EARBA STORAGE

A GILKES ENERGY COMPANY

Earba Pumped Storage Hydro Scheme

EIA Report

Chapter 2: The Proposed Development

February 2024

Quality Information

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2. The Proposed Development

2.1 Introduction

2.1.1 This chapter describes the principal components of the Proposed Development. It also describes the anticipated construction methodology, together with the outline programme for its construction. An overview of the operational and decommissioning phases of the development is also provided. The location of the Proposed Development is shown in **Figure 2.1 – Location Plan** and its general arrangement is shown in **Figure 2.2 – Scheme Arrangement** and **Figure 2.3 – Scheme Arrangement (Aerial)**.

2.1.2 The function of the Proposed Development would be to create a large-scale long duration electricity storage (LDES) scheme with up to 1800MW generation capacity to store and release energy to or from the electricity transmission system, to help balance supply and demand for power at a national scale. The Proposed Development would operate by transferring water between a lower reservoir, Lochan na h-Earba (Loch Earba) and an upper reservoir, Loch a' Bhealaich Leamhain (Loch Leamhain). The maximum water level of these existing lochs would be raised by constructing dams to increase their natural storage capacity. The reservoirs would be connected by an underground waterway system including up to three headrace tunnels.

2.2 Site Description

2.2.1 The Proposed Development would be situated within the Ardverikie Estate "the Estate" to the south of Loch Laggan approximately mid-way between Newtonmore and Spean Bridge.

2.2.2 The site comprises predominantly wet heath, with some smaller areas of blanket bog, dry heath, mire, woodland and scrub. There is a small area of scheduled ancient woodland along the shore of Loch Earba. The Estate is used for highland sports, outdoor recreation, commercial forestry, hydroelectric generation (there are two existing reservoir storage hydro schemes), holiday accommodation and as a film location.

2.2.3 The site is within the River Spean catchment upstream of Loch Laggan. Lochan na h-Earba drains to Loch Laggan via the Allt Labhrach and Loch a' Bhealaich Leamhain via the Allt Loch a' Bhealaich Leamhain, the Allt Cam and the River Pattack. The catchment is already heavily modified by the operation of the existing Ardverikie and Lochaber Hydro Schemes.

2.3 Scheme Operation

2.3.1 The Proposed Development would be operated either in 'generating' mode or in 'pumping' mode. Generating mode is when electricity would be produced by releasing water from the upper reservoir through the reversible pump turbines and into the lower reservoir. Pumping mode is when electricity would be imported to pump water through the reversible pump turbines from the lower up to the upper reservoir. The generating capacity of the scheme would be up to 1800 MW, with

enough storage with the upper reservoir full to generate for approximately 22 hours at this capacity (a storage capacity of 40 GWhr).

2.4 Site Selection

2.4.1 Pumped storage hydro for long duration electricity storage requires a site with the following attributes:

1. Suitable topography to be able to create an upper and lower reservoir, either by altering the level of an existing waterbody or by creating a new one;
2. As high as possible an elevation difference between the upper and lower reservoirs;
3. As short as possible distance between the upper and lower reservoirs;
4. Suitable geological conditions;
5. Practicable access to the electricity transmission network;
6. Practicable access to the site;
7. The minimum number and impact of any effects on the natural environment from construction and operation of the scheme; and
8. The minimum number and impact of any effects on other uses of the site from construction and operation of the scheme.

The Proposed Development scored highly on these attributes compared with others considered within the UK.

Compared with the existing pumped storage hydro schemes in operation in the UK and those already in the planning system, the Proposed Development would have the highest energy storage capacity and would effectively double the UK's existing energy storage capacity. This is illustrated in Plate 2.1 below.

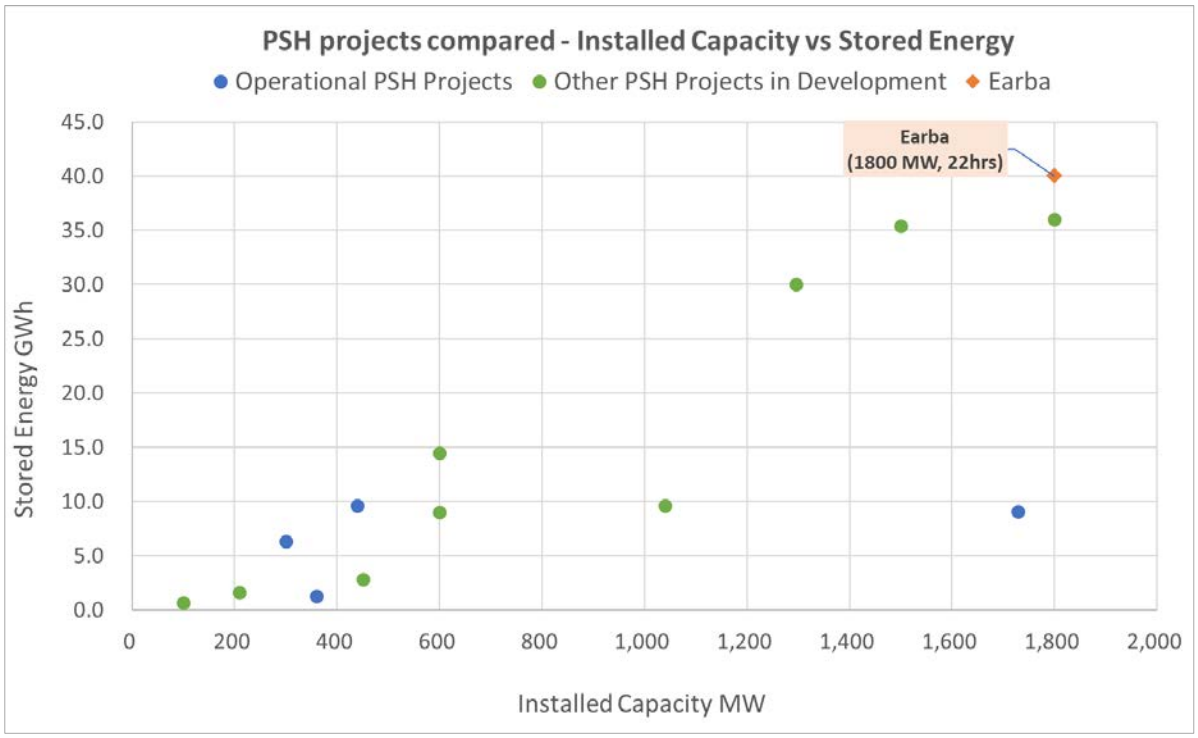

Plate 2.1 – PSH Projects Compared

2.5 Scheme Description

2.5.1 The principal components of the Proposed Development would be:

- The Leamhain Dam and Upper Reservoir
- The Shuas and Shios Dams and Lower (Earba) Reservoir
- The Underground Waterway System and Associated Structures
- The Powerhouse and Substation
- The Pitridh and Shuas Aqueducts
- A new junction off the A86 and bridge over the River Spean / Moy Channel
- Access Tracks and Footpaths
- Temporary Construction Facilities and Borrow Pits
- Areas of Habitat Compensation and Enhancement

