities). All species except *Baldellia ranunculoides* were classified as 'Least Concern' or 'Data deficient' for their conservation value, with *Baldellia ranunculoides* being classed as near threatened according to the IUCN Red List of Threatened Species. No invasive non-native species (INNS) were identified.

The following conclusions can be drawn from the Aquatic Ecology Survey report:

- Sections of riverine habitat within the Upper and Lower Area of the Proposed Development had the potential to support salmonid fish populations.
- Despite suitable habitat conditions to support fish populations, it is unlikely that brown trout are present within the Upper Areas of the Proposed Development (Loch Fearna and Allt a' Mheil catchments).
- Populations of brown trout and common minnow were found within the lower reaches of the Allt Fearna upstream of Loch Quoich which is within the Lower Area of the Proposed Development. The presence of both fry and parr indicate recent recruitment in this area.
- eDNA sampling of Loch Fearna confirmed no detection of Arctic charr and brown trout within samples.
- Water quality parameters presented optimal conditions for salmonid fish across all sampling locations.
- Macroinvertebrate communities recorded were dominated by common and widespread taxa and no species of conservation interest were recorded.
- Aquatic macrophytes communities within Loch Fearna were limited in diversity and no species of conservation interest were recorded.
- Other that common minnow, no invasive non-native species (INNS) were recorded across any of the surveys.

Further eDNA sampling of Loch Quoich and inflowing tributaries is proposed to inform on fish populations within the wider loch catchment. An assessment of the availability of spawning habitat within inflowing tributaries of Loch Quoich is also proposed.

1 Introduction

Gavia Environmental Ltd. was commissioned by Fearna PSH Ltd. to undertake an aquatic ecology assessment to determine the status of fish habitat, fish and macroinvertebrate populations and water quality in relation to the proposed Fearna Pumped Storage Hydro scheme, hereafter 'the Proposed Development' – (Grid Reference NH055030). Loch Fearna is a small and relatively shallow freshwater loch with an area of 10 ha, a catchment area of 1.35 km^2 (included within the River Garry catchment), and a mean depth of 6.6 m. It will form part of the upper reservoir within the Proposed Development and is situated at an elevation of 538 m (Above Ordnance Datum - AOD). The Loch Fearna catchment is composed of a total of seven adjacent tributaries (in- and outflow). Six adjacent tributaries feed into the loch taking their source northward in Coire Glas. An additional tributary taking its source from an area of bog is also present (situated southeast of the Loch – Grid Refence NH055028) but is considered a minor watercourse. The outflow of Loch Fearna is situated southwest via the Allt Fearna which flows south to Loch Quoich. Loch Quoich forms the lower reservoir (also within the River Garry catchment). Loch Quoich is a large freshwater reservoir and is the third and highest Loch on the Garry system. The basin of Loch Quoich is steep with uniform sides. The surface area is 1,746 ha, the catchment area is 13,221 ha, and the mean depth is 31.9 m, with a maximum depth of 85.6m. Since 1955, a hydroelectric dam has been in operation on the eastern end of Loch Quoich (Grid Reference NH070023) which has an operational level range of between 175.38 m AOD and 201.38 m AOD.

There are no desk records of fish populations within Loch Fearna and its tributaries as well as within the watercourses of Coire Dubh. In Loch Quoich, the presence of the hydroelectric dam at the eastern end, presents a migratory barrier for anadromous migratory species such as Atlantic salmon (*Salmo salar*), Sea trout (*Salmo trutta*), Lamprey (*Petromyzon marinus*) and Eels (*Anguilla anguilla*). Consequently, the presence of anadromous migratory fish species was ruled out via desk-study. However, an extant population of Arctic charr (*Salvelinus alpinus*), Brown trout (*Salmo trutta*) and Common minnow (*Phoxinus phoxinus*) are known to be present within Loch Quoich. The first record of Arctic charr in Loch Quoich was registered in 1913 and the last in 1995 (Maitland and Adams, 2017). It is important to note that there is evidence in literature that Arctic charr occasionally use riverine habitat. There is no evidence of riverine use on the tributaries of Loch Quoich but there is downstream of Quoich dam (Maitland and Adams, 2017). According to the SEPA Water Classification Hub (2022) the macroinvertebrate population in Loch Quoich has been classified *Good*.

During initial survey works carried out to inform scoping, it was recommended that further baseline surveys were needed to be undertaken to inform Ecological Impact Assessment (EcIA). Surveys were carried out predominantly in relation to areas likely to be affected by the construction footprint of the Proposed Development. Study objectives for this aquatic ecology assessment are provided below in **Section 1.1** and the study area is defined in **Section 3.3.**

1.1 Study Objectives

The objectives of this study were to conduct:

- a fish habitat assessment;
- a fish population assessment;
- an in-situ water quality assessment;
- a macrophyte (aquatic plants) survey on Loch Fearna, and;
- a macroinvertebrate population assessment on watercourses and waterbodies potentially affected by the Proposed Development within the construction footprint (see **Section 3.3** Study Area).

An eDNA assessment to inform on fish populations in Loch Fearna and Loch Quoich was also carried out.

An updated engineering drawing of the Proposed Development was provided by the client on 12/07/2023 (**Appendix A** – **Figure 11.1.1.0**).

The proposed main access track for the Proposed Development is the **Southern Access Route (SAR)**. Aquatic ecology surveys relating to this part of the project are detailed in a separate document (**Appendix 11.2 – Southern Access Route (SAR) Aquatic Ecology Surveys**).

2 Project Personnel

The project personnel are listed below in the **Table 1**.

Table 1: Project Personnel

Personnel	Role
Matthew Askin, CSci FGS	Technical Director (Project Director)
Joris Philip BSc, MSc, MFSBI	Freshwater Ecologist - Environmental Consultant (Project Manager)
Donald Morrison BSc (Hons), MIFM	Freshwater Ecologist – Principal Environmental Consultant
Toni Dwyer BSc, MSc	Freshwater Ecologist - Environmental Consultant

3 Methodology

3.1 Legislation, Planning Policy and Guidance

The fish population assessment was conducted by using electrofishing techniques under Marine Scotland licence (Application Reference CSM-23-117). The Ness District Salmon Fishery Board and The Ness and Beauly Fisheries Trust were both notified prior about the intention to survey, as this is a condition of the licence.

3.2 Desk Study

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

- AMBER Report of Case Studies Demonstrating the Effects of Barrier Removal, Mitigation and Installation – for information on eDNA data relating to Loch Quoich;
- Bing Maps – aerial imagery was obtained and used to inform the field survey;
- Maitland and Adams (2017) *Arctic Charr in the Lochs of Scotland: An Assessment of Distribution and Status*;
- NatureScot Sitelink – A search was performed to identify sites with relevant (aquatic) interests within 2 km of the development;
- Ordnance Survey Mapping – site mapping was reviewed to inform survey location selection;
- Scotland's Environment Web – data on obstacles to fish migration on affected watercourses obtained to guide likely species present; and

- SEPA – the SEPA Water Classification Hub was referred to for information on the classification status of the affected watercourses.

3.3 Study Area

3.3.1 Proposed Development

The design of the Proposed Development (**Appendix A**) is comprised of an upper reservoir (including the existing Loch Fearna basin) and a lower reservoir (Loch Quoich) connected by a series of tunnels. The inundation zone of the upper reservoir comprises Loch Fearna and areas of Coire Glas and Coire Dubh (**Image 1**) (the latter featuring the source of the Allt a' Mheil watercourse). For the purposes this survey report, the '**Upper Area**' of the Proposed Development includes Loch Fearna, Coire Glas and Coire Dubh and the upper reaches of the Allt a' Mheil to immediately downstream of the existing hydroscheme. This area is affected by proposed dam infrastructure, proposed access tracks and inundation zones. The '**Lower Area**' of the Proposed Development includes areas of Loch Quoich within the construction footprint and watercourses potentially impacted by proposed access tracks and run off from construction activities taking place within the upper area.

Sections of watercourses in between these the Upper and Lower areas were considered too steep to support fish populations and were predominantly inaccessible on the grounds of health and safety therefore were not included within the scope of this assessment.

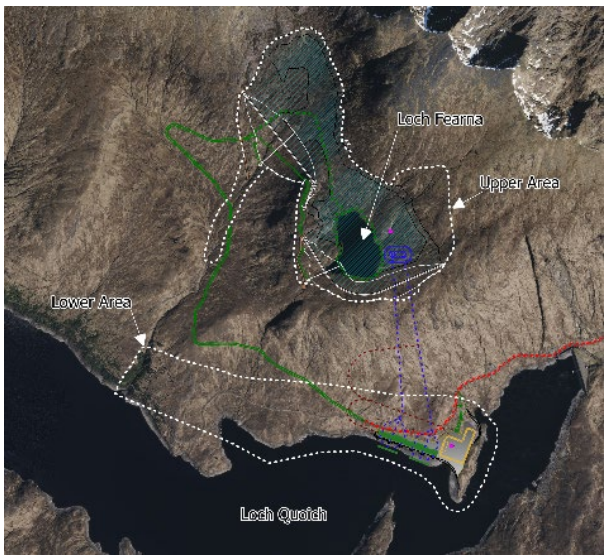

Image 1: Loch Fearna, Loch Quoich, Upper and Lower Survey Areas

3.3.2 Fish Habitat Assessment

The fish habitat assessment was conducted within the Upper and Lower Area of the Proposed Development on watercourses likely to be affected during the construction and operational phases of the project. Fish habitat assessment survey locations with downstream and upstream extents are listed below in **Table 2** and shown in **Appendix A – Figures 11.1.2.1-11.1.2.12**. A description and rationale for selection is provided below.

