EARBA STORAGE

A GILKES ENERGY COMPANY

Earba Pumped Storage Hydro Scheme

EIA Report

Chapter 12: Geology, Soils and Water

February 2024

Quality Information

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Revision History

Revision	Revision Date	Details	Authorised
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Contents

12.1 Executive Summary

This Chapter sets out the assessment of the potential effects on geology, soils and the water environment of the Proposed Development. It considers both the construction and operational phases of the development life. Water management and the transfer of water to and from a lower reservoir, Lochan na h-Earba (Loch Earba) and an upper reservoir, Loch a' Bhealaich Leamhain (Loch Leamhain) is considered in detail in **Chapter 6: Hydrology and Water Management**, and potential effects on ecology is given in **Chapter 8: Terrestrial Ecology** and **Chapter 11: Aquatic Ecology**.

The scope of the assessment was informed by scoping responses received from statutory and non-statutory consultees and further consultation undertaken after the formal scoping exercise as the Proposed Development design was developed in response to the findings of site surveys.

Information for the study area was compiled using baseline information from a desk study which was verified by an extensive programme of field work. The assessment was undertaken considering the sensitivity of receptors identified during the baseline study and considering mitigation measures incorporated in the development design. It has also considered potential future changes to baseline conditions.

The assessment considered designated sites and where these are water dependent and have a potential hydrological connection to the Proposed Development these have been considered in the assessment.

The assessment includes information on recorded peat depths, and these have been used to prepare a site-specific Peat Management Plan (PMP) and Peat Landslide Hazard Risk Assessment (PLHRA) which are provided as Technical Appendices. A schedule of proposed permanent watercourse crossings associated with the Proposed Development is also provided as a supporting Appendix. The PMP considers in detail the condition of peat and carbon rich soils recorded at site and how these will be safeguarded as required by National Planning Framework 4 (NPF4).

The field work included investigation of private and public water supply sources in order to determine those of which might be hydrologically connected to and at risk from the Proposed Development. Measures required to protect these sources have been confirmed. A site specific private water supply risk assessment has been prepared and is presented as a supporting appendix.

As requested by consultees carbon balance calculations have also been prepared and are presented as an appendix to this Chapter.

Subject to the adoption of best practice construction techniques and a project specific Construction Environmental Management Document (CEMD), no significant adverse effects on the soils, geology and the water environment have been identified. The CEMD includes provisions for drainage management plans which will be agreed with statutory consultees, including Scottish Environment Protection Agency (SEPA) and NatureScot and which will be used to safeguard water resources and manage flood risk. A commitment to deploy Sustainable Drainage Systems (SuDS) in these plans has been made. The CEMD also includes provision of a Pollution Prevention Plan which would also be agreed with statutory consultees including SEPA prior to any construction works being undertaken.

Notwithstanding these safeguards, a programme of baseline and construction phase water quality monitoring is proposed which would be used to confirm that the Proposed Development does not have a significant effect on the water environment. The monitoring

programme would also be used to ensure private water supplies, and water dependent designated sites are safeguarded. It is proposed that the monitoring programme is agreed with statutory consultees.

Further, a programme of monitoring to ensure ground stability and safeguarding of peat has been proposed.

12.2 Introduction

12.2.1 This Chapter considers the potential effects of the Proposed Development on geology, soils and the water environment during construction and operation. The assessment of impacts has been made on the basis of the Proposed Development as fully described in **Chapter 2: The Proposed Development**. Where likely significant effects are predicted during construction and operation, appropriate mitigation measures are proposed, and the significance predicted. Residual effects are then assessed.

12.2.2 This assessment uses information and findings presented in **Chapter 6: Hydrology and Water Management** and **Chapter 8: Terrestrial Ecology**. This Chapter also presents summary information from the following Appendices:

- Appendix 12.1: Peat Landslide and Hazard Risk Assessment (PLHRA);
- Appendix 12.2: Peat Management Plan (PMP);
- Appendix 12.3: Schedule of Watercourse Crossings;
- Appendix 12.4: Groundwater Dependent Terrestrial Ecosystems (GWDTEs) Assessment;
- Appendix 12.5: Private Water Supply (PWS) risk assessment; and
- Appendix 12.6: Carbon Balance Calculations.

12.2.3 This assessment has been carried out by SLR Consulting Limited.

12.3 Scope of Assessment

Study Area

12.3.1 The Study Area encompasses the area over which all desk-based and field data were gathered to inform the assessment presented in this Chapter. The Study Area for geology, soils and water comprises all elements of the Proposed Development and a 500m buffer to the Site Boundary. The Study Area adopted for the assessment of Groundwater Dependent Terrestrial Ecosystems is 250m in accordance with Scottish Environment Protection Agency guidance.

Consultation Responses

12.3.2 To inform the scope of the assessment, consultation was undertaken with statutory and non-statutory bodies. **Table 12.1** summarises the scoping and consultation responses relevant to the geology, soils and the water environment and provides information on where and/or how points raised have been addressed in this assessment.

12.3.3 Full details on the consultation responses and scoping opinion can be reviewed in **Chapter 4: Assessment Methodology, Scoping and Consultation**.

Table 12.1 Consultation Responses

Consultee	Issue Raised	Response / Action Taken
Scottish Environmental Protection Agency (SEPA) Scoping 13 March 2023	Further consideration is required to the route of the track up to Leamhain Dam, the number of watercourse crossings needs to be reduced.	Number of watercourse crossings has been minimised as part of the site design evolution, see **Figure 12.1** and **Appendix 12.3: Schedule of Watercourse Crossings.**
	Development should avoid disturbing the area of deep peat south of the existing track to Lochan Earba. The existing track to Lochan Earba should be utilised and new floating track should be used where possible to reduce the volume of excavated peat and should be shown on a clear plan. A Habitat Management Plan should include proposals for peatland restoration works on the site as mitigation for peat habitat loss and make use of disturbed peat, including for example, restoration of any redundant tracks or historic peat cuttings.	Effects on peat are considered in **Appendix 12.1: PLHRA** and **Appendix 12.2: PMP**. A summary is included in **Section 12.6** and **Section 12.8** in this Chapter. Details of peat re-use and habitat restoration is provided in **Appendix 12.2: PMP** and a Habitat Management Plan is included in **Appendix 8.6**. Areas of deep peat have been avoided where technically feasible and existing tracks utilised where possible.
	The finalised habitat plans should include information on the NVC survey classification and quantify the area of GWDTE that will be lost by the development (including inundation) and proposed compensation measures. Areas of new track should be demonstrated to avoid good quality or rare GWDTE habitats.	Potential effects on GWDTEs are discussed in **Appendix 12.4: GWDTE Assessment**. A summary is included in **Section 12.6** of this Chapter.
	We can confirm than an outline Construction Environmental Management Plan need not to be provided with the application. This is on the understanding that; the proposed Soil Management Plan will address all aspects of soil management and any related waste management, peat management is covered by a PMP, detailed site plans are submitted which demonstrate how the environment has been minimised through design and all mitigation is detailed within a suitably robust schedule of mitigation.	Noted. A mass balance strategy which details the volumes to rock generated and which would be re-used by the Proposed Development is presented as **Appendix 2.4**.

Consultee	Issue Raised	Response / Action Taken
	The proposed hydro scheme will require an authorisation under CAR.	Noted.
	Other elements of the scheme must be designed to avoid impacts upon the water environment. Where activities such as watercourse crossings, water diversions or other engineering activities in or impacting on the water environment cannot be avoided then the submission must include justification of this and a map showing; all proposed temporary and permanent infrastructure overlain with all lochs and watercourses, a buffer or at least 10m drawn around each loch or watercourse, and detailed layout of all proposed mitigation including cut off drains, location and size of settlement ponds.	Watercourses and features and a 10m buffer are shown on **Figure 12.1** and discussed within **Section 12.6** and **Section 12.8** within this Chapter.
	Watercourse crossings must be designed to accommodate the 0.5% Annual Exceedance Probability (AEP) flows.	Assessment on GWDTE is presented in **Appendix 12.4**. It has been confirmed that all new watercourse crossings will be designed to convey the 0.5% AEP plus an allowance for climate change.
	GWDTE and groundwater abstractions must be outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions.	The location of groundwater abstractions and GWDTE have been confirmed and are assessed in this Chapter. See **Appendix 12.4 (GWDTE)** and **Appendix 12.5 (PWS)**.
	Measures to prevent pollution should be included as part of the assessment.	Pollution prevention measures are given in **Section 12.8**.
The Highland Council (THC) Scoping 31 March 2023	The EIAR should include a full assessment on the impact of the development on peat, in line with NPF4, Policy 5. The assessment of the impact on peat must include peat probing for all areas where development is proposed. The Council are of the view this should	Peat probing of all development areas has been undertaken. Potential effects on peat are discussed in detail in **Appendix 12.1: PLHRA** and **Appendix 12.2: PMP**.

