Chapter 13: Fish - Contents

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13. Fish

13.1 Executive Summary

13.1.1 This Chapter considers the potential effects, including cumulative effects, of the Proposed Development on fish (including fish habitat and fish fauna) during construction and operation. Where likely significant effects are predicted during construction and operation, appropriate mitigation measures are proposed, and the significance of predicted residual effects are assessed. The Ecological Impact Assessment (EcIA) was undertaken following good practice guidelines current at the time of writing (CIEEM, 2018). This assessment has been carried out by Gavia Environmental Ltd.

13.1.2 A baseline assessment detailing existing information relating to protected and notable species and habitats, and designated nature conservation sites was undertaken.

13.1.3 Baseline field surveys were undertaken in summer - autumn 2022. Surveys undertaken included riverine fish habitat assessment (including salmonid spawning suitability), loch fish habitat assessment (including salmonid spawning suitability) and electrofishing surveys (fish population assessment). All surveys were undertaken in accordance with relevant good practice guidelines.

13.1.4 No designated sites with relevance for fish are contained within the site boundary, however there are hydrological links with the River Moriston SAC, which is located approximately 2 km northwest of the site boundary on the opposite side of Loch Ness. Potential impacts of the Proposed Development on the qualifying features of the River Moriston SAC are assessed as part of a Shadow Habitats Regulations Assessment (HRA), which is included as a standalone document to the section 36 application.

13.1.5 Potential significant adverse effects, prior to mitigation, were identified on important ecological features during the construction and operational phases of the Proposed Development, including Arctic charr, Atlantic salmon, European eel, ferox brown trout, river / sea lamprey and sea trout. Potential significant cumulative adverse effects have also been identified during the operational phase, prior to mitigation, on Atlantic salmon and sea trout.

13.1.6 Identified impacts, potentially causing adverse significant effects include: noise and vibration during cofferdam construction (Loch Ness), attraction of adult salmon and lamprey to outlet during generation (Loch Ness), attraction of (downstream migrating) salmon and sea trout smolts to the intake during abstraction (Loch Ness), attraction of (upstream migrating) elvers to outlet during generation (Loch Ness), impingement / entrainment / loss of (upstream migrating) elvers to intake during abstraction (Loch Ness), attraction of (downstream migrating) silver eels to the intake during abstraction (Loch Ness), attraction of lamprey to the intake during abstraction (Loch Ness).

13.1.7 Identified cumulative impacts, potentially causing adverse significant cumulative effects include: downstream migrating salmon and sea trout smolts becoming attracted to multiple sources of water abstraction and upstream migrating adult salmon becoming attracted to multiple sources of water generation.

13.1.8 Where potential likely adverse significant effects were predicted, mitigation has been proposed. Mitigation measures to be employed during the construction phase include: a ’soft start' approach to piling operations to allow fish in the immediate vicinity of the works to disperse; a temporary

bubble curtain deployed around any blasting works to attenuate noise effects and deter fish from the area; a Construction Environmental Management Plan (CEMP), Pollution Prevention Plan (PPP), and Water Quality Monitoring Plan (WQMP) implemented by the Principal Contractor and overseen by an Aquatic Clerk of Works (ACoW), floodlighting used during construction directed away from loch edges and watercourses; and a fish rescue and relocation where instream works (piling, dewatering, culvert installation) will take place.

13.1.9 Mitigation measures to be employed during the operational phase include: operational limits agreed for pumping and generating phases as part of a CAR licence; an appropriately designed fish deterrent system installed at the inlet / outlet preventing delays to migration and reducing predation impacts; CCTV in operation at the outlet to deter and monitor instances of poaching; and a Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.

13.1.10 Following the implementation of mitigation measures, there are no predicted residual adverse significant effects on fish during the construction or operational phases.

13.2 Introduction

13.2.1 This Chapter considers the potential effects, including potential cumulative effects, of the Proposed Development on fish (including fish habitat and fish fauna) during construction and operation. As described in **Chapter 3: Description of Development**, with proper maintenance the Proposed Development should remain functional indefinitely. If the project were to be decommissioned, it is anticipated that the potential effects on fish would be equal to or lesser than the construction impacts. As such, a separate assessment of potential decommissioning effects on fish is not included in this Chapter. Where likely significant effects are predicted during construction and operation, appropriate mitigation measures are proposed, and the significance of predicted residual effects are assessed.

13.2.2 This assessment has been carried out by Gavia Environmental Ltd. A table presenting relevant qualifications and experience of key staff involved in the preparation of this Chapter is included in **Volume 4, Appendix 4.1: EIA Team**, contained within Volume 4 of this EIA Report.

13.3 Scope of Assessment

Study Area

13.3.1 The study area encompasses the area over which all desk-based and field data were gathered to inform the assessment presented in this Chapter.

13.3.2 Field study areas comprised of watercourses and waterbodies contained within and flowing in and out of the site boundary, as well as 'control' areas also covered out with the site boundary on Loch Ness and the Allt Leachd Gowerie, see **Volume 4, Appendix 12.1, Figure 1.1**: **Field Study Areas.**

Zone of Influence

13.3.3 The 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. For aquatic features (especially migratory fish), this is likely to extend beyond the site boundary, for example where there are ecological or hydrological links beyond the Proposed Development. The zone of influence would vary for different ecological features depending on their sensitivity to an environmental change. It may therefore be appropriate to identify different zones of influence for different features. The scoping exercise narrowed down the Important Ecological Features (IEF). The zone of influence has been set for each IEF (see **Table 13.1: Important Ecological Features (IEF's) Rationale for Consideration and Zones of Influence** below).

Table 13.1 Important Ecological Features (IEF's) Rationale for Consideration and Zones of Influence

Important Ecological Feature	Rationale for Selection	Zone of Influence
Arctic Charr	Arctic Charr are of National UK importance and are a UKBAP Priority species (added in 2007) considered to be 'threatened or declining in range' (JNCC, 2007). Scotland represents a stronghold for Arctic charr in Europe, with populations present in 258 lochs, although populations have undergone declines in recent years due to climate change and lake engineering (NatureScot, 2022a). Locally, Arctic charr provide an important food source to nationally important ferox trout (*Salmo trutta*). Arctic charr have been recorded as consistently more abundant in the South of Loch Ness (Winfield *et al*., 2002). In previous hydro developments within Scotland Arctic Charr have become accidently entrained in power station systems resulting in the establishment of Arctic charr populations in upper reservoir water bodies such as in the Cruachan Reservoir from Loch Awe, and Loch Errochty from the Loch Garry populations (Walker, 2007). Despite this, Arctic charr have been noted as responding well to fluctuating water levels (originating from hydro-electric schemes) that destroy littoral flora and fauna, adversely effected salmonids, but not plankton, leaving high prey densities for Arctic Charr (Maitland, 1992). <u>Spawning</u> Similar to salmonids, Arctic charr spawn between autumn / late winter in gravel areas along loch margins. Spring spawning charr are known to spawn at depth (Frost 1965). Arctic charr in Loch Ness are not known to utilize river mouths as spawning areas, however, an isolated population in Loch Garry is known to spawn in the River Garry (NBFT, 2022). Although many Arctic Charr populations spawn in the littoral zone, some spawn at greater depths.[1] During research work carried out on Lake Windemere, Frost (1965) concluded shallow spawning grounds ranged from 1–3 m depth and were used by Autumn (mainly November) spawning Charr, while deeper spawning grounds ranged from 15-20m depth[2]. Research carried out on three Irish lakes by Low (2011) found littoral zone spawning sites were found to be long, narrow strips running parallel to the shore at a maximum depth of 1.24 m[3].	Affected areas of Loch Ness.
Atlantic Salmon	Atlantic salmon are of national UK importance and a UKBAP Priority species (added in 2007) due to populations 'threatened or in declining range (JNCC, 2007). Atlantic salmon are also protected under Schedule 3	Affected areas of Loch Ness and the wider Ness catchment,

[1] Klemetsen, A., Amundsen, P.-A., Dempson, J.B., Jonsson, B., Jonsson, N., O'Connell, M.F. & 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: 1-59.

[2] Frost, W.E. 1965. Breeding habits of Windermere charr, *Salvelinus willughbii (Günther)* and their bearing on speciation of these fish. Proceedings of the Royal Society, Series B 163: 473 232-284.

[3] Low, J., Igoe, F., Davenport, J. & Harrison, H. 2011. Littoral spawning habitats of three southern Arctic charr (*Salvelinus alpinus L.)* populations. Ecology of Freshwater Fish 20(4)

	of the Conservation (Natural Habitats, &c.) Regulations 1994 (in freshwater only) limiting capture methods (NatureScot, 2022). Atlantic salmon form a qualifying feature of the River Moriston SAC (SAC EU Code UK0030259) but are not a primary reason for site selection (JNCC, 2022). Atlantic salmon are present in Loch Ness and within the wider Ness catchment. Atlantic salmon utilize Loch Ness as a migratory pathway to natal spawning grounds but are not resident in the waterbody for prolonged periods. It is currently unknown the routes taken by adult migratory Atlantic salmon through Loch Ness. Atlantic salmon originating in the upper, middle and lower Ness catchment have the potential to be present within close proximity to the Proposed Development as migratory routes in Loch Ness are not known. <u>Spawning</u> Atlantic salmon are not known to spawn on loch margins and utilize such areas as pathways only, with the exception of those peripheral to the mouths of rivers, notably the River Moriston.	particularly the River Moriston and River Oich.
Brook Lamprey *Lampetra planeri*	The brook lamprey population within Loch Ness is of National (Scotland) importance and included on the Scottish Biodiversity List but not a UKBAP priority fish species like its sea and river lamprey counterparts. <u>Spawning</u> Brook lamprey spawning occurs in shallow streams inflowing streams of Loch Ness in fine substrate areas.	Affected areas of Loch Ness.
Brown Trout	Brown trout are a UKBAP priority species and listed as of National UK importance (JNCC, 2007). Small, isolated populations of resident brown trout, similar to that present in Loch Kemp, are widespread in upland lochs, streams and rivers in the Highland region. <u>Spawning</u> Brown trout predominantly utilize rivers and streams to spawn but are more likely to spawn in loch margins than sea trout and Atlantic salmon.	Affected areas of Loch Ness, Loch Kemp and inflowing streams to Loch Kemp.
European Eel	The status of European eels is of International importance and listed as critically endangered on the IUCN Red List and under Annex V of the OSPAR convention due to recruitment reaching 1-5% of historical figures (IUCN, 2022; OSPAR Commission, 2022). Nationally, European eels are considered a UKBAP priority species (JNCC, 2007), present on the Scottish Biodiversity List (NatureScot, 2020) and designated a Priority Marine Feature where they are considered to be a marine nature conservation priority in Scottish waters. European eel management plans have also been developed by Marine Scotland Science in compliance with Council Regulation (EC) (No 1100/2007) to establish measures for the recovery of the species (Marine Scotland, 2020). Young European eels, or elvers, run into the river in May and June. Silver eels (sexually mature) migrate to sea between August and December.	Affected areas of Loch Ness, Allt a Chinn Mhonaich and the wider Ness catchment.
Ferox Brown Trout	Ferox trout, as *Salmo trutta,* are considered of National UK importance and a UKBAP priority species, however, are not specifically mentioned	Affected areas of Loch Ness.

	despite being of increased conservation concern due to smaller population densities and occurrence in Scottish Lochs. Spawning Location and preferences of ferox brown trout is not well established, however, spawning is known to occur in rivers within the Loch Ness catchment, notably the River Enrick.	
Sea Lamprey and River Lamprey	Both sea and river lampreys are UKBAP Priority fish species (JNCC, 2007). River lamprey are additionally listed on Annex II and V of the EU Habitats Directive Appendix III of the Bern Convention, with sea lamprey listed on Annex II.	Affected areas of Loch Ness and the wider Ness catchment.
Sea Trout	Sea trout, as *Salmo trutta,* are a UKBAP Priority fish species and of National UK importance (JNCC, 2007). Sea trout occur widely throughout the rivers of the Highland region where impassable barriers are not present. Spawning Sea trout are not known to spawn on loch margins and utilize such areas as pathways only, with the exception of those peripheral to the mouths of rivers.	Affected areas of Loch Ness and the wider Ness catchment.
Loch Salmonid Spawning Habitat (Loch Ness)	Loch salmonid spawning habitat is of importance for the successful recruitment of loch dwelling fish species such as Arctic Charr and brown trout (both UKBAP priority species).	Affected areas of Loch Ness.
Loch Salmonid Spawning Habitat (Loch Kemp)	Loch salmonid spawning habitat is of importance for the successful recruitment of loch dwelling brown trout (UKBAP priority species).	Affected areas of Loch Kemp.
Riverine Fish Habitat	Riverine fish habitat is of importance for brown trout (UKBAP priority species) populations.	Inflowing / outflowing streams to Loch Kemp and the Allt a Chinn Mhonaich.

Consultation Responses

13.3.4 To inform the scope of the assessment for the Proposed Development, consultation was undertaken with statutory and non-statutory bodies. **Table 13.2: Consultation Responses** summarises the scoping and consultation responses relevant to fish and provides information on where and/or how points raised have been addressed in this assessment.

13.3.5 Full details on the consultation responses and scoping opinion can be reviewed in **Chapter 5: Scoping and Consultation**, and associated appendices.

Table 13.2: Consultation Responses

Consultee	Consultation Type	Issue Raised	Response/Action Taken
Energy Consents Unit (ECU)	Scoping	Ministers agree with MSS, NatureScot, SEPA, Scottish Canals and the NDSFB that the submission should include comprehensive considerations of potential impacts on fish species and their habitats (including potential cumulative impacts).	See relevant responses to these consultees below.
The Highland Council (THC)	Scoping	The EIA Report should address the likely impacts on the nature conservation interests of all the designated sites in the vicinity of the proposed development. It should provide proposals for any mitigation that is required to avoid these impacts or to reduce them to a level where they are not significant.	Nature conservation interests of the River Morriston SAC are assessed as part of the shadow HRA, which is included as a standalone document to the section 36 application. Freshwater Pearl Mussel Population surveys were carried out on the River Moriston by Gavia Environmental in 2023 in consultation with NatureScot in relation to the Shadow HRA, which is included as a standalone document to the section 36 application.
		The EIA Report needs to address the aquatic interests within local watercourses, including downstream interests that may be affected by the development. The EIA Report should evidence consultation input from the local fishery board(s) where relevant.	Aquatic interests within local watercourses are addressed throughout this chapter and **Chapter 12: Aquatic Ecology.** Consultation with Ness District Salmon Fishery Board (Ness DSFB) is included within this Consultation Responses **Table 13.2**.
Scottish Environmental Protection Agency (SEPA)	Scoping	Consideration may also need to be given to whether the development will result in an effect on salmon smolt movement from Loch Dochfour into the River Ness, an issue SEPA is currently considering. This can be discussed further as part of CAR pre-application discussions	This is considered as an operational effect in **Section 13.8.34** and as a cumulative effect in **Section 13.8.52**. There are no modifications to the Dochfour Weir proposed as part of the application for the Proposed Development. Furthermore, the project would replicate the stop pumping level proposed by the other operational and consented PSH projects on Loch Ness so that a section of water in Loch Ness / Dochfour is reserved for compensation flow.

		SEPA ask for the assessment to include information on the morphological impact on Loch Kemp.	In response to the SEPA Scoping Response, On the 24th May, ASH asked SEPA (via email) if they could clarify their comment that the assessment should 'include information on the morphological impact on Loch Kemp' SEPA responded on the 29th May 2022 to confirm that following further internal discussion, they had concluded an assessment of the morphology is not required.
		SEPA are aware of the following invasive non-native species in the Ness catchment: Flatworm (*Phagocata woodworthi),* Freshwater shrimp (*Crangonyx pseudogracilis*) and Nuttall's Waterweed (*Elodea Nuttallii*). They ask for an assessment to determine whether the species are already present in the Loch Kemp system and if they are not measures should be outlined to stop the spread	INNS are covered in **Chapter 12: Aquatic Ecology** of the EIA Report.
Naturescot (NS)	Scoping	NS expect that the EIA Report to consider and mitigate the risk to the long-term status of the River Moriston SAC, designated for Freshwater Pearl mussel (FWPM) and Atlantic Salmon, and request monitoring to determine fish behaviour in Loch Ness. The survey should also take into account potential impacts caused by the Red John pump Storage scheme.	The River Morriston SAC is assessed as part of the Shadow HRA, which is included as a standalone document to the section 36 application. Freshwater Pearl Mussel population surveys were carried out on the River Moriston by Gavia Environmental in 2023 in consultation with Naturescot in relation to the shadow HRA.
		NS advise that the outfall of the pump storage scheme could affect spawning ground for Atlantic charr in Loch Ness so the fish survey should also include impacts on Atlantic Charr.	Impacts on Arctic Charr are considered in **Section 13.8.19**. Baseline survey works have focused on salmonid spawning habitat suitability at shoreline and perpendicular transects (100 m intervals) within the Development Area boundary and to a buffer of up to 650 m. Shoreline habitats were assessed on foot aided by use of bathyscope. Perpendicular transects were conducted via boat-based Spyball camera and were adapted from methodology carried out by Coyle and Adams (2011).

		NS consider that it would be worth considering the impact of ALAN (Artificial Light At Night), especially on invertebrates, birds and mammals.	Effects of lighting are considered in **Section 13.8.17**.
		NS advise that the River Moriston SAC is designated for Atlantic Salmon and FWPM. Atlantic salmon are also a critical component of FWPM life cycle as host fish. Therefore, impacts on salmon will have indirect impacts on FWPM and this link needs to be considered in any assessment.	Potential impacts of the Proposed Development on the qualifying features of the River Moriston SAC are assessed as part of Shadow HRA, which is included as a standalone document to the section 36 application. Impacts on Atlantic salmon adults and smolts are addressed in **Sections 13.8.9, 13.8.22, 13.8.26, 13.8.31 - 13.8.36, 13.8.55 - 13.8.60** and **Tables 13.10: Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation** and **13.11: Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation** and **13.12: Likely Operational Phase Cumulative Impacts and Effects on IEFs Prior to Mitigation.**
		NS request that the Fish assessment is expanded to include an assessment of the implications of modelled flows in and out of the River Ness for salmon migration. They consider it essential that impacts on the flow rates in the River Ness are considered alongside the impact of the existing pumped storage scheme at Foyers, plus other pumped storage schemes planned or being considered around Loch Ness.	As part of a CAR licence to be agreed with SEPA, the Proposed Development would have operational limits for pumping and generating. The 'stop pumping' level of the Proposed Development would be above the stop pumping level of the operational Foyers PSH, which is above the main Ness Weir Fish Pass Crest (14.93 m AOD). This means that the abstraction of water associated with the Proposed Development would not drop Loch Ness levels below the current Foyers stop pumping levels and would continue to allow fish passage to/from the River Ness at the Ness Weir. The cumulative effects of other pumped storage schemes are considered in **Sections 13.8.48 - 13.8.60.**
		NS advise that the Fish assessment also needs to include monitoring and mitigation proposals to avoid significant loss of smolts due to entrainment. NS recommend the use of monitoring arrays around the outfall /pumping area and a range of mitigation measures, which include modifying operation of the scheme.	Impacts on Atlantic salmon smolts are addressed in **Section 13.8.26,** and **Table 13.11: Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation.** Proposed mitigation measures are included in **Section 13.9.**