Table 2: Fish Habitat Assessment Survey Locations

Survey Location	Downstream Easting	Downstream Northing	Upstream Easting	Upstream Northing	Description & Rationale for Selection
H_SL_1	803334	205458	803392	205479	Unnamed watercourse flowing into the north west of Loch Fearna. Affected by the inundation zone of the Proposed Development. (Upper Area)
H_SL_2	803363	205581	803398	205650	Unnamed watercourse second eastern tributary of Loch Fearna. Affected by the inundation zone of the Proposed Development (Upper Area).
H_SL_3	803299	205632	803597	205954	Unnamed watercourse tributary of Loch Fearna. Affected by the inundation zone of the Proposed Development (Upper Area).
H_SL_4	803152	205693	803624	206130	Unnamed watercourse fourth eastern tributary of Loch Fearna. Affected by the inundation zone of the Proposed Development (Upper Area).
H_SL_5	802976	205712	803200	206190	Unnamed watercourse southeast of Loch Fearna (easternmost tributary). Affected by the inundation zone of the Proposed Development (Upper Area).
H_SL_6	802937	205295	802985	205368	River Allt a' Fearna (outflow of Loch Fearna). Affected by the Fearna Dam footprint of the Proposed Development (Upper Area).
H_SL_7	803675	204944	803812	205506	Watercourse taking its source east of Coire Dubh. Affected by the inundation zone and the Coire Dubh Dam footprint of the Proposed Development (Upper Area).
H_SL_8	803685	204955	804225	205477	Unnamed watercourse taking its source north of Coire Dubh. Affected by the inundation zone and the Coire Dubh Dam footprint of the Proposed Development (Upper Area).
H_SL_9	803685	204955	804579	205271	Unnamed watercourse taking its source west of Coire Dubh. Affected by the inundation zone and the Coire Dubh Dam footprint of the Proposed Development (Upper Area).
H_SL_10	803067	204599	803685	204955	River Allt a' Mheil, downstream of H_SL_7, 8 & 9. Downstream of the Coire Dubh Dam and crossed by the proposed access track (Upper Area).
H_SL_11	802179	204036	802390	204181	River Allt a' Mheil (confluence with Loch Quoich) (Lower Area).
H_SL_12	801984	204752	802174	204855	River Allt a' Fearna (confluence with Loch Quoich) (Lower Area).

3.3.3 Fish Population Assessment

3.3.3.1 Electrofishing Survey

The study area comprised the main tributaries of Loch Fearna (EF_1, EF_2, EF_3, EF_4 – **Table 3**), however, survey locations EF_1 and EF_2 were not assessed as on the day of survey, it was decided that they were minor watercourses, not featuring suitable characteristics to undertake an electrofishing survey. It is important to note that the proposed inundation zone was updated in the Proposed Development design and will now be extended towards Coire Dubh. This will affect the Allt a' Mheil and this watercourse was therefore included in the assessment (survey locations EF_6 and EF_8). The outflow of Loch Fearna (EF_5) (source of the Allt Fearna) as well as its confluence with Loch Quoich (EF_7) were also assessed. The confluence between the Allt a' Mheil and Loch Quoich was inaccessible due to health and safety reasons and therefore was not included within the assessment. This location is not expected to have been suitable for supporting fish populations due to steep gradients and bedrock substrate. At each accessible survey location, in-situ water quality parameters (Temperature (°C), Oxidation Reduction Potential (mV), pH, Dissolved Oxygen (% and $mg.l^{-1}$), Conductivity ($\mu s.cm^{-1}$), Total Dissolved Solid ($mg.l^{-1}$)) were also recorded. Fish population assessment survey locations are detailed below in **Table 3** and shown in **Appendix A – Figure 11.1.3.1-11.1.3.2**.

Table 3: Fish Population Assessment Survey Locations (including Water Quality Monitoring)

Survey Location	Easting	Northing	Description
EF_1	205452	803333	North-western tributary of Loch Fearna. Not assessed because of Unproductive Habitat.
EF_2	205632	803299	Second tributary to the east of EF_1. Not assessed because of Unproductive Habitat.
EF_3	205688	803158	Third tributary to the east of EF_2.
EF_4	205717	802978	Forth tributary to the east of EF_3.
EF_5	205336	802965	Loch Fearna outflow: River Allt Fearna.
EF_6	205035	803761	Main eastern affluent of the River Allt a' Mheil taking source in Coire Dubh.
EF_7	204787	802051	Confluence between the River Allt Fearna and Loch Quoich.
EF_8	204612	803080	River Allt a' Mheil downstream of existing hydroscheme dam.

3.3.4 Environmental DNA (eDNA)

Environmental DNA (eDNA) samples were collected in 2023 at strategic locations in the littoral zone of Loch Fearna and Loch Quoich. Sampling Locations are provided in **Table 4** and shown in **Appendix A – Figure 11.1.4.0**.

Table 4: Environmental DNA: Sampling Locations

Sampling Location	Waterbody	Easting	Northing
eDNA_1	Loch Fearna	205431	803035
eDNA_2	Loch Feana	205443	803247
eDNA_3	Loch Fearna	205547	803361
eDNA_4	Loch Fearna	205690	803213
eDNA_5	Loch Fearna	205723	802986
eDNA_6	Loch Fearna	205506	802937
eDNA_7	Loch Quoich	205368	801923
eDNA_8	Loch Quoich	205177	801893
eDNA_9	Loch Quoich	204798	802019
eDNA_10	Loch Quoich	201648	803964
eDNA_11	Loch Quoich	206182	801529

3.4 Fish Habitat Assessment Methodology

The fish habitat assessment was conducted using an adapted version of SEPA hydropower guidelines on assessing habitat suitability for juvenile salmonids. This guidance has been recommended by the Marine Directorate on similar pumped storage hydro scheme projects.

Using the SEPA approach, habitat types are classified under four main categories; Bedrock channels, Lamprey habitat, Productive habitat and Obstructions to migration. This method was adapted to sub-divide Productive habitat into *Productive: Good* and *Productive: Moderate*. A category for '*Unproductive*' was added and sub-divided into *Unproductive: Bedrock* and *Unproductive: Other*. Habitat characteristics such as bankside cover, flow types, depths and riparian habitats were collected on a SFCC habitat form to help inform these assessments at each Survey Location. These amendments to the method allowed for a more informed assessment of the fish habitat present and allowed scope for habitat categories not included under the SEPA method to be recorded e.g. man-made concrete channels or peat laden ditches.

Predominant habitats were recorded within specific sections and the average wetted width of the channel was recorded. Where the habitat characteristics changed, a new section was annotated on the map with grid references of the start and end points noted. It is important to note that not all habitat features (productive or unproductive) are necessarily continuous within a watercourse section; they may often be isolated and too small to map, in this case a target note was recorded or a longer section with a constant succession of impassable features (waterfall or underground channel) were immediately characterised as

Unproductive (Other) until a section with Productive habitat was found. 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 recorded. 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 conducted upstream of this point.

3.5 Fish Population Assessment Methodology

3.5.1 Fish Population Survey Method

Assessment of the species composition, abundance and age class structure of fish population was conducted in reasonable accordance with the Scottish Fisheries Coordination Centre guidelines on undertaking and managing electrofishing operations (SFCC, 2007) and British Standards (BS 14011 - Sampling of fish with electricity & BS 14962 Guidance on the scope and selection of fish sampling methods). The survey team comprised of three experienced surveyors. The survey lead was qualified to SVQ Level III (leading electrofishing operations and undertaking fish habitat surveys), both assistants were qualified to SVQ Level II (introduction to electrofishing). The surveys were undertaken using a ©Hans Grassl Electrofishing kit which was battery powered and was set up to drive a single anode. Smooth DC current was applied as this is generally accepted as the least damaging to fish during this type of survey. Fish Population Assessment using electrofishing must be undertaken within the optimal time of the year corresponding to the biology of the targeted species. Juvenile Salmonids usually emerge from *redds* (spawning grounds) early in the spring and take from 5 to 10 weeks (variable according to resource availabilities and water temperature) to reach the *fry* stage and a sufficient size to be safely captured and identified to the species level. Furthermore, water temperature must be comprised within the optimal range for electrofishing (10 – 15˚C). Under the SFCC protocol, surveyors should perform a maximum of four electrofishing runs per site. To obtain a fully quantitative estimate and confidence limits of the population present (N.B. a minimum of two electrofishing runs must be performed). Draft guidelines from the European Inland Fisheries Advisory Commission (EIFAC) state that *"Sites must be surveyed at least three times except and unless the second catch is very much smaller than the first and the field estimates of population size indicate (a) that the population size exceeds 200, and (b) that the probability of capture of an individual fish is greater than 0.6. Under these circumstances a third fishing need not be carried out"*. However, it is usual that additional electrofishing runs are performed to increase the reliability of the estimate.

3.5.2 Quantitative Electrofishing Survey

A fully quantitative electrofishing survey was conducted. A fully quantitative electrofishing survey is the enumeration of a stock component within a given site. The estimate of the total population is calculated from the number of fish caught over multiple electrofishing runs. In order to calculate the population estimate, the method used is depletion sampling (where fish are removed from a site in a series of successive electrofishing runs). Depletion methods are considered as self-calibrating as the catch data is used to derive the probability of capture (Wyatt and Lacey, 1994). The population estimate is based on the rate at which the number of individuals caught for each catch on successive runs drop off. For the estimation to be valid, the removal method must significantly reduce the population size with each successive sampling run. Each survey was conducted within an approximate 100 m^2 section (the section area was calculated accurately according to the widths and the length of the watercourse).

3.5.3 Fish Processing

Caught individuals were carefully placed in an aerated freshwater container with a small hand net. Fish were then placed in an anaesthetic container (10 $ml.l^{-1}$ – Benzocaine) prior to measuring. The fork length (mm) was recorded, and the individuals were placed into a

recovery container (aerated freshwater). At the end of the processing, all individuals were carefully released at the upstream limit of the survey section.

3.6 Macroinvertebrate Population Assessment

Macroinvertebrates samples were collected using the standard SEPA and Environment Agency kick sampling method. A three-minute kick sample was conducted in riffled areas, moving within the river to account for differences in substrate and habitat types. During each kick sample the net was held down-stream of the surveyor, with its bottom edge in contact with the substrate. The surveyor kicked and dislodged the substrate, moving slowly backwards, and in an upstream direction. Invertebrates dislodged from the substrate were washed downstream and trapped in the net. This was followed by a one-minute manual search in which substrate too large to dislodge during the initial three-minute sample were over-turned and examined. To account for surface macroinvertebrate presence a further one-minute sweep was conducted in the shallow margins and across the surface of the river. In lentic water systems such as Loch Fearna and Loch Quoich, sweep sampling was the preferred method of sampling. This relied on a disturbance of the substrate and then a sweeping like motion in a figure of eight of the pond net through the water column to collect the sample (Chadd, 2010). The macroinvertebrate sample was collected using a standard Freshwater Biological Association Pond net (mesh diameter 1.0 x 1.0mm); which was disinfected with Virkon S prior to and after use. Invertebrates and substrate trapped in the pond net or collected during the manual search were stored in a labelled sample container (with a paper sample identification label also added to the sample container for security) for later extraction.