The Leamhain Dam and Upper Reservoir

2.5.2 A rockfill dam would be constructed just below the outflow of Loch a' Bhealaich Leamhain to create an upper reservoir capable of storing approximately 55 million cubic metres of water. This would raise the level of the loch from its existing level of 636m AOD to a maximum level of 710m AOD. The reservoir would inundate an area of approximately 110 Ha as shown in **Figure 2.4 - Upper Leamhain Reservoir - Plan**.

2.5.3 The plan, sections and finishes of the dam are shown in **Figure 2.5 – Leamhain Dam GA.**

2.5.4 The dam would be a concrete or asphalt faced rockfill dam. The material for the dam would be quarried from borrow pits within the reservoir drawdown footprint. The faces of the dam will be at an approximately 1:1.5 gradient. The upstream

face would have an impermeable membrane of concrete or asphalt. The downstream face would be rockfill.

2.5.5 The dam would have an access track across the crest, together with other facilities including a bottom outlet valve house for passing water past the dam as required, and facilities for the release of compensation flows to the watercourse downstream, reached by an access track around the toe of the south side of the dam. There would also be a concrete-lined spillway down the north side of the dam to accommodate the discharge of flood flows in the event that these occurred when the reservoir was already full.

2.5.6 During construction of the dam and associated facilities, Loch Leamhain would be temporarily partially drained to the level 612m AOD. This would offer significant benefits for silt and drainage management during construction and allow for working areas and some of the borrow pits for the dam construction to remain below the final low water level in the reservoir, by reducing the requirement for these facilities to be in otherwise undisturbed montane peatland areas. Dewatering of the loch during the construction period would be maintained by means of over-pumping from the loch to the Allt Loch a' Bealaich Leamhain, while using best practice in drainage and silt control management.

2.5.7 A description is given of the proposals for de-watering Loch Leamhain, including a construction sequence, pollution prevention and drainage management in **Appendix 2.1 - Leamhain Dam Construction – Draft Pollution Prevention Plan**.

The Shuas and Shios Dams and Lower (Earba) Reservoir

2.5.8 Two earthfill or rockfill embankment dams would be constructed at each end of Loch Earba (Shios Dam and Shuas Dam) to create a reservoir capable of storing approximately 65 million cubic metres of water. This would raise the level of the loch, which is already a reservoir for the existing 1MW Ardverikie hydro scheme, from its existing top water level of 353m AOD to a maximum level of 376m AOD. The reservoir would inundate an area of approximately 365 ha as shown in **Figure 2.6 - Lower Earba Reservoir - Plan**.

Shios Dam

2.5.9 The north-eastern dam, the Shios Dam, shown in **Figure 2.7 – Shios Dam GA** is relatively constrained in its location by the existing dam and local topography. The dam would be an earthfill or rockfill dam with a nominal gradient of up to approximately 1:3 to the upstream and downstream faces. The upstream face would incorporate an impermeable membrane – either concrete or asphalt. The downstream face of the dam would require a section of concrete spillway but would otherwise be topsoiled and vegetated to blend in with the surrounding areas. There would be some flexibility in the final design of the profile of the dam to alter it to improve its setting in the landscape.

2.5.10 The Shios dam would be constructed from materials won from the construction of the powerhouse and tunnels, supplemented by material from local borrow pits.

2.5.11 For the existing 1MW Ardverikie hydro scheme there is currently no requirement to release any hands-off flow to the Allt Labhrach, but it is expected that this would be required by SEPA for the Earba PSH scheme. The dam will include facilities for

the release of this flow. It will also incorporate a mechanism for releasing water to the existing Ardverikie hydro scheme, which will remain in operation. These will include a valve house and stilling pond at the toe of the dam. The dam will have a spillway for the safe passing of any flood flows.

Shuas Dam

2.5.12 The southwestern dam, the Shuas Dam, shown in **Figure 2.8 – Shuas Dam GA**, will be located at or close to the SW end of Loch Earba. This location has been selected based on preliminary ground investigation, the avoidance of areas of peatland and other ecological sensitivities to its south-west, the setting of the dam within the landscape, and construction logistics considerations. Whilst preliminary geotechnical investigations already carried out give reasonable confidence on the dam location, the final micrositing of this dam would be based on further detailed ground investigations prior to commencing construction. A micrositing allowance of up to 50m to the southwest and 100m to the northeast of the indicated location is requested.

2.5.13 The Shuas Dam would be an earthfill dam with a nominal gradient of up to approximately 1:3 to the upstream and downstream faces. The downstream face of the dam will be topsoiled and vegetated to match the surrounding areas. There is some flexibility in the final design of the profile of the dam to alter it to improve its setting in the landscape.

Promontories

2.5.14 The area of grassland separating the existing Earba lochs would be permanently inundated by the Earba reservoir. In order to break up the linearity of the reservoir margins, promontory areas landscaped with trees, similar to that existing on the south shore of the existing north Earba Loch, would be created at the north and south sides reservoir as shown in **Figure 2.2 – Scheme Arrangement**. The general arrangement of these promontories is shown on **Figure 2.9 – GA of Promontories**

Underground Waterway System

2.5.15 The underground waterway system, shown in **Figure 2.2 – Scheme Arrangement,** and **Figure 2.10 - Tunnel Layout Plan** plus **Figure 2.11 –Tunnel Section**, would include:

- up to three headrace tunnels connecting the Leamhain Reservoir to the Powerhouse;
- Intake/outfall arrangements including screens and isolation gates at the northern end of the Leamhain Reservoir – the upper control works;
- up to three surge shafts on the upper flank of Creag Pitridh;
- an access adit tunnel from Coire Pitridh to approximately the mid-point of the headrace tunnels to facilitate access for tunnel construction on multiple fronts and for maintenance access;
- Tailrace tunnels between the powerhouse and the Earba Reservoir;
- Access tunnels from the powerhouse area to the headrace tunnels; and
- Intake/outfall structures including screens and isolation gates on the East shore of the Earba Reservoir – the lower control works.