		NS broadly agree with the proposed scope of the fish assessment but request that further information is included in the EIA Report and advise that full details of type and reasoning behind each survey as well as methodology is provided in the EIA Report.	Methodology of the surveys undertaken is included in **Sections 13.6.3 – 13.6.9** and **Volume 4, Appendix 12.1: Loch Kemp Baseline Aquatic Surveys.**
		NS advise that Loch Ness supports both Arctic charr and ferox trout. Recent work the Ness DSFB has identified some spawning sites for the trout, but nothing is known about the spawning sites of Arctic charr in the area. NS note efforts to establish spawning areas for Arctic charr by SSE for the pumped storage facility at Loch Lochy (Coire Glas) and advise a similar methodology is carried out for this EIA.	Baseline survey works have focused on salmonid spawning habitat suitability at shoreline and perpendicular transects (100 m intervals) within the site boundary and to a buffer of up to 650 m. Shoreline habitats were assessed on foot aided by use of bathyscope. Perpendicular transects were conducted via boat-based Spyball camera and were adapted from methodology carried out by Coyle and Adams (2011). The assessment was also supplemented by the best available scientific literature on Arctic charr spawning areas within Loch Ness. The perimeter of Loch Ness is 80,000 m; therefore it was concluded that an assessment of the entire perimeter to quantify all suitable charr spawning habitats would be a huge undertaking and unfeasible at this level of detail. A high-level desk study following a similar methodology to Coire Glas was carried out using geological mapping of superficial deposits and bathymetry but due to timing constraints a field survey could not be carried out pre-submission. Habitat surveys alone would also not provide information on locations of where Arctic charr are spawning. This would be very difficult to evidence with underwater cameras on a waterbody the size of Loch Ness, also given the variation in the timing of spawning.
Ness District Salmon Fisheries Board (NDSFB)	Scoping (Other Consultation)	On 31st August 2021, Statera received an email from the Ness District Salmon Fisheries Board (NDSFB) which confirmed that they have a long-standing financial agreement with SSE over their Foyers pumping station. The letter states whilst NDSFB initially thought that they would not welcome another pump storage facility, they acknowledge that	Statera confirmed that they would attend the suggested meeting, which was set up on 19th September 2022. At the meeting it was noted that NDSFB's principal concern is smolts getting 'lost' on way back out to sea, which they believe is being exacerbated by the operation of Foyers PSH. Following several discussions with NDSFB, the Applicant has made a commitment to Ness DSFB on a without prejudice basis to contribute to further research and practical measures that might be employed to benefit Atlantic salmon. Options that are being considered are tracking surveys, trap

		renewable energy is of considerable benefit and they do see a potential way forward for the proposal. NDSFB suggest that a meeting should be arranged between the Developer, NDSFB and the Director of the Ness Fisheries Board to help mitigate some concerns by dealing with a significant problem of smolts traveling down a poorly designed weir built in the Victorian era.	and transport, reintroduction of hatcheries and a bubble curtain across the Canal at Dochfour. Both the Applicant and NDSFB recognise that any research and measure to be employed will require the cooperation of other stakeholders to be fully successful. An appropriately designed fish deterrent system would be installed at the intake of the Proposed Development in Loch Ness, which would deter smolts from the intake. This measure will serve as mitigation for the Proposed Development and is discussed in **Section 13.9**.
Ness District Salmon Fisheries Board (NDSFB)	Scoping	NDSFB are concerned with the Entrainment and/or impingement of salmon and sea trout smolts at the Loch Ness inlet, in particular those originating from the River Moriston SAC.	Potential impacts of the Proposed Development on the qualifying interests of the River Morriston SAC are assessed as part of the shadow HRA, which is included as a standalone document to the section 36 application. The Applicant has consulted with experts on fish screening and will in any event be deploying appropriately designed screens (see **Section 13.7)** i.e., the Applicant will adopt the precautionary approach. The Applicant is also proposing mitigation in the form of fish deterrent systems around the Development (as described in **Section 13.9)** and is also in discussion with Ness DSFB about the feasibility of undertaking a trap and transport programme for smolts in the River Moriston and River Oich, in consultation with Ness DSFB (see above). Impacts on Atlantic salmon smolts are addressed in **Section 13.8.26,** and **Table 13.11: Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation**. Proposed mitigation measures are included in **Section 13.9.**
		The fishery board request that the EIA completes a thorough assessment of the cumulative impact on loch and river levels, in the context of climate change. They request that the cumulative impact of the proposed scheme and others already operational, or consented, need to be included within the hydrological modelling.	This issue was addressed in a letter (**Ref 120019-L-NDSFB1-1.0.0**) issued by ASH to ECU on the 29th April 2022. This letter notes the Applicant has been in discussions with Scottish Canals since July 2021 and is carrying out detailed hydrological modelling to assess the range of impacts on Loch Ness, taking account of the existing Foyers PSH operation and the consented Red John PSH scheme. This assessment is included in **Chapter 7: Water Management** and is referenced int this Chapter where relevant.

			The letter also confirmed that the EIA Report would provide reassurance that the compensation flow at Dochfour Weir can be maintained, and it is assumed that this would be covered by a Condition of Consent. Further details are provided in **Chapter 7: Water Management**. The Developer therefore recognises that the Water Management of Loch Ness is key and will need to be discussed and agreed with SEPA, as part of the CAR licence application.
		NDSFB request that the potential impact of the proposal on salmon smolts emigrating from the River Moriston needs to be considered fully.	Potential impacts of the Proposed Development on salmon smolts are discussed in **Sections 13.8.9, 13.8.26, 13.8.31-13.8.32** and **Tables 13.10: Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation** and **13.11: Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation** and cumulative effects are discussed in **Sections 13.8.51 and 13.8.53 - 13.8.60** and **Table 13.12: Likely Operational Phase Cumulative Impacts and Effects on IEFs Prior to Mitigation**. Potential impacts of the Proposed Development on the qualifying interests of the River Morriston SAC are assessed as part of the shadow HRA, which is included as a standalone document to the section 36 application.
Ness District Salmon Fisheries Board	Scoping	NDSFB request that all potential impacts of the proposed scheme, and the cumulative impact of the other PSH schemes in Loch Ness on adult, and smolt, migration through Loch Ness need to be considered.	Potential impacts of the Proposed Development on Atlantic salmon adults and smolts are addressed in **Sections 13.8.9, 13.8.22, 13.8.26, 13.8.31 - 13.8.36, 13.8.55 - 13.8.60** and **Tables 13.10: Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation** and **13.11: Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation** and **13.12: Likely Operational Phase Cumulative Impacts and Effects on IEFs Prior to Mitigation**. Cumulative effects are discussed in **Section 13.8.48 - 13.8.60** and **Table 13.12: Likely Operational Phase Cumulative Impacts and Effects on IEFs Prior to Mitigation**.
		NDSFB point out that there are few detailed tracking studies on adult, or smolt stage, salmonid passage or use of Loch Ness, and none that we are aware of studying Atlantic salmon, and consider that this major knowledge gap needs to be addressed as part of this	This issue was addressed in a letter (**Ref 120019-L-NDSFB1-1.0.0**) issued by ASH to ECU on the 29th April 2022. This letter acknowledges that there would be benefit in such studies being undertaken in the wider context and advises that whilst the Applicant would

		EIA, as it has not been considered fully for previous PSH schemes on Loch Ness.	be happy to participate in this research, they do not consider it reasonable to undertake such studies as part of the EIA assessment for the Proposed Development, particularly given the timeframes that would be required to obtain meaningful results from such studies. The letter also notes that the completion of such research has not been a requirement for other recently consented PSH schemes. Although the Applicant did not receive a direct response to this letter, it is noted in the ECU Scoping Opinion, that Minister's advise that the Applicant should note all scoping responses regarding fish species and their habitats and comply with any information requirements set out therein. In response to this, the Applicant has made a commitment to Ness DSFB on a without prejudice basis to contribute to further research and practical measures that might be employed to benefit Atlantic salmon. Options that are being considered are tracking surveys, trap and transport, reintroduction of hatcheries and a bubble curtain across the Canal at Dochfour. Both the Applicant and NDSFB recognise that any research and measure to be employed will require the cooperation of other stakeholders to be fully successful. An appropriately designed fish deterrent system would be installed at the intake of the Proposed Development in Loch Ness, which would deter smolts from the intake. This measure would serve as mitigation for the Proposed Development and is discussed in **Section 13.9** of this Chapter.
Marine Scotland Science (MSS)	Scoping	MSS agree with the concerns raised by the NDSFB and NS regarding the potential impacts of the Proposed Development on migratory salmonids that use Loch Ness to travel to and from their marine feeding grounds. SEPA similarly expressed concerns regarding potential impacts on smolt movements specifically in relation to Loch Dochfour as Dochfour weir may be a partial barrier to migratory fish in certain flow conditions. We welcome the proposal by the Developer to carry out surveys to identify fish species and their habitats within the watercourses and areas of the lochs which could be at risk of being impacted as a result of the proposed	The Applicant recognises that the Water Management of Loch Ness is key and will need to be discussed and agreed with SEPA, as part of the CAR licence application. **Chapter 7: Water Management** of this EIA Report provides describes how the compensation flow at Dochfour Weir (also referred to as the Ness Weir) can be maintained, and it is assumed that this would be covered by a Condition of Consent. Details of the surveys undertaken to identify fish species and their habitats within the watercourses and areas of the lochs which could be at risk of being impacted as a result of the Proposed Development is included in **Section**

		development. We advise that full details and further discussion of surveys including methodology i.e a. eDNA, smolt/adult trapping, acoustic sampling, electrofishing and the survey results should be presented in the EIA Report.	**13.6.3 – 13.6.9** and **Volume 4, Appendix 12.1: Loch Kemp Baseline Aquatic Surveys.** An assessment of potential impacts on smolt migration at Ness Weir as a result of the operation of the Proposed Development is included in **Section 13.8.32** of this Chapter. A cumulative assessment of potential impacts on smolt migration at Ness Weir as a result of the operation of the Proposed Development and other operational and consented schemes is included in **Section 13.8.53 -13.8.60** of this Chapter.
		MSS also advise that the EIA Report should include different habitat use by fish species within the waterbodies i.e a. spawning areas of used by Arctic charr and ferox trout in Loch Ness.	The different fish species and habitats for waterbodies potentially impacted by the Proposed Development are covered in **Table 13.1: Important Ecological Features (IEF's) Rationale for Consideration and Zones of Influence** of this Chapter.
		The associated fisheries of the different fish species should also be considered.	Potential impacts on recreational fishing are considered **in Chapter 9: Land Use and Recreation.** Locals **Chapter 20: Socioeconomic and Tourism** highlights fisheries boards / groups which would potentially have an interest in the Proposed Development.
		The information on the presence of fish species and their habitat use should be used to assess the potential impacts of the construction and operation of the Proposed Development on the fish populations and associated fisheries.	Impacts on fish species during the construction and operational phases of the Proposed Development are addressed in **Section 13.8** Potential Significant Effects of this Chapter.
		These impacts could include the following: Entrainment into intakes in fast flowing water and MSS support the advice provided by NS in the need to monitor any entrainment of smolts;	Impacts of entrainment of fish during the operational phase of the Proposed Development are addressed in **Section 13.8.26.** Cumulative effects are discussed in **Section 13.8.** of this Chapter **Sections 13.8.51 and 13.8.52.**
		Impingement screens including the smolt sluice adjacent to the Dochgarroch Lock as discussed by Scottish Canals;	Impacts of impingement of fish during the operational phase of the Proposed Development are addressed in **Section 13.8.22-13.8.29.** Cumulative effects are discussed in **Sections 13.8.51 and 13.8.52.**

		changes in water quantity and flow regimes through abstraction and discharge. Although the maximum and minimum level limits of Loch Ness are to remain within the current limits MSS agree with NS and the Ness DSFB regarding the potential cumulative impact of the Proposed Development and other existing developments (i.e a. the existing pumped storage hydroelectric scheme at Foyers, the consented Red John pumped storage hydroelectric scheme and Caledonian Canal) on the water levels and flow rates in and out of Loch Ness which may have an impact on migratory salmonids. Flow regimes are likely to differ in Allt an t-Sluichd (the watercourse flowing from Loch Kemp to Loch Ness) and Loch Kemp where water levels are likely to rise by approximately 28 m;	As part of a CAR licence to be agreed with SEPA, the Proposed Development would have operational limits for pumping and generation. The stop pumping level of the Proposed Development would be above the stop pumping level of the operational Foyers PSH. The implementation of the stop pumping levels and a description of how the water level of Loch Ness would be managed during the operation of the Proposed Development **Chapter 7: Water Management**. This includes a cumulative assessment of impacts on Loch Ness water levels with other operational and consented schemes in Loch Ness. An assessment of potential impacts on adult and smolt salmonid migration at Ness Weir as a result of the operation of the Proposed Development is included in **Section 13.8.31 - 13.8.33** of this Chapter. A cumulative assessment of potential impacts on adult and smolt salmonid migration at Ness Weir as a result of the operation of the Proposed Development and other operational and consented schemes is included in **Section 13.8.51 - 13.8.60** of this Chapter.
		Deterioration of water quality i.e a. through the release of sediment associated with excavation works in the construction of dams, access tracks and tunnels, and the spillage of hydrocarbons;	Potential impacts of the Proposed Development on water quality during the construction phase are addressed in **Section 13.8.16** Further details are also provided in **Chapter 14: Geology, Soils and Water** of this EIA Report**.**
		Disturbance or removal of valuable fish habitat;	Potential impacts on valuable fish habitat during the construction phase of the Proposed Development are addressed in **Section 13.8** Potential Significant Effects and summarised in **Table 13.10: Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation.**
		altering fish behaviour, disturbance, injury or mortality resulting from noise and vibration associated with the construction and operation of the pumped storage scheme;	Potential impacts of noise and vibration from the Proposed Development during the construction phase are addressed in **Sections 13.8.6-13.8.15** and summarised in **Table 13.10: Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation**. Potential impacts of noise and vibration during the operational phase of the Proposed Development are addressed in **Sections**

			13.8.44 - 13.8.45 and summarised in **Table 13.11: Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation.**
		risk to fish migration; and	Potential impacts on fish migration during the operational phase of the Proposed Development are addressed in **Section 13.8** and summarised in **Table 13.11: Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation** of this Chapter**.**
		MSS advise that a cumulative impact assessment on the fish populations as a result of the present proposal and other local developments (operational and consented) should be carried out and discussed by the developer in the EIA report. This assessment should inform appropriate mitigation measures and monitoring requirements.	Potential cumulative impacts of the Proposed Development and other operation and consented development on fish are addressed in **Section 13.8.47 - 13.8.64** and summarised in **Table 13.12: Likely Operational Phase Cumulative Impacts and Effects on IEFs Prior to Mitigation.** Mitigation measures are provided in **Section 13.9.**
		Proposed mitigation measures (i.e a. the avoidance of identified valuable fish habitat, appropriate screen mesh size and velocity of water approaching water inlets, and monitoring of water quantity and quality and fish behaviour and migration patterns) should be drawn up to avoid and/or minimise any potential impacts and full details of all mitigation should be provided in the EIA report.	Embedded mitigation is provided in **Section 13.7** and proposed mitigation measures in **Section 13.9**.
		MSS advise that the Developer should consider such monitoring (i.e a. smolt/adult trapping, acoustic telemetry) to identify any impacts (including cumulative impacts) on fish populations, should they occur, throughout the construction and operation of the proposed development. Full details of proposed monitoring should be discussed in the EIA Report.	Whilst the developer acknowledges that there would be benefit in such studies being undertaken in the wider context, willing to make a contribution towards this research, they do not consider it reasonable to undertake such studies as part of the EIA assessment for Proposed Development, particularly given the timeframes that would be required to obtain meaningful results from such studies, and note that the completion of such research has not been a requirement for other recently consented PSH schemes. The Applicant has made a commitment to Ness DSFB on a without prejudice basis to contribute to further research and practical measures that might be employed to benefit Atlantic salmon. Options that are being considered are tracking surveys, trap and transport, reintroduction of hatcheries and a bubble curtain across the Canal at Dochfour. Both the Applicant and NDSFB

			recognise that any research and measure to be employed will require the cooperation of other stakeholders to be fully successful. An appropriately designed fish deterrent system would be installed at the intake of the Proposed Development in Loch Ness, which would deter smolts from the intake. This measure would serve as mitigation for the Proposed Development and is discussed in **Section 13.9** of this Chapter. Whilst, making these commitments, the Applicant maintains that it would not be proportionate for a smolt tracking study research to fall within the scope of this EIA Report. The developer has committed to monitoring the effectiveness of proposed mitigation measures during the operational phase.
Scottish Canals	Scoping	SC has a smolt sluice adjacent to the Dochgarroch Lock which must be fully operational between 1st April to 1 July annually. The assessment should consider the impact of fluctuating water levels on the smolt sluice and the fish pass within the Ness Weir.	Detailed proposed water levels within Loch Ness in relation to Ness Weir and the Caledonian Canal are provided in **Chapter 7: Water Management** of this EIA Report. Potential impacts on migratory fish as a result of fluctuations in water levels (in Loch Ness) as a result of the Proposed Development (in isolation and in-combination with other PSH are discussed in **Section 13.8.31-13.8.33** and **13.8.53-13.8.60** of this Chapter.
Fisheries Management Scotland.	Scoping	FMS fully endorse the Scoping Response provided by the NDSFB and note that the Scottish Government have recognised that Scotland's wild salmon populations are at crisis point and have recently published a Wild Salmon Strategy.	Noted. Please refer to responses to the NDSFB Scoping Response in this Consultation Table.
NatureScot	Gate Check Response	NS have not yet had the opportunity to view the detail of the shadow Habitats Regulations Appraisal (HRA), and recommend the Applicant share a copy of their draft HRA prior to the application being submitted. NS also note that the applicant does not propose to carry out smolt monitoring in Loch Ness due to time constraints for this application. However it should be noted that this information may be required to complete our HRA and NS may need to request this survey work during the application process. At this stage NS note that there is no opportunity to comment on the	Whilst the Applicant acknowledges that there would be benefit in tracking studies being undertaken in the wider context and willing to make a contribution towards this research, they do not consider it reasonable to undertake such studies as part of the EIA assessment for the Proposed Development, particularly given the timeframes that would be required to obtain meaningful results from such studies, and note that the completion of such research has not been a requirement for other recently consented PSH schemes.

		quality of the work undertaken or the findings of studies undertaken and advice is given without prejudice to a full and detailed consideration of the impacts of the proposal if it is submitted for formal consultation as part of the EIA or planning process.	The Applicant has made a commitment to Ness DSFB on a without prejudice basis to contribute to further research and practical measures that might be employed to benefit Atlantic salmon. Options that are being considered are tracking surveys, trap and transport, reintroduction of hatcheries and a bubble curtain across the Canal at Dochfour. Both the Applicant and NDSFB recognise that any research and measure to be employed will require the cooperation of other stakeholders to be fully successful. An appropriately designed fish deterrent system would be installed at the intake of the Proposed Development in Loch Ness, which would deter smolts from the intake. This measure would serve as mitigation for the Proposed Development and is discussed in **Section 13.9** of this Chapter. The Applicant has committed to monitoring the effectiveness of proposed mitigation measures during the operational phase.
Marine Directorate	Gate Check Response	MD-SEDD welcome the proposed assessment on fish and their habitats and the accompanying list of surveys undertaken. MD-SEDD note that a “loch fish habitat assessment” was undertaken. However, there is no reference in the report to fish population surveys/assessment carried out in the lochs despite the scoping report stating that fish surveys will be carried out in Loch Ness and Loch Kemp. MD-SEDD advise that up to date information on the fish populations in Loch Ness around the vicinity of the proposed development and in Loch Kemp should be sought. MD-SEDD reiterate previous advice that full details of fish survey work should be provided in the EIA report. Both fish habitat and population data should be used to inform the assessment on fish populations. The latter is outlined in Appendix 1 of the gate check report and should include an assessment on salmon, sea trout, ferox trout and Arctic charr populations, spawning suitability for Arctic charr in Loch Ness and an assessment of potential cumulative impacts in operation with the Foyers and Red John Pumped Storage Schemes.	It was concluded that destructive sampling techniques for sensitive species would not be appropriate where there is already available existing literature on fish populations within Loch Ness and Loch Kemp. Information on fish populations was obtained via desk study (see **Table 13.9: Summary of Desk Study**). In the absence of fish population data, the assessment uses the precautionary principle that fish species considered important ecological features (IEFs) may be in close proximity to the proposed development (including resident and migratory fish). The assessment on fish populations includes assessment on salmon, sea trout, ferox trout and Arctic charr populations, spawning suitability for Arctic charr as well as other fish species including European eel, brook, river and sea lamprey in Loch Ness and an assessment of potential cumulative impacts in operation with the Foyers PSH (operational) and Red John PSH (consented). Using the precautionary principle, brown trout were considered to be widespread within Loch Kemp. Fish population surveys on the tributaries of loch kemp also recorded brown trout as the only fish species present. An assessment is made on impacts on brown trout in **Section 13.8.20.**

		Similarly an assessment should be considered by the developer on the fish populations in Loch Kemp where the water level is likely to be raised by up to 28 m. Information on fish habitat and populations within both lochs should also be used to draw up appropriate fish protection/mitigation measures, including fish screens at water inlets, monitoring of flow velocity specifically at the mouth of the River Moriston and in front of fish screens and controlled operation times during sensitive periods e.g. smolt migration times. MD-SEDD welcome the proposed electrofishing surveys and we advise that fully quantitative electrofishing surveys should be carried out in all watercourses that are likely to be impacted by the proposed development, including the River Moriston SAC, Allt an t-Sluichd, and Allt a'Chinn Mhonaich. MD-SEDD welcome the detailed assessment of the potential impacts of the proposed development on the River Moriston SAC. Full details of this assessment and other watercourses should be presented in the EIA report. MD-SEDD welcome the proposed tracking studies of salmonid adults and/or smolts in Loch Ness. MD-SEDD welcome the intention of the developer to make use of existing salmonid migration data in Loch Ness and associated tributaries. The report on the Moray Firth River Ness Missing Salmon Project (reference below) provides useful information. MD-SEDD advise that tracking studies should be carried out to assess the potential impact of the proposed development on the behaviour of salmonid smolts and adults (including smolts and adult salmonids migrating to and from the River Moriston SAC) in the vicinity of the proposed development during the construction and the operation of the development. These studies should also	Embedded mitigation regarding curtailment of the development during operation and proposed fish screening is addressed in **Section 13.7.** Electrofishing surveys were conducted on the Allt a'Chinn Mhonaich, Allt Paiteag and Allt Leachd Gowerie. Surveys were unable to be conducted on the Allt an t-Sluichd due to exceptionally low water levels during the 2022 season, with fish mortality evident in the watercourse due to lack of flow. Potential impacts of the Proposed Development on the qualifying interests of the River Morriston SAC are assessed as part of the shadow HRA, which is included as a standalone document to the section 36 application. Whilst the Applicant acknowledges that there would be benefit in tracking studies being undertaken in the wider context and willing to make a contribution towards this research, they do not consider it reasonable to undertake such studies as part of the EIA assessment for the Proposed Development, particularly given the timeframes that would be required to obtain meaningful results from such studies, and note that the completion of such research has not been a requirement for other recently consented PSH schemes. The Applicant has made a commitment to Ness DSFB on a without prejudice basis to contribute to further research and practical measures that might be employed to benefit Atlantic salmon. Options that are being considered are tracking surveys, trap and transport, reintroduction of hatcheries and a bubble curtain across the Canal at Dochfour. Both the Applicant and NDSFB recognise that any research and measure to be employed will require the cooperation of other stakeholders to be fully successful. An appropriately designed fish deterrent system would be installed at the intake of the Proposed Development in Loch Ness, which would deter smolts from the intake. This measure would serve as mitigation for the Proposed Development and is discussed in **Section 13.9** of this Chapter. The Applicant has also committed to monitoring the effectiveness of proposed mitigation measures during the operational phase.

		consider the potential cumulative impacts on salmonid populations migrating through Loch Ness associated with the proposed development and other developments in Loch Ness. Details of the proposed study should be presented in the EIA report along with details on long term monitoring that is discussed in Appendix 1 of the report.	