3.7 Environmental DNA (eDNA) Sampling (2023)

Water samples were collected in the littoral zone and processed through a Sterivex Millipore Sterile filter (0.22 um) with a manual pumping system. It is important to note that the volumes of water differ according to the Survey Location because of limitations of the pumping system when dealing with different volumes of particulates within the water sample.

Further eDNA sampling was carried out during January 2025 upon Loch Quoich. The results of this analysis is not yet available for inclusion here, but will be included within a future SEPA CAR licence application.

3.8 Analysis and Statistics

3.8.1 Fish Habitat Assessment

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 ground 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 classification along the watercourse. Sections within each survey location were then given a rating for fish habitat quality (**Table 5**).

Table 5: Adapted SEPA Fish Habitat Classifications

Fish Habitat	Conditions	
Productive Habitat (Good)	Salmonid Spawning Ground	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt. Substrate size predominantly pebbles and cobbles (lower size limit).
	Salmonid Fry	○ Atlantic salmon: Shallow (<0.2 m) and fast flowing water indicative of riffle and run with a substrate dominated by pebbles and cobbles (lower size limit). ○ Brown trout: Slow to medium flowing shallow water with a substrate dominated by pebbles (upper size limit), cobbles (lower size limit), often concentrated at stream margins.
	Salmonid Parr	○ Atlantic salmon: Riffle and run habitat that is generally faster and deeper than fry habitat (0.2 - 0.4 m). Substrate size range comprise from pebbles (upper size limit), cobbles (lower size limit) to boulder. ○ Brown trout: Variety of substrate sizes (from pebble to boulder); undercut banks, tree roots; deeper and slower water.
Productive Habitat (Moderate)	Suitable habitat characteristics (i.e., mentioned in the above section 'Productive Habitat (Good)' but with the presence of unsuitable elements (i.e., lack of bankside cover, high variation of water flow, bedrock, silt, and algae).	
Unproductive Habitat (Bedrock Channels)	Habitat primarily consists of adverse conditions with the presence of limited suitable elements. (dominated by bedrock).	
Unproductive Habitat (Other)	Habitat primarily consists of adverse conditions with the presence of limited suitable elements.	
Obstructions to Migration	Impassable waterfalls, weirs, bridge sills.	
Lamprey Habitat	Optimal: Stable fine sediment or sand; ≥15 cm deep with low water velocity and the presence of organic detritus as well as macrophytes. Sub-optimal: Shallow sediment (<15 cm deep), unequal and interspersed among coarser substrates.	

3.8.2 Population Estimate

Population estimates were calculated using analysis of depletion catches with a maximum likelihood estimation procedure. The maximum likelihood estimator of Carle and Strub (1978) is a development of the Zippin (1958) method. It has the advantage of being able to produce population estimates and confidence intervals under situations where the Zippin method fails (when the probability of catch varies from run to run, or when the population size is small which was the case in the study). However, despite being more robust than the Zippin method, it is still susceptible to the same violations mentioned above as the Zippin method is, and the confidence intervals of the data should be considered when the data are interpreted. Statistical analyses were conducted under R studio program (Version 2023.06.1). A removal depletion model from the Carle and Strub (1978) method has been used to calculate population estimates, catching probability and confidence intervals. The package FSA – Fisheries Stock Assessment Methods version 0.9.4 (Ogle and Wheeler, 2023) has been used to conduct the analysis. The number of individuals caught for each of the three runs have been implemented in a removal model using the *removal* function. The population estimate and the confidence interval have been extracted using the *summary* function.

3.8.3 SFCC Classification Scheme

The SFCC developed a national river classification scheme for Scottish rivers (Godfrey, 2005). The following classification is based on data collected in the Moray Firth Region and therefore applicable in the catchment (**Table 6**)

Table 6: SFCC Classification Scheme - N individual/100 m^2 in stream <4m wide

Species/Age-class	A	B	C	D	E	F
Brown trout fry 0+	39.0+	21.0 - <39.0	14.3 - <21.0	5.9 - <14.3	<5.9	0
Brown trout parr >0+	18.1+	13.7 - <18.1	9.1 - <13.7	3.9 - <9.1	<3.9	0
Atlantic salmon fry 0+	86.8+	35.8 - <86.8	22.6 - <35.8	8.6 - <22.6	<8.6	0
Atlantic salmon parr >0+	30.9+	18.9 - <30.9	11.7 - <18.9	5.3 - <11.7	<5.3	0
Classification	***Excellent***	***Good***	***Moderate***	***Poor***	***Very Poor***	***Absent***

3.8.4 Macroinvertebrate Population Assessment

Analysis of macroinvertebrate population was conducted by Gavia Environmental Ltd. approved third-party contractor Riverwood Ecology. Macroinvertebrate samples were classified to species level where it was appropriate to do so. The following scores were calculated for each sample (Interpretation of the Taxonomic level and the scores for BMWP, PSI and CCI are provided in **Table 7 & 8**):

- BMWP - Biological Monitoring Working Party score;
- NTAXA (TL1 and TL2) - Count of BMWP family taxa in the sample;
- ASPT (TL1 and TL2) - Average score per (BMWP/WHPT) taxon;
- LIFE (TL5 and TL2) - Lotic-Invertebrate index for Flow Evaluation;
- PSI (TL5 and TL3) - Proportion of Sediment-sensitive Invertebrates;
- E-PSI (FAM and TL5) - Empirically Weighted Proportion of Sediment-sensitive Invertebrates Index;
- CCI (TL5) - Community Conservation Index (TL5 only) and
- WHPT (TL2) - Whalley-Hawkes-Paisley-Trigg index.

Table 7: Macroinvertebrate Taxonomic Level

Code	Description
TL1	Taxonomic Level 1 - The 78 "BMWP family" level taxa in RIVPACS IV
TL2	Taxonomic Level 2 - The 112 "WHPT family" level taxa in RIVPACS IV
TL3	Taxonomic Level 3 - 'All Families'
TL5	Taxonomic Level 5 - The 417 "WFD Species" level taxa in RIVPACS IV (including component members of species groups)

Table 8: Key and Score interpretation for Macroinvertebrate Analysis.

BMWP Score Category Interpretation		PSI Score Category Interpretation	
0 – 10	Very Poor	0 - 20	Heavily Sedimented
11 – 40	Poor	21 - 40	Sedimented
41 – 70	Moderate	41 - 60	Moderately Sedimented
71 – 100	Good	61 - 80	Slightly Sedimented
> 100	Very Good	81 - 100	Minimally Sedimented

CCI Score Category Interpretation	
0 - 5	Low Conservation Value
>5 - 10	Moderate Conservation Value
>10 - 15	Fairly High Conservation Value
>15 - 20	High Conservation Value
>20	Very High Conservation Value

3.8.5 Environmental DNA (eDNA)

Primers were designed to amplify fragments in a range of 101– 250 bp to allow for Sanger sequencing in order to be able to validate eDNA detection when necessary. Annealing temperature was validated using Primer Express 3.0 (Life Technologies) and cross-amplification to unrelated species was verified using Primer Blast (Zhao et al., 2012). All designed primers and probes were validated for amplification of targeted species and for cross-amplification with related species using in-house extracted genomic DNA from various tissues for fish, amphibians, molluscs, and crustaceans using a salt DNA extraction protocol (Aljanabi & Martinez, 1997), and from blood for reptiles using the DNeasy blood and tissue kit (Qiagen). Primer screening was performed with FAST SYBR Green (Life Technologies). Amplifications were performed on a 7,500 Fast Real-Time PCR System (Applied Biosystems) in a final volume of 20 µl: 10 µl of Fast SYBR® Green Master Mix, 1 µl of each primer (10 µM), 2 µl of DNA (5–10 ng) and 6 µl of UltraPure Distilled Water (DNAse, RNAse, Free, Invitrogen™) following these conditions: 95°C for 20 s, 40 cycles × [95°C for 3 s, 60°C for 30 s]. The full eDNA report from University of Glasgow is available in **Appendix F.**

3.8.6 Macrophytes

The standard approach to biological monitoring of standing water habitats, as recommended by the JNCC was employed for the macrophyte survey (Interagency Freshwater Group, 2015).

Four 100 m transects were conducted on Loch Feana; this is considered representative where the waterbody area is <100 ha. Where waterbodies are small (<5 ha) fewer transects are considered sufficient to characterise the waterbody. Loch Fearna is approximately 10ha in size.

Locations of the transects were strategic to characterise macrophyte communities and/or where species of interest are likely to occur (e.g. selection is not random). Where possible,

the selection should be based on previous surveys. As historical macrophyte data was not present prior to this survey, transect locations were chosen to represent the potential range of habitats or species within the marginal areas of waterbodies. This was assessed by undertaking an initial walkover of the waterbody perimeter prior to conducting transect surveys. At least one transect should be located in the sheltered part of the shore where plant fragments are likely to accumulate.

The strandline survey was incorporated into each 100 m transect recording the presence / absence of species. This was sub-divided into 5 equal sections with presence of species recorded within each section. This did not comprise a formative part of the assessment but was undertaken as a guide to inform the potential presence of charismatic species. In the event wader and /or boat surveys could not be undertaken this may be used in the assessment.