Headrace Tunnels

2.5.16 Each headrace tunnel would be up to approximately 10m in internal diameter and fully lined with concrete or steel. As the tunnels approach the powerhouse they would split so that one tunnel continues to each of the powerhouse shafts. There are various options for the vertical alignment of the tunnels and for construction access to them. The surface features of these options are covered by the infrastructure component described within this chapter.

2.5.17 Material from construction of the tunnel systems will be used in the construction of the lower reservoir dams and the promontories.

Leamhain Reservoir Upper Control Works

2.5.18 Up to three intake/outfall structures located side by side at the NW end of Loch Leamhain would feed up to three headrace tunnels carrying water between the upper and lower reservoirs, through the powerhouse. These are shown in **Figure 2.12 – Upper Control Works GA.** The intakes would be reinforced concrete structures, largely below the reservoir operational low water level. Flows through the intakes would be reversible, depending on whether the scheme was pumping or generating. The intakes would incorporate screens with a small bar spacing to prevent debris and fish from entering the underground waterway system, and a maximum approach velocity limit of approximately 0.3 m/sec in front of the screens. Access to the screens for maintenance would be with the reservoir at its lowest operating level.

2.5.19 A shaft would connect each tunnel to the surface, approximately 200m back from the outfall screens. These shafts would contain hydraulic gates for the isolation of the tunnels. The gatehouses would be semi-buried, set into the hillside, with access from the downslope side facing the Leamhain Reservoir. This would reduce the visual impact of the gatehouses from the popular walking routes close to this location. Details are shown in **Figure 2.13 – Upper Control Works Isolation Gates GA.**

Surge Shafts

2.5.20 Surge shafts would connect each tunnel to the surface to provide relief for transient water pressures within the tunnels during operation. The size and top level of the surge shafts is dictated by the hydraulics of the tunnels, which in turn drives the location of the surge shafts to where there is sufficient elevation. Each surge shaft would be up to 15m diameter at the surface. The surge shafts would be located on the flank of Creag Pitridh. At the surface there would be a concrete wall approximately 2.5m high around each surge shaft to provide security against personnel falling into the shafts. Details are shown in **Figure 2.14 – Surge Shafts GA.**

2.5.21 It is planned to construct the surge shafts with a raise boring technique which leaves the excavation arisings in the tunnel at the bottom of the shaft to be transported out through the low-level tunnels. This reduces the transport of excavated material from the top of the shafts, and consequently the scale of access track and site establishment required there.

Coire Pitridh Access Adit

2.5.22 An intermediate tunnel adit in Coire Pitridh would provide access to approximately the mid-point of the tunnels. This would allow access for construction of the tunnels to proceed on multiple fronts concurrently. The adit would be retained for any future access and maintenance works in the tunnels. The arrangement of the adit portal is shown in **Figure 2.15 – Pitridh Access Tunnel Adit GA.**

Tailrace Tunnels

2.5.23 An approximately 100m long tailrace tunnel would connect each pump turbine to the lower control works in the Earba Reservoir. These tunnels would be concrete lined.

Earba Reservoir Lower Control Works

2.5.24 The lower control works would need to accommodate flows into and from the powerhouse, depending on whether the scheme is operating in pumping or generating mode. The arrangement of these facilities is shown in **Figure 2.16 – Lower Control Works GA.**

2.5.25 The lower control works would comprise up to six concrete inlet / outlet structures positioned side by side at the end of the tailrace tunnels. These structures would house the necessary screen arrangements and be shaped to smoothly channel the water in and out of the Earba Reservoir at low velocities.

2.5.26 The tailrace tunnels and lower control works would be below the normal Earba Reservoir minimum operating water level. The top of the structure would be just visible when the reservoir is at its lowest operating level. The tailrace screen frontage would be approximately 200m long and 18m in depth, below lowest operating level.

2.5.27 The tailrace tunnels would be provided with hydraulic gates for isolation of the tunnels from the reservoir during some maintenance activities. The gates would be connected to the ground surface by shafts, each with a hoist chamber at the top to house the operating mechanisms for the gates. The gate hoist chambers would be set below ground level, details are shown on **Figure 2.17 – Lower Control Works Isolation Gates GA.**

2.5.28 The majority of construction at the lower control works would take place in dry conditions using drill, blast, muck and haul tunnelling techniques. The tailrace tunnel portals would be formed in an excavation behind a natural cofferdam of unexcavated material to minimise the amount of underwater construction work. Part of the excavation of the tailrace tunnels is likely to commence from this excavation.

2.5.29 The tailrace structures would require screens for the exclusion of fish and debris, likely to be vertical bar screens with a 12mm spacing and a maximum approach velocity limit of approximately 0.3 m/sec in front of the screens.

2.5.30 A hardstanding area would be provided to allow for access to and cleaning of the screens and maintenance of the lower control works.

2.5.31 Landscape mitigation, including mounding and planting would be provided to minimise visual impact.

The Powerhouse and Switchyard

2.5.32 The powerhouse, located by the shore of Loch Earba, would comprise a series of up to six shafts approximately 70m deep, sunk from a floor level of 377m AOD in a benched cutting on rock excavated approximately 25m below the sloping hillside, as shown in typical section on **Figure 2.18 – Powerhouse Plan** and **Figure 2.19 – Powerhouse Typical Cross Section**. Each shaft would contain a reversible pump turbine and motor generator together with associated equipment. The shafts would sit beneath a surface building which would contain an overhead crane and other facilities including offices, storage, transformers and other equipment.