Consultee	Issue Raised	Response / Action Taken
	include probing not just at the point of infrastructure as proposed by the scheme but also covering the areas of ground which would be subject to micrositing limits / limits of horizontal deviation.	A summary is included in **Section 12.6** and **Section 12.8** in this Chapter.
	Carbon balance calculations should be undertaken and included within the EIAR with a summary of the results provided focussing on the carbon payback period for the development.	Carbon balance calculations are included in **Appendix 12.6**.
	The EIAR should fully describe the likely significant effects of the development on the local geology, including aspects such as borrow pits, earthworks, site restoration and the soil generally including direct effects and any indirect effects. Proposals should demonstrate construction practices that help to minimise the use of raw materials and maximise the use of secondary aggregates and recycled or renewable materials. Where borrow pits are proposed the EIAR should include information on the depth of borrow pit floor and the borrow pit final reinstated profile.	Details of local geology are included in **Section 12.6** of this Chapter. A mass balance strategy and borrow pit plan is included as **Appendix 2.4**.
	The EIAR needs to address the nature of the hydrology and hydrogeology of the land, and of the potential impacts on water courses, water supplies including private supplies, water quality, water quantity and on aquatic flora and fauna. Impacts on watercourses, lochs, groundwater, other water features and sensitive receptors, such as water supplies, need to be assessed. Measures to prevent erosion, sedimentation or discolouration will be required, along with monitoring proposals and contingency plans. Assessment will need to recognise periods of high rainfall which will impact on any calculations of runoff, high flow in watercourses and hydrogeological matters.	Effects on private water supplies are discussed in **Appendix 12.5: PWSRA**. **Appendix 12.4: GWDTE Assessment** considers potential effects on water dependent habitat.
	If culverting is proposed, either in relation to new or upgraded tracks,	Details of the proposed watercourse crossings are

Consultee	Issue Raised	Response / Action Taken
	then it should be noted that SEPA has a general presumption against modification, diversion or culverting of watercourses. Schemes should be designed to avoid crossing watercourses, and to bridge watercourses where this cannot be avoided. The EIAR will be expected to identify all water crossings and include a systematic table of watercourse crossings or channelising, with detailed justification for any such elements and design to minimise impact. The table should be accompanied by photographs of each watercourse affected and include dimensions of the watercourse.	included in **Appendix 12.3: Schedule of Watercourse Crossings**.
	The need for, and information on, abstractions of water supplies for concrete works or other operations should also be identified. The EIAR should identify whether a public of private source is to be utilised, full details on the source and details of abstraction need to be provided.	Details of proposed water abstraction are presented in **Chapter 2** (Construction Stage Water Abstractions) and this Chapter, see **Section 12.8**.
	The Council's Environmental Health Service have stated that the applicant the applicant will be required to carry out an investigation to identify any private water supplies, including pipework, which may be adversely affected by the development and to submit details of the measures proposed to prevent contamination or physical disruption. Highland Council has some information on known supplies but it is not definitive and an on-site survey will be required.	Effects on private water supplies are discussed in **Appendix 12.5: PWSRA**.
	The Council's Flood Risk Management Team have confirmed that they have no comment at this stage.	Noted.
NatureScot Scoping 24 March 2023	Key issues which need to be addressed within the EIAR include the impacts on Ben Alder and Aonach Beag Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) and the impacts on	See **Section 12.6** and **12.8** of this Chapter. Effects on SAC, SSSI and other habitats are discussed in

Consultee	Issue Raised	Response / Action Taken
	Rannoch-Nevis-Mamores-Alder Wild Land Area. This includes potential flooding and pollution impacts on Loch Pattack. With regards to geology, soils and the water environment, NatureScot defer to the advice set out in SEPA's response on the 13 March. The measures requested by SEPA minimise significant impacts on important peatland habitats.	detail in **Chapter 8: Terrestrial Ecology**. Noted.
Scottish Water Scoping 13 April 2023	There are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.	Noted.
Marine Scotland Science Scoping 27 April 2023	Agree with the advice provided by NatureScot regarding the potential flooding and pollution events on Loch Pattack. Agree with SEPA that use should be made of existing infrastructure and minimise the number of watercourse crossings where possible. The design of watercourse crossings should include the uninhibited passage of fish.	Potential effects on fish are included in **Chapter 11: Aquatic Ecology**.
Scottish Government Energy Consents Unit (ECU) Scoping 27 April 2023	Scottish Ministers are satisfied with the scope of the EIA set out in the scoping report. Scottish Ministers request that the company contacts Scottish Water and makes further enquires to confirm whether there are any Scottish Water assets which may be affected by the development and includes details in the EIA report of any relevant mitigation measures to be provided. Scottish Ministers request that the company investigates the presence of any private water supplies which may be impacted by the development. The EIA report should include details of any supplies identified by this investigation, and if any supplies are identified, the company should	Noted. Details of Scottish Water infrastructure and private water supplies are included in **Section 12.6** of this Chapter. Potential effects on private water supplies is presented in full in **Appendix 12.5: PWSRA**. Peat effects are discussed in detail in **Appendix 12.1: PLHRA** and **Appendix 12.2: PMP**.

Consultee	Issue Raised	Response / Action Taken
	provide an assessment of the potential impacts, risks and any mitigation which would be provided. Scottish Ministers consider that there is a demonstrable requirement for peat landslide and hazard risk assessment (PLHRA), the assessment should be undertaken as part of the EIA process to provide Ministers with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures. The PLHRA: Best Practice Guide for Proposed Electricity Generation Developments (2nd Edition) should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures.	

Issues Scoped out of Assessment

12.3.4 The following aspects have been scoped out of the assessment:

- Detailed Flood Risk and Drainage Impact Assessment. Published mapping confirms that most of the site is not located in an area identified as being at flood risk now or in the future. A screening of potential flooding sources (fluvial, coastal, groundwater, infrastructure etc.) is presented in the **Section 12.6** and measures that would be used to control the rate and quality of runoff are included in **Section 12.8**. It is noted that management of the reservoirs and full flood risk associated with failure of any of the proposed dams would be considered by the Reservoirs (Scotland) Act 2011, following grant of any planning permission.
- Water quality monitoring. Classification data is available from SEPA for the principal watercourses (as discussed in **Section 12.6**) and there are no known sources of potential water pollution that might give rise for the need for water quality monitoring as part of the EIA. Water quality monitoring is recommended prior to, during and post construction if the Proposed Development were to be granted planning permission.
- Increased flood risk caused by blockages to flow in watercourses during operation and maintenance of the Proposed Development. Any required watercourse crossings would be subject to routine maintenance requirements under the Controlled Activity Regulations (CAR), flood risk onsite is low, and the development design would ensure no critical infrastructure is located in an area prone to flood risk.
- Geomorphological Assessment. A hydromorphology assessment has been undertaken and is reported in **Chapter 6: Hydrology and Water Management.** In addition as part of the baseline surveys photographs and records of existing or baseline water features have been recorded and is presented in **Appendix 12.3: Schedule of Watercourse Crossings**.
- Decommissioning Effects. With proper maintenance, the Proposed Development should remain functional indefinitely. In the unlikely event of decommissioning, it

is expected that the potential effects on soils, geology and the water environment would be equal to and / or lesser than the construction impacts. Mitigation outlined in **Section 12.8** would be applicable during decommissioning of the project.

- Cumulative or In-Combination Effects. No other development of a significant size are currently proposed near to and in the same surface water catchments as the Proposed Development.

12.4 Legislation, Policy and Guidance

Legislative Context

- EU Water Framework Directive (2000/60/EC);
- EU Drinking Water Directive (98/83/EC);
- The Environmental Act 1995;
- Environmental Protection Act 1990;
- Reservoirs (Scotland) Act 2011;
- The Flood Risk Management (Scotland) Act 2009;
- Water Environment and Water Services (Scotland) Act 2003 (WEWS Act); and
- The Water Environment (Controlled Activities) (Scotland) Amendment Regulations (CAR) 2013 (CAR);
- The Water Supply (Water Quality) (Scotland) Regulations, 2001;
- Private Water Supplies (Scotland) Regulations 2006; and
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017.

Policy Context

12.4.1 The following policy has been considered in the assessment.

12.4.2 National Planning Framework 4 (NPF4)[1] adopted by the Scottish Government on 13 February 2023 provides planning guidance and policies regarding sustainable development, tackling climate change and achieving net zero. Policies relevant to this Chapter include:

- Policy 2 (Climate Mitigation and Adaptation);
- Policy 5 (Soils);
- Policy 20 (Blue and Green Infrastructure); and
- Policy 22 (Flood Risk and Water Management).

12.4.3 In addition, the Highland-wide Local Plan (HwLDP)[2] provides planning guidance on the type and location of the development that can take place in the region. The

[1] Scottish Government (2023) National Planning Framework 4 (NPF4)

[2] The Highland Council (2012) Highland wide Local Development Plan (HwLDP)

Local Plan presents development policies of which the following are relevant to this study:

- Policy 60: Other Important Habitats and Article 10 Features;
- Policy 63: Water Environment;
- Policy 64: Flood Risk; and
- Policy 69: Electricity Transmission Infrastructure.

Technical Guidance

12.4.4 The following technical guidance has been considered in the assessment.

12.4.5 Planning Advice Notes (PANs), published by the Scottish Government, including:

- PAN 61 Planning and Sustainable Urban Drainage Systems; and
- Online Planning Advice on Flood Risk (which supersedes PAN 69).

12.4.6 SEPA Pollution Prevention Guidance Notes (PPG) and Guidance of Pollution Prevention (GPP):

- GPP01 Understanding your environmental responsibilities – good environmental practices;
- GPP02 Above Ground Oil Storage;
- GPP03 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP05 Works and Maintenance in or near Water;
- PPG06 Working at Construction and Demolition Sites;
- PPG07 Safe Storage - The Safe Operation of Refuelling Facilities;
- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- GPP22 Dealing with Spills.

12.4.7 CIRIA publications:

- C532 Control of Water Pollution from Construction Sites (2001);
- C741 Environmental Good Practice on Site (2015); and
- C753 The SUDS Manual (2015).

12.4.8 SEPA publications;

- SEPA, 2010, Engineering in the Water Environment: Good Practice Guide – River Crossings;
- Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010);

- Groundwater Protection Policy for Scotland, Version 3 (2009); and
- Guide to Hydropower Construction Good Practice, Version 3 (2019).