Issues Scoped Out of Assessment

13.3.6 Direct impacts on salmonid spawning habitat at Loch Paiteag and Lochan a' Choin Urie have been scoped out of this assessment as it is clear from the updated infrastructure layout that these lochs would not be affected by the infrastructure or maximum inundation. Furthermore, the salmonid spawning habitat recorded during surveys undertaken for the Proposed Development at these two locations was deemed to be predominantly unsuitable.

13.3.7 Loch Cluanie also featured no suitable salmonid spawning habitat so has been scoped out despite being within the maximum inundation. Impacts during construction on water quality at Lochan a' Choin Urie is possible with the construction of the 'construction and operational' access track however this is covered in **Chapter 12: Aquatic Ecology.**

13.4 Legislation, Policy and Guidance

Legislative Context

13.4.1 The following legislation has been considered in the assessment:

- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora;
- Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy - the 'Water Framework Directive' (WFD);
- The Conservation (Natural Habitats, &c.) Regulations 1994;
- The Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003;
- Wildlife and Countryside Act 1981 (as amended) (the 'WCA');
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011 (as amended); and
- Planning (Scotland) Act 2019.

Policy Context

13.4.2 The following policy has been considered in the assessment:

- National Planning Framework 4 (NPF4) (2023).

Technical Guidance

13.4.3 The following technical guidance has been considered in the assessment:

- CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester;
- Environment Agency (2005) Screening for Intake and Outfalls: a best practice guide;
- Highland Nature: Biodiversity Action Plan 2021 – 2026;
- Inverness and Nairn Local Biodiversity Action Plan (LBAP) 2003;
- Ness District Salmon Fishery Board Annual Reports (2017 - 2021);

- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (CAR);
- SEPA (2010) Engineering in the water environment: good practice guide River crossings Second edition, November 2010; and
- SEPA (2017) Guidance for Pollution Prevention (GPPs).

13.5 Methodology

Desk Study

13.5.1 In order to identify the potential ecological sensitivities on fish associated with the Proposed Development, a desk study was conducted in advance of the field surveys. This included a review of:

- Existing data on statutory designated sites available through NatureScot Sitelink website for statutory designated sites up to 2 km from the Proposed Development;
- Scotland's environment web for data on obstacles to fish migration and SEPA River and loch classifications; and
- Other pre-existing biological data relevant to the Proposed Development were also searched for to which the authors had access and were in the public domain and did not have a non-commercial copyright licence (CC-BY-NC).

Field Study

13.5.2 The Ecological Impact Assessment (EcIA) presented here has been informed by a series of technical field surveys, as described in **Volume 4, Appendix 12.1: Loch Kemp Baseline Aquatic Surveys**. In summary, the surveys included:

- Riverine fish habitat assessment (including salmonid spawning suitability);
- Loch fish habitat assessment (including salmonid spawning suitability); and
- Electrofishing surveys (fish population assessment).

Assessment Methodology

13.5.3 The EcIA was undertaken following good practice guidelines current at the time of writing (CIEEM, 2018). A summary of this methodology is provided below:

- Identify and characterise Important Ecological Features (IEFs);
- Identify and characterise impacts and their effects;
- Identify measures to avoid and mitigate effects;
- Assess the significance of any residual effects after mitigation;
- Identify appropriate compensation measures to offset significant residual effects; and
- Identify opportunities for ecological enhancement and monitoring.

Evaluation of Important Ecological Features

13.5.4 Evaluations are applied to those sites, habitats and species (important ecological features) that have been scoped into the assessment and those that are predicted to be affected by the Proposed

Development. **Table 13.3: Evaluating Important Ecological Features (IEFs) Geographically** gives examples of how different types of IEFs may be evaluated geographically.

Table 13.3 Evaluating Important Ecological Features (IEFs) Geographically

Level of Nature Conservation Value	Examples of Receptors
International (including European)	European sites: SPAs and SACs, (p)SPAs and (c)SACs Other International sites: Ramsar wetlands Habitats and populations of species that represent the qualifying interests of internationally designated sites.
National	Site of Special Scientific interest (SSSI) (biological) All populations of Wildlife and Countryside Act (1981) (as amended in Scotland) Schedule 8 plants. Presence of Annex 1 habitat (i.e a. blanket bog and Groundwater Dependent Terrestrial Ecosystems (GWDTE)) All viable populations of species listed as Critically Endangered, Endangered, Vulnerable or Threatened in relevant Red Data Books*. Nationally important population /assemblage of an EPS, Schedule 1 and/or 5 species.
Council	Sites/populations that meet SSSI designation criteria but have not been designated due to there having been better examples in the relevant Area Of Search. Regionally important population/area of a species and habitat of Principal Importance or SBL priority species and habitats. Regionally important population/assemblage of an EPS, Schedule 1 and/or 5 species. Regionally important assemblages of other species. Regionally designated geodiversity sites. Regionally important assemblages of other species.
Local	A breeding population of a species or a viable area of a habitat that is listed in a Local BAP because of its rarity in the locality. A breeding population of a species on the Scottish Biodiversity List has been identified by the local authority as being a material consideration in terms of its planning process. All breeding populations of an EPS, Schedule 1 and/or 5 species that have not been captured in higher categories above. Assemblages of other species that are of importance in the context of the local authority area.
Site	Other species and habitats which are, in the opinion of the assessor, of note and for which mitigation measures could be recommended as a good practice measure.

Criteria for Assessment of Impacts

13.5.5 An understanding of how ecological features would respond to the Proposed Development is required to determine the magnitude of any likely impacts which may arise through construction or operational phases. It is only necessary to describe in detail the effects which are likely to be significant and impacts/effects which are unlikely to occur, or if they did happen would unlikely be significant and can be scoped out (CIEEM 2018).

Beneficial or Adverse Effects

13.5.6 Beneficial and adverse effects are determined whether the change is in accordance with the following nature conservation policy and objectives:

Beneficial – a change which improved the quality of the environment, for example, increasing species diversity or extending / improving habitat extent. This can also include reducing the rate of existing environmental decline; and

Adverse – a change which results in a reduction of the quality of the environment, for example, habitat destruction, habitat fragmentation, loss of species or pollution events.

Extent

13.5.7 The extent of an impact refers to the geographical area over which the impact may occur over typically representative conditions. For example, increased sediment run-off in watercourses.

Frequency and Timing

13.5.8 The resulting effect of an impact is influenced by the number of times an activity occurs. For example, a vehicle driving across sensitive habitat; one vehicle may have a slight impact, but the habitat may recover, however, frequent vehicle passes may significantly degrade the habitat to the point where it may not recover and be permanently lost.

Reversibility

13.5.9 An impact from which recovery is not possible within a reasonable timescale or there is no chance of action to implement successful mitigation, the impact is classed as irreversible. An impact from which spontaneous recovery or with which recovery is possible through successful mitigation is classed as reversible. It should be noted that in some cases the same activity can cause impacts which are both irreversible and reversible.

Duration

13.5.10 CIEEM (2018) states that duration is defined in the relative context of ecological traits, such as the lifecycle of a species. The duration of an activity may differ from the duration of the resulting effect caused by the activity[4]. **Table 13.4: Duration of Effects** defines the timescales used within this assessment.

[4] CIEEM (2018) CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester. Available: Combined-EclA-guidelines-2018-compressed.pdf (cieem.net)

Table 13.4: Duration of Effects

Duration	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (30+ years), except where there is likely to be substantial improvement after this period in which case the Long Term maybe more applicable.
Long term	Between 15 years up to (and including) 30 years.
Medium term	Between 5 years up to (but not including) 15 years.
Short term	6 months - 5 years.
Temporary	< 6 months

Sensitivity

13.5.11 The sensitivity of an ecological receptor to a particular impact should also be considered as well as the zone of influence. Sensitivity criteria is variable across the taxonomic groups and behavioural sensitivity can also vary across individuals of the same species. Sensitivity can also be dependent on species' activity, for example, species are more likely to be susceptible to disturbance during the spawning seasons. As such, professional judgement is used when assigning sensitivity to an ecological receptor. Sensitivity is determined according to the species' behaviour, outlined using the criteria in **Table 13.5: Levels of Sensitivity**.

Table 13.5: Levels of Sensitivity

Level of Sensitivity	Definition
High	Species in remote areas, away from human disturbance which would result in a long-lasting reaction to a disturbance event. Habitats which are considered to have a slow recovery time and could not re-establish quickly.
Medium	Species which are tolerant to human activity which result in a short-term reaction to a disturbance event. Habitats which are considered to have a medium-term recovery time.
Low	Species which are regularly subject to human disturbance which result in a brief reaction to a disturbance event. Habitats which are considered to have a short-term recovery time and could readily established.

Magnitude

13.5.12 The magnitude of an impact refers to the size, intensity, or volume of and should be quantified where possible in absolute or relative terms. For example, exact areas of habitat loss or percentage of species population decline (CIEEM, 2018). **Table 13.6: Criteria for describing the magnitude of impact on IEFs** defines the four levels of magnitude used in this assessment; these are generally considered to be adverse unless stated otherwise.

Table 13.6: Criteria for describing the magnitude of impact on IEFs

Magnitude of Impact	Description
High	High impacts may include those that result in large-scale, permanent (or at least the lifetime of the Proposed Development) changes in an IEF, and likely to change its ecological integrity. These impacts are likely to result in overall changes in the conservation status of a species population or habitat type at the location(s) or geographical scale under consideration.
Medium	Medium impacts may include moderate-scale, permanent (with respect to the lifetime of the Proposed Development) changes in an IEF, or larger-scale temporary changes, but the integrity of the feature is not affected. This may mean that there are temporary changes in the conservation status of a species-population or habitat type at the location(s) or geographical scale under consideration, but these are unlikely to be irreversible or long-term.
Low	Low impacts may include those that are small in magnitude, have medium-scale temporary changes, and where integrity is not affected. These impacts are unlikely to result in overall changes in the conservation status of a species population or habitat type at the location(s) under consideration, but it does not exclude the possibility that mitigation or compensation will be required.
Negligible	There is no perceptible change in the ecological feature.

Significance of Effects

13.5.13 The combined assessment of both the sensitivity of the receptor (Nature Conservation Value) and the magnitude of potential impact determines whether an effect is likely to be significant (**Table 13.7). Table 13.7: Significance of Effects Matrix** describes the significance of each effect. Effects categorised as Moderate or Major significance are evaluated as '**significant**' under EIA Regulations, whilst those categorised as Minor are evaluated as '**not significant'**. This assessment also includes effects which are considered to have a significance criteria lower than minor and therefore 'imperceptible' These are also evaluated as 'not significant'. Where potential effects are identified as being significant, the mitigation hierarchy (avoid, mitigate, compensate, enhance) is applied to mitigate for these significant effects. Significance criteria is defined in **Table 13.8: Significance Criteria .**

Table 13.7: Significance of Effects Matrix

Nature Conservation Value	Magnitude of Potential Impact				
		High	Medium	Low	Negligible
	International	**Major**	**Major**	**Moderate**	Minor
	National (Scotland)	**Major**	**Major**	**Moderate**	Minor
	Council (Highlands)	**Major**	**Moderate**	Minor	Imperceptible
	Local (Whitebridge)	Minor	Minor	Minor	Imperceptible
	Low (Site)	Imperceptible	Imperceptible	Imperceptible	Imperceptible

Table 13.8: Significance Criteria

Significance Criteria	Definition
Major	Significant effect. The effect is likely to result in a permanent/long term and a highly significant effect on the integrity of the feature. Usually only applied to adverse effects.
Moderate	Significant effect. The effect is likely to result in a medium-term with a high/medium extent. These beneficial or adverse effects are considered to be critical factors and are likely to be material in the decision-making process.
Minor	No significant effect. Likely effect the feature at an insignificant level by virtue of its limited duration and/or extent, but there would probably be no effect on its integrity. May become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor.
Imperceptible	No perceptible effect / negligible effect. This is also not a significant effect.

Assumptions and Limitations

13.5.14 There is very limited baseline data available on the movements of migratory fish, including Atlantic salmon and sea trout, within the Ness catchment that can be used to assess the potential effects and magnitude of impact on these fish in relation to their migratory routes (out with the development boundary) within Loch Ness. The assumption is therefore made in the impact assessment that migratory fish routes could be affected. This limitation could be addressed by further tracking studies but the costs associated with this may be high and several years of survey

may be required to build up a meaningful dataset. The Developer has made a commitment to NDSFB to contribute financially to such a study but this is not within the scope of this EIA Report.

13.5.15 Limited electrofishing data was available from the 2022 survey season as water levels in **some** of the watercourses were too low for effective surveying. In the absence of data it is assumed that brown trout populations are present throughout all of the tributaries and outfall of Loch Kemp. During site visits in September 2022, some dead brown trout were spotted in the Allt an t-Sluichd (outfall of Loch Kemp) due to very low water conditions / oxygen levels, brown trout were also noted in the upper reaches of the Allt a' Chinn Mhonaich.

13.6 Baseline Conditions

Existing Baseline

13.6.1 Details of the existing baseline are provided below under 'Desk Study and Designated Sites' and 'Field Study'.

Desk Study and Designated Sites

13.6.2 The findings of the desk study is presented in **Table 13.9: Summary of Desk Study.**

Table 13.9: Summary of Desk Study

Designated Sites / Habitats / Species / Constraints	Source (s)	Relevant Data
River Moriston Special Area of Conservation (SAC)	NatureScot Sitelink	Information on the River Moriston Special Area of Conservation (SAC) which lies approximately 2 km north west of the Site. Status: Unfavourable no change. Pearl mussels are known to be present from downstream of a hydro-electric dam to the confluence with Loch Ness. Annex II species that are a primary reason for the selection of this site are Freshwater pearl mussel *Margaritifera margaritifera.* Annex II species present as a qualifying feature, but not a primary reason for site selection are Atlantic salmon *Salmo salar.* 'The River Moriston flows into the northern side of Loch Ness, and supports a functional freshwater pearl mussel population. Pearl mussels are present from downstream of a hydro-electric dam to the confluence with Loch Ness. Due to illegal pearl-fishing the population is not abundant but survey results show that 40% of the population is composed of juveniles. This is the highest percentage recorded in any Scottish pearl mussel population and indicates that recent successful recruitment has taken place'[5].

[5] Joint Nature Conservation Committee (2015) River Moriston Designated Special Area of Conservation (SAC). Available: https://sac.jncc.gov.uk/site/UK0030259 (Last accessed 15/11/2022)

Loch Kemp	UK Lakes Portal[6]	Loch Kemp (Water Body ID 20328) is a small freshwater lake located in Highland, Scotland. It is generally shallow with low alkalinity and is situated at low altitude. The loch surface area is 26 ha, perimeter is 2 km, mean depth is 8 m with a maximum depth of 15.5 m. The mean conductivity of the water is 52 µS/cm.
Loch Ness	SEPA River and Loch Classifications	Loch Ness is a lake (ID: 100156), in the River Ness catchment of the Scotland river basin district. It is 55.3 km^2 in area. It is classed as not heavily modified and not artificial. The Loch was last classified in 2020. Classification: Good status / potential
	UK Lakes Portal[7]	Loch Ness (Water Body ID 18767) is a large freshwater lake located in Highlands, Scotland, 7.95 km from sea. It is generally deep with low alkalinity and is situated at low altitude. The loch surface area is 5533 ha, perimeter is 80 km, mean depth is 132 m with a maximum depth of 229.8 m. The mean conductivity of the water is 40 µS/cm.
	Chapter 7: Water Management	Foyers Power Station (Pumped Storage Scheme) was constructed in the 1970's and utilises water from Loch Ness, causing fluctuations in loch level during its operation. The construction of Foyers led to modification of the Ness Weir at the outlet of the Loch with the installation of two sluice gates to provide minimum flows for fish passage in dry conditions. The sluice gates discharge a minimum flow into the River Ness during periods when Loch Ness is drawn down below the weir crest level. Foyers is now owned by SSE Renewables Ltd (SSE) and SSE also operates the sluice gates at Ness weir as required. As described in **Section 7.9 of Chapter 7: Water Management**, the Applicant understands that the then North of Scotland Electricity Board (NSHEB, now SSEN Renewables) (1970) formed an agreement with the then British Waterways (now Scottish Canals) to maintain Loch Ness levels above 15.27m AOD. This prevents Foyers PSH from abstracting water from Loch Ness if water levels reduce to this level, to safeguard canal operations and maintain a compensation flow over Ness Weir. This is referred to as the Foyers PSH 'stop pumping level'[8] throughout this chapter, as provided in **Table 7.3: Stop Pumping Levels, Abstraction and Discharge Flows for Loch Ness PSHs** of **Chapter 7: Water Management.** Foyers has been in operation since 1974. There is no evidence of any link between this scheme and an adverse effect on fish populations, but potential cumulative effects are considered within this chapter.

[6] UK Centre for Ecology and Hydrology UK Lakes Portal Loch Kemp Water Body ID 20328. Available: Loch Kemp - UK Lakes Portal (ceh.ac.uk)

[7] UK Centre for Ecology and Hydrology UK Lakes Portal Loch Ness Water Body ID 18767. Available: Loch Ness - UK Lakes Portal (ceh.ac.uk)

River Moriston - Loch Ness to Dundreggan Dam	SEPA River and Loch Classifications	River Moriston - Loch Ness to Dundreggan Dam is a river (ID: 23381), in the River Ness catchment of the Scotland river basin district. The main stem is approximately 8.8 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. Classified in 2020 Classification: Moderate ecological potential
Obstacles to fish migration	Scotland's Environment Web	One obstacle to fish migration was recorded on Scotland's Environment Web on the Allt Leachd Gowerie watercourse which is a tributary of Loch Kemp. During field studies however this looked to have been recorded in error as there was no obstacle to fish at this location. No other barriers to fish migration were recorded on Scotland's Environment Web, however sections of watercourses within the site were noted as impassable to fish during field studies and by reviewing OS mapping. Stretches of watercourses with stream gradients of ≥6 % are considered to be unsuitable / non-productive habitat for Atlantic salmon, sea trout and brown trout[9]. Sections of Allt an t-Sluichd and Allt a Chinn Mhonaich over steeper gradients towards Loch Ness exceeded this figure and were therefore ruled out for further survey.
Ness Weir	Scottish Canals, Ness DSFB, Fichtner	Ness weir is situated at the north-eastern end of Loch Ness where Loch Ness (Loch Dochfour) splits between the River Ness and the Caledonian Canal. A figure of the weir is included in **Volume 2, Figure 7.4: Ness Weir Overview**. The original weir was constructed in 1825 and now consists of a set of sluice gates for water regulation, a fish pass (known as the spout), the service weir and the waste weir. Strengthening works with steel sheet piles was completed in 2018. There is a smolt chute situated at the waste weir which was installed to allow migratory smolts which bypass the main fish pass passage to the River Ness. The Ness District Salmon Fisheries Board consider the smolt chute to be 'an ineffective design' (Pers. Comm Brian Shaw). A site visit was carried out in June 2023 during low loch levels (Loch Level was 1.26 m, with the typical mean low level 1.39 m). The chute had limited attraction for downstream migrating smolts with very little flow and water depth (See **Plate 13.11** and **Plate 13.2**.)