2.5.33 The sides of the powerhouse "benched cutting" at 377m AOD would be tiered, with intermediate benches which would be planted with trees and other vegetation. The powerhouse surface building would have a green roof. Its roofline would be below the general profile of the surrounding ground level and so screening it from views along the Earba glen. Other landscaping mitigations would include native woodland planting around the powerhouse such that it is enclosed within a wooded area located on the surrounding landform between 390 – 420m AOD, well above the sunken powerhouse platform. The areas of planting are shown in **Figure 2.38 – Landscape Planting Plan**.

2.5.34 An indoor electrical switchyard with a plan footprint of approximately 150m x 70m would be required to the north end of the Powerhouse. The ground level of the switchyard would be the same as that for the Powerhouse, on the sunken platform with screening by native woodland planting on the higher existing ground around it. The switchyard would be designed and constructed by the Transmission Network Operator, SSEN Transmission.

2.5.35 Further details of the preliminary architectural design of the powerhouse and switchyard are given in the Design Statement attached at **Appendix 2.2 – Sustainable Design Statement.**

2.5.36 The Developer has accepted a Grid Connection Offer from National Grid. The powerhouse would be connected to the national electricity network by a buried cable between the powerhouse switchyard and a new substation located adjacent to the Beauly Denny overhead powerline at Kinloch Laggan. The switchyard, buried cable and sub-station would be constructed by the Transmission Network Operator, SSE Networks, and they would be responsible for any planning consents required for the cable and sub-station. The grid connection would be covered by a separate planning application so consideration of the environmental effects associated with it is not considered in this Section 36 Application and supporting EIA Report.

Pitridh Aqueduct

2.5.37 An aqueduct with a number of intakes would pick up flows from the watercourses Allt Coire Pitridh and Allt Coire a' Chlachair to divert them around the Shuas Dam into the Earba Reservoir. The overall layout and arrangement of this aqueduct is shown in **Figure 2.20 - Pitridh Aqueduct Plan and Long Section (Sheets 1-3).**

2.5.38 The intakes would be low profile stone and concrete structures with local boulders on the downstream faces. Facilities would be provided for the release of hands-off flows.

2.5.39 The aqueduct would be an open trapezoidal channel up to approximately 5m wide and 2-3m deep, lined with local boulders to maintain a semi natural appearance similar to the existing Allt Coire Pitridh burn. Details are shown on **Figure 2.21 - Pitridh Aqueduct Details.**

Shuas Aqueduct

2.5.40 Although flows up to a 1:1,000 year return flow + 20% for climate change event from the Allt Coire Pitridh and Allt Corie a' Chlachair would be diverted to the Earba Reservoir via the Pitridh Aqueduct, higher flow events than this would spill down the original watercourses below the diverted burns and into the area to the southwest of the Shuas Dam. In addition, there would be a flow from the small direct catchment for this area, as well as hands-off flows from the Pitridh and Chlachair burns. Because the Earba Dam would be blocking the original outlet of these watercourses to Loch Earba, an alternative drainage outlet would be required. It is proposed to construct a new water conduit – the Shuas Aqueduct – and divert any flows to this area through this into the small reservoir to the west of this area, which in turn drains to the Abhainn Ghuilbinn.

2.5.41 The aqueduct would comprise an intake structure feeding a buried pipeline. The arrangement of this aqueduct is shown in **Figure 2.22 - Shuas Aqueduct GA**.

Access Tracks and Footpaths

2.5.42 Access tracks would be provided for the construction of the Proposed Development and for operational, maintenance, and emergency access.

2.5.43 The Proposed Development would be accessed for both construction and operation from the A86 trunk road at Moy Bridge. Existing tracks would be utilised wherever possible, subject to upgrading to the standard necessary for the expected construction and operational traffic. New permanent tracks will be necessary to replace sections that would become inundated by the new Earba reservoir, for access to the Leamhain reservoir, and where deviation from existing tracks is necessary to avoid locations of ornithological ecological sensitivity.

2.5.44 All of the permanent tracks would be reduced in width after completion of construction.

2.5.45 Safe access for recreational users will be maintained throughout the construction and operation of the Proposed Development. Where existing routes are altered by inundation or new structures, alternative routes would be provided, with these in place before the original routes are affected by construction. Details of these arrangements are included in **Chapter 15 – Recreation and Access**.

2.5.46 The overall layout of the existing and proposed assess tracks and footpaths is shown in the following figures:

- Figure 15.1 – Site Plan Showing Existing Access Routes and Footpaths
- Figure 15.2 – Site Plan Showing Access Routes and Footpaths During Construction

- Figure 15.3 – Site Plan Showing Access Routes and Footpaths During Operation

2.5.47 Detailed plans and sections of the proposed tracks are referenced below.

Junction with the A86 to Site Entrance Compound SC1

2.5.48 A new junction would be built to access the site from the A86 trunk road. This would be designed to a standard agreed with Transport Scotland. The preliminary layout of the new junction is shown in **Figure 2.23 - A86 Junction GA.** The new junction will include a new bridge over the River Spean / Moy Channel – the existing bridge is unsuitable – and would lead directly into a site entrance compound area (SC1). This bridge is shown in **Figure 2.24 - River Spean (Moy) Bridge.** The original junction and bridge would be retained for use by Corrour Estate traffic and by recreational users. It would be preferable to have only one bridge over the Moy Channel to reduce the environmental impact on the banks of the channel. However, as this is already an engineered canal between Loch Laggan and the rest of the Laggan Reservoir, it is suggested that in view of the channel banks' already modified status, as well as the need to keep the separate access to the neighbouring estate functioning throughout construction and into the future, retaining the original bridge as well as the new one should be acceptable.

2.5.49 The new bridge would be designed to accommodate the 1 in 200 year flood event including an up to date allowance for climate change.

Track from SC1 to Main Compound SC2 at Loch Earba

2.5.50 Access from the site entrance compound (SC1) to the main compound (SC2) and the powerhouse at Loch Earba would initially follow the line of the existing track, which will be widened and strengthened. Some localised realignment may be necessary at bends. The alignment of this track is shown on **Figure 2.25 – Access Track from SC1 to Powerhouse (Sheets 1–11)**.