12.5 Methodology

Desk Study

12.5.1 An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information on geology, hydrology, and hydrogeology. The following sources of information have been consulted to characterise baseline conditions:

- Loch Earba – Geological Interpretation Report. Fichtner, ref.: S3773-0030-0009, November 2023
- Earba Pumped Hydro Scheme – Hydromorpholoical Appraisal. Envirocentre, ref.: 13794, October 2023.
- Ordnance Survey (OS) 1:50,000 and 1:25,000 scale mapping;
- National Library of Scotland, Historic Ordnance Survey (OS) Mapping[3];
- Natural England MAGIC map[4];
- NatureScot SiteLink[5];
- James Hutton Institute, The National Soil Map of Scotland (1:250,000)[6];
- British Geological Survey (BGS) Onshore GeoIndex (1:50,000)[7];
- BGS Hydrogeological maps of Scotland[8];
- SEPA flood maps[9];
- SEPA environmental data[10];
- data request to SEPA regarding details of registered/licensed abstractions and discharges (August 2023); and
- data requests to THC regarding details of historic flooding records and private water abstractions (August 2023).

12.5.2 In addition a programme of water flow monitoring has been initiated and is report in **Chapter 6: Hydrology and Water Management**.

[3] National Library of Scotland Historical Ordnance Survey Mapping. Available at https://maps.nls.uk/geo/explore/#zoom=5.0&lat=56.00000&lon=-4.00000&layers=1&b=1 accessed July 2023

[4] Natural England MAGIC map. Available at https://magic.defra.gov.uk/MagicMap.aspx accessed July 2023

[5] NatureScot SiteLink. Available at https://sitelink.nature.scot/home accessed July 2023

[6] James Hutton Institute, National Soil Map of Scotland. Available at https://soils.environment.gov.scot accessed July 2023

[7] British Geological Survey, Onshore Geoindex. Available at https://mapapps2.bgs.ac.uk/geoindex/home.html accessed July 2023

[8] British Geological Survey, Hydrogeological maps of Scotland. Available at https://www.bgs.ac.uk/datasets/hydrogeological-maps-of-scotland/ accessed July 2023

[9] Scottish Environment Protection Agency, Flood Maps. Available at https://www.sepa.org.uk/environment/water/flooding/flood-maps/ and https://map.sepa.org.uk/reservoirsfloodmap/Map.htm accessed July 2023

[10] Scottish Environment Protection Agency, Environmental Data. Available at https://www.sepa.org.uk/environment/environmental-data/ accessed July 2023

Field Study

12.5.3 The project hydrologists, geologists and ecologists have worked closely on this assessment to ensure that appropriate information is gathered to allow a comprehensive impact assessment to be completed.

12.5.4 Detailed site visits and walkover surveys have been undertaken by SLR on the following dates:

- January 2023 to conduct a site walkover and initial peat / soil depth probing exercise;
- May and June 2023 to conduct additional peat / soil depth probing and augering exercise; and
- August 2023 to conduct additional peat / soil depth probing, augering exercise, conduct a watercourse crossings assessment, GWDTE assessment and carry out a private water supply survey.

12.5.5 The field work has been undertaken in order to:

- verify the information collected during the desk and baseline study;
- undertake a visual assessment of the main surface waters and identify and verify private water supplies;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified potential GWDTE (in consultation with the project ecologist);
- visit any potential watercourse crossings and prepare a schedule of potential watercourse crossings if required;
- assess peat condition and quality;
- inspect rock exposures and establish by probing, an estimate of overburden thicknesses, peat depth and stability;
- confirm underlying substrate, based on the type of refusal of a peat probe and by coring; and
- allow appreciation of the site, determine gradients, potential borrow pit locations, access routes, ground conditions, etc., and to assess the relative location of all the components of the Proposed Development.

12.5.6 The desk study and field surveys have been used to identify potential development constraints and have been used as part of the iterative design process.

12.5.7 The data obtained as part of the desk study and collected as part of the field work has been processed and interpreted to complete the impact assessment and recommend mitigation measures where appropriate.

Assessment Methodology

12.5.8 The significance of potential effects of the Proposed Development has been assessed by considering two factors: the sensitivity of the receiving environment and the potential magnitude of impact, should that effect occur.

12.5.9 The assessment methodology has also been informed by experience of carrying out such assessments for a range of pumped storage schemes and other

developments, knowledge of soils, geology and the water environment characteristics in Scotland and cognisance of good practice.

12.5.10 This approach provides a mechanism for identifying the areas where mitigation measures are required and for identifying mitigation measures appropriate to the significance of potential effects presented by the Proposed Development.

12.5.11 Criteria for determining the significance of effect are provided in **Table 12.2**,**Table 12.3** and **Table 12.4**.

12.5.12 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which is set out in **Table 12.2**. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 12.2 Sensitivity of Receptor

Sensitivity	Definition
High	• SEPA Water Framework Directive Water Body Classification: High-Good or is close to the boundary of a classification: Moderate to Good or Good to High; • receptor is of high ecological importance or National or International value (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), habitat for protected species) which may be dependent upon the hydrology of the study area; • receptor is at risk from flooding in the future (2080) and/or water body acts as a current active floodplain or flood defence; • receptor is used for public and/or private water supply (including Drinking Water Protected Areas (DWPAs)); • groundwater vulnerability is classified as High; • if a Groundwater Dependent Terrestrial Ecosystem is present and identified as being of high sensitivity; and • soil type and associated land use is highly sensitive (e.g. unmodified blanket bog peatland).
Moderate	• SEPA Water Framework Directive Water Body Classification: Moderate or is close to the boundary of a classification: Low to Moderate; • moderate classification of groundwater aquifer vulnerability; and • soil type and associated land use moderately sensitive (e.g. arable, commercial forestry).

Sensitivity	Definition
Low	• SEPA Water Framework Directive Water Body Classification: Poor or Bad; • receptor is not at risk of flooding in the future (2080); • receptor not used for water supplies (public or private); and • soil type and associated land use not sensitive to change in hydrological regime and associated land use (e.g. intensive grazing of sheep and cattle).
Not Sensitive	• receptor would not be affected by the Proposed Development e.g. lies within a different and unconnected hydrological / hydrogeological catchments.

Magnitude of Impact

12.5.13 The potential magnitude of impact would depend upon whether the potential effect would cause a material or detectable change. In addition, the timing, scale, size and duration of the potential effect resulting from the Proposed Development are also determining factors.

12.5.14 The criteria that have been used to assess the magnitude of impact are defined in **Table 12.3**.

Table 12.3 Magnitude of Impact

Magnitude	Criteria	Definition
Major	Results in loss of attribute	Long term or permanent changes to the baseline geology, hydrology, hydrogeology and water quality such as: • permanent degradation and total loss of the soils habitat; • loss of important geological structure/features; • wholesale changes to watercourse channel, route, hydrology or hydrodynamics; • changes to the site resulting in an increase in runoff with flood potential and also significant changes to erosion and sedimentation patterns; • major changes to the water chemistry; and • major changes to groundwater levels, flow regime and risk of groundwater flooding.

Magnitude	Criteria	Definition
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material short to medium term changes to baseline geology, hydrology, hydrogeology and water quality, such as: • loss of extensive areas of soils habitat, damage to important geological structures/features; • some fundamental changes to watercourses, hydrology or hydrodynamics. – changes to site resulting in an increase in runoff within system capacity; • moderate changes to erosion and sedimentation patterns; • moderate changes to the water chemistry of surface runoff and groundwater; and • moderate changes to groundwater levels, flow regime and risk of groundwater flooding.
Low	Results in minor impact on attribute	Detectable but non-material and transitory changes to the baseline geology, hydrology, hydrogeology and water quality, such as: • minor or slight loss of soils or slight damage to geological structures/feature; • minor or slight changes to the watercourse, hydrology or hydrodynamics; • changes to site resulting in slight increase in runoff well within the drainage system capacity; • minor changes to erosion and sedimentation patterns; • minor changes to the water chemistry of surface runoff and groundwater; and • minor changes to groundwater levels, flow regime and risk of groundwater flooding.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity	No perceptible changes to the baseline soils, geology, hydrology, hydrogeology and water quality such as: • no impact or alteration to existing important geological environs; • no alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns; • no pollution or change in water chemistry to either groundwater or surface water; and

Magnitude	Criteria	Definition
		• no alteration to groundwater recharge or flow mechanisms.

Significance of Effects

12.5.15 The sensitivity of the receiving environment together with the magnitude of the impact determines the significance of the effect, which can be categorised into level of significance as identified in **Table 12.4**.

12.5.16 In some cases, the potential sensitivity of the receiving environment or the magnitude of potential impact cannot be quantified with certainty and therefore professional judgement remains the most robust method for identifying the predicted significance of a potential likely effect.

Table 12.4 Significance of Effect

Magnitude of Impact	Sensitivity			
	High	Moderate	Low	Not Sensitive
Major	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

12.5.17 Effects of 'Major' or 'Moderate' significance are considered to be 'significant' in terms of the EIA Regulations.

12.5.18 A statement of residual effects, following consideration of any further specific mitigation measures, where identified, is then given.

Assumptions and Limitations

12.5.19 The assessment uses site investigation, survey data and publicly available data sources, including but not limited to SEPA, Met Office, THC, and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages.

12.5.20 It is considered that the data and information used to complete this assessment is robust and that there are no significant data gaps or limitations.