[9] Mills, D.H. (1973) Preliminary assessment of the characteristics of spawning tributaries of the River Tweed with a view to management. In: M.W. Smith & W.M. Carter (eds.). International Atlantic Salmon Symposium, St Andrew's, International Atlantic Salmon Special Publication Series 4 (1), 145-55.

Plate 13.1: Smolt chute entrance from the Caledonian Canal. Limited attraction for smolts to enter the bypass.

Plate 13.2: Smolt chute flowing towards the River Ness with minimal flow and water depth across the waste weir during low loch levels.

Invasive Non-Native Species (INNS)	Ness DSFB	Pink salmon *Oncorhynchus gorbuscha* have been recorded within the Ness catchment. The first reporting was in 2017 on the mainstem River Ness. Pink salmon have a 2-year life cycle and they were recorded within the catchment in 2019 and 2021 but in much lower numbers than 2017[10]. The viability of a breeding population / distribution of the species and impact as an invasive species is currently unclear.
Arctic Charr	Scottish Naturalist, Ness and Beauly Fisheries Trust and Researchgate.	Information on Arctic Charr in Loch Ness. Arctic Charr have been recorded via gill netting techniques in the littoral (0-10 m), Sub-Littoral (10-30 m), Pelagial (0-40 m) and the Profundal (180-220 m) zones of Loch Ness. They have also been recorded at two locations surveyed by seine netting; Dores Beach and Brachla Beach[11]. Arctic charr in Loch Ness are not known to utilize river mouths as spawning areas[12] Locally, Arctic charr provide an important food source to nationally important ferox trout. Arctic charr have been recorded as consistently more abundant in the South of the Loch.[13]
European Eel	Biotechniques and Appendix 12.1	Information on European eel in Loch Ness. Loch Ness Project eDNA survey concluded an abundance of eel DNA within Loch Ness.[14] Eel was recorded as present on the Allt a Chinn Mhonaich watercourse K_EF1 (NH 45096 16197) during electrofishing field studies carried out by Gavia Environmental in 2022.

[10] Ness District Salmon Fishery Board (2021) 2021 Annual Report. Available: 2021-Annual-report-draft-cmpressed.pdf (dsfb.org.uk)

[11] Shine, A.J., Kubecka, J., Martin, D.S. and Duncan, A. (1993). Fish habitats in Loch Ness. Scottish Naturalist 105: 237–255.

[12] Ness & Beauly Fisheries Trust. (2022). Arctic Charr. [Online] Available at: http://www.nessandbeauly.org.uk/arctic-charr/.

[13] Winfield, I. J., Bean, C. W. and Hewitt, D. P. (2002) The Relationship Between Spatial Distribution and Diet of Arctic Charr, Salvelinus Alpinus, In Loch Ness, U.K

[14] Straiton (2019) Biotechniques International. Journal of Life Science Methods. Available: DNA Analysis Identifies Theory for Loch Ness Monster - BioTechniques

Ferox Trout	The Wild Trout Trust	Information on Ferox Trout which are present in Loch Ness. It is estimated that Ferox are present in less than 10% of lochs where brown trout are present in Scotland. Given brown trout are present in thousands of sites, the limited distribution of ferox, their apparent low density in the lakes that they do inhabit suggests a level of scarcity and vulnerability of populations[15]. Location and preferences of ferox brown trout is not well established, however, spawning is known to occur in rivers within the Loch Ness catchment, notably the River Enrick.

Field Study

13.6.3 Full details of the field studies carried out by Gavia Environmental are located in **Volume 4, Appendix 12.1: Loch Kemp Baseline Aquatic Surveys**.

13.6.4 Riverine Fish habitat surveys in accordance with SFCC, modified to allow for categorisation of habitats, were carried out at survey locations across 5.2 km of river on Allt a Chinn Mhonaich, Allt Leachd Gowerie, Allt an t-Sluichd and on other tributaries and outfalls of the lochs on the site. Riverine fish habitat quality is illustrated in **Volume 4, Appendix 12.1: Loch Kemp Baseline Aquatic Surveys, Figures 2.1-2.9** and ranged from Poor (KP2, KP3, KP4, KP5, LCU1 and LCU2) to Low (KP8, LG6, LG7 and LG8) to Moderate (TS1, KP1, KP6, KP7, KP9, KP10, LG1, LG3, LG4, LG5, LCM1, LCM2 and LCM3) to Good (TS2, LG2 and LCM4). None of the survey locations were classified as High for fish habitat quality. Of the total riverine fish habitat quality surveyed (5.2km), Poor made up 18.2%, Low made up 18.9%, Moderate made up 50.1% and Good made up 12.8%. Riverine fish habitat quality rated as Good was mostly out with the area of maximum inundation (LCM4 and TS2).

13.6.5 A broad habitat assessment of the littoral zone was undertaken at Loch Kemp, Loch Ness, Loch Cluanie, Loch Pàiteag and Lochan a' Choin Uire (**Volume 4, Appendix 12.1: Loch Kemp Baseline Aquatic Surveys, Figures 3.1 – 3.5**). This was mapped and divided into transects, with surveyors making notes on substrate composition and assigning a rating of optimal, sub-optimal or unsuitable for salmonid spawning habitat to each transect. Additionally, perpendicular boat transects were conducted. The habitat assessment was based on that methodology designed for assessing Vendace (*Coregonus albula*) developed by Coyle and Adams (2011); however it is equally useful to map salmonid fish habitat in open waters. Optimal spawning habitats within the littoral zones of the inland lochs on the site was mainly restricted to one area of Loch Kemp (LKS26) and a small section of a boat transect at Lochan a' Choin Urie (LCB1.10-1.11) (which is out with the area of maximum inundation). Loch Ness featured optimal spawning habitat within the planning boundary (LNS8,9,12-13) however to put this result into context, the shoreline transects out with the Development Area to the north-east were also predominantly optimal (LNS16-19). Loch Kemp shoreline transects ranged from Unsuitable (LKS2, LKS6, LKS9, LKS10, LKS11, LKS14, LKS17, LKS18, LKS19, LKS20, LKS21, LKS22, LKS23, LKS25, LKS27, LKS28, LKS31, LKS32, and LKS33) to Sub-Optimal (LKS1, LKS3, LKS4, LKS5, LKS7, LKS8, LKS, LKS12, LKS13, LKS16, LKS24, LKS29 and LKS30) to Optimal (LKS26). Unsuitable spawning habitat made up 64.6% of the shoreline, Sub-Optimal spawning habitat made up 32.1% of the shoreline and Optimal spawning habitat made up 3.3% of the shoreline. Loch Kemp boat transects ranged from Unsuitable (LKB1.1-1.5, LKB2.1-2.4, LKB3.1-3.5, LKB4.1-4.4, LKB5.1-5.5, LKB6.1-6.3, LKB7.3-7.6, LKB8.1-8.4, LKB9.1-9.6, LKB10.1-10.5 and LKB11.1-11.4) to Sub-Optimal

[15] The Wild Trout Trust (2022) Ferox Trout. Available: https://www.wildtrout.org/content/ferox-trout#:~:text=It%20was%20estimated%20that%20Ferox,scarcity%20and%20vulnerability%20of%20populations.

(LKB1.6, LKB2.5) to Optimal (LKB7.1 - LKB7.2). The Loch Cluanie shoreline transect was recorded as 100% Unsuitable (LCLS1).

13.6.6 Loch Ness shoreline transects ranged from Unsuitable (LNS1, LNS2, LNS3, LNS4, LNS7, LNS10 and LNS14) to Sub-Optimal (LNS5, LNS6, LNS11 and LNS15) to Optimal (LNS8, LNS9, LNS12, LNS13, LNS16, LNS17, LNS18 and LNS19). Unsuitable spawning habitat made up 40.5% of the shoreline surveyed, Sub-Optimal spawning habitat made up 16.4% of the shoreline surveyed and Optimal spawning habitat made up 43.1% of the shoreline surveyed (**Volume 4, Appendix 12.1: Loch Kemp Baseline Aquatic Surveys, Figures 3.2.1 – 3.2.3**).

13.6.7 For context, of the total Optimal spawning habitat recorded at Loch Ness, 73.9% was outwith the Development Area and unlikely to be directly affected by construction, with the remaining 27.1% inside the Development Area.

13.6.8 Assessment of the species composition, abundance and age class structure of fish population was carried out in reasonable accordance with SFCC 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). Fish population surveys by electrofishing were carried out at survey locations rated as *Moderate* or above for fish habitat quality. Brown trout of 0+ and 1++ age class were present at all three survey locations (K_EF1 – K_EF3). Analysing the fish population assessment results against the SFCC Regional Classification Scheme for the Moray Firth, trout fry densities ranged from Very Low (K_EF2 and K_EF3) to Good (K_EF1) and trout parr densities ranged from Very Low (K_EF2 and K_EF3) to Low (K_EF1). European eel and lamprey ammocoetes were captured at survey location K_EF1. No other fish species were captured in the field studies.

13.6.9 A high level desk study and site visit highlighted potential for optimal salmonid spawning habitat suitability at Dores Beach. (approximately 22 km northeast of the Proposed Development) Substrate was primarily homogenous in size and geology. At the east end of the beach (Grid Ref: NH 59794 34860) this was a gravel/cobble mix (approx. 70/30% coverage). At the west end of the beach (Grid Ref: NH 59409 35183) substrate was 100% cobble. In both cases substate continued 10 m out from the shoreline and the supralittoral zone extended 5 m back to an elevation of ~2 m from water levels at the time of the visit.

Future Baseline

13.6.10 Trends in population declines should be considered when determining a future baseline. The European eel has declined by 98% since 1980[16]. Arctic charr populations have undergone declines in recent years due to climate change and lake engineering[17].

13.6.11 Rod data within the Ness catchment shows variation since records began but a general decline, concurrent with national rod catch data. It is worth noting that catch and release is practiced for conservation, so the majority of fish are returned to the catchment rather than being retained nowadays. There has also been substantial reductions in netting both in river and at sea so at the times of higher rod catches (1960's -1990's), the adult fish may have had more severe direct

[16] Sonne, C., Peng, W., Alstrup, K. O., and Lam, S. (2021) European eel population at risk of collapse Available Online: European eel population at risk of collapse | Science

[17] NatureScot. (2022a). Arctic charr. [Online] Available at: https://www.nature.scot/plants-animals-and-fungi/fish/freshwater-fish/arctic-charr

anthropogenic effects from fisheries than nowadays with more retained and hence the populations may have been much higher than rod catches suggest.

13.6.12 Climate change has impacts on aquatic ecosystems. The ten warmest years on record in Scotland have all occurred since 1997. The average temperature in the last decade (2010-2019) was around 0.7 °C warmer than the 1961-1990 average. Over the past few decades, there has been an increase in rainfall across Scotland, with an increasing proportion due to heavy rainfall events. The average year in the last decade (2010-2019) was 9% wetter than the 1961-1990 average[18].

13.6.13 A report published by Scotland's Centre of Expertise for Waters (CREW) showed that between 2015 and 2019, 97% of monitored Scottish lochs and reservoirs increased in temperature. While most warmed by up to 1.0 °C per year over this period, 9% increased by more than that – some by up to 1.3 °C per year. These changes increase the risk of harmful algal blooms developing, which could impact on ecological features including fish and their habitats. It is expected that waters in the south and east of Scotland are expected to warm the most at first, however this climate-related impact will reach all parts of the country by 2040[19].

13.6.14 Shallower lakes (such as Loch Kemp) with shallow thermoclines (regions of rapid temperature change) may be more susceptible to warming whereas in deeper lochs (such as Loch Ness) higher water temperatures tend to lengthen the period of thermal stratification and deepen the thermocline.

13.6.15 Predicted effects of climate change include average temperatures increasing across all seasons, typical summers will be warmer and drier, typical winters will be milder and wetter and intense, heavy rainfall events will increase in both winter and summer.

13.6.16 These effects have impacts on fish including reduction in dissolved oxygen levels and reduced river flow and loch levels in summer for fish. In winter there will be a greater risk off egg washout during heavy rainfall events. Temperature fluctuations will also have impacts on egg incubation, hatch times and may alter seasonal behaviour of fish.

13.6.17 Scottish Canals is committed to improving fish passage within the canal network through the Scottish Government's 'Wild Salmon Strategy Implementation Plan 2023-2028'. Provided that effective mitigation / improvements are made to the canal, this is likely to improve the downstream migration for salmon and sea trout smolts at Ness Weir, where a proportion of smolts are known to enter the canal and become lost. This could have a beneficial effect on salmon and sea trout populations within the Ness catchment within the next 5 years following improvements.

13.7 Mitigations by Design / Embedded Mitigation

13.7.1 A Construction Environmental Management Plan (CEMP), Pollution Prevention Plan (PPP) and Water Quality Monitoring Programme (WQMP) would be implemented by the Principal Contractor and

[18] Scotland's Environment (2021) How has Scotland's climate changed? Available Online: Changing climate | Scotland's environment web

[19] Linda May, Philip Taylor, Iain D. M. Gunn, Stephen J. Thackeray, Laurence R. Carvalho, Peter Hunter, Mairéad Corr, Anne J. Dobel, Alanna Grant, Gemma Nash, Emma Robinson and Bryan M. Spears (2022). Assessing climate change impacts on the water quality of Scottish standing waters. CRW2020_01. Scotland's Centre of Expertise for Waters (CREW). Available online with Technical Appendices at: [Assessing climate change impacts on the water quality of Scottish standing waters] | CREW | Scotland's Centre of Expertise for Waters

overseen by a Freshwater Ecologist or Aquatic Clerk of Works (ACoW) with experience of working with aquatic ecosystems.

13.7.2 The tunnel would be constructed using underground drilling and blasting through rock which would avoid the need for any watercourse crossings in relation to the tunnel.

13.7.3 Instream works would be avoided, where practical, during sensitive spawning and migration periods for fish. Sensitive periods are October – June to cover salmonid spawning, egg development in gravels, hatching and also the migration of salmon and sea trout smolts between mid-March – end June. Due to the programme of works, there are instances where instream works cannot be avoided during sensitive spawning and migration periods for fish and appropriate additional mitigation would be provided where this is the case (see **Section 13.9**).

13.7.4 The approach velocity of water across the intake screen during abstraction / pumping mode would be <0.3 m/s. This would ensure that most fish species would be able to overcome the effect of entrainment / impingement at the screens.

13.7.5 Outflow would be diffused using vane structures on the outlets to spread the flow over a wider area to reduce the potential for attraction / entrainment / impingement of upstream migrating fish.

13.7.6 Appropriately designed vertical bar screens of maximum 12.5 mm mesh aperture to cover the intake/outlet would be implemented to prevent fish from entering into the underground waterway system at Loch Ness and Loch Kemp. This would prevent the risks of fish entrapment, injury and mortality or translocation. The screens would require daily inspection and maintenance or a self-cleaning mechanism to prevent blockage / damage from foliage and debris. It is possible that smaller fish (i.e elvers) may be able to pass through a 12.5 mm screen however using a recommended mesh size for elver of 2 mm would result in continual foliage / debris build up and increase velocities across the screen, likely increasing overall impacts on fish. Elvers however are weaker swimmers so are unlikely to be able to overcome the outflow velocities across the screens during generation.

13.7.7 The proposed water management of Loch Ness by the Applicant features curtailment of the Proposed Development during operation through the implementation of a 'stop pumping' (or 'hands off') level (i.e the loch level at which the Proposed Development would stop abstracting water from Loch Ness) and a 'stop generating' level (i.e the loch level at which the Proposed Development would stop releasing water into Loch Ness), at which operations of the Proposed Development would cease and the scheme would enter standby mode (see **Chapter 7: Water Management** for further details). The exact details of this curtailment would be agreed with the regulator SEPA as part of a CAR Licence process but the stop pumping level allocated to the Proposed Development would be above the stop pumping level assigned to the operational Foyers PSH to ensure that it would not restrict the operation of the existing PSH. In turn, the Foyers PSH stop pumping level, which is stated as 15.27m AOD[20] in **Table 7.3: Stop Pumping Levels, Abstraction and Discharge Flows for Loch Ness PSHs** of **Chapter 7: Water Management,** ensures that the existing scheme does not draw water down below the minimum levels required for the operation of the Caledonian Canal and to maintain a compensation flow across Ness Weir (see **Volume 2, Figure 7.3: Historic Loch Ness Levels with**

[20] As noted in **Section 7.9** of **Chapter 7: Water Management**, the Applicant has based its analysis on the levels and flows in the agreements or licenses (as shown in **Table 7.3**). It is the Applicant's understanding that the 'stop pumping' level of Foyers PSH is dictated by the agreement between British Waterways (BWB) and North of Scotland Electricity Board (NSHEB, now SSEN Transmission) (1970). Notwithstanding this, the stop pumping level that would be allocated to the Proposed Development through the CAR Licence process and would not be below the stop pumping level of Foyers PSH.

Pumped Hydro Curtailment Levels). The implementation of a stop pumping level would mean that the abstraction of water associated with the Proposed Development would not cause water levels in Loch Ness to reduce below the current Foyers stop pumping level (either in isolation or in-combination with Foyer PSH and/or other future schemes on Loch Ness, which would also be subject to similar operational restrictions) although this level would be approached more often. Other factors, such as a drought period, could cause water levels to reduce below the Foyers stop pumping level, but at this level no PSH schemes would be abstracting water from Loch Ness.

13.7.8 The purpose of the 'stop generating' level would be to prevent flooding events in Loch Ness and River Ness. As with the stop pumping level, the exact stop generating level for the Proposed Development would be agreed with SEPA as part of a CAR Licence process, but the for the purposes of this assessment, it is assumed that all PSH schemes on Loch Ness would stop generating at the 1 in 10 year flooding event, given as 17.44 m AOD in **Chapter 7: Water Management**.

13.7.9 The implementation of a stop pumping and stop generating level for all PSH schemes in Loch Ness, including the Proposed Development, would mean Loch Ness water levels would continue to operate largely within the existing loch level range, although variation in water levels within these limits would be more frequent within likely daily and weekly cycles (See **Section 7.9** of **Chapter 7: Water Management** for further details). The overall range of levels would slightly increase because releases for generation cause a temporary increase in level before the resulting increase in flow over the Ness Weir (see description in **Table 13.9: Summary of Desk Study**) brings the level back down. The level exceeded on average for 1% of the time (i.e 3-4 days per year) may increase by around 4 cm if both Red John PSH and the Proposed Development are introduced to Loch Ness. There would also be a small reduction in the average loch level of Loch Ness of around 3 cm under this scenario.

13.7.10 The outflow from Loch Kemp (Allt an t-Sluichd) would receive a regulated compensation flow to be agreed with SEPA and NatureScot following the building of the Dam 1. This could have a beneficial effect for fish and address the seasonal fish kills and very low flows that were encountered during the baseline field studies in September 2022 (under natural conditions) if a flow was maintained throughout the summer and early autumn months. However, as the Allt an t-Sluichd runs through the Ness Woods SAC, this would need to be considered in parallel with flow conditions that are considered favourable to qualifying features of the SAC, including bryophyte and lichen species (i.e., it would need to be determined whether or not a dry / drought period during the summer months is beneficial to such species). However, during recent consultation with SEPA in relation to the CAR licence for the Proposed Development (see **Chapter 5: Scoping and Consultation**), SEPA suggested that the dry conditions captured by the water gauge, which has been in place at the outflow from Loch Kemp and suggests that this watercourse is dry 20% of the time, seems unlikely and this finding is more likely the result of extreme dry conditions experienced in the Whitebridge area in summer / early autumn 2022 , during the monitoring period. Further monitoring is required, but if SEPA's comments are correct, then it may be feasible to maintain a compensatory flow from the Allt an t-Sluichd throughout the summer months, which could be beneficial to both fish and species associated with the Ness Woods SAC.