2.5.51 Approximately 1.5km from the A86, the track would diverge to the north of the existing track alignment to mitigate potential disturbance to a number of sensitive ornithological sites. The original track would however be retained for pedestrian and cycle access, and for Estate access to Lubvan, with new links to the existing path in Coire Pitridh and the proposed new access track on the north shore of the Earba Reservoir.

2.5.52 Material to construct the track between the site entrance compound SC1and the main compound SC2 at Loch Earba would be won from the existing borrow pit (BP1) adjacent to the site entrance compound.

Tracks around the Earba Reservoir

2.5.53 New permanent tracks outwith the dam and reservoir footprints would be constructed for both construction and operational access. The proposed alignment of the main track along the south shore of Loch Earba from the powerhouse to Shios Dam is shown in **Figure 2.26 – Access Track from Powerhouse to Shios (Sheets 1-9)** which would also give access for construction of the separately consented buried grid connection cables which would be laid adjacent to this track in a cable wayleave. The existing track along the south shore of Loch Earba would

be retained for construction use until it becomes inundated by filling of the reservoir.

2.5.54 A new landrover track would be constructed along the north shore of Loch Earba, running at grade above the level of the proposed reservoir inundation. This would be used for recreational access along Loch Earba during the construction period when the south shore track would be busy with construction traffic. During operation of the Proposed Development, this track would become part of a circular cycling/walking route around Loch Earba. It would also be used by the Estate for land management purposes. A mountain footpath would be constructed from this track up to the base of the Binnein Shuas cliffs to improve access for rock climbers.

Track from the Powerhouse to the Leamhain Reservoir

2.5.55 A new track would be constructed between the powerhouse at the west end of the Loch Earba reservoir and the Loch Leamhain dam and reservoir. The alignment is shown on **Figure 2.27 – Access Track from Powerhouse to Leamhain (Sheets 1– 14)**. This would incorporate a branch to the surge shafts on Creag Pitridh. A track would also branch off the main dam access track at the Bealaich Leamhain to access the intake at the west end of Loch Leamhain. In Coire Pitridh the new track would be separated from the existing Munro access footpath. Sections showing the most extensive hairpin (location shown on Fig. 2.27 sheet 3) and cuttings (Fig. 2.27 sheet 10) for the tracks are shown on **Figure 2.28 - Cross Sections through Hairpin bend and Cuttings**. The track cuttings would be aligned to avoid the established footpaths as far as possible.

2.5.56 The Leamhain Reservoir access track would be a two-way track, with the exception of the branch to the surge shafts, which would be single track with passing places in areas where the topography is unsuitable for a wider track.

Access Track Construction

2.5.57 Site access tracks would typically be constructed with graded rock or gravel won from borrow pits within the Site. Except for the access from the A86 to the site entrance compound, all access tracks would have an unbound surface, i.e. not tarmacked.

2.5.58 The proposed widths of the access tracks is shown in **Table 2.1- Track Widths** below.

Table 2.1 – Track Widths

Track Section	Construction Period Detail	Operation Period Detail
A86 Junction to the Powerhouse site	8m, generally cut, but with sections of floating construction over any blanket bog.	Reduced from 8m to 6m

Track Section	Construction Period Detail	Operation Period Detail
Powerhouse site to Shios Dam, south side of Earba Reservoir	6m wide cut track	Reduced from 6m to 4m with passing places
North side of Earba Reservoir	3m wide cut landrover track	3m wide
Rock climber's access track to Binnein Shuas cliffs	1m wide mountain path	1m wide mountain path
Walkers' path connecting the existing estate track at the small reservoir to the stalkers' path in Coire Pitridh	1m wide mountain path	1m wide mountain path
Adjacent to the Pitridh Aqueduct	3m wide cut track	3m wide
Shuas Dam crest track	n/a	3.5m wide
Shios Dam crest track	n/a	3.5m wide
Powerhouse site to Leamhain Dam (Leamhain Track)	6m wide cut track	Reduced to 4m with passing places
Leamhain track to surge shafts	6m wide cut track, reduced to 4m where constrained by topography	Reduced to 4m with passing places
Leamhain track to tunnel adit	6m wide cut track	Reduced to 4m with passing places
Leamhain track to Leamhain intake and reservoir	6m wide cut track	Reduced to 4m with passing places
Tracks within the Leamhain Reservoir drawdown zone	6m wide cut track	6m wide
Leamhain Dam crest track	n/a	3.5m wide
Leamhain Dam gatehouse access track	6m wide cut track within dam construction working area	Reduced to 4m wide

2.5.59 The alignment of tracks has wherever possible been designed to avoid areas of peat, but where this is not possible and the depth of peat is over 1m, floating road construction would be utilised. Peat depths at the proposed access track locations are shown in **Figure 12.2.3 – Peat Depths.**

2.5.60 In all other areas the tracks would be constructed using cut track techniques. Details of these track construction methods are shown in **Figure 2.29 - Access Track Details (Sheet 1)** and **Figure 2.30 - Access Track Details (Sheet 2)**.

2.5.61 Peat and soil from excavations on site would be utilised for reinstatement along both sides of the track verges and allowed to regenerate naturally. Further details are provided in **Appendix 2.3 - Outline CEMD** and **Appendix 12.2 - Draft Peat Management Plan**. In areas where tracks would be more visible, for example traversing the flank of a hillside, these would be landscaped by bunding to the downslope side of the tracks.

2.5.62 Drainage of access tracks will be designed to the requirements of SEPA using regular drainage grips and small diameter cross drains as required at closely spaced intervals to disperse run-off locally.

Footpath Construction

2.5.63 Construction details for the proposed temporary and permanent new footpaths, including signage, are included in the Draft Access Management Plan at **Appendix 15.1 – Draft Access Management Plan**.

Mass Balance Strategy

2.5.64 A mass balance (spoil management) strategy and borrow pit plan has been designed for the Proposed Development which would maximise the use of materials generated from within the site for use in the construction of the permanent works and which would put any surplus materials generated from construction of the permanent works to beneficial use within the site. This would minimise the environmental impact of the Proposed Development by avoiding the need to transport bulk materials to the site wherever possible and by minimising the generation of any waste material that would need to be taken off site for disposal. The mass balance strategy is attached at **Appendix 2.4 – Mass Balance Strategy and Borrow Pit Plan.**

2.5.65 The following materials would be won from the site:

- Aggregates for the construction of access tracks;
- Aggregates for the site manufacture of concrete (cement would need to be imported);
- Rock and earth fill materials for construction of the dams; and
- Earth and peat materials for use in reinstatement. This would include materials for the construction of the promontories on either side of the centre of the Earba Reservoir to replicate and maintain the existing natural and visual separation between the two Earba Lochs.