Wader surveys were conducted over the same 100 m transects with five sections surveyed perpendicular to the main transect line at 20 m intervals each covering an area of 1 m^2 (see **Image 2**). Additional 1 m^2 areas were surveyed at depths of 0.25 m, 0.5 m, 0.75 m and >0.75 m. A bathyscope and/or grapnel hook was used to examine the species present at each sampling point. The following data was recorded from each transect:

I. All species present;

II. An estimate of total abundance using the DAFOR scale (see **Table 8**); and

III. A photograph of a selection of species identified for future reference.

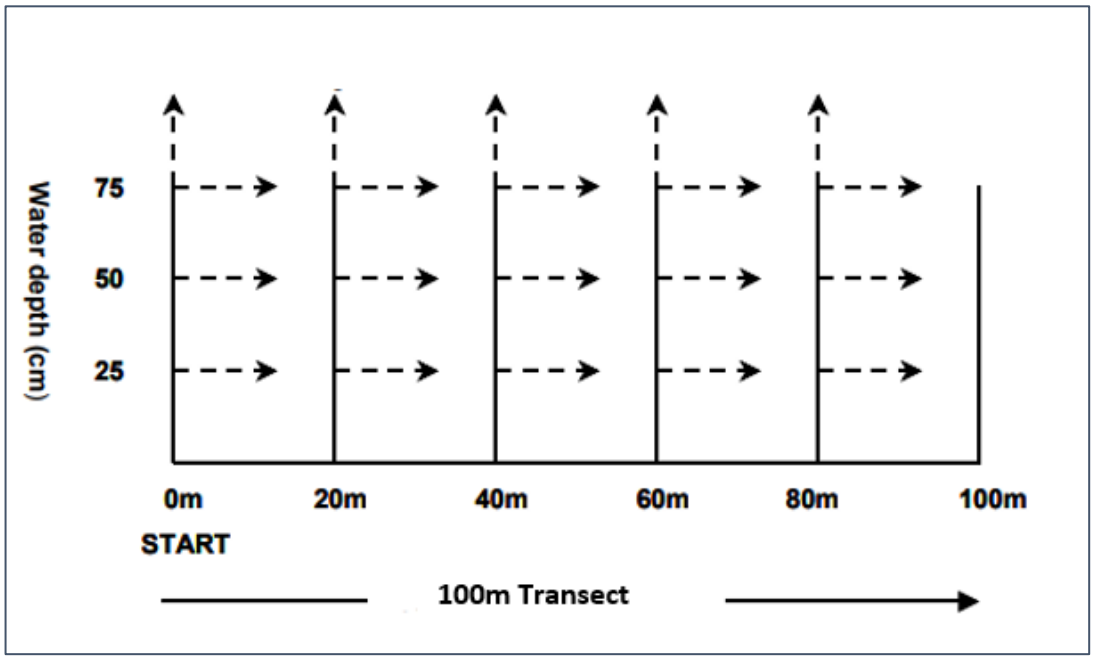

Image 1. The location of Survey Sections Relevant to the 100 m Transect (Interagency Freshwater Group, 2015).

DAFOR abundance categories were given to each species identified based on the percentage coverage within each transect, as shown in **Table 9**. This provides a comparable base for future surveys to identify growth / reduction in species coverage in addition to species present.

Table 9. DAFOR Abundance Category

Abundance	Cover

D	Dominant	50-100%
A	Abundant	30-50%
F	Frequent	15-30%
O	Occasional	5-15%
R	Rare	<5%

Boat surveys were not conducted as part of this survey due to the logistical challenges of transporting a boat to Loch Fearna with no access track and extremely steep gradient on approach. Grapnel hooks were used to obtain samples where water depth was >5 m. Conservation statuses for plants was assessed via the Botanical Society of Britain & Ireland (2024) latest 'List of Conservation Statuses for all UK Plants'.

Macrophyte surveys were limited to Loch Fearna. A survey was not conducted on Loch Quoich as during the 2024 optimal survey window, the Loch levels were much higher than normal resulting in marginal areas which are normally dry due to the existing Quoich Power Station operation and devoid of aquatic vegetation were flooded. This would have meant that data collected along transects in marginal areas would have been likely meaningless. JNCC guidance states that '*If on the day of survey, water levels are obviously raised or lowered, survey should be postponed as results are unlikely to be comparable'* (JNCC 2015).

4 Results

4.1 Desk Study

4.1.1 SEPA Water Classification Hub

Loch Quoich is a lake (ID: 100186), in the River Ness catchment of the Scotland river basin district. It is 17.5 square kilometres in area. The water body has been designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant impact on water storage for hydroelectricity generation (Quoich Dam). The Loch is classed as *Poor* for Fish and Fish barrier, Good for water quality and aquatic plants and has an overall status of *Good Ecological Potential*.

River Garry - Loch Poulary to Loch Quoich is a river (ID: 20256), in the River Ness catchment of the Scotland river basin district. The main stem is approximately 7.3 kilometres in length. The water body has been designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant impact on water storage for hydroelectricity generation. This section of river is classed as *Poor* for Fish, Fish Ecology and has an overall status of *Poor Ecological Potential*.

River Garry - Loch Garry to Loch Poulary is a river (ID: 20255), in the River Ness catchment of the Scotland river basin district. The main stem is approximately 4.6 kilometres in length. The water body has been designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant impact on water storage for hydroelectricity generation. This section of river is classed as *High* for Fish, Fish Ecology and has an overall status of *Good Ecological Potential*.

No other waterbodies or watercourses potentially affected by the Proposed Development were classified by SEPA on the Water Classification Hub (2023).

4.1.2 Protected Areas

No protected areas with a relevance to aquatic ecology have been identified within the Proposed Development.

Loch Garry is part of the West Inverness-shire Lochs SPA / SSSI is within 5.7 km of the Proposed Development. *The sites are both designated for the following species; black-throated diver and common scoter. As these are considered terrestrial species, Effects on the qualifying interests of these designated sites are covered under Chapter 8: Ecology.*

4.1.3 Records of Arctic charr

Maitland and Adams (2017) *Arctic charr in the lochs of Scotland: An Assessment of Distribution and Status* lists records of Arctic charr in Loch Quoich. Most records are now historic (1913-1995) with the previous record being from 1995 and catch data very limited i.e. single catches. 'Note 4' also states '*some evidence of riverine use*' but this was confirmed to be on the mainstem Gearr Garry / River Garry downstream of Quoich dam rather than within the tributaries of Loch Quoich.

The AMBER report recorded Arctic charr in Loch Quoich above Quoich Dam in eDNA surveys in 2018.

4.1.4 Barriers to Migration

Within the Proposed Development, no desk records of anthropogenic barriers to migration were identified (Water Classification Hub, 2020). However, a hydroelectric dam is present on the eastern end of Loch Quoich (Grid Reference NH070023). The feature is located approximately 700 m to the east of the Proposed Development and currently operates with no fish pass. Therefore, the presence of migratory species such as Atlantic salmon and Sea trout has not been considered. Furthermore, a hydroelectric dam has been identified on the

River Allt a' Mheil (situated at the end of an existing access track - Grid Reference NH046031).

4.2 Fish Habitat Assessment

A total of 12 Survey Locations with defined sections have been surveyed within upper and lower areas of the Proposed Development. A total of 1462.50 m^2 of habitat was classified as *Productive: Good*. Those sections feature within the following Survey Locations; H_SL_4 and H_SL_5 (the lower reaches of unnamed tributaries of Loch Fearna), taking their source in Coire Glass and H_SL_9 (a short section of the westernmost tributary of the River Allt a' Mheil), taking its source in Coire Dubh. All of these sections were within the upper area of the Proposed Development.

A total area of 1184 m^2 of habitat was classified as *Productive: Moderate*. Those sections correspond to the following Survey Locations; H_SL_5 (a very short section of unnamed watercourse which is a tributary of Loch Fearna) H_SL_6 (the very upper reaches of the Allt Fearna at the out flow from Loch Fearna), H_SL_9 (immediately upstream of the confluence with the Allt a'Mheil), H_SL_10 (four short sections on the Allt a' Mheil) spread between sections of unsuitable bedrock) and H_SL_12 (the lower reaches of the Allt Fearna upstream of the confluence with Loch Quoich).

A total area of 2154.50 m^2 of habitat was classified as *Unproductive: Bedrock*. Those sections correspond to the following Survey Locations; H_SL_9 (a short, steep section of the westernmost tributary of the River Allt a' Mheil), H_SL_10 (several short sections and one long continuous section on steep gradient of the Allt a' Mheil), H_SL_11 (a short section of the Allt a' Mheill upstream of the confluence with Loch Quoich) and H_SL_12 (a section of the Allt Fearna on steeper gradient crossed by the main public road).

A total area of 3306.50 m^2 of habitat was classified as *Unproductive: Other*. Those sections correspond to the following Survey Locations; H_SL_1, H_SL_2, H_SL_3, H_SL_4 and H_SL_5 watercourses flowing into Loch Fearna featuring sections with steep gradients, underground sections and peat channels), H_SL_7 and H_SL_8 (tributaries of the Allt a' Mheil which were steep and minor in nature) and H_SL_10 (the upper reaches of the Allt a' Mheil, downstream of confluences).

A map of the fish habitat assessment classification is available in **Appendix A – Figures 11.1.2.1-11.1.2.12**.

Total areas and percentages for each habitat category are shown in **Table 10** below.

Table 10: Area and Percentage of Fish Habitat Classification.

Classification	Area (m^2)	Percentage
Productive: Good	1462.50	18.03 %
Productive: Moderate	1184.00	14.60 %
Unproductive: Bedrock	2154.50	26.57 %
Unproductive: Other	3306.50	40.78 %
Total	**8,107.50**	**100 %**

4.3 Fish Population Assessment

Brown trout and common minnow were recorded at the confluence between the Allt Fearna and Loch Quoich (survey location EF_7, within the 'Lower Area'). Notably, the common minnow population were harbouring colour sexual dimorphism such that individuals were mature, and ready to spawn (for both male and female). No fish were found in any of the

other survey locations, including within the Loch Fearna catchment (EF_3, EF_4, EF_5 and EF_6) and the Allt a' Mheil Catchment (EF_6 and EF_8). Therefore all of the survey locations within the 'Upper Area' had an absence of fish.