13.7.11 The culvert to be installed on the Allt Leachd Gowerie for construction and operational access would conform to the SEPA good practice guide on river crossings to allow fish passage through the culvert.

13.7.12 Once constructed, Dam 4 would prevent upstream fish passage from Loch Kemp to the Allt Leachd Gowerie. It was concluded based on the results of the fish habitat assessment that the upper reaches of the Allt Leachd Gowerie beyond the location of Dam 4 offered limited potential to support fish populations with *Low* fish habitat quality and *Unsuitable* salmonid spawning habitat present within

high organic substrates and coniferous plantation. Maintaining upstream fish passage at this Dam location would offer limited value for fish.

13.8 Potential Significant Effects

13.8.1 This section considers the potential temporary construction phase and permanent operational phase effects with associated significance of effect (prior to mitigation), of the Proposed Development based on the typical activities described in **Chapter 3: Description of Development**. Decommissioning impacts are expected to be equal to and / or lesser than the construction impacts so are not covered by this assessment.

Construction Effects

Temporary Works Footprint inc. Cofferdam (Loch Ness)

Arctic Charr

13.8.2 Arctic charr have the potential to be impacted by the temporary loss of optimal salmonid spawning habitat due to the location of temporary works on the shore of Loch Ness. There would be a net loss of available spawning habitat and potentially less recruitment as a result of the temporary infrastructure. It should be noted that, as a proportion of the optimal salmonid spawning habitat within the study area at Loch Ness, the majority of the *Optimal* habitat was located out with the Proposed Development site boundary (74%). The available habitat around the entire perimeter of Loch Ness has not been assessed however a high level desk and field study highlighted areas such as Dores Beach which were suitable with wave washed gravels and pebbles present. As these works are temporary, the habitat affected at the location of the works may recover following the demobilisation of the construction phase. The significance of this effect prior to mitigation is considered to be **Minor (Not Significant)**.

Juvenile Lamprey

13.8.3 Juvenile lamprey have the potential to be impacted by the temporary loss of nursery habitat due to the location of temporary works on the shore of Loch Ness. However, this is unlikely to be a significant effect as any impacts would also be very localised. Sand was the dominant substrate type across most of the boat transects in field studies, especially beyond the shoreline which featured coarser material. The significance of this effect prior to mitigation is considered to be **Imperceptible (Not Significant)** for brook lamprey and **Minor (Not Significant)** for river / sea lamprey.

Dam Construction

Brown Trout

13.8.4 Brown trout populations in Loch Kemp, Allt an t-Sluichd and Allt Leachd Gowerie have the potential to be impacted by the dam construction works. The construction of the dams would need to take place in a dry channel meaning that watercourses would be diverted / over pumped during construction. Resident brown trout populations may be affected by these operations, causing displacement, mortality or the temporary loss of habitat relating to the construction footprint. The significance of this effect prior to mitigation is considered to be **Minor (Not Significant)**. For permanent loss of habitat in relation to the dams see **paragraph 13.8.34**.

Access Tracks

Brown Trout

13.8.5 The Allt Leachd Gowerie watercourse would be culverted for a construction and operational access track (8m Wide Running Surface Reinstated to 4m). The installation of this culvert would need to take place in a dry channel meaning that the watercourse would be diverted / over pumped during construction. Resident brown trout populations may be affected by these operations, causing displacement, mortality or the loss of habitat relating to the construction footprint. For permanent loss of habitat in relation to the culvert see **paragraph 13.8.36**. Fish spawning habitat at this location was deemed *Unsuitable* and fish habitat quality was deemed *Low*. A poorly installed culvert could create a migratory barrier to fish therefore the installation must adhere to SEPA good practice river crossings[21]. The significance of this effect prior to mitigation is considered to be **Minor (Not Significant**.

Noise and Vibration

13.8.6 Fish species in Loch Ness and Loch Kemp within the vicinity of the works area, have the potential to be impacted by temporary cofferdam construction activities including sheet piling and blasting. Effects of noise associated with construction work on fish are behavioural, sub-lethal or lethal. Magnitude of impact is proportional to the sound level, distance between noise source, fish receptor and species of fish. Sound travels at greater speeds in water than within air. A behavioural response of avoidance can be more detrimental to migratory fish which may alter their natural migratory routes or cause delays in comparison with non-migratory fish which may simply move to another area of the loch.

13.8.7 Perception of noise for different species of fish and at different life stage is critical in determining extent of impact. For example, variation in noise perception is proportional to the distance between the swim bladder and the inner ear. In small species, or fish in younger life stages associated with smaller physical appearances, this distance is smaller resulting in more acute noise perception.

13.8.8 Due to the lack of available baseline data on the migratory routes of fish through Loch Ness, a precautionary principle is adopted that assumes Atlantic salmon, sea trout, sea lamprey, river lamprey and European eel would be in close proximity to the cofferdam works area.

Atlantic Salmon and Sea Trout

13.8.9 Atlantic salmon and sea trout smolts are more sensitive to underwater noise than adult fish as they are smaller and are also known to passively migrate so may be less likely to emit a behavioural response of avoidance than adult fish. This would make them more prone to sub-lethal or lethal effects. The significance of effect for Atlantic salmon smolts prior to mitigation is considered to be **Major (Significant)**. The significance of this effect for sea trout smolts prior to mitigation is considered to be **Moderate (Significant)**.

Eels

13.8.10 Juvenile eels (elvers) have been shown to be more prone to predation incidents and experience diminished spatial performance and elevated levels of stress when exposed to anthropogenic

[21] SEPA (2010) Engineering in the water environment: good practice guide River crossings Second edition, November 2010

noise.[22] The significance of this effect for eels prior to mitigation is considered to be **Major (Significant)**.

Lamprey

13.8.11 Migratory river / sea lamprey also have the potential to be affected by underwater noise produced by piling. The significance of this effect for migratory river / sea lamprey prior to mitigation is considered to be **Major (Significant)**.

13.8.12 Juvenile lamprey which reside within soft sediments may also be at particular risk of sub-lethal and / or lethal effects from underwater noise as they would be expected to remain *in situ* rather than emit a behavioural response. The significance of this effect for juvenile brook lamprey prior to mitigation is considered to be **Minor (Not Significant)** and for juvenile river / sea lamprey is considered to be **Major (Significant).**

Arctic Charr, Brown Trout and Ferox Trout

13.8.13 Non-migratory fish species such as Arctic charr, brown trout and ferox trout also have the potential to be impacted by temporary cofferdam construction activities but are more likely to emit a behavioural response of avoidance to noise than the aforementioned smolts. The significance of this effect for Arctic charr prior to mitigation is considered to be **Moderate (Significant)**, for brown trout **Minor (Not Significant)** and ferox trout **Moderate (Significant)**.

13.8.14 Acoustic propagation modelling would be required to display the current and potential soundscape of the underwater environment in Loch Ness to determine the extent / distance to which noise travels laterally and horizontally within the water column, and the interaction of noise with environmental variables. This has not been conducted within this assessment.

13.8.15 It is expected that once *in situ*, the cofferdam would help to attenuate the noise impacts on fish from other construction activities at the loch shores.

Dust and Construction Run Off

13.8.16 All fish species within the site and zone of influence have the potential to be impacted by water quality changes as a result of dust and run off from construction works. The CEMP with appropriately designed Pollution Prevention Plan (PPP), Water Quality Monitoring Programme (WQMP) and regular monitoring from an on-site Aquatic Clerk of Works (ACoW) should negate the risks associated with this. The impact scale and significance of effect are summarised for each IEF in **Table 13.10 Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation.**

Lighting

13.8.17 During the winter all work areas across the site would have temporary construction lighting at the start and end of the working day for surface works. Fish have the potential to be impacted with floodlit watercourses increasing the chances of displacement and / or predation of fish. Working hours would be minimised to limit the use of lighting during these hours and appropriate mitigation would be implemented to minimise illumination, glare or light spillage from these lights to nearby

[22] Simpson, S. D., Purser, J. and Radford, A. N. (2014) Anthropogenic noise compromises antipredator behaviour in European eels. August 2014. Anthropogenic noise compromises antipredator behaviour in European eels - Simpson - 2015 - Global Change Biology - Wiley Online Library

receptors. The impact scale and significance of effect are summarised for each IEF in **Table 13.10: Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation**.

Table 13.10: Likely Construction Phase Impacts and Effects on IEFs Prior to Mitigation

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
Arctic Charr	National	Noise and vibration during cofferdam construction (Loch Ness).	Behavioural response of avoidance. Acute physical injury or morality.	Temporary **Low**, adverse impact.	Moderate, Significant
		Temporary works footprint (Loch Ness).	Net loss of spawning habitat (<0.25% of total Loch Ness shoreline)	Temporary, **Negligible,** adverse, impact.	Minor, Not Significant
		Dust and run off from construction work (i.e. a major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact.	Minor, Not Significant
		Construction Lighting (Loch Ness).	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up).	Temporary **Negligible**, adverse impact.	Minor, Not Significant
Atlantic Salmon	International	Noise and vibration during cofferdam construction (Loch Ness).	Behavioural response of avoidance affecting migration routes. Acute physical injury or morality of smolts.	Temporary **Medium**, adverse impact.	Major, Significant
		Dust and run off from construction works. (i.e a major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact.	Minor, Not Significant
		Lighting.	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up).	Temporary **Negligible**, adverse impact.	Minor, Not Significant
Brook Lamprey	Local	Noise and vibration during cofferdam construction (Loch Ness).	Behavioural response of avoidance. Acute physical injury or morality.	Temporary **Medium**, adverse impact.	Minor, Not Significant
		Temporary works footprint (Loch Ness).	Loss of nursery habitat.	Temporary, **Negligible,** adverse, impact.	Imperceptible, Not Significant

		Dust and run off from construction work (i.e a. major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact.	Imperceptible, Not Significant
		Lighting.	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up). Lampey ammocetes buried within the sediment would not be effected by light pollution.	Temporary **Negligible**, adverse impact.	Imperceptible, Not Significant
Brown Trout	Local	Noise and vibration during cofferdam constructions (Loch Ness and Loch Kemp).	Behavioural response of avoidance. Acute physical injury or morality.	Temporary **Low**, adverse impact.	Minor, Not Significant
		Construction of dams 1 and 4. (Loch Kemp, Allt an t-Sluichd and Allt Leachd Gowerie).	Displacement, mortality or the temporary loss of habitat within **temporary**[23] works footprint.	Temporary **Medium**, adverse impact.	Minor, Not Significant
		Watercourse crossing (Allt Leachd Gowerie).	Displacement, mortality or the temporary loss of habitat within **temporary**[24] works footprint.	Temporary **Low**, adverse impact.	Minor, Not Significant
		Dust and run off from construction work (i.e a. major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact.	Imperceptible, Not Significant
		Lighting.	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up).	Temporary **Negligible**, adverse impact.	Imperceptible, Not Significant
European Eel	National	Noise and vibration during cofferdam construction (Loch Ness).	Avoidance affecting migration routes. Acute physical injury or morality.	Temporary **Medium**, adverse impact.	Major, Significant

[23] Permanent works footprint is addressed under operational phase effects.

[24] Permanent works footprint is addressed under operational phase effects.

		Dust and run off from construction work (i.e a. major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact.	Minor, Not Significant
		Lighting.	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up).	Temporary **Negligible**, adverse impact.	Minor, Not Significant
Ferox Brown Trout	National	Noise and vibration during cofferdam construction (Loch Ness).	Behavioural response of avoidance. Acute physical injury or morality.	Temporary **Low**, adverse impact.	Moderate, Significant
		Dust and run off from construction work (i.e a. major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact	Minor, Not Significant
		Lighting.	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up).	Temporary **Negligible**, adverse impact.	Minor, Not Significant
River / Sea Lamprey (Migratory and Anadromous)	National	Noise and vibration during cofferdam construction (Loch Ness).	Behavioural response of avoidance affecting migration routes. Acute physical injury or morality.	Temporary **Medium**, adverse impact	Major, Significant
		Temporary works footprint (Loch Ness).	Loss of nursery habitat.	Temporary, **Negligible,** adverse, impact	Minor, Not Significant
		Dust and run off from construction work (i.e a. major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact	Minor, Not Significant
		Lighting.	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up). Lampey ammocetes buried within the sediment would not be effected by light pollution.	Temporary **Negligible**, adverse impact.	Minor, Not Significant
Sea Trout	Council	Noise and vibration during cofferdam construction (Loch Ness).	Behavioural response of avoidance affecting migration routes. Acute physical injury or morality of smolts.	Temporary **Medium**, adverse impact	Moderate. Significant

		Run off from construction works.	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact	Imperceptible, Not Significant
		Lighting.	Displacement and increased predation risk (<1% of total Loch Ness shoreline lit up).	Temporary **Negligible**, adverse impact.	Imperceptible, Not Significant
Loch Salmonid Spawning Habitat (Loch Ness)	Local	Temporary works footprint (Loch Ness).	Loss of spawning habitat (<0.25 of total Loch Ness shoreline).	Temporary, **Negligible,** adverse, impact	Imperceptible, Not Significant
Riverine Fish Habitat (Allt Leachd Gowerie and Allt an t-Sluichd)	Site	Construction footprint of dams 1 and 4[25].	Loss of fish habitat.	Temporary, **Low,** adverse, impact	Imperceptible, Not Significant
	Site	Dust and run off from construction work (i.e a. major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact	Imperceptible, Not Significant
Riverine Fish Habitat (Allt a Chinn Mhonaich)	Site	Dust and run off from construction work (i.e a. major incident).	Changes in water quality and fish habitat.	Temporary **Negligible**, adverse impact	Imperceptible, Not Significant

[25] Permanent works footprint is addressed under operational phase effects.

Operational Effects

Loss of Salmonid Spawning Habitat due to Inundation at Loch Kemp

13.8.18 Optimal salmonid spawning habitat has the potential to be impacted by the inundation at Loch Kemp due to the increased depth of maximum inundation and constant fluctuations in water level. This optimal habitat was a very localised area (LK26) and made up 3.3% of the total shoreline habitat at Loch Kemp. The significance of this effect for salmonid spawning habitats of Loch Kemp prior to mitigation is considered to be **Imperceptible (Not Significant)**.

Loss of Habitat due to Permanent Infrastructure at Loch Ness

Arctic Charr

13.8.19 Arctic charr have the potential to be impacted by the permanent loss of optimal salmonid spawning habitat due to the location of permanent infrastructure and tailrace. There would be a net loss of available spawning habitat and potentially less recruitment as a result of the infrastructure. For context as a proportion of the optimal salmonid spawning habitat within the study area at Loch Ness, the majority of the optimal habitat was located out with the development boundary (74%). The available habitat around the entire perimeter of Loch Ness has not been assessed but a high-level desk study and site visit highlighted areas such as Dores Beach which was suitable for spawning with wave washed gravels and pebbles present. The area of permanent infrastructure makes up around 0.25% of the total perimeter of Loch Ness. The significance of this effect for Arctic charr prior to mitigation is considered to be **Minor (Not Significant)**.

Brown Trout

13.8.20 Brown trout are more likely to spawn in rivers and streams but also have the potential to spawn along the loch shore within optimal spawning habitats. As above with Arctic charr, the magnitude of impact is very minimal within the context of the Loch Ness shoreline as a whole and the other spawning opportunities available outside the planning boundary. The significance of this effect for brown trout prior to mitigation is considered to be **Imperceptible (Not Significant)**.

Lamprey

13.8.21 Juvenile lamprey have the potential to be impacted by substrate changes caused by erosion at the tailrace and also by the position of the permanent infrastructure. There is the potential for nursery habitat (sand sediments highlighted in the field studies) to be affected / lost which would impact on the species recruitment at this location. However, this is unlikely to cause a significant effect as any impacts would be very localised as the area of permanent infrastructure only makes up around 0.25% of the total perimeter of Loch Ness. Sand was the dominant substrate type across most of the boat transects in field studies, especially beyond the shoreline which featured coarser material. The significance of this effect for juvenile brook lamprey prior to mitigation is considered to be **Imperceptible (Not Significant)**.. The significance of this effect for juvenile sea / river lamprey prior to mitigation is considered to be **Minor (Not Significant)**.

Attraction of Fish to the Outlet (during generating phase)

Atlantic Salmon and Sea Trout

13.8.22 The migratory behaviour of Atlantic salmon and sea trout within the Ness catchment is unclear but it is likely that adult migratory fish seek refuge in Loch Ness during the spring and summer months and move around prior to running further up the catchment to spawn. Adult Atlantic 'spring' salmon

from the River Moriston catchment enter the loch early in the year and are known to congregate around the mouth of the river (a popular fishing location) waiting to run the river during sufficient flows. The effect of operational hydro scheme water releases is known to encourage fish to enter the river but some fish may drop back into the loch for refuge when the water level in the river reduces. The same is likely true of Atlantic salmon returning to the River Oich catchment which also is impacted by hydro schemes. Although they have a very strong homing instinct, upstream migrating adult Atlantic salmon and sea trout in Loch Ness may be attracted to the outlet during generation as migratory fish tend to face onto an oncoming current (known as a rheotactic[26]). This could result in temporary delays to migration and make fish at greater risk to poaching from members of the public. During generating phase (up to 15 hrs), there would be intermittent breaks in generating. This should allow distracted fish to disperse from the area and continue on their migration. The more severe risk associated with fish attraction to the outlet would be fish becoming trapped within the underground waterway system however fish screens would be designed such that they would be totally impassable to these species at this age class with mesh size of max 12.5 mm. The significance of effect for adult Atlantic salmon prior to mitigation is considered to be **Moderate (Significant)**. The significance of effect for adult sea trout prior to mitigation is considered to be **Minor (Not Significant)**.

European Eel

13.8.23 European eels could also be impacted in similar ways. Elvers (juvenile eels) which are much smaller than yellow / silver eels are at particular risk on their upstream migrations (May – end June) during generation periods where they may be attracted to the outlet screen. The recommended mesh size for elvers is max 3 mm spacing, however the design of fish screens at the outlet is to be 12.5 mm spacing. There is therefore the potential adverse effect of elvers becoming entrained and trapped within the underground waterway system. The sustained swimming speed of European eel for 0.10 m body length has been shown to be 0.09 m/s, with a burst speed of 1.01 m/s. Elvers cannot swim against current velocities of >0.5 m/s. The output velocity during generation is expected to be 0.41 m/s, which is at the upper limit of elver swimming capabilities. Despite this, due to the possible attraction to the outlet and using the precautionary principle, elvers would have the ability to pass through outlet screens. The significance of this effect for eels (elvers) prior to mitigation is considered to be **Moderate (Significant)**.

River / Sea Lamprey

13.8.24 River and sea lamprey could be attracted in similar ways to salmon and sea trout. These adult fish are unlikely to be able to pass through the screens if they become attracted to the flow, however this distraction may present short delays to migrations, increased predation, and energy expenditure. Impacts would be very localised and only affect fish migrating in the vicinity of the Proposed Development. The significance of effect for river and sea lamprey prior to mitigation is considered to be **Moderate (Significant)**.

Brown Trout and Ferox Brown Trout

13.8.25 Mature brown trout and ferox could be attracted in similar ways to salmon and sea trout during spawning periods where they are more likely to be moving around the catchment, making short migrations to spawning tributaries. These adult fish are unlikely to be able to pass through the

[26] O'Keeffe, N. & Turnpenny, A.W.H. (2005) Screening for Inlet and Outlets: a best practice guide. Science Report SC030231. Environment Agency: Bristol

screens if they become attracted to the flow, however this distraction may present short delays to migration during spawning periods. Impacts would be very localised and only affect fish migrating in the vicinity of the Proposed Development. The significance of effect for brown trout prior to mitigation is considered to be **Imperceptible (Not Significant)** and for ferox trout **Minor (Not Significant)**.

Attraction of Fish to the Intake (during pumping cycle)

Atlantic Salmon and Sea Trout Smolts

13.8.26 Downstream migrating Atlantic salmon and sea trout smolts, which are attracted to outflows whilst migrating through loch systems, may be impacted by the Loch Ness intake by attraction to the draw of water from the intake resulting in entrainment. Fish screens of maximum mesh size **12.5 mm** would be present at the intake. The best practice guide for screening for intakes and outfalls recommend screens dimensions of ≤12.5 mm to protect migratory salmonids from hydro scheme infrastructure[27]. Attraction towards the screen during abstraction however could present a delay to migration and is also likely to make smolts more vulnerable to predation from mammalian, avian and aquatic predators (otter, goosander, cormorant, pike and ferox trout). Any delays to migration caused by anthropogenic effects can also have a negative impact on these species on the timing of their migration to sea as they have evolved to time their downstream migration to reach the sea at the optimum time (Ness DSFB, 2022). The sustained swimming speed of Atlantic salmon for 0.15m body length is 0.54 m/s[28] and the predicted maximum velocity approaching the intake is less than 0.3 m/s, therefore smolts would have the ability to overcome the draw of the intake velocity voluntarily preventing any injury / mortality associated with impingement on the screens. In the absence of baseline data on smolt migration pathways within Loch Ness, the impacts on smolts are considered using the precautionary principle. The significance of this effect for Atlantic salmon smolts prior to mitigation is considered to be **Major (Significant)**. The significance of this effect for sea trout smolts prior to mitigation is considered to be **Moderate (Significant)**.