2.5.66 These materials would be generated from the following sources:

- Aggregates would be sourced from the powerhouse excavation, from the excavation of the underground waterway systems, and from a number of borrow pits;
- Rock materials would be sourced from excavation of the powerhouse, the underground waterway system and from a number of borrow pits;
- Earth fill materials would be sourced from the powerhouse excavation and from removal of in situ material from the footprints of the dams; and
- Only where necessary, peat will be taken from the footprint of the various structures.

Borrow Pits

2.5.67 Borrow pits would be established at the locations shown in **Figure 2.2 – Scheme Arrangement**. The precise locations would be subject to micro-siting following detailed ground investigations. Some preliminary ground investigation (GI) has however been carried out at these locations to establish the suitability of the materials for use in the works, the depth to rock where this is the desired borrow material, and the volumes of peat and other soils which would need to be temporarily stored before being used to restore the borrow pits on completion of extraction operations. This GI has been used in developing the mass balance strategy at **Appendix 2.4 – Mass Balance Strategy and Borrow Pit Plan**. Borrow pits would be established at the following locations:

- **Borrow Pit 1 (BP 1)** - at the Moy Bridge area, at the location of the proposed site entrance compound SC1, is based on enlargement of an existing borrow pit there. The material from this borrow pit would be used to construct the tracks up to Loch Earba and the powerhouse area and for the manufacture of concrete. Details of borrow pit BP1 / SC1 are given in **Figure 2.2.1 - Site Compound SC1 / Borrow Pit BP1 - Plan and Sections.**
- Borrow Pit 2 (BP2)– not used. This was omitted following peat surveys.
- **Borrow Pit 3 (BP3)** - between the two existing Earba Lochs. Gravel material from this area which lies within the final inundation area would be suitable for track and dam construction and for the manufacture of concrete. Details shown in **Figure 2.2.2 - Borrow Pit BP3 / SC5 - Plan and Sections.**
- **Borrow Pit 4 (BP4)** - adjacent to the Shios Dam. Materials used in construction of the Shios dam. Details are shown in **Figure 2.2.3 - Borrow Pit BP4 - Plan and Sections.**
- **Borrow Pits 5A and 5B** (BP5A and BP5B) - at the north and south of Loch Leamhain, within the proposed reservoir drawdown, materials used in construction of the Leamhain dam shown in **Figure 2.2.4 - Borrow Pit BP5A and 5B - Plan** and **Figure 2.2.5 - Borrow Pit BP5A and 5B – Sections.**
- The powerhouse and shaft excavations shown on **Figure 2.19 - Powerhouse Typical Cross Section** would become a borrow pit for generation of aggregate and rock materials for use elsewhere within the works, mainly for the rockfill dams.
- As well as the powerhouse cutting and shaft works, the powerhouse area would also contain the temporary and permanent tunnel adits which would be used to extract the majority of the tunnel spoil from the underground works, which would be re-used in the dams and local works landscaping.
-

Construction Stage Water Abstractions

2.5.68 During the construction stage of the project temporary abstraction points would be required to supply water for the following activities:

- Welfare facilities at the construction site compounds located at all the main works areas;
- Concrete production;
- Drilling;
- Piling;
- Grouting;
- Dust suppression; and
- Wheel washing.

2.5.69 Water for the above activities would be required for the full duration of the construction programme, albeit at varying abstraction rates.

2.5.70 Dewatering would be required in several parts of the site, the extent of which will be a function of the local ground conditions. It is expected that dewatering techniques will be required at the dam and the upper & lower control works construction areas.

2.5.71 The details of all abstraction and dewatering required during the construction phase would be set out in the Principal Contractor's methodology, which would be submitted to SEPA as part of the requirements of the construction license required under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 covering the Construction Works.

Site Drainage

2.5.72 At the detailed design stage, a Drainage Impact Assessment (DIA) would be provided. The DIA would include details relating to any existing drainage and the management of surface water drainage, which would be designed in line with general Sustainable Drainage Systems (SuDS) principles. Mitigation measures to manage the residual risk of overland flow/pluvial flooding would be included in the DIA.

2.5.73 Natural flood management techniques would also be applied to reduce the rate of runoff where possible. Tracks would not act as preferential pathways for runoff and efforts would be made to retain any existing drainage network. Appropriate drainage would be provided to restrict runoff to pre-development rates and to minimise erosion to existing watercourses. The DIA would ensure that post development runoff rate is no greater than pre-development runoff rate (i.e. greenfield runoff) for all return periods up to the 1 in 200 year event including an allowance for climate change.

2.5.74 Runoff from all events up to and including the 1 in 200 year plus climate change event would be managed within the site boundary, with no flooding to critical roads or buildings.

Site Accommodation

2.5.75 A number of site compounds would be required to accommodate the construction site establishment and lay down areas, as well as a workers' residential camp. The locations of these compounds are shown in **Figure 2.2 – Scheme Arrangement.**

2.5.76 A Site Entrance Compound (SC1), shown in **Figure 2.2.1 - Site Compound SC1 / Borrow Pit BP1 - Plan and Sections**, would be established for the duration of the construction of the Proposed Development on an area south of the Moy channel at the entrance point of the new access junction and would be in the same location as Borrow Pit 1 (BP1). This would be located on the area of wet heath, avoiding the blanket bog adjacent to this area.

2.5.77 This compound would include the following facilities:

- Access security;
- Site offices;
- Parking for cars and lorries;
- Laydown Areas; and
- Wheel wash facilities.

2.5.78 The site entrance compound would be surrounded by an earth bund to screen the area visually and acoustically from neighbouring properties.

2.5.79 The Main Construction Compound and Accommodation Camp (SC2) would be located in the area to the southwest of the Shuas Dam. The final arrangement for this would be developed during design development and procurement and would be agreed with the planning authority in advance of works on the Proposed Development commencing.