12.6 Baseline Conditions

Existing Baseline

Site Setting

12.6.1 The Proposed Development is situated within the Ardverikie Estate to the south of Loch Laggan approximately mid-way between Newtonmore and Spean Bridge, centred on National Grid Reference (NGR) NN 46495 81270.

12.6.2 Review of OS mapping indicates that the ground elevations range between 250m Above Ordnance Datum (AOD) to the north west of the Site along the banks of the River Spean to 940m AOD within the south western extent of the Site along the north western slopes of Beinn a'Chlachair. Loch Earba is situated at approximately 360m AOD whilst Loch Leamhain is situated at approximately 640m AOD.

Statutory Designated Sites

12.6.3 Review of **Figure 12.1** confirms that no statutory designated sites are located within the Site Boundary.

12.6.4 Two designated sites are located within the study area:

- A small part of the north western boundary of the study area intercepts the Creag Meagaidh Site of Special Scientific Interest (SSSI), which also forms part of the Creag Meagaidh Special Protection Area (SPA) and Special Area of Conservation (SAC) further north. The designation is for breeding bird assemblage, upland habitat assemblage, upland birch woodland and vascular plant assemblage. The SSSI, SPA and SAC is located within a different surface water catchment to the Proposed Development, north of the River Spean and Loch Laggan. Therefore, these designated sites are not considered further in this Chapter.
- A small part of the southern boundary of the study area lies within the Ben Alder and Aonach Beag SSSI and SAC, which also includes Ben Alder SPA. The SSSI, SAC and SPA are designated for upland habitat assemblage (including blanket bogs), breeding bird assemblage, bryophyte assemblage, lichen assemblage, vascular plant assemblage and Dalradian outcrops. The designated site is located downstream of Loch Leamhain and is therefore hydraulically connected to the Proposed Development. Measures to maintain existing water flow paths and water quality are presented in this Chapter and potential effects as a consequence of the Proposed Development on the SSSI and SAC are also considered in **Chapter 8: Terrestrial Ecology**.

Geology

Soils and Superficial Deposits

12.6.5 An extract of the 1:250,000 National soil map of Scotland is presented as **Figure 12.2.** The principal soil types recorded at the Site include peat, peaty gleys, peaty podzols and peaty rankers with lithosols. Areas of humus iron podzols are recorded near the River Spean and alpine to sub alpine podzols are noted on higher and steeper ground.

12.6.6 An extract of the peatland classification dataset published by Scottish Natural Heritage (now NatureScot) is shown on **Figure 12.3.** Areas of Class 1 and 2, which are considered to be nationally important carbon-rich soils, areas of deep peat and priority peatlands, are located within the Site particularly to the south

west of Loch Earba and east of Loch Leamhain. A small discrete area of Class 2 is also noted on the north eastern slopes of Binnein Shuas.

12.6.7 Discrete areas of Class 3 and Class 5 are recorded along the banks of Loch Earba and within the centre of the Site respectively. Class 3 peatland is not considered to be priority peatland but it is associated with wet acidic type soils where occasional peatland habitats can be found whilst Class 5 peatland is not considered a peatland habitat but may include carbon rich soils and deep peat.

12.6.8 Superficial geology mapping published by BGS, shown on **Figure 12.4,** indicates that the Site is generally underlain by glacial till and hummocky glacial deposits.

12.6.9 Head deposits are noted within the south eastern extent of the Site near Loch Leamhain, whilst discrete areas of peat deposits are noted within the centre and north western extent of the Site. Areas of alluvial, glaciofluvial and alluvial fan deposits are noted along the banks of River Spean and Loch Earba. Superficial deposits are shown to be absent of the hill tops locally, particularly along the slopes of Creag Pitridh.

12.6.10 As part of the baseline assessment, a comprehensive peat probing exercise and condition assessment has been conducted and informs the PLHRA and PMP (**Appendix 12.1** and **Appendix 12.2**). As part of the assessment augering of the peat was undertaken to assess its composition, quality and fibrous content. In summary:

- more than 6,400 peat probes were undertaken across the Site;
- all elements of the Proposed Development have been subjected to peat probing;
- approximately 85% of peat probes recoded either no peat or a peat depth of <1m;
- where encountered peat within the Site is predominately fibrous to pseudo fibrous. Most of the shallow peat is classified as H3 – H4 in the upper acrotem, and H3 – H7 in the lower catotelm using the Von Post Classification, showing insignificant to moderate decomposition;
- no amorphous peat was recorded in the peat cores advanced at Site; and
- where technically feasible, areas of confirmed peat have been avoided by the Proposed Development.

12.6.11 Fitchner report the findings of site investigations undertaken at the proposed dams, the power waterway, and powerhouse. The investigations completed include a programme of borehole drilling (sonic and rotary boring), laboratory material testing, rock testing, a geophysical investigation, geological mapping, and trial pitting. As a result of the geological conditions and geological properties are well understood and have been used to inform the design of the Proposed Development.

Bedrock Geology

12.6.12 An extract of the regional BGS bedrock geological mapping is presented on **Figure 12.5** indicates the Site is underlain by units of metamorphic rocks mostly comprising psammite, semipelite, gneissose, quartzite and schistose. Igneous intrusions of the Scottish Highland Ordovician Minor Intrusion Suite (granite and pegmatite) are noted across the Site particularly within the centre of the Site.

12.6.13 Several inferred faults, trending north east to south west, are recorded within the south eastern extent of the Site near Loch Leamhain and along centre of Loch Earba, see **Figure 12.5**.

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

12.6.14 Extracts of the 1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets and BGS 1:625,000 scale Hydrogeology of Scotland map are presented in **Figures 12.6** and **12.7** respectively.

12.6.15 With reference to **Figure 12.7** it is shown that the bedrock deposits beneath the Site are unlikely to contain significant groundwater. The BGS classify the bedrock as a very low productivity aquifer, whereby, small amounts of groundwater may be present within the near surface weathered zone or secondary fractures.

12.6.16 The Aquifer Productivity and Groundwater Vulnerability datasets (**Figure 12.6**) classify the underlying aquifer (superficial and bedrock) according to the predominant groundwater flow mechanism (fracture or intergranular) and the estimated groundwater productivity.

12.6.17 It is shown that the majority of the superficial deposits at Site are classified as not a significant aquifer. Small areas of moderate and high aquifer productivity dominated by intergranular flow are noted within the alluvial fan, glaciofluviual and alluvium deposits within the Site, near Loch Earba and River Spean. The bedrock aquifer is confirmed to be a very low to low productivity aquifer, generally without groundwater except at shallow depth with flow almost entirely through fractures and other discontinuities.

12.6.18 Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being most vulnerable. Review of **Figure 12.6** shows that the potential groundwater vulnerability in the uppermost aquifer beneath the Proposed Development has a vulnerability of Class 4 and 5. The highest vulnerability is noted where little to no superficial deposits are recorded and thus little attenuation of potential pollutants might occur prior to entry to groundwater.

Groundwater Levels and Quality

12.6.19 Groundwater recharge at and surrounding the Site is limited by the following factors:

- steeper topographic gradients will result in rainfall forming surface water runoff;
- the peat and glacial till deposits inhibit infiltration owing to their generally low bulk permeability; and
- the underlying bedrock displays a low permeability that inhibits groundwater recharge.

12.6.20 SEPA has confirmed it does not maintain any groundwater level monitoring locations within the study area. In the absence of published information or data held by SEPA, it is anticipated that some groundwater will be present as perched groundwater within the more permeable horizons of the glacial till deposits and within weathered zone, fractures or faults within the bedrock deposits.

12.6.21 Shallow groundwater is also likely be present within the alluvium and glaciofluvial superficial deposits and which is likely to be in hydraulic continuity with the

adjacent surface water features. Shallow perched groundwater was proven in the site investigation boreholes advanced within the Shuas Dam footprint.

12.6.22 All of Scotland's groundwater bodies have been designated as Drinking Water Protected Areas under the Water Environment (Drinking Water Protected Area) (Scotland) Order 2013 and require protection for their current use or future potential as drinking water resources.

12.6.23 The current status of groundwater bodies in Scotland has been classified by SEPA in accordance with the requirements of the Water Framework Directive (WFD). SEPA have identified that the Site is underlain by the Upper Glen Coe groundwater body (SEPA ID: 150693) which was classified in 2020 (the last reporting cycle) with an Overall Status of Good with no pressures identified.

Groundwater Dependent Terrestrial Ecosystems (GWDTE)

12.6.24 A National Vegetation Classification (NVC) habitat mapping exercise has been completed as part of the ecology baseline assessment to identify potential GWDTEs within the Site. The results of the NVC habitat mapping exercise are discussed in detail within **Chapter 8: Terrestrial Ecology** and areas of potential GWDTE are shown on **Figure 12.8**. As assessment of potential areas of GWDTE, and in particular a discussion whether the habitats are sustained by ground or surface water, is presented in **Appendix 12.4: GWDTE Assessment**.

12.6.25 The GWDTE assessment confirms that large areas of the Study Area do not contain GWDTE and that potential GWDTE habitats are generally sustained by the high average rainfall and water logging of low permeability soils.

12.6.26 Notwithstanding this, some base rich groundwater flushes are recorded and support GWDTE habitat. In many instances these are located above (e.g. at a higher elevation) than the Proposed Development and therefore not at risk during the construction or operational phases of the site life. There are, however, some instances where this habitat lies with the inundation zone of Loch Leamhain or close to the required site infrastructure and will be lost as a consequence of the Proposed Development. Accordingly, **Chapter 8: Ecology** presents details of proposed compensation and an Outline Biodiversity Enhancement and Management Plan.