European Eel

13.8.27 Downstream migrating silver eels which are larger than elvers are unlikely to be affected as the recommended screen mesh size for this life stage is maximum 12.5-20 mm. The sustained swimming speed of eels of body length 0.70 m has been shown to be 0.58 m/s with a burst speed of 1.26 m/s.[29] It is highly likely that silver eels would have the ability to voluntarily swim away from the draw of the intake, overcoming the predicted velocities of <0.3 m/s and unable to pass through the screens if they were to be attracted. The significance of this effect for silver eels prior to mitigation is considered to be **Moderate (Significant)**.

13.8.28 Upstream migrating elvers, although not actively looking for an outlet to the loch may become involuntarily drawn into the screen, if migrating on the southern side of Loch ness, creating risks of impingement on the screens or entrainment into the underground waterway system. This could

[27] Turnpenny, A.W.H. & O'Keeffe, N. (2005) Screening for Intake and Outfalls: a best practice guide. Available: Microsoft Word - W6_103 TR_amended__1.doc (publishing.servici.e aov.uk)

[28] Tang, J. & Wardle, C. S. (1992) Power Output of Two Sizes of Atlantic Salmon (*Salmo Salar*) at their Maximum Sustained Swimming Speeds. The Journal of Experimental Biology Volume 166. pp. 33-46

[29] Sheridan, S., Turnpenny, A., Horsfield, R., Solomon, D., Bamford, D., Bayliss, B., Coates, S., Dolben, I., Frear, P., Hazard, E., Tavner, I., Trudgill, N., Wright, R. & Aprahamian, M. (2011) Screening at Inlets and Outlets: measures to protect eel (*Anguilla anguilla*). International Fish Screening Techniques

result in delays to migration, increased predation, injury, mortality, or translocation. The significance of this effect for elver prior to mitigation is considered to be **Moderate (Significant)**.

River / Sea Lamprey

13.8.29 The issue of fish being drawn in involuntarily at the intake applies to other fish species. The predicted maximum velocity approaching the intake is less than 0.3 m/s. The swimming speed of juvenile lamprey (ammocoetes) is usually between 0.10 and 0.30 m/s[30]. These swimming speeds seem to apply when the lamprey are disturbed or are seeking out food resources. Most larval movement results from passive downstream migration rather than actively moving around. Mature (migratory) sea lamprey of body length 0.58 m have been shown to be capable of moving up to 4.8-5.5 m/s[31]. These species therefore have the ability to voluntarily swim away from the draw of the intake, overcoming the predicted velocities of <0.3 m/s. Due to potential delays to migration and predation, the significance of this effect for lamprey prior to mitigation is considered to be **Moderate (Significant)**.

Fluctuations in Water Levels (Loch Kemp)

Brown Trout

13.8.30 Brown trout may be impacted by the constant fluctuations in water level within Loch Kemp once the Proposed Development is operational. Fish occupying the newly flooded areas at maximum inundation may become stranded on dry land or more likely within smaller puddles when the water level drops back to the minimum inundation level during the generation cycle. This would make these brown trout at a greater risk of death or predation. It is anticipated that the majority of fish would drop back with the drop in water levels to the natural loch level or to existing river channels. The significance of this effect for brown trout prior to mitigation is considered to be **Minor (Not Significant)**.

Fluctuations in Water Levels (Loch Ness)

13.8.31 Although Foyers PSH is operational and considered part of the baseline scenario, there could be a situation where the Proposed Development would be operational when Foyers PSH is not. This section of the assessment therefore considers potential impacts on water levels in Loch Ness under a scenario where the Proposed Development is operating in isolation.

13.8.32 The proposed operational regime of the Proposed Development would operate largely within the current maximum and minimum range of loch levels in Loch Ness, due to the implementation of stop pumping (or 'hands off') and stop generating levels enforced through the CAR Licence, as described in **Section 3.7**. These levels would be agreed with SEPA, but the stop pumping level of the Proposed Development would be above the stop pumping level assigned to the operational Foyers PSH to ensure it does not restrict the operation of the existing PSH. Foyers in turn has a stop pumping level applied to ensure it does not draw water down below the minimum levels required for the

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

[31] Hoover, J. J. and Murphy, C. E. 2018. Maximum swim speed of migrating Sea Lamprey *Petromyzon marinus*): reanalysis of data from a prior study. ERDC/TN ANSRP-18-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center. http://el.erdc.usace.army.mil/ansrp/ansrp.html

operation of the Caledonian Canal and to maintain a compensation flow over the crest of Ness Weir (see **Volume 2, Figure 7.3: Historic Loch Ness Levels with Pumped Hydro Curtailment Levels**).

13.8.33 Based on a sensible worst-case scenario, as described in **Section 7.8**, of **Chapter 7: Water Management**, hydrological modelling predicts that water levels in Loch Ness would reduce by 0.08 m during a four-hour pumping cycle (i.e. when water is pumped up from the lower reservoir and stored in the upper reservoir) of the Proposed Development operating in isolation. During a generation cycle (when water is released from the upper reservoir into the lower reservoir) of the same time period, water levels in Loch Ness would increase by 0.10 m However if either the stop pumping or the stop generating level in Loch Ness were reached during a cycle, operation of the Proposed Development would cease and it would enter standby mode.

Salmonids

13.8.34 Salmonid migration has the potential to be impacted by fluctuations in water levels at Loch Ness at Ness Weir. Adult salmon and sea trout migrating into Loch Ness (via Loch Dochfour) are aided during upstream migration by an existing main fish pass known as 'the spout' at Ness Weir (as shown by the 'Fish Pass' on **Volume 2, Figure 7.4: Ness Weir Overview)**. It is important that flows over this section of the weir are maintained to allow fish passage into the Loch Ness. As described above, the Proposed Development would have a stop pumping level above the stop pumping level of the existing Foyers PSH, which in turn is above the level of the main fish pass crest at Ness Weir (14.93 m AOD). This means that the abstraction of water associated with the Proposed Development would not cause loch levels to reduce below the current Foyers stop pumping level and would continue to allow fish passage to/from the River Ness at the Ness Weir. Furthermore, under a scenario where the Proposed Development was abstracting water from Loch Ness in isolation (i.e., at a time when Foyers PSH was not operating) the minimum level that the loch could be drawn down too, would be less than the existing baseline scenario (i.e. where Foyers PSH would be operating in isolation). The significance of this effect of the Proposed Development operating in isolation on the **upstream** migration of salmonids is considered to be **Minor (Not Significant)** prior to mitigation.

13.8.35 Downstream migrating salmon and sea trout smolts also rely on the main fish pass (the spout) at Ness Weir for exiting the loch, although some smolts are also known to move beyond this area and congregate in the Caledonian Canal. As mitigation for this existing issue, Scottish Canals operate a smolt sluice immediately upstream of the Dochfour lock gates in the canal during the smolt run period annually and a 'smolt chute' also runs across the waste weir at the Ness Weir[32](as shown by the 'Smolt Chute' on **Volume 2, Figure 7.4: Ness Weir Overview** and **Plate 13.1** and **13.2)** , to act as secondary means for smolts to pass from the canal to the River Ness if they enter the canal rather than travelling over the main fish pass.

13.8.36 As noted above, the stop pumping level of the Proposed Development would be above the stop pumping level of the operational Foyers PSH, which in turn is above the level of the main fish pass crest at Ness Weir (14.93 m AOD). Therefore, the abstraction of water associated with the Proposed Development would not cause loch levels to reduce below the current Foyers stop pumping level and would continue to allow fish passage to/from the River Ness at the Ness Weir via the main fish pass. However, the Foyers PSH stop pumping level is below the level of the secondary smolt chute at Ness Weir. This highlights a potential existing problem for smolt passage in this area and the same would likely be true for the stop pumping level of the Proposed Development. However, as the

[32] The function of the Waste Weir is for any debris to flow down the river rather than the service weir.

Proposed Development would have a higher stop pumping level than the Foyers PSH, under a scenario where the Proposed Development was abstracting water from Loch Ness in isolation (i.e., at a time when Foyers PSH was not operating) the minimum level that the loch could be drawn down too, would be less than the existing baseline scenario (i.e. where Foyers PSH would be operating in isolation). Smolt which enter the canal when the water level is below the level of the smolt chute would also still be able to re-enter the River Ness through the smolt sluice operated by Scottish Canals at the Dochfour lock gates. The significance of this effect for the **downstream** migration of salmonids for the Proposed Development operating in isolation is therefore considered to be **Minor (Not Significant)** prior to mitigation. An assessment of the likely significant effects of the Proposed Development on salmonid migration (upstream and downstream) at the Ness Weir **in combination** with Foyers PSH and other consented schemes in Loch Ness is provided separately in **paragraphs 13.8.53 - 13.8.60**.

Arctic Charr

13.8.37 Arctic charr spawning has the potential to be impacted by fluctuations in water levels at Loch Ness. Due to the homogeneity of substrate and availability of optimal habitat there is a potential risk that Arctic Charr may spawn in areas of gravel on shallow waters during periods of elevated water levels associated with the Proposed Development (following a generation phase) that may become exposed when the water level retreats (during pumping). This could result in the eggs deposited in these areas becoming unviable. There is a potential risk that Arctic Charr spawning in the shallowest margins may spawn in areas which are subsequently drawn down during periods of abstraction.

13.8.38 Food sources for Arctic Charr which mainly feed on plankton in open water would be less affected by fluctuation of water levels than other fish species (i.e. brown trout) which feed within the littoral zone which would be more affected by fluctuations in water levels[33].

13.8.39 Although many Arctic Charr populations spawn in the littoral zone, some spawn at greater depths.[34] During research work carried out on Lake Windemere, Frost (1965) concluded shallow spawning grounds ranged from 1–3 m depth and were used by Autumn (mainly November) spawning Charr, while deeper spawning grounds ranged from 15-20 m depth[35]. Research carried out on three Irish lakes by Low (2011) found littoral zone spawning sites were found to be long, narrow strips running parallel to the shore at a maximum depth of 1.24 m[36].

13.8.40 The proposed operational regime of the Proposed Development would operate within the current maximum and minimum range of loch levels of Loch Ness due to the stop pumping and stop generating limits applied. The effect of the Proposed Development on loch levels operating in isolation would be less that the baseline conditions (e.g. Foyers PSH operating in isolation) since the stop pumping level of the Proposed Development would be higher than the stop pumping level of

[33] Maitland P. S. (1992) The status of Arctic Charr *Salvelinus Alpinus* (L), In Southern Scotland: A Cause For Concern. Freshwater Forum 2: pp 8.

[34] Klemetsen, A., Amundsen, P.-A., Dempson, J.B., Jonsson, B., Jonsson, N., O'Connell, M.F. & 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: 1-59.

[35] Frost, W.E. 1965. Breeding habits of Windermere charr, *Salvelinus willughbii (Günther)* and their bearing on speciation of these fish. Proceedings of the Royal Society, Series B 163: 473 232-284.

[36] Low, J., Igoe, F., Davenport, J. & Harrison, H. 2011. Littoral spawning habitats of three southern Arctic charr (*Salvelinus alpinus L.)* populations. Ecology of Freshwater Fish 20(4)

the existing Foyers PSH. Given the literature on the range of depths that Arctic Charr are known to spawn at, drawdown levels would not be expected to leave deposited eggs exposed. Only a negligible impact is expected where charr have spawned in extremely shallow water. The significance of this effect for Arctic Charr prior to mitigation is considered to be **Minor (Not Significant)**. An assessment of the likely significant effects of the Proposed Development on Arctic charr spawning **in combination** with Foyers PSH and other consented schemes in Loch Ness is provided separately in **paragraphs 13.8.61-13.8.64**.

Permanent Dams

Brown Trout

13.8.41 Brown trout within Loch Kemp, Allt an t-Sluichd and Allt Leachd Gowerie would be impacted by the permanent dams which would be present during the operational phase. These are expected to create migratory barriers to the resident trout within these watercourses. Some downstream migration may be possible. Spawning habitats within these watercourses beyond the dams were however deemed to be *Sub-Optimal* or *Unsuitable* and fish habitat quality assessed as *Low* and *Moderate* in these areas during 2022 field studies. The significance of this effect for brown trout prior to mitigation is considered to be **Minor (Not Significant)**.

Compensation Flows (Allt an t-Sluichd)

13.8.42 The Allt an t-Sluichd watercourse was also found to be drying up in September 2022 with dead fish evident. Assuming a compensatory flow can be maintained throughout the summer months (see **Section 13.7**), the regulation of the flow on this watercourse is expected to provide a benefit for trout within this watercourse, as the channel would remain wetted during drought spells which is not currently the case. The significance of this effect for brown trout is considered to be **Minor (Not Significant)**.

Watercourse Crossing

Brown Trout

13.8.43 The Allt Leachd Gowerie watercourse would be culverted for construction and operational access (to accommodate tracks with a 8 m Wide Running Surface, to be reinstated to 4 m following construction). This would potentially impact on brown trout with instream habitat being affected. Fish spawning habitat at this location however was deemed *Unsuitable* and fish habitat quality was deemed *Low*. A poorly installed culvert could create a migratory barrier to fish. The installation must adhere to SEPA good practice river crossings[37]. The far greater barrier to fish on this watercourse during the operational phase would be dam 4 approximately 130 m downstream (a permanent feature). The significance of this effect for brown trout prior to mitigation is considered to be **Minor (Not Significant)**.

Operational Noise and Vibration / Lighting

13.8.44 Fish species have the potential to be impacted by operational noise and vibration associated with the Proposed Development. Anticipated effects are expected to be non-lethal for fish but may cause temporary displacement and avoidance of the area around the Proposed Development. A positive effect of fish displacement caused by noise and vibration would be that fish may avoid impacts

[37] SEPA (2010) Engineering in the water environment: good practice guide River crossings Second edition, November 2010

associated with water abstraction and generation (as discussed for salmon, sea trout, eels and lamprey). The significance of this effect for all species is considered to be **Imperceptible / Minor (Not Significant)**.

13.8.45 All fish species have potential to be affected by artificial lighting at night (ALAN). The powerhouse building would have operational lighting. Anticipated effects are expected to be local displacement and avoidance of the area around the Proposed Development. A positive effect of fish displacement caused by lighting would be that fish may avoid impacts associated with water abstraction and generation (as discussed for salmon, sea trout, eels and lamprey). Underwater lighting is also proposed as a fish deterrent mitigation method in **Section 13.9**. Given the small-scale nature of lighting required in this area, the significance of this effect for all species prior to mitigation is considered to be **Imperceptible / Minor (Not Significant).**

Temperature Changes through Water Transfer

13.8.46 Fish species have the potential to be impacted by temperature changes through water transfer in Loch Ness. During generating cycles, increases in water temperature would be experienced up to 200 m into the loch from the shoreline, and around 2 km along the shoreline to the northeast and 600 m to the southwest. An extremely conservative assumption whereby discharges from Loch Kemp into Loch Ness would reach 20°C whilst Loch Ness remains at 6°C has been modelled by Ramboll using TUFLOW-FV, an industry-standard advection-dispersion model. The area experiencing temperatures greater than 15°C is limited to 140 m to the southwest of the plume location, 360 m to the northeast and up to 65 m away from the shoreline, covering a maximum surface area of 32,500 m². In the extremely unlikely event that temperatures did approach temperatures of 20°C, based on Ramboll's modelling, potential impacts are limited to <0.0004% of the volume of Loch Ness being impacted. Temperatures would rapidly return to background levels at the end of discharges[38]. The optimum temperature range for Atlantic salmon is thought to span 6-20°C, within which maximal growth occurs at 16-17°C. Atlantic salmon exhibit thermal stress at approximately 23°C with mortality at approximately 33°C[39]. For Arctic charr, optimal temperature preference is between 10.9 to 11.6°C[40]. They can also live in environment with a temperature range of between 0-6 with an optimal preference for 4.5°C[41]. Sudden temperature variation up to 2°C can modify physiology and behaviour[42]. Temperature is of particular importance for charr which may potentially spawn in areas affected by temperature fluctuation. Egg development may be affected with eggs developing quicker than in other areas of the loch where temperature would be stable. The upper temperature limit for survival of eggs of Arctic charr is 8°C[43]. Temperatures in localised areas adjacent to the

[38] Otton, H. and Gaskell, S. (2023) Technical Note: Thermal Plume Modelling Loch Ness.

[39] Fisheries Management Scotland (2023) Changing Temperature Patterns in: Water Temperature. Available: Water temperature - Fisheries Management Scotland (fms.scot)

[40] Siikavuopio, S. I., Sæther, BS., Johnsen, H. et al. (2014) Temperature preference of juvenile Arctic charr originating from different thermal environments. Aquat Ecol 48, 313–320. https://doi.org/10.1007/s10452-014-9485-0

[41] Larsson, S., Forseth, T., Berglund, I., Jensen, A.J., Näslund, I., Elliott, J.M. And Jonsson, B. (2005), Thermal adaptation of Arctic charr: experimental studies of growth in eleven charr populations from Sweden, Norway and Britain. Freshwater Biology, 50: 353-368. https://doi.org/10.1111/j.1365-2427.2004.01326.x

[42] Leblanc, C. A., Horri, K., Skúlason, S., Benhaim, D. (2019) Subtle temperature increase can interact with individual size and social context in shaping phenotypic traits of a coldwater fish PLoS ONE 14(3): e0213061. https://doi.org/10.1371/journal.pone.0213061

[43] Elliott, J.M. and Elliott, J.A. (2010), Temperature requirements of Atlantic salmon *Salmo salar*, brown trout *Salmo trutta* and Arctic charr *Salvelinus alpinus*: predicting the effects of climate change. Journal of Fish Biology, 77: 1793-1817. https://doi.org/10.1111/j.1095-8649.2010.02762.x

Proposed Development would fluctuate above this during the period of egg incubation. The optimum temperature for growth in European eel has been found to be 22–23°C. The ultimate upper lethal temperature was found to be 38°C and the critical thermal maximum varied from 33 to 39°C for fish acclimated at 14 to 29°C. Eels enter a state of lethargy at temperatures varying from 1 to 3°C.[44] Literature on temperature preferences for other fish species is limited but effects are likely to be very localised. Due to the localised nature, limited extent and duration of water temperature changes, the significance of this effect for Arctic Charr is **Minor (Not Significant)** and for all other species is considered to be **Imperceptible (Not Significant)**.