2.5.80 This compound, illustrated indicatively in **Figure 2.31 SC2 - Main Construction Compound and Accommodation Camp,** would incorporate the following facilities:

- The main site offices and associated welfare facilities;
- Temporary accommodation facilities for up to 600 people, including welfare and recreation facilities;
- Workshop and internal storage facilities;
- Parking;
- Laydown areas for materials deliveries;
- Plant storage areas;
- Facilities for power generation, water supply and waste treatment;

2.5.81 In the Loch Earba area, site compounds, materials handling areas and office and welfare facilities would be needed for construction of the two dams, the powerhouse and for access for driving the tunnels. These are shown in **Figure 2.32** as SC3, **Figure 2.33** as BP3/SC5, **Figure 2.34** as SC6A and SC6B. (SC4 is not used).

2.5.82 A small satellite compound SC7 would be required at the surge shafts location as shown in **Figure 2.35**.

2.5.83 At the Loch Leamhain dam and upper control works, a large site compound SC8 would be established within the proposed reservoir inundation area and the drawn

down Loch Leamhain. This would accommodate large materials handling areas as well as site accommodation, welfare and lay-down areas. The proposed areas and layout for this compound is shown in **Figures 2.36** and **2.37.** A description is given of the proposals for de-watering Loch Leamhain, construction sequence, pollution prevention and drainage management in **Appendix 2.1 - Leamhain Dam Construction – Draft Pollution Prevention Plan**.

2.5.84 Areas within the footprint of the lower reservoir would have the disadvantage of becoming inundated as impoundment of this reservoir would commence before the rest of the construction and reinstatement works are complete. However, these areas would be restricted to materials handling areas and would be reinstated before impoundment.

Areas of Habitat Compensation and Enhancement

2.5.85 The Proposed Development would include a very significant package of habitat compensation and enhancement works, including approximately 600ha of peatland restoration as well as approximately 1,500ha of fenced land around the Earba reservoir and surrounding hills which will provide an area for woodland restoration, and some further species-specific habitat enhancement works. These proposals would demonstrably contribute significantly to the enhancement of biodiversity, including restoring degraded habitats and building and strengthening nature networks and the connections between them. Details of the proposed habitat compensation and enhancement works are outlined in **Chapter 8 – Terrestrial Ecology** and **Appendix 8.6 - Outline Biodiversity Enhancement and Management Plan**.

2.6 Site Traffic

2.6.1 Construction traffic to the Proposed Development would take access from the A86 at Moy Bridge. All operational or maintenance traffic would also utilise this access route.

2.6.2 An estimate of construction traffic generation and the potential effects of this on the local road network, is included in **Chapter 17: Transport and Access.**

2.6.3 During operation, the Proposed Development would be manned from the administration area inside the powerhouse. It is estimated that an average of 10 to 15 staff would require daily access to the site. Infrequent access by heavier vehicles for maintenance and refurbishment would occur as required.

2.7 Construction Programme and Working Hours

2.7.1 An outline programme has been prepared for the Proposed Development and is attached at **Appendix 2.5 - Outline Project Programme.**

2.7.2 It is anticipated that the construction and commissioning period would last approximately five to six years and the workforce would reach approximately 500 people on-site at the peak of the construction phase. The number of construction workers on-site will vary depending on the stage of the works.

2.7.3 Normal construction shifts would generally apply for the surface works – access tracks, dams, powerhouse, upper control works and lower control works - but

these could be subject to some variation to suit the ongoing work, weather conditions and time of year. It is anticipated that surface works would generally be undertaken between 07.00 and 19.00 hours, seven days a week and that underground operations would continue 24 hours a day, seven days a week. As the workforce would be housed within the site, these hours should not lead to any "out-of-hours" traffic on the local roads.

2.7.4 It is proposed that the movement of HGVs into or out of the Site would only take place between 08.00 and 18.00 on Mon - Friday and 08.00 - 16.00 hours on Saturdays and Sundays.

2.7.5 Although it will be far enough away from any noise sensitive receptors so as not to cause any nuisance, any surface blasting on site would only take place between the hours of 09.00 to 17.00 on Monday to Friday inclusive and 10.00 to 14.00 on Saturdays, Sundays and on National Public Holidays, unless otherwise approved in advance in writing by the Planning Authority.

2.7.6 Underground operations and other agreed works that would continue to take place out-with normal surface working hours, would have management measures in place to ensure that any noise and lighting is mitigated for receptors above ground. The final CEMD, to be prepared by the appointed Principal Contractor, will include a Construction Noise and Vibration Management Plan (CNVMP) for construction activities, including blasting activities. This plan will also include measures that would be implemented during construction to ensure local receptors are not adversely affected by noise and measures for community liaison to advise on the timing and duration of blasting activities. The final CNVMP will be submitted to the Planning Authority for approval prior to the commencement of the Proposed Development. An outline noise Management Plan is provided in **Appendix 18.3 – Draft Construction Noise and Vibration Management Plan (CNVMP)**. Further information on Noise is provided in **Chapter 18: Noise and Vibration** .

2.8 Construction Environmental Management

Construction Environmental Management Processes

2.8.1 Construction mitigation and environmental protection measures would be managed through a suite of documents under the umbrella of a Construction Environmental Management Document (CEMD). An outline CEMD is attached at **Appendix 2.3 – Outline Construction Environmental Management Document**.

2.8.2 The Construction Environmental Management Document (CEMD) would apply to all construction activities and be implemented via the Contractors' Construction Method Statements. In particular, the CEMD would specify conditions relating to protection of habitats and species, pollution prevention and the means by which site monitoring would occur. The final site-specific CEMD would be drawn up by the Applicant, in consultation with the Highland Council (THC), Scottish Environment Protection Agency (SEPA), and NatureScot, once planning permission had been obtained and the main contractor appointed.