At survey location EF_7, the fully quantitative population estimate for brown trout was 19.00 ± 2.00 (CI = [15.07; 22.92]). Within the brown trout population, the estimate relating to the percentage of brown trout fry was 8.00 ± 0.76 (CI = [6.49; 9.50]) and brown trout parr was 10.00 ± 1.11 (CI = [7.81; 12.18]). SFCC regional classifications were categorised as *Low* for brown trout fry and *Moderate* for brown trout parr (this is based on the first run of the electrofishing survey only as per Godfrey, 2005). Fully quantitative population estimates and SFCC regional classifications are shown in **Table 11** below.

Table 11: Fully Quantitative Population Estimates and SFCC Regional Classification.

Survey Location	Survey Technique and Sample Area	Population Estimate		sd		CI		SFCC Regional Classification	
		Brown trout *fry*	Brown trout *parr*	Brown trout *fry*	Brown trout *parr*	Brown trout *fry*	Brown trout *parr*	Brown trout *fry*	Brown trout *parr*
EF_1	Not surveyed								
EF_2	Not surveyed								
EF_3	Fully Quantitative (~100 m^2)	N/A	N/A	N/A	N/A	N/A	N/A	***Absent***	***Absent***
EF_4	Fully Quantitative (~100 m^2)	N/A	N/A	N/A	N/A	N/A	N/A	***Absent***	***Absent***
EF_5	Fully Quantitative (~100 m^2)	N/A	N/A	N/A	N/A	N/A	N/A	***Absent***	***Absent***
EF_6	Fully Quantitative (~100 m^2)	N/A	N/A	N/A	N/A	N/A	N/A	***Absent***	***Absent***
EF_7	Fully Quantitative (~100 m^2)	**8.00**	**10.00**	**0.76**	**1.11**	**[6.49;9.50]**	**[7.81;12.18]**	***Poor***	***Moderate***
EF_8	Fully Quantitative (~100 m^2)	N/A	N/A	N/A	N/A	N/A	N/A	***Absent***	***Absent***
Classification Key		***Excellent***	***Good***	***Moderate***	***Poor***	***Very Poor***	***Absent***		

4.4 Water Quality Sampling

The water quality results are shown in **Table 12**. Temperature ranged from 10.80°C (SL6) to 13.03 °C (SL5), with an average of 12.08 °C. The dissolved oxygen concentration (DO as %) was at total saturation and consistent throughout the sampling locations and ranged from 101.20% (SL2) to 107.50% (SL6), with an average of 105.2%. Dissolved oxygen (DO as mgl^{-1}) ranged from 10.19 mgl^{-1} (SL5) to 11.75 mgl^{-1} (SL2), with an average of 10.90 mgl^{-1}. pH was consistent throughout the survey locations, ranging from 7.31 (SL6) to 7.90 (SL5), with an average of 7.61. Conductivity (EC) was consistent and relatively low across the sampling locations, ranging from 14 $\mu s.cm^{-1}$ (SL4) to 24 $\mu s.cm^{-1}$ (SL1), with an average of 19 $\mu s.cm^{-1}$. Total Dissolved Solids (EC) was also consistent and relatively low across the sampling locations, ranging from 10.00 mgl^{-1} (SL5) to 14.50 mgl^{-1} (SL2) with an average of 12.36 $\mu s.cm^{-1}$. Oxidation Reduction Potential (ORP) ranged from 87.2 mV (SL4) to 280.7 mV (SL7) with an average of 152.2 mV.

Table 12: Water Quality Monitoring Sampling Locations

Sampling Location	Temperature (°C)	ORP (mV)	pH (units)	DO (%)	DO ($mg.l^{-1}$)	EC ($\mu s.cm^{-1}$)	TDS ($mg.l^{-1}$)
EF_1	11.60	169.00	7.64	106.90	10.84	24.00	14.00
EF_2	11.40	172.00	7.50	101.20	11.75	23.00	14.50
EF_3	10.70	99.40	7.63	105.00	10.96	19.00	12.00
EF_4	13.00	87.20	7.70	107.30	10.67	14.00	12.00
EF_5	13.03	129.00	7.90	102.10	10.19	16.00	10.00
EF_6	10.80	128.30	7.31	107.50	11.19	17.00	11.00
EF_7	14.00	280.70	7.62	106.20	10.71	20.00	13.00
EF_8	11.10	127.00	7.42	106.90	11.12	19.00	12.00

4.5 Macroinvertebrate Population Assessment

The macroinvertebrate population assessment indices scores are presented in Table 13. Three Sampling Locations (FE1, FE2 and FE 4) were classed with the BMWP (TL1) analysis score as *Very Good*, with one significantly above the >100 threshold at 120 (FE1). Four Sampling Locations (FE3, FE6, FE7 and FE9) were classed as *Good*. Sampling Location FE5 was classed as *Moderate* and FE8 as *Poor*.

Regarding the PSI (TL5) analysis score, six Sampling Locations (FE1, FE2, FE3, FE6, FE7 and FE8) were classed as *Minimally Sedimented.* Two Sampling Locations (FE4 and FE5) as *Slightly Sedimented* and one Sampling Location (FE9) as *Sedimented*. Furthermore, on the PSI (FAM) (TL3) analysis score, five Sampling Locations (FE1, FE3, FE5, FE6 and FE8) were classed as *Minimally Sedimented* and the remaining Sampling Locations (FE2, FE4, FE7 and FE9) were classed as *Slightly Sedimented*. The Sampling Locations FE1, FE2, FE3, FE4, FE5, FE6, FE7 and FE8 were classed *as Minimally Sedimented* for the E-PSI (FAM) analysis score and Sampling Location FE9 was classed as *Slightly Sedimented*. The results are the same for the E-PSI (TL5) analysis scores except Sampling Locations FE5 and FE9 were classed as *Slightly Sedimented*.

One Sampling Location (FE8) was classed as *High Conservation Value* on the Community Conservation Index (CCI) analysis score however this score is skewed by a low number of taxa present (5). Two Sampling Locations (FE1 and FE5) were classed as *Fairly High Conservation Value* and the remaining six Sampling Locations (FE2, FE3, FE4, FE6, FE7 and FE9) were classed as *Moderate Conservation Value*.

WHPT scores ranged from 27.1 (FE8) to 150 (FE1). A full list of species is presented in **Appendix E**.

Table 13: Results of the Macroinvertebrate Population Assessment: Indices Scores

Biotic Index	*Spring*								
	FE1	*FE2*	*FE3*	*FE4*	*FE5*	*FE6*	*FE7*	*FE8 (Loch Quoich)*	*FE9 (Loch Fearna)*
	24/05/2023	*24/05/2023*	*24/05/2023*	*24/05/2023*	*24/05/2023*	*24/05/2023*	*24/05/2023*	*24/05/2023*	*24/05/2023*
Grid Reference	NH 05474 03367	NH 05674 03332	NH 05719 03147	NH 05761 02974	NH 05349 02955	NH 04847 02076	NH 05468 01994	NH 05922 01729	NH 05717 03133
BMWP (TL1)	120	104	89	103	45	95	95	24	82
NTAXA (TL1)	18	17	13	15	9	14	15	5	13
ASPT (TL1)	6.67	6.12	6.85	6.87	5.00	6.79	6.33	4.80	6.31
LIFE (TL5)	8.81	8.50	8.67	8.08	8.17	8.77	8.36	8.00	7.20
LIFE(FAM) (TL2)	7.56	7.27	7.83	7.43	7.29	8.00	7.14	7.00	6.64
PSI (TL5)	97.44	97.14	100.00	80.77	72.00	96.77	84.38	100.00	30.43
PSI(FAM) (TL3)	85.29	76.67	95.65	79.17	81.25	96.00	70.37	100.00	61.54
E-PSI (FAM)	97.12	97.07	100.00	93.65	84.81	99.14	91.99	100.00	61.98
E-PSI (TL5)	95.54	95.54	100.00	91.86	80.65	100.00	90.82	100.00	75.44
CCI (TL5)	10.88	8.75	9.62	9.23	12.86	9.23	5.57	15.00	5.00
WHPT (TL2)	150	130.2	98.5	117.9	55.1	114	117.8	27.1	91.9
NTAXA (TL2)	20	19	13	15	10	15	17	5	14
ASPT (TL2)	7.50	6.85	7.58	7.86	5.51	7.60	6.93	5.42	6.56

4.6 Environmental DNA (eDNA) Sampling

The results of the eDNA analysis are included within **Appendix F**. The main conclusions of the report were:

- Presence or absence cannot be determined in either loch system due to being lower than the limit of detection/quantification as stated by the qPCR standard curve. Furthermore, both Loch samples were indistinguishable from the negative control.
- Melt-curve analysis (Appendix 3) indicates that Loch sample background amplicons are unlikely to be Charr in origin.
- To improve sensitivity and determine the presence or absence of *S. alpinus*, it is suggested an increase in water be pumped through the filter during eDNA sampling to improve the potential of a positive detection. Blocking of the filter could be avoided by coarse pre-filtration of the water sample prior to pumping.
- Metabarcoding of Loch Fearna samples revealed 12S rRNA to be a 100% match to *Salmo salar* (Atlantic salmon) and are unlikely to be *S. alpinus* (97.65% match when Blasted through NCBI).

Discussion on the Salmo salar result in the Loch Fearna samples is discussed in Section 5.5 below.

4.7 Macrophytes

In total 11 species were identified throughout Loch Fearna: 9 submerged/floating; and 4 emergent/edge species (*Juncus bulbosus* & *Littorella uniflora were* identified in both submerged and emergent communities). All species except *Baldellia ranunculoides* were classified as 'Least Concern' or 'Data deficient' for their conservation value, with *Baldellia ranunculoides* being classed as near threatened according to the IUCN Red List of Threatened Species. A full species list is provided in **Table 14**.

No invasive non-native species were identified in any of the lochs sampled.

National Vegetation Communities (NVC) around the loch are generally dominated by wet heath M15 *Scirpus cespitosum-Erica tetralix* wet heath, with the aquatic communities largely split between A22 *Littorella uniflora-Lobelia dortmanna* community and A24 *Juncus bulbosus* community.