[44] Sadler, K. (2006) Effects of temperature on the growth and survival of the European eel, *Anguilla anguilla* Journal of Fish Biology 15(4):499 – 507

Table 13.11 Likely Operational Phase Impacts and Effects on IEFs Prior to Mitigation

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
Arctic Charr	National	Loss of optimal shoreline spawning habitat due to permanent infrastructure (Loch Ness).	Net loss of spawning habitat (0.25% of total Loch Ness shoreline).	Permanent, **Negligible**, adverse, impact.	Minor, Not Significant
		Shoreline spawning habitats being affected by fluctuating water levels (Loch Ness)	Eggs becoming exposed as a result of drawdown of Loch Ness during abstraction.	Permanent, **Negligible**, adverse, impact.	Minor, Not Significant
		Operational noise and vibration / lighting.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Minor, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Egg development affected by warmer average temperatures.	Permanent, **Negligible**, adverse, impact.	Minor, Not Significant
Atlantic Salmon	International	Attraction of adult fish to outlet during generation (Loch Ness).	Delays on upstream migration of adult fish, increased predation and poaching.	Permanent, **Low**, adverse, impact (with embedded mitigation).	Moderate, Significant
		Attraction of (downstream migrating) smolts to the intake during abstraction (Loch Ness).	Delays to migration. Increased predation, increased energy burden.	Permanent, **Medium** adverse, impact.	Major, Significant
		Fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration at the Caledonian Canal.	Delays to migration. Increased predation, increased energy burden.	Permanent, **Low** adverse, impact.	Minor, Not Significant
		Fluctuations in water levels (Loch Ness) causing issues with upstream adult migration at Ness Weir.	Delays to migration. Increased predation, increased energy burden.	Permanent, **Low**, adverse, impact (with embedded mitigation).	Minor, Not Significant

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
		Operational noise and vibration / lighting.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Minor, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
Brook Lamprey	Local	Erosion of the sediment at the tailrace (Loch Ness).	Net loss of nursery habitat.	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
		Construction of permanent infrastructure (Loch Ness).	Loss of nursery habitat in Loch Ness (0.5% of total Loch Ness shoreline).	Permanent, **Negligible,** adverse, impact	Imperceptible, Not Significant
		Operational noise and vibration.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Imperceptible, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
Brown Trout	Local	Loss of optimal shoreline spawning habitat due to permanent infrastructure (Loch Ness).	Net loss of spawning habitat (0.5% of total Loch Ness shoreline).	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
		Attraction of adult fish to outlet during generation (Loch Ness).	Delays to migration during spawning periods. Increased predation.	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
		Continual fluctuations in water levels (Loch Kemp and tributaries).	Fish strandings during minimum inundation.	Permanent, **Medium**, adverse, impact.	Minor, Not Significant
		Permanent dams (Loch Kemp, Allt an t-Sluichd and Allt Leachd Gowerie).	Migratory barriers to resident trout.	Permanent, **High**, adverse, impact.	Minor, Not Significant
		Watercourse crossing (Allt Leachd Gowerie).	Displacement, mortality or the loss of habitat within culvert footprint.	Permanent **Low**, adverse impact	Minor, Not Significant
		Compensation flow Allt an t-Sluichd.	Regulation of the flow causing the habitat to be wetted throughout usual drought periods, a positive benefit for fish and aquatic life.	Permanent **Medium**, beneficial impact.	Minor, Not Significant
		Operational noise and vibration / lighting.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Imperceptible, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
European Eel	National	Attraction of (upstream migrating) elvers to outlet during generation (Loch Ness).	Delays on upstream migration of elvers. Increased predation.	Permanent, **Low,** adverse, impact.	Moderate, Significant
		Impingement / Entrainment / Loss of (upstream migrating) elvers to intake during abstraction (Loch Ness).	Impingement on the screen, translocation or mortality.	Permanent, **Medium,** adverse, impact.	Moderate, Significant

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
		Attraction of (downstream migrating) silver eels to the intake during abstraction (Loch Ness).	Delays on downstream migration of silver eels. Increased predation.	Permanent, **Medium,** adverse, impact	Moderate, Significant
		Operational noise and vibration / lighting.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Minor, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes.	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
Ferox Brown Trout	National	Attraction of adult fish to outlet during generation (Loch Ness).	Delays to migrations during spawning periods.	Permanent **Negligible**, adverse, impact	Minor, Not Significant
		Operational noise and vibration / lighting.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Minor, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes.	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
River / Sea Lamprey (Migratory and Anadromous)	National	Loss of nursery habitat through permanent infrastructure and erosion of the sediment at the tailrace.	Net loss of nursery habitat in Loch Ness.	Permanent, **Negligible**, adverse, impact	Minor, Not Significant
		Attraction of (upstream migrating) adults to outlet during generation (Loch Ness).	Delays on upstream migration. Increased predation.	Permanent, **Low,** adverse, impact.	Moderate, Not Significant

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
		Attraction of lamprey to the intake during abstraction (Loch Ness).	Delays to migration. Increased predation.	Permanent, **Low,** adverse, impact.	Moderate, Not Significant
		Operational noise and vibration / lighting.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Minor, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes.	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
Sea Trout	Council	Attraction of adult fish to outlet during generation (Loch Ness).	Delays on upstream migration of adult fish.	Permanent, **Low**, adverse, impact.	Minor, Not Significant
		Attraction of (downstream migrating) smolts to the intake during abstraction (Loch Ness).	Delays to migration. Increased predation.	Permanent, **Medium,** adverse, impact.	Moderate, Significant
		Fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration.	Delays to migration. Increased predation.	Permanent, **Low,** adverse, impact.	Minor, Not Significant
		Fluctuations in water levels (Loch Ness) causing issues with upstream adult migration at Ness Weir.	Delays on upstream migration of adult fish.	Permanent, **Low**, adverse, impact (with embedded mitigation).	Minor, Not Significant
		Operational noise and vibration / lighting.	Temporary displacement.	Permanent **Negligible,** adverse, impact	Imperceptible, Not Significant

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes.	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
Loch Salmonid Spawning Habitat (Loch Ness)	Local	Permanent infrastructure and tailrace.	Loss of optimal spawning habitat (0.5% of total Loch Ness shoreline).	Permanent **Negligible,** adverse, impact	Imperceptible, Not Significant
		Localised temperature changes through water transfer (Loch Ness).	Thermal stress and behavioural changes	Permanent, **Negligible**, adverse, impact.	Imperceptible, Not Significant
Loch Salmonid Spawning Habitat (Loch Kemp)	Site	Flooding of original shoreline habitat at periods of maximum inundation.	Loss of optimal spawning habitat due to inundation.	Permanent **Negligible,** adverse, impact	Imperceptible, Not Significant
Riverine Fish Habitat (Allt Leachd Gowerie)	Site	Flooding riverine habitat at periods of maximum inundation.	Loss of good quality fish habitat due to inundation.	Permanent **Negligible,** adverse, impact	Imperceptible, Not Significant

Cumulative Effects Construction

13.8.47 No cumulative effects during the construction phase have been identified at this stage.

Cumulative Effects Operational

The Caledonian Canal (Operational)

13.8.48 The Caledonian Canal runs parallel to the River Ness at the outlet of Loch Ness (Loch Dochfour). This can present an impact on downstream migrating fish as they follow the draw of the canal rather than following the natural river course over the main fish pass at Ness Weir and become lost in the canal, causing delays in their migration. This can then result in losses due to predation and increased energy burdens. The initial results of the Ness 'Missing Salmon Project' (a tracking study) detected Atlantic salmon smolts (3 tagged individuals) entering the Caledonian Canal at Dochfour which were not subsequently detected versus smolts which went down the River Ness (11 individuals, 9 of which were detected on the final receiver)[45].

Foyers Power Station (PSH) (Operational)

13.8.49 The operational Foyers PSH (300 MW) (see **Volume 2, Figure 1.2: Site Context**) presents similar adverse effects highlighted for migratory fish during the operational phase of the Proposed Development (**paragraphs 13.8.22–13.8.29 and 13.8.31-13.8.33**). No additional mitigation is in place on the Foyers scheme other than fish screens at the intake. Foyers raises / reduces the water level in Loch Ness by up to 266 mm during a single generating or abstraction cycle.

Red John Pumped Storage Hydroscheme (Consented)

13.8.50 The consented 450 MW Red John PSH (Planning Ref: ECU00000728) (see **Volume 2, Figure 1.2: Site Context**) would also present the same adverse effects highlighted for migratory fish during the operational phase of the Proposed Development (**paragraphs 13.8.22–13.8.29 and 13.8.31-13.8.33**). No additional mitigation was proposed on the Red John PSH other than fish screening and funding for a patrol bailiff to monitor poaching of adult fish. The scheme would have a similar effect on water levels in Loch Ness to the operational Foyers PSH, although the upper reservoir of the Red John PSH has a smaller capacity than Foyers PSH and would only raise / reduce the level of Loch Ness by up to 90 mm during a single generating or abstraction cycle.

Attraction of Fish to the Intakes of Multiple PSH (during pumping cycle)

13.8.51 The cumulative effect of the Caledonian Canal, Foyers PSH, Red John PSH (once operational) and the Proposed Development (once operational) could potentially have an impact on downstream migrating Atlantic salmon and sea trout smolts. Once all three pumped storage schemes are in operation, there would be three potential areas where smolts may be attracted into during passive downstream migrations, before they find the exit of the Loch. As discussed in **paragraph 13.8.26** attraction towards the screen during abstraction (pumping cycle) could present delays to migration and is also likely to make smolts more vulnerable to predation from mammalian, avian and aquatic predators (otter, goosander, cormorant, pike and ferox trout). Any delays to migration caused by anthropogenic effects can also have a negative impact on these species on the timing of their migration to sea as they have evolved to time their downstream migration to reach the sea at the

[45] Scottish Centre for Ecology and the Natural Environment, University of Glasgow & Atlantic Salmon Trust (2019) Ness 'Missing Salmon Project' 2019. Available: moray_firth_tracking_project_-_river_ness_report.pdf (marine.gov.scot) Last Accessed 13/09/2023.

optimum time (Ness DSFB, 2022). The significance of this effect for salmon smolts prior to mitigation is considered to be **Major (Significant)**. The significance of this effect for sea trout smolts prior to mitigation is considered to be **Moderate (Significant)**.

Attraction of Fish to the Outlets of Multiple PSH (during generating cycle)

13.8.52 The cumulative effect of the generating phase of Foyers PSH, Red John PSH (once operational) and the Proposed Development (once operational) could potentially have an impact for upstream migrating adult salmon and sea trout. Once all three PSHs are in operation, there would be three potential areas where adult salmon and sea trout may be attracted into during upstream migration, on route to spawning grounds, potentially causing delays to migration and increased energy burden. Migratory adult fish do however have a strong homing instinct and only minimal delays are expected. The significance of this effect for adult salmon prior to mitigation is considered to be **Moderate (Significant)**. The significance of this effect for adult sea trout prior to mitigation is considered to be **Minor (Not Significant)**.

Fluctuating Water Levels (Loch Ness)

13.8.53 The Proposed Development, Foyers PSH and Red John PSH would all operate within their respective stop pumping ('hands off') and stop generating levels allocated through their respective CAR Licences, as described in **Section 3.7**. These levels have been / would be agreed with SEPA, but the stop pumping level of both the Proposed Development and Red John PSH would be above the stop pumping level assigned to the operational Foyers PSH. Due to the implementation of these stop pumping / stop generating levels, even under a scenario where all three PSH schemes were operating simultaneously, variation in water levels would continue to operate largely within the current maximum and minimum range of levels in Loch Ness, but it is likely that there would be more variation in water level between these limits with multiple PHS schemes operating on the loch (as described in **Section 3.7)**. Further details are provided in **Chapter 7: Water Management.**

13.8.54 Based on a reasonable worst-case scenario, as described in **Section 7.9**, of **Chapter 7: Water Management**, hydrological modelling predicts that water levels in Loch Ness would reduce by 0.15 m during a four hour pumping cycle (i.e. when water is pumped up from the lower reservoir and stored in the upper reservoir) where all three PSH were operating pumping simultaneously. During a generation cycle (when water is released from the upper reservoirs into the lower reservoir) of the same time period, water levels in Loch Ness would increase by 0.21 m if all three PSH were operating pumping simultaneously. However, if loch levels breached the allocated stop pumping or stop generating level of any of the PSH schemes, operation would cease and the PSH would enter standby mode. When loch levels are low, both the Proposed Development and Red John PSH would reach their stop pumping level and need to cease operation before Foyers PSH. Foyers PSH would therefore remain the primary driver of minimum loch level during these drier periods.

Salmon and Sea Trout

13.8.55 The cumulative effect of three PSHs in operation, abstracting water, may have an impact on migratory fish entering and exiting Loch Ness. As discussed in **paragraph 13.8.32**, the stop pumping level of the Proposed Development (and also Red John PSH) would be above the stop pumping level of the operational Foyers PSH, which in turn is above the level of the main fish pass crest at Ness Weir (14.93 m AOD). This means that the abstraction of water associated with all three PSH operating simultaneously (or in isolation) would not cause loch levels to reduce below the current Foyers PSH stop pumping level and would continue to allow fish passage from the River Ness at the

Ness Weir. The significance of this effect for upstream migrating adult salmon and sea trout prior to mitigation is considered to be **Minor (Not Significant)**.

13.8.56 As previously described in **paragraph 13.8.35**, downstream migrating salmon and sea trout smolts also rely on the main fish pass at Ness Weir for exiting the loch, although some smolts are also known to move beyond this area and congregate in the Caledonian Canal. As mitigation, Scottish Canals operate a smolt sluice at the Dochfour lock gates during the smolt run and a 'smolt chute' also runs across the waste weir at the Ness Weir as a secondary point of entry to the River Ness through the weir.

13.8.57 As with upstream migrating adult salmon and sea trout, the abstraction of water associated with all three PSH operating simultaneously (or in isolation) would not cause loch levels to reduce below the current Foyers PSH stop pumping level and would therefore continue to allow fish passage from the River Ness at the Ness Weir. However, the Foyers PSH stop pumping level is below the level of the secondary smolt chute at Ness Weir. This highlights a potential existing problem for smolt passage in this area and the same would likely be true for the stop pumping level of the Proposed Development, as well as the consented Red John PSH. If all three schemes were operating simultaneously, water levels could be drawn down below the smolt chute level more frequently and more rapidly during periods of abstraction that take place when the loch level is lower. On this basis, there is a possibility that smolts bypassing the main fish pass would be further delayed on their downstream migration during these periods, compared to the existing scenario where Foyers PSH would operate in isolation. Delays make smolts more vulnerable to predation from mammalian, avian and aquatic predators (e.g., otter, goosander, cormorant, pike and ferox trout). Any delays to migration caused by anthropogenic effects can also have a negative impact on these species on the timing of their migration to sea as they have evolved to time their downstream migration to reach the sea at the optimum time (Ness DSFB, 2022).

13.8.58 It should be noted that although water levels may fall below the smolt chute level at Ness Weir more frequently if multiple PSH schemes are abstracting water from Loch Ness simultaneously, the opposite effect would be true for the pumping cycles of these schemes. This would mean that water levels would also increase above the smolt chute level more frequently and more rapidly if multiple PSH schemes are pumping water into Loch Ness simultaneously. During periods of higher water levels associated with multiple PSH pumping water into Loch Ness, there would also be a greater attraction for smolts to descend the main fish pass, increasing escapement from the loch. This could have a beneficial impact on smolts, by reducing the delay on smolt migration compared to the existing situation, where only Foyers PSH would be pumping water back into Loch Ness at any given time and may help to counteract the effect of more frequent lower loch levels. This assessment also assumes a scenario where Foyers PSH, Red John PSH and the Proposed Development would be abstracting water from Loch Ness simultaneously and the loch levels would be low enough that the combined abstraction cycles of the three schemes would bring the water levels below the level of the smolt chute at Ness Weir. In reality, this scenario would not occur every time the Proposed Development undergoes an abstraction / pumping cycle.

13.8.59 It should also be noted that there is uncertainty about whether the existing smolt chute **at** Ness Weir (as shown on **Plate 13.1** and **13.2)** currently provides effective passage for smolts, especially at lower water levels where there is less attraction towards its inlet. It is unlikely that the smolt pass provides effective mitigation for smolts entering the canal with limited attraction and a lack of flow compared with the main fish pass. The Ness District Salmon Fisheries Board consider it to be *'an*

ineffective design'[46]*.* The Applicant has considered means of improving fish passage for migratory fish at Ness Weir as detailed in **paragraph 13.11**. Smolts which enter the canal when the water level is below the level of the smolt chute would also still be able to re-enter the River Ness through the smolt sluice operated by Scottish Canals at the Dochfour lock gates.

13.8.60 The significance of this effect for salmon smolts prior to mitigation is considered to be **Minor (Not Significant)**. The significance of this effect for sea trout smolts prior to mitigation is considered to be **Minor (Not Significant)**.

Arctic Charr

13.8.61 Due to the homogeneity of substrate and availability of optimal habitat there is a potential risk that Arctic Charr may spawn in areas of gravel on shallow waters during periods of elevated water levels associated with the Proposed Development and in combination with other operational and consented PSH (following a generation phase) that may become exposed when the water level retreats (during pumping). This could result in the eggs deposited in these areas becoming unviable. There is a potential risk that Arctic Charr spawning in the shallowest margins may spawn in areas which are subsequently drawn down during periods of abstraction. This is based on a worst-case scenario whilst multiple pumped storage schemes are in operation at the same time.

13.8.62 Food sources for Arctic Charr which mainly feed on plankton in open water would be less affected by fluctuation of water levels than other fish species (i.e. brown trout) which feed within the littoral zone which would be more affected by fluctuations in water levels[47].

13.8.63 Although many Arctic Charr populations spawn in the littoral zone, some spawn at greater depths.[48] During research work carried out on Lake Windemere, Frost (1965) concluded shallow spawning grounds ranged from 1–3 m depth and were used by Autumn (mainly November) spawning Charr, while deeper spawning grounds ranged from 15-20m depth[49]. Research carried out on three Irish lakes by Low (2011) found littoral zone spawning sites were found to be long, narrow strips running parallel to the shore at a maximum depth of 1.24 m[50].

13.8.64 As stated in **paragraph 13.8.54,** under a reasonable worst case scenario**,** if the Proposed Development, Foyers PSH and Red John were to release water simultaneously, the water level in Loch Ness would rise by 0.15 m over four hours and pumping for the same duration would lead to a drop in Loch Ness water levels of 0.21 m, although operation would cease if the water levels breached the stop pumping or stop generating levels allocated to these PSH schemes. The sensitive periods of for spawning and egg development for Arctic Charr (October - May) where Loch levels are generally higher due to seasonality. Historic loch Level data for Loch Ness shows a trend of higher

[46] Ness District Salmon Fisheries Board (2023) Pers Comm Brian Shaw 12th October 2023.

[47] Maitland P. S. (1992) The status of Arctic Charr *Salvelinus Alpinus* (L), In Southern Scotland: A Cause For Concern. Freshwater Forum 2: pp 8.

[48] Klemetsen, A., Amundsen, P.-A., Dempson, J.B., Jonsson, B., Jonsson, N., O'Connell, M.F. & 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: 1-59.

[49] Frost, W.E. 1965. Breeding habits of Windermere charr, *Salvelinus willughbii (Günther)* and their bearing on speciation of these fish. Proceedings of the Royal Society, Series B 163: 473 232-284.

[50] Low, J., Igoe, F., Davenport, J. & Harrison, H. 2011. Littoral spawning habitats of three southern Arctic charr (*Salvelinus alpinus L.)* populations. Ecology of Freshwater Fish 20(4)

average water levels during the winter, which may reduce the overall risk of egg failure[51] due to drawdown, compared with if Loch levels were at minimum levels. Given the literature on the range of depths that Arctic Charr are known to spawn at, drawdown levels would not be expected to leave deposited eggs exposed. Only a negligible impact is expected where charr have spawned in extremely shallow water. The significance of this effect for Arctic Charr is considered to be **Minor (Not Significant)**.

[51] River Levels. 2023. Loch Ness at Foyers. Available: Loch Ness at Foyers :: the UK River Levels Website

Table 13.12 Likely Operational Phase Cumulative Impacts and Effects on IEFs Prior to Mitigation

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
Arctic Charr	National	More frequent fluctuations in water levels (Loch Ness) causing issues with egg viability in the extremely shallow margins.	Marginal spawning areas becoming periodically dry during egg development, reducing egg viability.	Permanent, **Low**, adverse, impact	Minor, Not Significant
Atlantic Salmon	International	Downstream migrating smolts becoming attracted to multiple sources of water abstraction (Caledonian Canal, Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Delays to migration, increased predation, increased energy burden.	Permanent, **Medium** adverse, impact.	Major, Significant
		Upstream migrating adult salmon becoming attracted to multiple sources of water generation (Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Delays to migration, increased predation, increased energy burden.	Permanent, **Low**, adverse, impact	Moderate, Significant
		More frequent fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration at the Caledonian Canal.	Delays to migration, increased predation, increased energy burden.	Permanent, **Low**, adverse, impact	Minor, Not Significant
		More frequent fluctuations in water levels (Loch Ness) causing issues with upstream adult salmon migration at the Ness Weir.	Delays to migration, increased predation, increased energy burden.	Permanent, **Low**, adverse, impact	Minor, Not Significant
Sea Trout	Council	Downstream migrating smolts becoming attracted to multiple sources of water abstraction (Caledonian Canal, Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Delays to migration, increased predation, increased energy burden.	Permanent, **Medium** adverse, impact.	Moderate, Significant

IEF	Importance Level	Impacts	Effects	Impact Scale	Significance of Effect Prior to Mitigation
		Upstream migrating adult sea trout becoming attracted to multiple sources of water generation (Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Delays to migration, increased predation, increased energy burden.	Permanent, **Low**, adverse, impact	Minor, Not Significant
		More frequent fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration at the Caledonian Canal.	Delays to migration, increased predation, increased energy burden.	Permanent, **Low**, adverse, impact	Minor, Not Significant
		More frequent fluctuations in water levels (Loch Ness) causing issues with upstream adult sea trout migration at the Ness Weir.	Delays to migration, increased predation, increased energy burden.	Permanent, **Low**, adverse, impact	Minor, Not Significant

13.9 Mitigation

Mitigation during Construction Phase

13.9.1 A Construction Environmental Management Plan (CEMP), Pollution Prevention Plan (PPP) and Water Quality Monitoring Programme (WQMP) would be implemented by the Principal Contractor and overseen by an Aquatic Ecologist / ACoW.