2.8.3 The CEMD will include the following:

- Pollution Prevention Plan – (Appendix 2.1, including Loch Leamhain PPP)
- Mass Balance Strategy – (Appendix 2.4) including:
  - Borrow Pit Management Plans and
  - Spoil Management Plans
- Site Monitoring Plan
- Waste Management Plan,
- Incident Response Plan
- Drainage Impact Assessment (Chapter 6 and CAR licence) and
- Drainage Management Plan (Chapter 6 and CAR licence)
- Biodiversity Enhancement and Management Plan (Chapter 8)
- Ecological Management Plan (Chapter 8)
- Species Protection Plans (SPPs) (Chapter 8)
- Tree Protection Plan (TPP) (Chapter 9)
- Surface Water Quality Monitoring Programme (SWQMP) (Chapter 11)
- Dust Mitigation Plan (Chapter 11)
- Peat Management Plan & Soil Management Plan (PMP & SMP) (Chapter 12)
- Peat Hazard Emergency Plan (Chapter 12)
- GWDTE Assessments and Exclusion Plan (Chapter 12)
- A Schedule of Watercourse Crossings (Appendix 12.3)
- Access Management Plan (Appendix 15.1)
- Construction Traffic Management Plan (CTMP) (Chapter 17)
- Abnormal Indivisible Load - Transport Management Plan, (Chapter 17)
- Construction Staff Travel Plan (Chapter 17)
- Construction Noise and Vibration Management Plan (Chapter 18)
- Reinstatement Plan

Ecological Clerk of Works

2.8.4 Construction will be supervised and monitored by specialist advisers including Ecological Clerks of Works (ECoW) to ensure that sensitive ecological habitats and species are adequately protected in accordance with the methodologies in the CEMD and associated documents.

Micro-siting

2.8.5 There may be a requirement to micro-site elements of the Proposed Development from the positions shown on **Figure 2.2 – Scheme Arrangement,** as a result of additional constraints encountered during site works. Any micro-siting would require agreement of the specialist advisors (e.g. the ECoW) as appropriate.

Schedule of Mitigation

2.8.6 A schedule of mitigation is included in **Chapter 20 – Mitigation Schedule** of this EIA Report, which consolidates and cross references all the suggested mitigation measures documented in this EIA Report to minimise or offset potential environmental effects.

Site Environmental Management

2.8.7 The Construction Main Contractor would have overall responsibility for environmental management on the Site. The services of specialist advisors, such as the project ECoW , would be retained as appropriate to be called on as required to advise on specific issues. The Main Contractor and the Applicant would ensure construction activities are carried out in accordance with the mitigation measures outlined in this EIA Report and those detailed in the approved CEMD.

2.8.8 Contractors would be required to adhere to the following in order to reduce or mitigate the environmental effect of the construction process:

The requirements set out in this EIAR;
the conditions of any granted consent; and
relevant environmental regulations.

2.8.9 A copy of any conditions of consent and the CEMD would be incorporated into tender and contract documents and form part of the contract between the Applicant and the Main Contractor. The selection criteria for the Main Contractor would include their record in dealing proactively with environmental issues, and provision of evidence that they incorporate all environmental requirements into their method statements and thereafter implement these on site.

Site Reinstatement

2.8.10 Reinstatement would be undertaken as soon as practical following the construction works in each area.

2.8.11 Site tracks and some hardstanding areas would be retained for use during maintenance operations, although except for the main track from the A86 to the powerhouse, construction tracks would be reinstated to 4 m with passing places. The track edges would as far as possible be blended to the adjacent contours, with natural vegetation being allowed to re-establish.

2.8.12 All construction equipment and other temporary infrastructure would be removed from site and the temporary storage areas would be reinstated.

2.9 Land Take

2.9.1 It is estimated that the maximum permanent development footprint of the Proposed Development would be approximately 310 Ha. During the construction period it is estimated that a further 103 Ha would be temporarily required which would be reinstated following completion of the construction works.

2.10 Lighting

Construction Lighting

2.10.1 For safety reasons, temporary lighting would be required for all external construction activities during hours of darkness and low natural light. This lighting

would be designed to minimise illumination, glare or light spillage to nearby receptors.

2.10.2 The final CEMD, to be prepared by the appointed Principal Contractor, will include a detailed description of lighting requirements for construction activities and measures that would be implemented during construction to minimise illumination, glare or light spillage out with the Site boundary.

Operational Lighting

2.10.3 Once operational, external lighting would only be provided at key areas, such as the lower control works but would only be used during essential operational and maintenance activities, for example if a switching operation was necessary in the external switchyard. No lighting would be operated by PIRs. Prior to the commencement of Proposed Development, final design details for the external lighting during operation would be agreed with the Planning Authority.

2.10.4 The powerhouse surface building will be designed with automatic blinds on all glazed windows and doors, with these closed between dusk and dawn.

2.11 Electric Car Charging Point Strategy

2.11.1 Wherever practicable, vehicles used in the operation of the Proposed Development would be electric vehicles (EVs). The powerhouse would be provided with sufficient charging points for all vehicles used to operate the scheme, as well as for staff vehicles to recharge whilst at work.

2.11.2 There is potential to locate temporary solar arrays within the footprints of the site compounds, which would enhance the sustainable use of electric vehicles and plant. Electrical power supply and charging from several of the local hydroelectric schemes in the vicinity of the works would also be explored as a viable sustainable temporary power supply.

2.12 Project Operation and Maintenance

2.12.1 The Proposed Development would be manned twenty-four hours a day, with most operations being controlled from the control building within the powerhouse or remotely. Regular visits would be made to inspect and maintain the scheme components as follows:

- Daily visits to the powerhouse, intake and tailrace screens for routine operation and maintenance;
- Weekly visits to the dams, for routine operation and maintenance;
- Non-routine and scheduled major maintenance tasks would be carried out at longer intervals as required. These tasks could potentially extend to several weeks/months;
- Periodic inspection of the underground tunnel works and dam structures; and
- As-required maintenance of the access tracks and other infrastructure.

2.13 Project Decommissioning

2.13.1 With proper maintenance, the Proposed Development should remain functional indefinitely and as such an assessment of decommissioning effects has not been provided as part of the EIA Report. If the Proposed Development ceases operation, decommissioning would take place and the site would be restored as follows:

- Moveable infrastructure would be removed;
- Underground tunnels would be sealed;
- Generation plant would be removed;
- Where removal of infrastructure, for example the dams, would result in more damage than leaving in place, they would be left in-situ; and
- Disturbed ground would be reinstated.

2.13.2 Full details of the decommissioning plan would be agreed with the appropriate authorities and landowners prior to any decommissioning works commencing.