Table 14: Macrophyte Species List

Transect	Waterbody	Start Transect Coordinates		End Transect Coordinates		Submerged / Floating	DAFOR	Emergent / Edge	DAFOR	Dominant Substrate Type
		Easting	Northing	Easting	Northing					
T1	Loch Fearna	205453	803151	205483	803111	*Lobelia dortmanna*	A	*Juncus bulbosus*	O	Boulders, Pebble, Gravel, Sand, Silt
						Juncus bulbosus	A			
						Potometon filiformis	F			
						Sublaria aquatica	O			
						Glyceria fluitans	O			
						Baldellia ranunculoides	R			
T2	Loch Fearna	205372	802978	205434	802944	*Baldellia ranunculoides*	R	*Juncus bulbosus*	O	Pebble, Gravel, Sand, Silt
						Juncus bulbosus	O			
						Lobelia dortmanna	F			
						Myriophyllum alterniflorum	F	*Succisa pratensis*	R	
T3	Loch Fearna	205707	802938	205739	803060	*Baldellia ranunculoides*	R	*Juncus bulbosus*	O	Sand dominated with Gravel and Silt beyond 0.5m depth
						Juncus bulbosus	O			
						Lobelia dortmanna	A			
						Potomageton filiformis	O	*Litorella uniflora*	R	
						Potomageton polygonifolius	O			
T4	Loch Fearna	205730	803128	205694	803208	*Glyceria fluitans*	O	*Equisetum fluviatile*	R	Gravel, Sand, Silt, Peat

Transect	Waterbody	Start Transect Coordinates		End Transect Coordinates		Submerged / Floating	DAFOR	Emergent / Edge	DAFOR	Dominant Substrate Type
		Easting	Northing	Easting	Northing					
						Litorella uniflora	O	*Litorella uniflora*	R	
						Lobelia dortmanna	A			
						Potometon filiformis	F			
						Potomageton polygonifolius	O			

5 Discussion

5.1 Fish Habitat Assessment

A fish habitat assessment was conducted on watercourses within the Upper and Lower Areas of the Proposed Development potentially affected by the construction footprint in order to forecast on the presence of suitable habitat for salmonid fish including brown trout.

The Upper Area of the Proposed Development included the Loch Fearna catchment (Loch Fearna tributaries and outflow) as well as the source of the Allt a' Mheil watercourse in Coire Dubh to the existing run of river hydro scheme dam on the Allt a' Mheil.

The Lower Area included the confluence of the Allt a' Mheil and the Allt Fearna with Loch Quoich. The obvious steep geomorphology separating the Upper and Lower areas, included a succession of impassable waterfalls.

Within the Upper Area, the Loch Fearna catchment was regarded as potentially suitable habitat for Brown trout, notably Survey Locations H_SL_4, H_SL_5, H_SL_6 and these featured sections over shallower gradients which were classified as *Productive: Good* (H_SL_4 and H_SL5) and *Productive: Moderate* (H_SL_5 and H_SL6). The remainder of the Loch Fearna tributaries (H_SL_1, H_SL_2 and H_SL_3) including the upper reaches of H_SL_4 and H_SL_5 were classified as *Unproductive: Other*. This was due to the presence of steep gradients, underground sections and peat substrate within channels with some sections of watercourse considered minor in nature and unlikely to support fish populations.

The Upper Area also included Coire Dubh (a basin north-west of Loch Fearna) and the Allt a' Mheil catchment. The habitat quality across this catchment was highly variable due to steep gradient and sections of bedrock. Three main tributaries showing on OS mapping feed the upper Allt a' Mheil. Only the furthest west tributary (H_SL_9) featured *Productive: Good* / *Productive: Moderate habitat*. This habitat typically featured across plateau areas where the gradient was less steep and instream substrates and flow types were more optimal. Survey locations H_SL_7 and H_SL_8 featured exclusively *Unproductive: Other* habitat due to the presence of steep gradients, underground sections and peat substrate within channels with some sections of watercourse considered minor in nature and unlikely to support fish populations. Survey location H_SL_10 featured predominantly *Unproductive: Bedrock* habitat across sections of extensive steep gradient and a succession of falls which would likely pose a barrier to fish migration. The lower reaches of H_SL_10 did however feature sections of *Productive: Moderate* habitat interspersed between sections of sheet bedrock.

Within the Lower Area, two watercourses were considered for habitat assessment (confluences of the Allt a' Mheil and the Allt Fearna with Loch Quoich). The lower reaches of the Allt a' Mheil (H_SL_11) was classified as *Unproductive: Bedrock* habitat due to the presence of steep bedrock channels as well as a succession of impassable waterfalls. The lower reaches of the Allt Fearna (H_SL_12) was classified as *Productive*: *Moderate* habitat and the presence of Brown trout in electrofishing surveys validates this. Upstream where the watercourse becomes steeper, the habitat classification changed to *Unproductive: Bedrock*. It is likely that some areas of the riverine habitat in the lower reaches of H_SL_11 and H_SL_12 become flooded given the operational regime of the existing Quoich Dam, this was also evident from reviewing different sets of aerial mapping.

In summary, due to the steepness of the gradient of watercourses across both the Upper and Lower Areas, Productive habitat for fish tended to be on areas of shallower sloping gradient where flow speed was less rapid and depth increased with a more diverse range of instream substrates available. *Productive: Good* habitat made up 18.03 %, *Productive: Moderate* habitat made up 14.60 %, *Unproductive: Bedrock* made up 26.57 % and *Unproductive: Other* made up 40.78 % of the total habitat surveyed.

5.2 Fish Population Assessment

A fish population assessment was conducted within the Upper and Lower Area of the Proposed Development. Electrofishing survey locations were chosen in areas where *Productive* fish habitat had been previously identified during the fish habitat assessment.

Watercourses within the Loch Fearna catchment were surveyed including unnamed inflowing tributaries (EF_3 and EF_4) and the Allt Fearna which is the outflow of the loch (EF_5). No fish were recorded within any of these locations despite *Productive* habitat for brown trout being present. This indicates an absence of brown trout in Loch Fearna given the likelihood that these burns would be used for fish spawning and subsequent nursery habitat for juvenile trout. Watercourses within the Allt a' Mheil catchment were also surveyed including the western most tributary in Coire Dubh (EF_6) and the Allt a' Mheil itself downstream of an existing run of river hydroscheme (EF_8), however despite these watercourses featuring areas of *Productive* habitat, fish were again absent from the survey locations. Therefore all of the survey locations within the 'Upper Area' had an absence of fish species.

Within the Lower Area, fish populations were found on the lower reaches of the Allt Fearna near Loch Quoich (EF_7). Common minnows captured at the confluence with the loch were harbouring breeding sexual dimorphism colour, were mature and ready to spawn, therefore the electrofishing transect was moved upstream of their spawning zone. A population of brown trout was found at this location. The density of brown trout fry was categorised as *Poor* and brown trout parr as *Moderate* (relating to the SFCC Moray Firth regional classifications). This survey location was relatively steep for an electrofishing site but was the best available habitat for surveying. The presence of brown trout could indicate access for spawning brown trout from Loch Quoich under certain water level conditions. It is worth noting that the confluence between the Allt a' Mheil and Loch Quoich could not be assessed because of unsafe access conditions however the fish habitat was classified as unproductive and unlikely to harbour fish populations.

In summary, despite suitable habitat conditions to support fish populations, it is unlikely that brown trout are present within the Upper Areas of the Proposed Development (Loch Fearna and Allt a' Mheil catchments). The steep gradient of these catchments, especially the geomorphology between the Upper and Lower Area present a complete barrier to fish migration. Relic populations of brown trout are commonly present above impassable barriers in the Scottish Highlands but this does not appear to be the case in this instance. High numbers of palmate newt were observed within Loch Fearna on the days of surveying, indicating they may be a top predator in the loch in the absence of fish populations[1].

5.3 Water Quality Sampling

The water quality parameters in an aquatic environment are essential to assess if a habitat is suitable to support populations of salmonid fish. Throughout the sampling locations, the temperature ranged from 10.70 to 14.00 ◦C. Dissolved oxygen ranged from 10.19 to 11.75 mgl^{-1}. Therefore temperatures and dissolved oxygen were in the optimal range for salmonids which is 6-20 °C, however, no values were within the range of 16-17 °C where maximal growth occurs in salmonids (Fisheries Management Scotland, 2023). This is not unexpected given the elevation of the drainage basin may contribute colder water on average. All values of dissolved oxygen fell within the assessment criteria, 8-15 mgl^{-1} and were considerably higher than hypoxic levels, <6 mg/L (Alver *et al.,* 2022) However, it is important to note that as temperature rises the capacity of the water to hold oxygen reduces. Results are only representative of a singular sampling event. The pH range observed throughout the sampling locations were between 7.31 to 7.90 and therefore are ranging within the optimal pH level for salmonids (pH 6.5 – 8.0) (Staurnes et al., 1995). The

[1] Wester Ross Fisheries Trust (2008) Trout lochs, (charr lochs) and fishless lochs. *In:* Arctic charr populations in NW Scotland (and other areas): their conservation and management requirements pp. 4 [Online] Available: wrft.org.uk/files/WRFT Arctic charr discovery week 2008 workshop report.pdf [Last Accessed 11/02/2025]

electrical conductivity was low (EC 14.00 to 24.00 µs.cm^{-1}) and this is indicative of pure water, and this is likely due to the elevation and geomorphology of the area. Interestingly, no brown trout population was recorded in the watercourses situated in the Upper Area of the Proposed Development (Coire Dubh and Coire Glas), which included the Loch Fearna and Allt a' Mheil catchments. An absence of fish in these areas is likely due to other factors such as barriers to migration as the water quality conditions, fish habitat and availability of food (macroinvertebrates) were all suitable for supporting salmonid fish.

5.4 Macroinvertebrate Population Assessment

No species of high nature conservation interest (i.e. vulnerable, endangered or critically endangered) were noted from the sampling conducted. Species recorded were dominated by common and widespread taxa, typical of a range of habitat types. Within the samples collected, the species composition was that of marginal and lotic environments. A large variation of family groups was present across the sampling locations.

The taxa representing the highest abundances were the following: *Elmis aenea* (Coleoptera – Elmidae – FE1), Chironomidae (Diptera – Chironomidae FE5), Simulium sp (Diptera – Simuliidae – FE5), Baetis muticus (Ephemeroptera – Baetidae - FE1) and *Polycentropus flavomaculus* (Tricoptera – Polycentropidae – FE5).