13.9.2 For the construction of Dams 1 and 4, which require instream works on the Allt an t-Sluichd and Allt Leachd Gowerie watercourses, fish rescue and relocation should be undertaken prior to the damming / dewatering of watercourses. This would protect resident trout populations in the vicinity of the works from harm.

13.9.3 For the installation of the culvert on the Allt Leachd Gowerie watercourse, fish rescue and relocation should be undertaken prior to the damming / dewatering of the watercourse. This would protect resident trout populations in the vicinity of the works from harm.

13.9.4 For the installation of the cofferdam at Loch Ness, a fish rescue should be undertaken around any soft sediment areas, suitable for juvenile lamprey in the immediate vicinity of the works prior to piling.

13.9.5 For the installation of the cofferdams at Loch Ness and Loch Kemp, a fish rescue should be undertaken within the enclosed cofferdam area prior to dewatering.

13.9.6 For the construction at the lower control works on the Loch Ness shoreline, a fish rescue and relocation should be undertaken around any soft sediment areas, suitable for juvenile lamprey within the works footprint.

13.9.7 Any piling operations should adopt a 'soft start' approach to allow adult fish within the immediate vicinity of the cofferdam works area to disperse unharmed. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.

13.9.8 A temporary bubble curtain would be employed around any piling or blasting operations at Loch Ness to attenuate underwater noise effects.

13.9.9 Any lighting used during construction should be directed away from the loch edges and watercourses to prevent the risk of increased predation of fish during the hours of darkness.

Mitigation During Operational Phase

13.9.10 An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement at the screens and reducing predation impacts. Fish deterrent systems work best when multiple fish deterrent types are working in tandem[52] and could include bubble curtains, acoustic fish deterrents (AFD) or intensive flashing light. The deterrent system would be deployed around the intake to deter fish during sensitive periods (Mid-March – end June for salmon and sea trout smolts and May – end July for elvers).

[52] A.W.H.Turnpenny & N. O'Keeffe (2005) Bubble screens in combination with other behavioural stimuli, Screening for Intake and Outfalls: a best practice guide. Available: Microsoft Word - W6_103 TR_amended__1.doc (publishing.service.gov.uk) Last Accessed: 13/09/2023

Bubble curtains and light-based systems are more applicable to European eels (elvers) which have poorer hearing capabilities[53] and are less likely to respond to acoustic stimuli.

13.9.11 CCTV would be in operation at the outlet area to deter and monitor instances of poaching.

13.9.12 In the first year of the operational phase, an ACoW would monitor problem areas where fish strandings occur within the area of maximum inundation and seek to introduce dug channels allowing passage back to natural loch / river channels at minimum inundation.

13.9.13 A Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.

13.10 Enhancement

Enhancement During the Operational Phase

13.10.1 Improving fish passage by opening up the channel on the Allt Paiteag between Loch Cluanie and the limit of maximum inundation. This would allow brown trout access to the upper reaches of the Allt Paiteag where spawning may take place. Spawning habitat could be improved in the upper reaches by the addition of gravel sized sediment and in-stream habitat could be improved by the addition of boulder sized sediment, providing cover for fish.

13.10.2 Coarse woody debris (CWD) would be submerged around loch shoreline areas and secured in place to create new habitats for loch macroinvertebrates. Broadleaved trees removed during the construction of the Proposed Development can be reused for this purpose. This would also provide an added benefit for fish. Areas for CWD submersion would be confirmed in the final project Habitat Management Plan, and would comprise lochs/lochans which are not subject to rapid water level changes, such as such as Lochan a Choin Uire, Loch Paiteag, Lochan a Mhonaich, Lochan nan Nighean and Lochan Scristan.

13.10.3 These measures are detailed in **Volume 4, Appendix 10.7: Outline Habitat Management Plan (non-SAC).**

13.11 Residual Effects

13.11.1 This section considers the potential residual effects and associated effect significance of the construction and operation of the Proposed Development, following the implementation of the mitigation measures proposed in **Section 13.9**.

Construction Phase Residual Effects

13.11.2 A summary of the construction phase residual effects on each IEF, prior and post avoidance, mitigation, compensation and enhancement is shown in **Table 13.13 Construction Phase Residual Effects.**

[53] Environment Agency (2021) Screening at intakes and outfalls: measures to protect eel. Available: Screening at intakes and outfalls: measures to protect eel. The Eel Manual – GEHO0411BTQD-E-E - openasfa.title (fao.org) Last Accessed: 13/09/2023

Table 13.13 Construction Phase Residual Effects

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
Arctic Charr	Noise and vibration during cofferdam construction (Loch Ness).	Moderate, Significant		Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		Minor, Not Significant
	Construction of lower control works (Loch Ness).	Minor, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Minor, Not Significant
	Dust and run off from construction work (i.e a major incident).	Minor, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Minor, Not Significant
	Construction Lighting (Loch Ness).	Minor, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation / fish displacement of fish during the hours of darkness.		Minor, Not Significant

Atlantic Salmon	Noise and vibration during cofferdam construction (Loch Ness).	Major, Significant		Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		Minor, Not Significant
	Dust and run off from construction works. (i.e a major incident).	Minor, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Minor, Not Significant
	Lighting	Minor, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation / fish displacement of fish during the hours of darkness.		Minor, Not Significant
Brook Lamprey	Noise and vibration during cofferdam construction (Loch Ness).	Minor, Not Significant		A fish rescue should be undertaken around any soft sediment areas, suitable for juvenile lamprey in the immediate vicinity of the works prior to piling to protect juvenile lamprey. Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		Imperceptible, Not Significant
	Construction of lower control works (Loch Ness)	Imperceptible, Not Significant		A pre-construction fish rescue and relocation should be undertaken around any soft sediment areas, suitable for juvenile lamprey within the works footprint.		Imperceptible, Not Significant

	Dust and run off from construction work (i.e a major incident).	Imperceptible, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Imperceptible, Not Significant
	Lighting	Imperceptible, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation / fish displacement of fish during the hours of darkness.		Imperceptible, Not Significant
Brown Trout	Noise and vibration during cofferdam construction (Loch Ness).	Minor, Not Significant		Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		Imperceptible, Not Significant
	Construction of dams 1 and 4 (Loch Kemp, Allt an t-Sluichd and Allt Leachd Gowerie).	Minor, Not Significant		A fish rescue and relocation should be undertaken prior to the damming / dewatering of watercourses.		Minor, Not Significant
	Watercourse crossing (Allt Leachd Gowerie).	Minor, Not Significant		A fish rescue and relocation should be undertaken prior to the damming / dewatering of the watercourse for culvert installation.		Imperceptible, Not Significant
	Dust and run off from construction work (i.e a major incident).	Imperceptible, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Imperceptible, Not Significant

	Lighting.	Imperceptible, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation / fish displacement of fish during the hours of darkness.		Imperceptible, Not Significant
European Eel	Noise and vibration during cofferdam construction (Loch Ness).	Major, Significant		Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		Minor, Not Significant
	Dust and run off from construction work (i.e a major incident).	Minor, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Minor, Not Significant
	Lighting	Minor, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation / fish displacement of fish during the hours of darkness.		Minor, Not Significant
Ferox Brown Trout	Noise and vibration during cofferdam construction (Loch Ness).	Moderate, Significant		Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area.		Minor, Not Significant

				The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		
	Dust and run off from construction work (i.e a major incident).	Minor, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Minor, Not Significant
	Lighting	Minor, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation / fish displacement of fish during the hours of darkness.		Minor, Not Significant
River / Sea Lamprey (Migratory and Anadromous)	Noise and vibration during cofferdam construction (Loch Ness).	Major, Significant		A fish rescue should be undertaken around any soft sediment areas, suitable for juvenile lamprey in the immediate vicinity of the works prior to piling. Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		Minor, Not Significant
	Construction of lower control works (Loch Ness)	Minor, Not Significant		A pre-construction fish rescue and relocation should be undertaken around any soft sediment areas, suitable for juvenile lamprey within the works footprint.		Minor, Not Significant

	Dust and run off from construction work (i.e a major incident).	Minor, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Minor, Not Significant
	Lighting	Minor, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation of fish during the hours of darkness.		Minor, Not Significant
Sea Trout	Noise and vibration during cofferdam construction (Loch Ness).	Moderate, Significant		Piling operations would adopt a 'soft start' approach to allow fish in the immediate vicinity of the works to disperse. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area. The ACoW should monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.		Minor, Not Significant
	Run off from construction works.	Imperceptible, Not Significant		A fish rescue and relocation should be undertaken prior to the damming / dewatering of watercourses.		Imperceptible, Not Significant
	Lighting	Imperceptible, Not Significant		Any floodlighting used during construction should be directed away from loch edges and watercourses to prevent the risk of increased predation of fish during the hours of darkness.		Imperceptible, Not Significant
Loch Salmonid Spawning Habitat (Loch Ness)	Construction of lower control works (Loch Ness).	Imperceptible, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Imperceptible, Not Significant

Riverine Fish Habitat (Allt Leachd Gowerie and Allt an t-Sluichd)	Construction footprint of dams 1 and 4[54].	Imperceptible, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Imperceptible, Not Significant
	Dust and run off from construction work (i.e a major incident).	Imperceptible, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Imperceptible, Not Significant
Riverine Fish Habitat (Allt a Chinn Mhonaich)	Dust and run off from construction work (i.e a major incident).	Imperceptible, Not Significant		A CEMP, PPP and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by an ACoW.		Imperceptible, Not Significant

[54] Permanent works footprint is addressed under operational phase effects.

Operational Residual Effects

13.11.3 A summary of the operational phase residual effects on each IEF, prior and post avoidance, mitigation, compensation and enhancement is shown in **Table 13.14: Operational Phase Residual Effects.**

Table 13.14 Operational Phase Residual Effects

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
Arctic Charr	Loss of optimal shoreline spawning habitat due to permanent infrastructure (Loch Ness).	Minor, Not Significant		N/A		Minor, Not Significant
	Shoreline spawning habitats being affected by fluctuating water levels (Loch Ness)	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (see Embedded Mitigation).		Minor, Not Significant
	Operational noise and vibration / lighting.	Minor, Not Significant		N/A		Minor, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Minor, Not Significant		N/A		Minor, Not Significant
Atlantic Salmon	Attraction of adult fish to outlet during generation (Loch Ness).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the outlet, preventing delays to migration and reducing predation impacts.		Minor, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
				CCTV in operation at the outlet to deter and monitor instances of poaching. A Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.		
	Attraction of (downstream migrating) smolts to the intake during abstraction (Loch Ness).	Major, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement on the screens and reducing predation impacts. A Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.		Minor, Not Significant
	Fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration at the Caledonian Canal.	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (see Embedded Mitigation).		Minor, Not Significant
	Fluctuations in water levels (Loch Ness) causing issues with upstream adult migration at Ness Weir.	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (see Embedded Mitigation).		Minor, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
	Operational noise and vibration / lighting.	Minor, Not Significant		N/A		Minor, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
Brook Lamprey	Erosion of the sediment at the tailrace (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
	Permanent infrastructure (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
	Operational noise and vibration.	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
Brown Trout	Loss of optimal shoreline spawning habitat due to permanent infrastructure (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
	Attraction of adult fish to outlet during generation (Loch Ness).	Imperceptible, Not Significant		An appropriately designed fish deterrent system would be installed which will deter fish from the outlet, preventing delays to migration and reducing predation impacts.		Imperceptible, Not Significant
	Continual fluctuations in water levels (Loch Kemp and tributaries).	Minor, Not Significant		In the first year of the operational phase, an ACoW would monitor problem areas and seek to introduce dug channels allowing passage back to natural loch / river channels at minimum inundation. A FMP would be implemented to monitor the impacts of the operational scheme on fish.		Imperceptible, Not Significant
	Permanent dams (Loch Kemp, Allt an t-Sluichd and Allt Leachd Gowerie).	Minor, Not Significant		N/A		Minor, Not Significant
	Watercourse crossing (Allt Leachd Gowerie).	Minor, Not Significant		The culvert to be installed on the Allt Leachd Gowerie for operational access would conform to the SEPA good practice guide on river crossings to allow fish passage through the culvert (embedded mitigation).		Minor, Not Significant
	Operational noise and vibration / lighting.	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
European Eel	Attraction of (upstream migrating) elvers to outlet during generation (Loch Ness).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the outlet, preventing entrainment / impingement on the screens and reducing predation impacts		Minor, Not Significant
	Impingement / entrainment / loss of (upstream migrating) elvers to intake during abstraction (Loch Ness).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement on the screens and reducing predation impacts. A FMP would be implemented to monitor the impacts of the operational scheme on fish.		Minor, Not Significant
	Attraction of (downstream migrating) silver eels to the intake during abstraction (Loch Ness).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement on the screens and reducing predation impacts.		Minor, Not Significant
	Operational noise and vibration / lighting.	Minor, Not Significant		N/A		Minor, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
Ferox Brown Trout	Attraction of adult fish to outlet during generation (Loch Ness).	Minor, Not Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the outlet, preventing entrainment / impingement on the screens and reducing predation impacts		Imperceptible, Not Significant
	Operational noise and vibration / lighting.	Minor, Not Significant		N/A		Minor, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
River / Sea Lamprey (Migratory and Anadromous)	Loss of nursery habitat through permanent infrastructure and erosion of the sediment at the tailrace.	Minor, Not Significant		N/A		Minor, Not Significant
	Attraction of (upstream migrating) adults to outlet during generation (Loch Ness).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the outlet, preventing entrainment / impingement on the screens and reducing predation impacts		Minor, Not Significant
	Attraction of lamprey to the intake during abstraction (Loch Ness).	Moderate, Not Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement on the screens and reducing predation impacts.		Minor, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
	Operational noise and vibration / lighting.	Minor, Not Significant		N/A		Minor, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
Sea Trout	Attraction of adult fish to outlet during generation (Loch Ness).	Minor, Not Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the outlet, preventing entrainment / impingement on the screens and reducing predation impacts CCTV in operation at the outlet to deter and monitor instances of poaching.		Imperceptible, Not Significant
	Attraction of (downstream migrating) smolts to the intake during abstraction (Loch Ness).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement on the screens and reducing predation impacts. A Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.		Minor, Not Significant
	Fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration.	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (See Embedded Mitigation).		Minor, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
	Fluctuations in water levels (Loch Ness) causing issues with upstream adult migration at Ness Weir.	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (See Embedded Mitigation).		Minor, Not Significant
	Operational noise and vibration / lighting.	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
Loch Salmonid Spawning Habitat (Loch Ness)	Permanent infrastructure (Loch Ness).	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant
	Localised temperature changes through water transfer (Loch Ness).	Minor, Not Significant		N/A		Minor, Not Significant
Loch Salmonid Spawning Habitat (Loch Kemp)	Flooding of original shoreline habitat at periods of maximum inundation.	Imperceptible, Not Significant		N/A		Imperceptible, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
Riverine Fish Habitat	Flooding riverine habitat at periods of maximum inundation.	Imperceptible, Not Significant		N/A	Improving fish passage by opening up the channel on the Allt Paiteag between Loch Cluanie and the limit of maximum inundation. This would allow brown trout access to the upper reaches of the Allt Paiteag where spawning may take place. Spawning habitat could be improved in the upper reaches by the addition of gravel sized sediment and in-stream habitat could be improved by the addition of boulder sized sediment, providing cover for fish. This would be implemented through the final HMO. An outline HMP is provided in **Volume 4, Appendix 10.7.**	Imperceptible, Not Significant

Cumulative Residual Effects

13.11.4 Provided that the proposed mitigation (including embedded mitigation) during the operational phase for Atlantic salmon and sea trout smolts is followed, the Proposed Development at Loch Kemp should have limited input to the overall cumulative effects of other schemes. Cumulative Residual Effects from the operational phase are summarised in **Table 13.15: Cumulative Operational Residual Effects .**

Table 13.15 Cumulative Operational Residual Effects

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
Atlantic Salmon	Downstream migrating smolts becoming attracted to multiple sources of water abstraction (Caledonian Canal, Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Major, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement on the screens and reducing predation impacts.		Minor, Not Significant
	Upstream migrating adult salmon becoming attracted to multiple sources of water generation (Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the outlet, preventing entrainment / impingement on the screens and reducing predation impacts. CCTV in operation at the outlet to deter and monitor instances of poaching. A Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.		Minor, Not Significant
	More frequent fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration at the Caledonian Canal.	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (see Embedded Mitigation).		Minor, Not Significant
	More frequent fluctuations in water levels (Loch Ness) causing issues with upstream adult salmon migration at the Ness Weir.	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (see Embedded Mitigation).		Minor, Not Significant

IEF	Impact	Significance of Effect Prior to Mitigation	Avoidance	Mitigation	Compensation / Enhancement	Residual Significance of Effect
Sea Trout	Downstream migrating smolts becoming attracted to multiple sources of water abstraction (Caledonian Canal, Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Moderate, Significant		An appropriately designed fish deterrent system would be installed which would deter fish from the draw of water from the intake, preventing entrainment / impingement on the screens and reducing predation impacts.		Minor, Not Significant
	Upstream migrating adult sea trout becoming attracted to multiple sources of water generation (Red John PSH (consented) and Kemp (in planning) and Foyers (operational).	Minor, Not Significant		Intensive strobe lighting underwater and acoustic fish deterrent (AFD) to act as a deterrent for adult Atlantic salmon around the Proposed Development (annual). CCTV in operation at the outlet to deter and monitor instances of poaching. A Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.		Imperceptible, Not Significant
	More frequent fluctuations in water levels (Loch Ness) causing issues with downstream smolt migration at the Caledonian Canal.	Minor, Significant		Operational limits to be agreed as part of CAR licence (see Embedded Mitigation)		Minor, Not Significant
	More frequent fluctuations in water levels (Loch Ness) causing issues with upstream adult sea trout migration at the Ness Weir.	Minor, Not Significant		Operational limits to be agreed as part of CAR licence (see Embedded Mitigation).		Minor, Not Significant

13.12 Conclusion

13.12.1 The main conclusions from the impact assessment on fish are described below:

13.12.2 Potential significant adverse effects were identified on several of the important ecological features identified during the construction and operational phases including Arctic charr, Atlantic salmon, European eel, ferox brown trout, river / sea lamprey, sea trout. Potential significant cumulative adverse effects have also been identified during the operational phase on Atlantic salmon and sea trout.

13.12.3 Identified impacts, potentially causing adverse significant effects include: noise and vibration during cofferdam construction (Loch Ness), attraction of adult salmon and lamprey to outlet during generation (Loch Ness), attraction of (downstream migrating) salmon and sea trout smolts to the intake during abstraction (Loch Ness), attraction of (upstream migrating) elvers to outlet during generation (Loch Ness), impingement / entrainment / loss of (upstream migrating) elvers to intake during abstraction (Loch Ness), attraction of (downstream migrating) silver eels to the intake during abstraction (Loch Ness), attraction of lamprey to the intake during abstraction (Loch Ness).

13.12.4 Identified cumulative impacts, potentially causing adverse significant cumulative effects include: downstream migrating salmon and sea trout smolts becoming attracted to multiple sources of water abstraction (Caledonian Canal, Red John PSH (consented) and Kemp (in planning) and Foyers (operational)) and upstream migrating adult salmon becoming attracted to multiple sources of water generation (Red John PSH (consented) and Kemp (in planning) and Foyers (operational)).

13.12.5 Where potential likely adverse significant effects were predicted, mitigation has been proposed. Mitigation measures to be employed during the construction phase include: a ’soft start' approach to piling operations to allow fish in the immediate vicinity of the works to disperse; a temporary bubble curtain deployed around any blasting works to attenuate noise effects and deter fish from the area; a Construction Environmental Management Plan (CEMP), Pollution Prevention Plan (PPP), and Water Quality Monitoring Plan (WQMP) implemented by the Principal Contractor and overseen by an Aquatic Clerk of Works (ACoW), floodlighting used during construction directed away from loch edges and watercourses; and a fish rescue and relocation where instream works (piling, dewatering, culvert installation) will take place.

13.12.6 Mitigation measures to be employed during the operational phase include: operational limits agreed for pumping and generating phases as part of a CAR licence; an appropriately designed fish deterrent system installed at the inlet / outlet preventing delays to migration and reducing predation impacts; CCTV in operation at the outlet to deter and monitor instances of poaching; and a Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish. below:

13.12.7 Following the implementation of mitigation measures, there are no predicted residual adverse significant effects on fish during the construction or operational phases.