Hydrology

Local Hydrology

12.6.27 The Proposed Development is located wholly within the surface water catchment of Lower Loch Laggan. Loch Laggan is located approximately 1.5km north of the Site. The outfall of the loch forms the River Spean which flows through the north western extent of the Site and continues to flow south westwards away from the Site. The Site is drained by the following sub catchments of Loch Laggan and the River Spean (see **Figure 12.1**):

- The north western extent of the Site is located within the surface water catchment of the Abhainn Ghuilbinn which flows generally north eastward to the west of the Site, before discharging into the River Spean approximately 800m west of the Site.
- The central and north eastern extent of the Site is located within Loch Earba surface water catchments, which comprises several watercourses and the two existing lochans. Loch Earba is fed by the Allt Coire Pitridh and Allt Coire

a'Chlachair which drains the central extent of the Site. The outflow of the loch comprises the Allt Labhrach watercourse which flows generally northwards before discharging into Loch Laggan approximately 1.3km north of the Site.

- Allt Cam drains the south eastern extent of the Site and forms the outflow from Loch Leamhain. Allt Cam continues to flow south eastwards away from the Site before discharging Loch Pattack approximately 2.8km east of the Site.

12.6.28 The discharge in the watercourses downstream of the proposed dams is considered in **Chapter 6: Hydrology and Water Management**.

12.6.29 None of the surface water catchments that drain the Site have been designated as a Drinking Water Protected Area (DWPA).

Surface Water Quality

12.6.30 Water quality is monitored by SEPA and classified annually in accordance with the requirements of the WFD. **Table 12.5** summarises classifications reported in 2020 (the last reporting cycle). Smaller watercourses within the Proposed Development are not monitored nor classified by SEPA.

Table 12.5 Surface Water Classification Data

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physico-Chemical Status	Hydro morphology
Loch Laggan (100198)	Good ecological potential	Bad	Good	Bad
River Spean – Loch Moy to Loch Laggan (20840)	Good ecological potential	Moderate	Not monitored	Moderate
Lower Loch Laggan (100205)	Good ecological potential	Bad	Good	Bad
Abhainn Ghuilbinn (20361)	Good	Good	High	Good
Allt Coire Pitridh (20371)	Good	Good	High	High
Lochan na h-Earba West (100204)	Good ecological potential	Moderate	High	Moderate
Mid Lochan na h-Earba (20370)	Good	Good	High	High

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physico-Chemical Status	Hydro morphology
Lochan na h-Earba East (100200)	Good ecological potential	Bad	High	Bad
Allt Labhrach (20369)	Bad ecological potential	Bad	Not monitored	Bad
Allt Cam (20372)	Good	Good	High	High

Fisheries

12.6.31 Fisheries locally are managed by the Lochaber Fisheries Trust (LFT) in partnership with Lochaber District Salmon Fishery Board (LDSFB). Fishery interests are discussed and assessed within **Chapter 11: Aquatic Ecology**.

Flood Risk

12.6.32 A summary of the potential sources of flooding and a review of the potential risk posed by each source to the Site is presented in **Table 12.6**.

Table 12.6 Flood Risk Screening

Potential Source	Potential Flood Risk to the Proposed Development	Justification
Coastal flooding	No	The Site is remote from the coast and lies on elevated ground. SEPA flood maps confirm that the Proposed Development is not at risk of tidal or coastal flooding.
River flooding	Yes	SEPA flood maps confirm fluvial flooding is noted within the Site. Flood extents are typically small and are limited to close to the banks of watercourses and lochs. A larger extent of flooding is noted immediately upstream of Loch Earba near the confluence of Allt Coire a'Chlachair and Allt Coire Pitridh and between the two existing lochans and beneath the footprint of the temporary compound proposed in this area.
Surface water flooding	Yes (minor)	SEPA flood maps confirm that surface water flood extents largely coincide with watercourses and lochs within the Site. This is not considered to pose a development constraint.

Groundwater flooding	No	Review of the SEPA groundwater flood map confirms that the Site is not at risk from groundwater flooding. This concurs with the desk-based assessment which has shown that there is little potential for significant groundwater beneath much of the Site.
Flood defence breach (failure)	No	SEPA has produced reservoir inundation maps for those sites currently regulated under the Reservoirs Act. Review of the mapping highlights that east of Loch Earba is highlighted as a breach scenario associated with the existing dam located at the outflow of Loch Earba Another breach scenario is shown along the Abhainn Ghuilbinn watercourse associated with a breach from Loch Meall Ardruighe. The inundation areas associated with both potential breach scenarios do not extend far from the respective watercourse corridors. Both impoundments are regulated by the Reservoir Act which afford inspections and if required repair of the existing dams. This mitigates and manages the flood risk from these sources and therefore it is not considered further,.
Flooding from artificial drainage systems	No	The Proposed Development is located within a remote area and no artificial drainage systems are recorded.
Flooding due to infrastructure failure	No	There is no infrastructure, such as water mains and sewers, located within the Site.
Historical Flooding Records	No	THC and SEPA have no records of historic flooding within the study area..

12.6.33 SEPA also publish potential future flood extents (to the year 2080) which account for the potential upfit in rainfall depths and intensities as a consequence of climate change. An extract of this mapping is show on **Figure 12.1** and confirms, no element of the Proposed Development, with the exception of the proposed temporary compound, watercourse crossings and areas within the proposed inundation areas, are located within the predicted floodplain extents.

Watercourse Crossings

12.6.34 The proposed development has sought to utilise existing tracks and access routes where possible. However, 23 new permanent crossings and one existing crossing which may be upgraded as part of the development, will be required.

12.6.35 The locations of the proposed crossings are shown on **Figure 12.1** and schedule of these crossing points, which includes photographs and dimensions of each crossing is shown in **Appendix 12.3: Schedule of Watercourse Crossings**.

Private Water Supplies and Licences Sites

12.6.36 Consultation with THC and SEPA has been undertaken to gather details of private and licenced water abstractions within the study area.

12.6.37 SEPA has provided information of Controlled Activity Regulation (CAR) authorisations within the study area. One authorisation is noted which permits the discharge of private sewage. Three registrations are also noted: two are associated with Loch Earba and one at Loch Meall Ardruighe. Details of the registered activities have not been provided by SEPA.

12.6.38 THC provided details of private water supply (PWS) sources. In addition, a programme of site investigation has been undertaken to confirm the location of PWS sources.

12.6.39 The risk the Proposed Development poses to the PWS sources in the study area has been considered as part of this assessment and is presented in **Appendix 12.5: PWSRA**. It confirms that:

- two PWS sources are potentially at risk from the Proposed Development; and
- one PWS source is not at risk from the Proposed Development.

12.6.40 **Appendix 12.5: PWSRA** confirms the measures that are required to safeguard these PWS and presents a monitoring schedule which can be used to confirm that the PWSs are not impaired should the Proposed Development be granted planning permission.

12.6.41 The Ardverikie Estate utilise a PWS which is taken from the existing hydro power water supply pipe from Loch Earba. Whilst the take-off point for the PWS supply is out with the study area the water source (e.g. Loch Earba) is part of the Proposed Development. Controls will be required to safeguard the Ardverikie Estate water supply but it is not considered a receptor in this assessment as the PWS source and distribution pipework is managed and owned by the Estate and who are party to the Application.

Summary of Sensitive Receptors

12.6.42 **Table 12.7** outlines the receptors identified as part of the baseline study, their sensitivity based upon the criteria contained in **Table 12.2** and which form the basis of the assessment. They are used as per the previously introduced methodology, in conjunction with an estimate of the magnitude of an effect to determine significance.

Table 12.7 Summary of Identified Receptors

Receptor	Sensitivity	Reason for Sensitivity
Statutory Designated Sites	High	Ben Alder and Aonach Beag SSSI and SAC, which also includes Ben Alder SPA, is located downstream of Loch Leamhain.

Receptor	Sensitivity	Reason for Sensitivity
Soils and Geology	High (Peat)	Areas of peat and carbon rich soils have been recorded within the Site. With the exception of peat, the superficial and bedrock geology is not rare and is not considered sensitive or further in this assessment.
Hydrogeology	High	Groundwater beneath the Site has been classified as Good and vulnerability is classified as High. All of Scotland's groundwater bodies have been designated as DWPAs.
Hydrology	High	Surface watercourses that drain the Site have generally been classified by SEPA with an overall classification of Good or Good ecological potential.
Flooding	Moderate	Little flood risk has been identified onsite, but the development has potential, without appropriate design, to alter surface water flow paths and could increase flood risk downstream of the site. A discrete are of flooding has also been identified to the south west of Loch Earba and where a proposed temporary compound is located.
Private Water Supplies	High	Two private water supplies have been confirmed within the study area and which could be at risk from the Proposed Development.
Licenced Abstractions	Not sensitive	No licenced abstractions are recorded within the study area.
GWDTE	High	Areas of potential GWDTEs have been identified by NVC mapping and by the GWDTE risk assessment (see **Appendix 12.4**). Assessed in **Chapter 8: Ecology**.

12.7 Future Baseline

12.7.1 Due to proposed consent in perpetuity, the temporal scope requires consideration for climate change to alter future baseline conditions. Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. This suggests that there may be greater pressures on water supplies and water levels in summer months in the future. In addition, summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated with extreme storm events, in summer and winter, are predicted to increase in volume and velocity.

12.8 Mitigation by Design

12.8.1 Mitigation has been developed as the project design has progressed as described in **Chapter 3: Consideration of Alternatives and Design Evolution**. The impact assessment and mitigation process has been iterative and therefore mitigation has been developed for the design to be as specific as possible and as an assumed part of the Proposed Development. This has included consideration of areas of deep peat or potential peat instability, watercourse locations, areas of potential flooding, PWS and GWDTE.