The Loch Quoich sample (FE8) contained the lowest number of taxa (5) of all the sampling locations. This result is not unexpected due to the Loch Quoich featuring an operational hydro dam causing the littoral zone of the loch to be impacted by regular drawdown and water level fluctuation. FE8 incidentally gave the highest Community Conservation Index (CCI) score however the low number of taxa in this sample also caused the Community Conservation Index (CCI) score to be skewed to a higher value.

Macroinvertebrates observed are categorised by a diverse range of environmental tolerances and preferences, consequently communities are likely to exhibit both qualitative and quantitative responses to the range of environmental changes (for example: water depth; water temperature; water quality changes) (Sykes *et al.,* 1999).

Altering the water level of Loch Fearna is likely to alter the profiles of the shoreline. Existing marginal habitat is dominated by shallow shelfs and/or gently sloping margins, this is predicted to become steeper in light of water level changes reducing the area of suitable habitat and therefore the diversity within these areas. Re-profiling or changes to marginal areas can negatively affect macroinvertebrates (Buglife, 2023). Due to this change, and increased rates of water level changes in drawdown zones, benthic communities are likely to shift to a dominance of mobile groups, e.g. beetles and water boatmen, that are able to track water levels or profundal communities better adapted to predicted future conditions. Loch Quoich will be less affected by water level changes as the Proposed Development will work within the limits of an existing hydroscheme.

5.5 Environmental DNA (eDNA) Sampling

A presence/absence Arctic charr-specific survey was conducted by the University of Glasgow[2] in July 2023. Metabarcoding confirmed the absence of Arctic charr in the Loch Fearna samples but indicated the presence of *Salmo salar* (Atlantic salmon) which due to markers could be *Oncorhynchus mykiss* (rainbow trout). After further discussion with the lab, it was decided that contamination within the lab was the most likely reason for these readings, given that the loch is inaccessible to migratory fish and is not a recreational rainbow trout fishery. Given the absence of juvenile trout in any of the inflowing watercourses which contained supporting habitat, it is unlikely that there is a fish population present. This is further supported by anecdotal feedback from local land managers and the RSPB, who have advised that they do not believe there is a fish population in Loch Fearna.

[2] Robertson, B. A. and Llewellyn, M. S. (2023). Detection of Arctic charr (Salvelinus alpinus) utilising eDNA, molecular approaches and metabarcoding to determine the presence of absence in Scottish loch systems. University of Glasgow.

NDSFB were also satisfied that Loch Fearna is fishless during consultations. Local land managers also confirmed that the loch has never been stocked with rainbow trout. The combination of existing hydroacoustic data and eDNA is considered sufficient to advise on likely distribution of Arctic charr in the water column in Loch Quoich, however further eDNA sampling of Loch Quoich and inflowing watercourses in early 2025 is proposed to inform on the fish populations within the waterbody.

The full eDNA report from University of Glasgow is available in **Appendix F**.

5.6 Macrophytes

In total, 11 macrophyte species were identified throughout Loch Fearna: 9 submerged/floating; and 4 emergent/edge species (*Juncus bulbosus* & *Littorella uniflora* were identified in both submerged and emergent communities). All transects undertaken indicated species with little conservation value, designated as 'Least Concern' or 'Data Deficient' with the exception of *Baldellia ranunculoides* which is classified as Near Threatened (Botanical Society of Britain & Ireland, 2024).

Emergent communities contributed four species. Each transect displayed fewer species counts when compared to the submergent communities, however, similar species were identified within each transect. Of the species identified within Loch Fearna the majority displayed relatively high abundance on the DAFOR scale with the majority of species being recorded as 'Frequent', 'Abundant' or 'Occasional'. Three species were categorised as 'Rare', three emergent (*Equisetum fluviatile*, *Litorella uniflora* & *Succisa pratensis*) and one submerged *(Baldellia ranunculoides*). No species were recorded to be in 'Dominant' abundance.

No invasive non-native species (INNS) were identified in the surveyed waterbody. Therefore, there is no risk of the proposed development facilitating the transfer of INNS between Loch Fearna and waterbodies further down the catchment.

The limited species present in Loch Fearna is consistent with those found in a 1993 survey on the same loch by Olivia Lassiere (1993) and those found in the nearest Loch of similar altitude and size, Loch a' Mhaoil Dhisnich, that recorded a dominance of *Juncus bulbolus*, *Littorella uniflora* and *Lobelia dortmanna* in association with *Myriophyllum alterniflorum* (Steele, 1989). The overall low macrophyte diversity and abundance is consistent with nutrient poor oligotrophic status Lochs (Smith *et al.,* 1987). This is further supported by the large presence of indicator species including: *Juncus bulbosus*, *Lobelia dortmanna* and *Subularia aquatica which* support the characterisation of oligotrophic status within Loch Fearna.

Studies of upper lochs utilised for Pump Storage Hydro (e.g. Cruachan Reservoir) have displayed negligible or reduced macrophyte communities during the operational period (no baseline surveys available) (Smith *et al.,* 1987). Within Loch Fearna, some of the more abundant species identified, e.g. *Juncus bulbosus,* have been shown to tolerate moderate water level changes but are absent if those fluctuations are too large. However, less robust species identified within the loch such as *Litorella uniflora*, have been documented to uncouple from the littoral zone as a result of changing water levels affecting shore substrate composition and slope angle (Bill, 2020). While the effect of current impoundments cannot be accurately concluded at this time, comparisons with other nutrient poor oligotrophic lochs suggest that a minimal effect is likely to occur due to a reduced baseline abundance/diversity (Smith *et al.,* 1987).

The frequency at which the maximum and minimum water levels will be reached for the proposed Pump Storage Hydro during operation is not known, however, water levels of Scottish lochs are known to fluctuate naturally around magnitudes of 1-3 m, with regulated Scottish reservoirs fluctuating between 0.3 m to 30 m (Smith *et al.,* 1987). Extreme changes in environmental conditions such as light, temperature and nutrient availability are likely to occur with major water fluctuations resulting in reduced macrophyte community assemblages and a less diverse and abundant macrophyte community. This decline is likely to further impact local macroinvertebrate communities, reducing overall diversity and

abundance in the marginal zones (Beckett *et al.,* 1992). Submergent macrophyte communities are also critical for maintaining sediment stability on loch margins. Any loss of species diversity and abundance as a result of the Proposed Development may contribute to deterioration and erosion of marginal substrate with consequent effects on water quality (Salgado *et al.,* 2010).

6 Conclusion

The following conclusions can be drawn from the Aquatic Ecology Survey report:

- Sections of riverine habitat within the Upper and Lower Area of the Proposed Development had the potential to support salmonid fish populations.
- Despite suitable habitat conditions to support fish populations, it is unlikely that brown trout are present within the Upper Areas of the Proposed Development (Loch Fearna and Allt a' Mheil catchments).
- Populations of brown trout and common minnow were found within the lower reaches of the Allt Fearna upstream of Loch Quoich which is within the Lower Area of the Proposed Development. The presence of both fry and parr indicate recent recruitment in this area.
- eDNA sampling of Loch Fearna confirmed no detection of Arctic charr and brown trout within samples.
- Water Quality parameters presented optimal conditions for salmonid fish across all sampling locations.
- Macroinvertebrate communities recorded were dominated by common and widespread taxa and no species of conservation interest were recorded.
- Macrophytes communities within Loch Fearna were limited and no species of conservation interest were recorded.
- Other than common minnow, no invasive non-native species (INNS) were recorded across any of the surveys.

Further eDNA sampling of Loch Quoich and inflowing tributaries is proposed to inform on fish populations within the wider loch catchment. An assessment of the availability of spawning habitat within inflowing tributaries of Loch Quoich is also proposed.

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8 Appendices

Appendix A Figures [See Separate Documents]

List of Figures

Appendix B Habitat Type Classification.

Table 15: Fish Habitat Type Classification (source: SEPA and SFCC)

Habitat Type	Classification
Atlantic Salmon - Spawning Gravel	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt. Substrate size predominantly pebbles and cobbles (lower size limit).
Brown 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 cobbles (lower size limit).
Atlantic Salmon Fry Habitat	Shallow (< 0.2 m) and fast flowing water indicative of riffle and run with a substrate dominated by pebbles and cobbles (lower size limit).
Atlantic Salmon Parr Habitat	Riffle and run habitat that is generally faster and deeper than fry habitat (0.2 - 0.4 m). Substrate size range comprise from pebbles (upper size limit), cobbles (lower size limit) to boulder.
Brown Trout Fry Habitat	Slow to medium flowing shallow water with a substrate dominated by pebbles and cobbles (lower size limit), often concentrated at stream margins.
Brown Trout Parr Habitat	Variety of substrate sizes (from pebble to boulder); undercut banks, tree roots; deeper and slower water.
Lamprey Spawning Habitat	Stable gravel up to 30 cm deep that is not compacted or contains excessive silt (may contain 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 as well as macrophytes. Sub-optimal: Shallow sediment (< 15 cm deep), unequal and interspersed among coarser substrates.
Eel - Habitat	Frequently burrow into mud substrate, cover from larger instream substrate and bankside crevices (gaps in bank modifications such as walls and log revetments).
Glides	Smooth laminar flow with little surface turbulence. Shallow glide (≤ 0.3 m, deep glide > 0.3 m).
Pools	No perceptible flow. Shallow pool (≤ 0.3 m, deep pool > 0.3 m).
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 the table are adapted from SFCC Habitat Manual (2007) and Hendry & Cragg-Hine (1997), lamprey from Maitland (2003).*

Appendix C Substrates and Flow Types

Table 16: Substrates and Flow Types (source: SFCC)

Substrate	Definitions	Flow Type	Definitions
SI	Silt: Fine, mostly inorganic material, individual particles visible	SM	Still Marginal: <10 cm deep, water still or eddying, no waves form behind a 2-3 cm wide rule placed in the current, smooth surface appearance, water flow is silent.
SA	Sand: Fine, inorganic particles, <2 mm 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: <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.
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 64-256 mm diameter	SG	Shallow Glide: <30 cm deep, water flow moderate to 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 >256 mm 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.

Appendix D Fish Habitat Assessment

Table 17: Fish Habitat Assessment Results

FID	Survey Location	Watercourse	Section	Classification
1	H_SL_1	Unnamed watercourse west of Loch Fearna (First tributary of Loch Fearna)	1	Unproductive: Other
2	H_SL_2	Unnamed watercourse second eastern tributary of Loch Fearna	1	Unproductive: Other
3	H_SL_3	Unnamed watercourse third eastern tributary of Loch Fearna	1	Unproductive: Other
4	H_SL_4	Unnamed watercourse fourth eastern tributary of Loch Fearna	1	Productive: Good
5	H_SL_4	Unnamed watercourse fourth eastern tributary of Loch Fearna	3	Unproductive: Other
6	H_SL_4	Unnamed watercourse fourth eastern tributary of Loch Fearna	2	Unproductive: Other
7	H_SL_5	Unnamed watercourse southeast of Loch Fearna (easternmost tributary)	1	Productive: Good
8	H_SL_5	Unnamed watercourse southeast of Loch Fearna (easternmost tributary)	2	Productive: Moderate
9	H_SL_5	Unnamed watercourse southeast of Loch Fearna (easternmost tributary)	3	Unproductive: Other
10	H_SL_6	River Allt a' Fearna (outflow of Loch Fearna)	1	Productive: Moderate
11	H_SL_7	Unnamed watercourse taking its source east of Coire Dubh	1	Unproductive: Other
12	H_SL_7	Unnamed watercourse taking its source east of Coire Dubh	2	Unproductive: Other
13	H_SL_8	Unnamed watercourse taking its source north of Coire Dubh	2	Unproductive: Other
14	H_SL_8	Unnamed watercourse taking its source north of Coire Dubh	1	Unproductive: Other
15	H_SL_9	Unnamed watercourse taking its source west of Coire Dubh	1	Productive: Moderate
16	H_SL_9	Unnamed watercourse taking its source west of Coire Dubh	2	Unproductive: Bedrock
17	H_SL_9	Unnamed watercourse taking its source west of Coire Dubh	3	Productive: Good
18	H_SL_9	Unnamed watercourse taking its source west of Coire Dubh	4	Unproductive: Other
19	H_SL_9	Unnamed watercourse taking its source west of Coire Dubh	5	Productive: Good
20	H_SL_9	Unnamed watercourse taking its source west of Coire Dubh	6	Unproductive: Other
21	H_SL_10	River Allt a' Mheil	1	Unproductive: Bedrock
22	H_SL_10	River Allt a' Mheil	2	Productive: Moderate
23	H_SL_10	River Allt a' Mheil	3	Productive: Moderate

24	H_SL_10	River Allt a' Mheil	4	Unproductive: Bedrock
25	H_SL_10	River Allt a' Mheil	5	Unproductive: Bedrock
26	H_SL_10	River Allt a' Mheil	6	Unproductive: Other
27	H_SL_10	River Allt a' Mheil	7	Productive: Moderate
28	H_SL_10	River Allt a' Mheil	8	Productive: Moderate
29	H_SL_10	River Allt a' Mheil	9	Unproductive: Bedrock
30	H_SL_10	River Allt a' Mheil	10	Productive: Moderate
31	H_SL_10	River Allt a' Mheil	11	Unproductive: Bedrock
32	H_SL_10	River Allt a' Mheil	12	Productive: Moderate
33	H_SL_10	River Allt a' Mheil	13	Unproductive: Bedrock
34	H_SL_10	River Allt a' Mheil	14	Unproductive: Other
35	H_SL_11	River Allt a' Mheil	1	Unproductive: Bedrock
36	H_SL_12	River Allt a' Fearna (confluence with Loch Quoich)	1	Productive: Moderate
37	H_SL_12	River Allt a' Fearna (confluence with Loch Quoich)	2	Unproductive: Bedrock

Appendix E Macroinvertebrate Population Assessment: Inventory

TAXA LIST

			FE1	FE2	FE3	FE4	FE5	FE6	FE7	FE8 Loch Quoich	FE9 Loch Fearna
			24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023	24/05/2023
Order	Family	Taxa Name	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance
BIVALVIA	SPHAERIIDAE	*Euglesa hibernica*					1				
BIVALVIA	SPHAERIIDAE	*Euglesa sp.*					39		2		1
COLEOPTERA	DYTISCIDAE	*Agabus guttatus*	2	3		2					
COLEOPTERA	DYTISCIDAE	*Dytiscidae*							4		1
COLEOPTERA	DYTISCIDAE	*Hydroporinae*									1
COLEOPTERA	DYTISCIDAE	*Platambus maculatus*									1
COLEOPTERA	ELMIDAE	*Elmis aenea*	140	21	80	48		10	84	1	2
COLEOPTERA	ELMIDAE	*Limnius volckmari*		1	1						1
COLEOPTERA	ELMIDAE	*Oulimnius sp.*				6	1				14
COLEOPTERA	ELMIDAE	*Oulimnius tuberculatus*				5	4	1			5
COLEOPTERA	HYDRAENIDAE	*Hydraena gracilis*	9	2							

COLEOPTERA	HYDROPHILIDAE	*Anacaena globulus*	1	4		7			2			
COLEOPTERA	SCIRTIDAE	*Elodes sp.*	2	8	32	9			10	1		
DIPTERA	CHIRONOMIDAE	*Chironomidae*	7	4	17	1	135	10	6			
DIPTERA	CHIRONOMIDAE	*Tanypodinae*	2	5			12	2	2		4	
DIPTERA	CHIRONOMIDAE	*Tanytarsini*	4		3			25	3	1	6	
DIPTERA	EMPIDIDAE	*Chelifera sp.*						1			1	
DIPTERA	EMPIDIDAE	*Clinocera sp.*					1		1			
DIPTERA	LIMONIIDAE	*Eloeophila sp.*	1	2								
DIPTERA	PEDICIIDAE	*Dicranota sp.*	2	2		3	3					
DIPTERA	PEDICIIDAE	*Pedicia sp.*		1							1	
DIPTERA	SIMULIIDAE	*Simulium argyreatum/variegatum*			1							
DIPTERA	SIMULIIDAE	*Simulium rostratum*			1		25			2		
DIPTERA	SIMULIIDAE	*Simulium sp.*					189	2				
EPHEMEROPTERA	AMELETIDAE	*Ameletus inopinatus*	2									
EPHEMEROPTERA	BAETIDAE	*Baetidae*							31			
EPHEMEROPTERA	BAETIDAE	*Baetis muticus*	152	33	2			43	9			
EPHEMEROPTERA	BAETIDAE	*Baetis rhodani/atlanticus agg.*	10	14	15	15		49	4			
EPHEMEROPTERA	HEPTAGENIIDAE	*Electrogena lateralis*	1	17	1	2			4		1	
EPHEMEROPTERA	HEPTAGENIIDAE	*Rhithrogena semicolorata*						70				
EPHEMEROPTERA	LEPTOPHLEBIIDAE	*Leptophlebia sp.*									2	

EPHEMEROPTERA	SIPHLONURIDAE	*Siphlonurus lacustris*				10					1
HEMIPTERA	VELIIDAE	*Velia caprai*	4	1							
HEMIPTERA	VELIIDAE	*Velia sp.*		20					3		
N/A	N/A	*Ostracoda*							1		
OLIGOCHAETA	N/A	*Oligochaeta*	2	1			16				1
PLECOPTERA	CHLOROPERLIDAE	*Siphonoperla torrentium*	2	12	2	15		3	7		
PLECOPTERA	LEUCTRIDAE	*Leuctra inermis*	19	17	8	2		11	3		
PLECOPTERA	LEUCTRIDAE	*Leuctra sp.*	10	8							
PLECOPTERA	NEMOURIDAE	*Amphinemura sp.*		1							
PLECOPTERA	NEMOURIDAE	*Amphinemura sulcicollis*	6	4	9	1		2	10		
PLECOPTERA	NEMOURIDAE	*Nemoura cinerea*									6
PLECOPTERA	NEMOURIDAE	*Nemoura sp.*									2
PLECOPTERA	NEMOURIDAE	*Protonemura meyeri*	2					2			
PLECOPTERA	PERLODIDAE	*Isoperla grammatica*	16	5	11	9	1	3	2		
TRICHOPTERA	GOERIDAE	*Silo pallipes*	1								
TRICHOPTERA	HYDROPSYCHIDAE	*Diplectrona felix*							2		
TRICHOPTERA	HYDROPSYCHIDAE	*Hydropsyche siltalai*						23	1		
TRICHOPTERA	HYDROPTILLIDAE	*Hydroptila sp.*		2				1			
TRICHOPTERA	LEPTOCERIDAE	*Mystacides azurea*									19
TRICHOPTERA	LIMNEPHILIDAE	*Chaetopteryx villosa*	11	2	9			1	1		

TRICHOPTERA	LIMNEPHILIDAE	*Halesus radiatus*									1
TRICHOPTERA	PHILOPOTAMIDAE	*Philopotamus montanus*				1					
TRICHOPTERA	POLYCENTROPODIDAE	*Plectrocnemia conspersa*	2	8		3	44	12	1		
TRICHOPTERA	POLYCENTROPODIDAE	*Plectrocnemia geniculata*							3		
TRICHOPTERA	POLYCENTROPODIDAE	*Plectrocnemia sp.*	4	8			16	7			
TRICHOPTERA	POLYCENTROPODIDAE	*Polycentropus flavomaculatus*			7		180			6	
TRICHOPTERA	POLYCENTROPODIDAE	*Polycentropus sp.*						6	12		5
TRICHOPTERA	RHYACOPHILIDAE	*Rhyacophila dorsalis*			1		1				
TRICHOPTERA	RHYACOPHILIDAE	*Rhyacophila sp.*	1					2			
TRICLADIDA	PLANARIIDAE	*Crenobia alpina*		1							
TROMBIDIFORMES	N/A	*Hydracarina*		1			1		1		

Appendix F eDNA Report 2023 (See separate document attached (Appendix 11.1.1))