12.8.2 A description of all elements of the Proposed Development is given in **Chapter 2: The Proposed Development.** Embedded mitigation and mitigation by design relevant to the soils, geology, and water environment is presented below.

Water Management

12.8.3 A compensation flow discharge to Allt Loch a'Bhealaich Leamhain which mimics the natural outflow from the existing (baseline) catchment would be made (see **Chapter 6: Hydrology and Water Management**). This outflow would also be maintained during construction. The rate of discharge will be agreed with SEPA as part of a CAR application and would be informed by a site-specific flow monitoring record. It is expected as part of the CAR application a compensation flow from Loch Earba to the Allt Labhrach watercourse will also be agreed.

12.8.4 The quality of water shed to and discharged via the Allt Labhrach and Allt Loch a'Bhealaich Leamhain would also be subject to controls agreed with SEPA during construction and operational phases and regulated by a CAR authorisation. Measures which would be used to minimise erosion and generation of suspended sediment, control water quality and the rate of storm water runoff during construction of the Proposed Development are given in the sections that follow.

12.8.5 The CAR authorisation(s) would also ensure fisheries interest are not impaired and the contribution of water to habitats downstream of the dams are maintained.

Peat Management and Landslide Hazard Risk Assessment

12.8.6 The potential presence of peat within the Site formed a key consideration in the design of the Proposed Development. Informed by the extensive programme of peat probing undertaken across the Site, the design has tried to avoided areas of deeper peat whilst maximising the potential energy yield of the development. Due to the design requirements of a PSH, it has not been possible to avoid all areas of deeper peat.

12.8.7 The peat depth probing has been undertaken in order to accurately determine the volume of peat which will be disturbed by the Proposed Development. This data has been used to prepare a site specific PMP (see **Appendix 12.2: PMP**) which details the peat conditions, the volume of acrotelmic and catotelmic peat which would be disturbed and how this would be safeguarded and re-used onsite.

12.8.8 As shown in **Appendix 12.1: PLHRA** and **Appendix 12.2: PMP** measures have been proposed to ensure the stability of peat and carbon rich soils and that peat and soils that would be disturbed by the Proposed Development can be safeguarded and beneficially re-used on Site. The Policy aims of NPF4, regarding soils and peat, are therefore met.

12.8.9 A Design and Geotechnical Risk Register would be compiled prior to any construction commencing on Site to include risks relating to peat instability, as this would be beneficial to both the developer and the Contractor in identifying potential ground stability risks during construction. Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits are identified in **Appendix 12.1: PLHRA**. These include:

- measures to ensure a well-maintained drainage system, to include the identification and demarcation of zones of sensitive drainage or hydrology in areas of construction;
- minimisation of 'undercutting' of peat slopes, but where this is necessary, a more detailed assessment of the area of concern would be required;
- careful micrositing of access track alignments to minimise effects on the prevailing surface and sub-surface hydrology;
- raising peat stability awareness for construction staff by incorporating the issue into the site induction (e.g. peat instability indicators and good practice);
- introducing a 'Peat Hazard Emergency Plan' to provide instructions for site staff in the event of a peat slide or discovery of peat instability indicators;
- developing methodologies to ensure that degradation and erosion of exposed peat deposits does not occur as the break-up of the peat top mat has significant implications for the morphology, and thus hydrology, of the peat (e.g. minimisation of off-track plant movements within areas of peat);
- developing robust drainage systems that would require minimal maintenance; and
- developing drainage systems that would not create areas of concentrated flow or cause over/under-saturation of peat habitats.

12.8.10 Notwithstanding any of the above good construction practices and methodologies, detailed design and construction practices would need to consider the particular ground conditions and the specific works at each location throughout the construction period. An experienced and qualified engineering geologist/geotechnical engineer would be appointed as a supervisor, to provide advice during the setting out, micrositing and construction phases of the Proposed Development.

Geology and Ground Stability

12.8.11 Given the presence of inferred fault lines on BGS mapping, there is potential for varying rock quality, even at significant depths. To mitigate issues with varying rock quality, which could result in unstable rock faces during underground excavation and tunnelling works, the potential requirement for lining of the tunnels and underground excavations is embedded in the design.

12.8.12 Seismic activity in the area could have the potential to destabilise the permanent works however, embedded within the design is the legal requirement that the proposed dams will be designed, constructed and operated in accordance with the Reservoirs (Scotland) Act 2011.

12.8.13 Although the impacts on geology have largely been scoped out, during the construction phase substantial excavation, tunnelling and earthworks will be required. A materials balance has been prepared (see **Appendix 2.4: Mass Balance Strategy and Borrow Pit Plan**) which shows that excavated materials can be used on site and in the formation of the required dams.

Buffer to Watercourses

12.8.14 In accordance with consultation responses, a minimum buffer of 10m has been applied to watercourses (shown on OS 1:25,000 mapping) and, with the exception of the proposed watercourse crossings, where practical any proposed construction activities or infrastructure has been located outside of this buffer. The buffer included the existing Loch Leamhain and Loch Earba but excludes the inundation area, which wouldn't be present until the Proposed Development is operational.

12.8.15 The layout of the access tracks was designed to minimise the requirement for watercourse crossings. Where possible existing tracks have been used and incorporated into the Proposed Development.

Groundwater Dependent Habitats

12.8.16 It has been shown that areas identified as being potentially moderately groundwater dependent are likely to be sustained by incident rainfall and local surface water runoff rather than by groundwater. Accordingly, the buffers proposed in SEPAs GWDTE guidance need not apply.

12.8.17 Measures, such as permeable access tracks and regular cross track drains, have been proposed to safeguard existing water flow paths and maintain existing water quality. It is considered therefore that the majority of water dependent habitats identified by the NVC mapping can be sustained. This would be confirmed, in accordance with good practice, by the Ecological Clerk of Works (ECoW) at the time of the construction who would ensure existing surface water flow paths and water flushes are maintained.

12.8.18 There are some GWDTE habitats that will be lost as a consequence of the Proposed Development. These are clearly identified in **Appendix 12.4: GWDTE Assessment**, and compensation measures presented in **Chapter 8: Ecology**.

Good Practice Measures

12.8.19 As a principle, preventing the release of any pollution or sediment is preferable to dealing with the consequences of any release. There are several general measures which cover all effects assessed within this Chapter, details of which are given below.

12.8.20 The Proposed Development will be undertaken in accordance with good practice guidance, including UK and Scottish guidance on good practice for construction projects detailed in **Section 12.4** of this Chapter.

Construction and Environmental Management Document

12.8.21 A contractual management requirement of the successful Principal Contractor would be the development and implementation of a comprehensive and site-specific CEMD. This document would detail how the successful Principal Contractor would manage the works in accordance with all commitments and mitigation detailed in the EIA Report, statutory consents and authorisations, and industry best practise and guidance, including pollution prevention guidance.

12.8.22 The CEMD will outline measures to ensure that the works minimise the risk of an adverse impact to peat, groundwater, surface water and water dependent habitats.

12.8.23 It is expected that the following will be included in the CEMD and would ensure the works are undertaken in accordance with good practice guidance, which includes, but is not limited to the following:

- any above ground on-site fuel and chemical storage would be bunded;
- emergency spill response kits would be maintained during the construction works;
- a vehicle management system would be put in place wherever possible to reduce the potential conflicts between vehicles and thereby reduce the risk of collision;
- a speed limit would be used to reduce the likelihood and significance of any collisions;
- drip trays will be placed under vehicles which could potentially leak fuel/oils;
- any water contaminated with silt or chemicals will not be discharged directly or indirectly to a watercourse without prior treatment; and
- foul water will be collected for offsite disposal at an appropriately licensed facility.

12.8.24 A wet weather protocol would be developed. This would detail the procedures to be adopted by all staff during periods of heavy rainfall. Tool box talks would be given to engineering/construction/supervising personnel. Roles would be assigned, and the inspection and maintenance regimes of sediment and runoff control measures would be adopted during these periods. In extreme cases, the above protocol would dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow.

Environmental / Ecological Clerk of Works

12.8.25 To ensure all reasonable precautions are taken to avoid negative effects on the soils and water environment, a suitably qualified Environmental / Ecological Clerk of Works (ECoW) will be appointed prior to the commencement of construction to advise the Applicant and the Principal Contractor on all ecological and hydrological matters. The ECoW will be required to be present onsite during the construction phase and will carry out monitoring of works and briefings with regards to any ecological and hydrological sensitivities on the site to the relevant staff of the Principal Contractor and subcontractors.

12.8.26 With respect to the water environment, the ECoW would also have responsibility to ensure water flow paths and quality to water dependant habitats are sustained during all phases of the Proposed Development.

Water Quality Monitoring

12.8.27 Water quality monitoring before and during the construction phase would be undertaken within the surface water catchments that drain from the Site to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring would be carried out at a specified frequency (depending upon the construction phase) on these catchments.

12.8.28 Monitoring would continue throughout the construction phase and immediately post construction. Monitoring would be used to allow a rapid response to any pollution incident as well as assess the impact of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. Water quality monitoring plans would be developed during detailed design (SEPA, THC, LFT and LDSFB would be consulted on the plan) and would be contained within the final CEMD.

12.8.29 The performance of the good practice measures would be kept under constant review by the water monitoring schedule, based on a comparison of data taken

during construction with a baseline data set, sampled prior to the construction period.

12.8.30 The water quality programme would also be used to confirm there is no impact to PWS sources, Ben Alder and Aonach Beag SSSI and SAC and Ben Alder SPA.

Pollution Risk

12.8.31 Good practice measures in relation to pollution prevention would include the following:

- refuelling would take place at least 50 m from watercourses;
- foul water generated onsite would be managed in accordance with PPG4;
- areas would be designated for production of concrete or washout of vehicles which are a minimum distance of 50 m from a watercourse;
- washout water would also be stored in the washout area before being treated and disposed of, or re-used in concrete production;
- if any water is contaminated with silt or chemicals, runoff would not enter a watercourse directly or indirectly prior to treatment;
- water would be prevented as far as possible, from entering excavations such as trenches and foundations;
- procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the Controlled Activity Regulations, to minimise the potential for accidental spillage; and
- a plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMD for the Proposed Development.

12.8.32 Over the longer term, it would be expected that inorganic and organic sediment derived from water transfer between the lochs, and from natural surface water runoff from the catchment to the lochs will accumulate within Loch Leamhain and Loch Earba. The accumulation of sediment could increasingly influence, and potentially reduce, the quality of water within the lochs through mobilisation of fine sediment into the water column increasing turbidity, nutrient enrichment, and oxygen depletion.

12.8.33 Sediment build up would also be monitored and when necessary sediment would be removed for appropriate disposal in accordance with waste legislation, although this is likely to be a very infrequent requirement.

Water Supply and Foul Water Management

12.8.34 During the construction phase water for the site welfare facilities will either be brought to site by tanker or be provided by a private water supply abstraction, with prior approval from THC (and if required SEPA).

12.8.35 During operation, it is expected that rainwater harvesting will be used for grey water requirements and potable water will be brought to Site or taken from a private water source yet to be determined, but which would be agreed with SEPA and THC prior to implementation.

12.8.36 During the construction phase all foul water generated from the welfare facilities would be collected and either removed from Site for treatment and disposal at an appropriately licensed facility or treated on site using a package waste water treatment plant subject to agreement with SEPA as required by CAR.

12.8.37 During the operational phase, subject to authorisation by SEPA as required by the CAR, foul water would either be disposed a package treatment plant, or to a septic tank or stored in a sealed tank prior to removal from Site for treatment and disposal at an appropriately licensed facility.

12.8.38 It is anticipated that the final foul drainage management proposals would be agreed with consultees as part of the final CEMD.

Erosion and Sedimentation

12.8.39 Good practice measures for the management or erosion and sedimentation would include the following:

- all stockpiled materials would be located out with a 50m buffer from watercourses wherever possible and not within 10m of a watercourse;
- water would be prevented as far as possible, from entering excavations such as trenches and foundations through the use of appropriate cut-off drainage;
- where the above is not possible, water would pass through silt/sediment traps to remove silt prior to discharge into the surrounding drainage system;
- clean and dirty water onsite would be separated, and dirty water would be filtered before entering the water environment;
- silt fences would be deployed as required to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, would be kept to a minimum;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- the ECoW and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

Fluvial Flood Risk

12.8.40 Construction and permanent site workers may be sensitive to flood risk at the development. During construction a wet weather working protocol would be used. This would restrict working in potential flood prone areas (for example in the inundation area or adjacent to watercourses), reducing the risk to workers, machinery, and downstream property.

12.8.41 An early activity would be to create the Pitridh and Shuas Aqueducts which would divert waters away for the proposed construction compounds at Shuas Dam, and thus would mitigate the flood risk shown on existing SEPA floodplain mapping to the southwest of Loch Earba. To facilitate construction of the dams, the water level in Loch Earba will also be actively managed, further reducing the flood risk.

12.8.42 The wet weather working protocol would also specify areas, which are not prone to flood risk, where construction equipment would be moved to should extreme rainfall or storm warnings be issued by the Met Office and/or SEPA.

12.8.43 It is proposed to adopt Sustainable Drainage Systems (SuDS) as part of the Proposed Development. SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced prior to development. Good practice in relation to the management of surface water runoff rates and volumes and potential for localised fluvial flood risk would include the following:

- drainage systems would be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- onsite drainage would be subject to routine checks to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding;
- drainage measures would attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk; and
- where necessary, check dams would be used within cable trenches in order to prevent trenches developing into preferential flow pathways.

12.8.44 Further information on drainage designs would be provided in the final CEMD.

12.8.45 Flood risk during the operational phase of the development would be mitigated, managed and regulated by the CAR licence and Reservoirs Act. The CAR authorisation will detail permitted rates and volume of discharge and will be cognisant of potential in-combination effects on flood risk as a result of operation of other PSH schemes in the Loch Laggan catchment (refer to **Chapter 6: Hydrology and Water Management**).

12.8.46 The probability of flood risk being increased as a consequence of the development is extremely low due to the high standard of design, management, and maintenance required under the Reservoirs Act. As required by the Act, routine inspection of the dams would be undertaken.

12.8.47 The freeboard incorporated in the design of the enlarged lochs mitigates the potential for wave action on the embankment crests and potential overtopping by waves, by ensuring water levels are below the crest level. Further peninsulas, constructed from site won rock, are proposed in Loch Earba to mitigate the potential effects of wave action.

Thermal Stratification

12.8.48 During operation, although highly unlikely, should there be extended periods of time that the system does not operate, this may provide time for heat to be transferred from the bedrock and in turn, could be then transferred to water if contained in the tunnels (again this is unlikely). Nonetheless, this temperature range is considered to be within the natural fluctuation of surface water in lochs and thus not discernible.

12.8.49 The tunnels would be constructed using a boring machine or by drill and blast techniques and will be lined as each tunnel is progressed. This will minimise the potential for groundwater to enter the tunnels. Once constructed, the tunnel lining and the circular cross-sectional shape of the tunnels will allow any groundwater to

flow around them. Further review of baseline conditions has confirmed the bedrock geology has little potential to store or allow movement of large quantities of groundwater.

12.8.50 The portals for the tunnels are likely to be constructed by excavation into the bedrock, and as such, it is not envisaged that sheet piling will be required. Again, little groundwater flow is expected as a consequence of low permeability of the superficial and bedrock deposits. The SuDS measures detailed above would be used to attenuate any limited groundwater ingress before it is discharged to surrounding ground. No direct discharge would be made to a watercourse.

Risk of Algal Blooms

12.8.51 Standing waterbodies such as lochs and reservoirs follow yearly cycles of stratification when a temperature gradient is created due to high temperatures, also freezing conditions can cause stratifications.

12.8.52 When high volumes of water are discharged into a standing waterbody during stratification, especially when the frequency of pumping / discharge cycles is high, this can alter the stability of the water column, especially when water enters at higher temperature and velocity that can mobilise nutrients from existing bed sediments. These conditions increase water turbulence, promoting the mobilisation of nutrients and making them more available for phytoplankton, thus increasing the potential for an algal bloom to occur. However, it is predicted that the risk of this occurring is low because the temperature of water discharged between Loch Leamhain and Loch Earba is not anticipated to be significantly different.

Permanent Watercourse Crossings

12.8.53 Good practice in relation to new water crossings involves the following:

- the design of the watercourse crossings would be agreed with SEPA prior to construction and be regulated in accordance with CAR;
- the appropriate crossing type would be identified from SEPA's good practice guidance and would take into account any ecological and hydrological constraints; and
- the crossing would be sized and designed so as to minimise effect upon flood risk (sized to accommodate at least the 200 year flow plus an allowance for the potential effects of climate change (currently 41%).

12.8.54 No works are proposed to existing watercourse crossings associated with existing access tracks. Should it become apparent, as part of the detailed design stage of the project, that an existing crossing needs to be replaced, then the principles identified above for new crossings would be used.

12.8.55 The location of proposed permanent watercourse crossings are shown in **Figure 12.1.** One existing crossing is to be upgraded and 23 new crossings are required to provide access to all elements of the Proposed Development. A schedule of watercourse crossings is shown as **Appendix 12.3: Watercourse Crossings.**

Dam Construction

12.8.56 The following measures are proposed to mitigate the effects of dam construction:

- as part of the detailed design stage of the project, and to reflect further site investigation that would be undertaken at that stage, it will be confirmed in the CEMD where proposed dam foundations have potential to intercept larger quantities of water and where piling and/or coffer dams will be specified to prevent significant groundwater inflows and therefore the need to manage significant amounts of water;
- where excavations for foundations encounter localised and limited quantities of groundwater or become flooded due to surface water runoff or heavy rainfall, appropriate treatment of dewatering would be instigated under direction of the site ECoW;
- no dewatering discharge would be permitted directly adjacent to watercourses;
- unless directed otherwise by the site ECoW, dewatering discharge would drain across buffer areas of vegetation of at least 20m width, which would provide for natural attenuation and dispersal of the flow and removal of silt;
- where no suitable vegetation is available for natural treatment of dewatering, the discharge would be passed through on-site settling tanks/lagoons prior to discharge by soakaway or to watercourse;
- the requirement for dewatering would be minimised in all locations by timely and efficient excavation of the foundation void and subsequent concrete pouring and backfilling;
- all procedures for dewatering would be agreed by the Principal Contractor with SEPA, THC and NatureScot, and detailed in the CEMD; and
- the Principal Contractor would develop a method statement to address the transport, transfer, handling and pouring of liquid concrete at foundation sites.

Concrete Batching, Transport and Pouring

12.8.57 In relation to works involving concrete batching, transport and pouring, the following mitigation would be adopted:

- where concrete transfers are required, measures would be adopted at the point of concrete transfer to prevent accidental spillage of liquid concrete and no transfers would be undertaken in proximity to watercourses or areas of standing water;
- there would be no wash-out of concrete carrying vehicles (except the concrete chute) with wash-out undertaken at the nearest compounds where suitably bunded/protected facilities would be provided. Chutes would be washed out to a suitable container, allowed to settle and disposed at suitably licensed facilities or reused in concrete production;
- excess concrete or wash-out liquid would not be discharged to drains or watercourses. Drainage from washout facilities would be collected and treated or removed to an appropriate treatment point/licensed disposal site; and
- vehicles and plant working at foundations would be confined to the area required for safe working only to prevent compaction, rutting and habitat damage to adjacent areas of land.

Permanent Access Track Construction

12.8.58 In relation to permanent access track construction the following principles would be adopted:

- tracks would be completed with permeable construction that will allow infiltration of rainwater and lateral movement of surface water flows;

- where required have frequent cross drains to maintain existing surface water flow paths, the location of drains would be determined in conjunction with the ECoW; and
- they would be constructed with rock and aggregate won onsite and therefore with the same geochemical properties as existing rock and tracks at Site.

Water Abstraction (Dust Suppression and Concrete Production)

12.8.59 Any water abstraction would only be made with authorisation from SEPA and in accordance with the CAR. Good practice that would be followed in addition to the CAR regulations includes:

- water use would be planned so as to minimise abstraction volumes;
- water would be re-used where possible; and
- abstraction volumes would be recorded.

12.9 Potential Significant Effects

12.9.1 This section considers the potential impacts and associated significance of effect of the construction, and operation of the Proposed Development based on the activities described in **Chapter 2: The Proposed Development**.

Construction Effects

Peat and Soils

12.9.2 It has been shown (see **Appendix 12.2: PMP**) and **Section 12.8** that the disturbance of peat and soils as a result of construction of the Proposed Development, can be minimised and the peat deposits safeguarded.

12.9.3 Peat is a high sensitivity receptor. With the identified safeguards and proposed good practice methodologies, the potential impact on deposits of soil and peat is assessed as negligible and thus the significance of effect is Negligible.

Surface Water and Groundwater Quality

12.9.4 As stated above, the Proposed Development would be established in accordance with relevant technical guidance, PPG/GPPs and other codes of best practice, to limit the potential for contamination of both ground and surface waters. In addition, a site-specific CEMD would be prepared by the Principal Contractor and include a groundwater and surface water quality management plan.

12.9.5 The above measures would significantly reduce the likelihood pollutants, including suspended solids, being discharged to nearby watercourses or groundwater.

12.9.6 The safeguards included in the Proposed Development design and the committed best practice construction techniques would also safeguard the quality of water which sustains water dependent habitat, Ben Alder and Aonach Beag SSSI and SAC, Ben Alder SPA and PWSs.

12.9.7 Surface water and groundwater are considered highly sensitive receptors. The Proposed Development and proposed safeguards embedded in the development design reduce the magnitude of potential impact to negligible, during the construction phase. The significance of effect is therefore assessed as Negligible.

Surface and Groundwater Flow

12.9.8 Water abstractions associated with construction works can result in local lowering of the water table. This is important in areas of peat deposits or near GWDTE, where the water table is characteristically near the ground surface.

12.9.9 The baseline assessment has determined that the deposits which underlie the Proposed Development are unlikely to contain significant amounts of groundwater. In addition, dewatering associated with construction would typically be shallow and temporary. As part of the detailed site design, which would include further site investigation, the potential for water ingress would be confirmed and measures to mitigate water ingress confirmed. Therefore, limited or little dewatering is likely to be required.

12.9.10 The flow of water from Loch Earba and Loch Leamhain will be maintained and controlled by a CAR authorisation agreed with and regulated by SEPA. The rate and volume of flow would be agreed post planning and as part of the detailed site design. This would be applicable to both the construction and operational phases of the site development.

12.9.11 Notwithstanding this, the best practice measures listed above would be included in the final CEMD and would be used to control and manage surface and groundwater flows and maintain existing water flow paths at a local scale and be used to ensure water flow paths to water dependent habitat, Ben Alder and Aonach Beag SSSI and SAC, Ben Alder SPA and PWSs would be maintained.

12.9.12 Surface water and groundwater are highly sensitive receptors. With these safeguards, the potential impact on ground and surface waters is assessed as negligible and thus the resultant significance of effect is Negligible.

Flood Risk

12.9.13 Areas of flood risk are considered to have a moderate sensitivity. As part of the detailed site design the Principal Contractor will prepare a detailed construction method statement which will have regard to areas of known and potential flood risk.

12.9.14 It is proposed that access to the Proposed Development will use existing tracks and watercourse crossings wherever possible. Where permanent new access tracks or watercourse crossings cannot be avoided, the new tracks and watercourse crossings will be constructed in accordance with the best practice methods outlined above. The design and capacity of the watercourse crossings would also be agreed by the Principal Contractor in consultation with SEPA as part of the detailed design.

12.9.15 A wet weather working protocol, use and adoption of SuDS, and construction of the Pitridh and Shuas Aqueducts have also been committed.

12.9.16 With these safeguards the magnitude of potential impact is assessed as negligible, and the resultant significance of effect is assessed as Negligible.

Designated Sites

12.9.17 With the best practice construction techniques to protect surface water and groundwater receptors outlined above, in combination with the proposed monitoring programme (see **Section 12.8**) the qualify interests of Ben Alder and Aonach Beag SSSI and SAC, and Ben Alder SPA would also be safeguarded.

12.9.18 The SSSI, SAC and SPA are considered highly sensitive receptors and the potential impact is assessed as negligible. The significance of effect is therefore considered as Negligible.

Operational Effects

12.9.19 During the operation phase of the Proposed Development, it is anticipated that routine monitoring of infrastructure would be occasionally required. Should any maintenance be required onsite which would involve construction activities, method statements would be developed and used which will adopt the best practices agreed with regulators as part of the construction phase CEMD.

12.9.20 Operation of the Proposed Development will be managed by a CAR licence obtained from SEPA which would be used to safeguard water resources, manage flood risk, and ensure sustainable use of water.

Peat and Soils

12.9.21 No excavation, movement or storage of peat or soils is anticipated during the operational site life.

12.9.22 Peat is a high sensitivity receptor. The potential impact on deposits of soil and peat is therefore assessed as negligible and thus the resultant significance of effect is Negligible.

Surface Water and Groundwater Quality

12.9.23 The possibility of a pollution event, resulting in surface water or groundwater impairment, occurring during operation is very unlikely. Any maintenance activities would be undertaken using the same controls agreed with statutory consultees and deployed during the construction phase, including supervision of all works. Further, the scope of works which might be undertaken are no different to the work which would be undertaken during the construction phase.

12.9.24 Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation would not have matured. Appropriate design of the drainage system, incorporating sediment traps, would reduce the potential for the increased delivery of sediment to natural watercourses. Potential effects from sedimentation or erosion during the operational phase are considered to come from linear features on steeper slopes, where velocities in drainage channels are higher. Immediately post-construction, flow attenuation measures would remain and be maintained to slow runoff velocities and prevent erosion until vegetation becomes established.

12.9.25 The Applicant is committed to delivering a Biodiversity Enhancement and Management Plan for the Proposed Development (see outline plan in **Appendix 8.6**), final details of which will be provided and agreed with consultees prior to construction commencing, and which it is expected will be secured by a condition of consent. Habitat management works would be undertaken in accordance with the best practice detailed in this Chapter and which would mitigate potential effects on ground and surface water quality.

12.9.26 Based upon this, the potential risk associated with frequency, duration and likelihood of a pollution event is low. It is, therefore, anticipated that the magnitude of a potential impact on surface water or groundwater during the operational phase of the Proposed Development would be negligible, as no detectable change would likely occur. Therefore, the significance of effect during the operational phase of

the Proposed Development is predicted to be Negligible on surface water and groundwater.

Surface and Groundwater Flow

12.9.27 During the operation of the Proposed Development, it is not anticipated that there would be any excavation or need to stockpile soils, reducing the potential for effects on surface and groundwater flows. Any excavation, handling and placement of material which might be undertaken should maintenance require this, would be subject to the same safeguards that would be used during the construction phase of the project.

12.9.28 The abstraction of surface and groundwater is regulated by SEPA through the CAR licences. Any authorisation issued by SEPA will specify maximum abstractions rates and volumes, periods of abstraction, and compensation flows which are required to be made from the Leamhain and Shios dams. It will also specify monitoring the Applicant will need to undertake to show that the abstraction is not impairing surface or groundwater flows.

12.9.29 The management of water and duration and rate of water movement between the proposed upper reservoir (Loch Leamhain) and lower reservoir (Loch Earba) will be agreed with consultees and regulated by SEPA by a CAR licence.

12.9.30 Given these controls, the likelihood and magnitude of potential impact on surface and groundwater flow paths would be negligible. Therefore, the potential significance of effect on surface and groundwater flow is Negligible.

12.9.31 No further or additional mitigation, therefore, is required other than the proposed confirmatory operational phase surface and groundwater programme.

Flood Risk

12.9.32 The proposed drainage infrastructure would be subject to routine inspection, and if required maintenance. Where identified, any remedial works would be undertaken using the same controls deployed during the construction phase of the project.

12.9.33 The design, efficacy, inspection and maintenance of the proposed dams will be controlled and regulated by the Reservoirs Act. The Act will ensure that the dams do not increase flood risk.

12.9.34 The likelihood and magnitude of impact which have the potential to increase flood risk would be negligible following adherence to good practice measures. Therefore, the potential significance of effect on surface and groundwater is Negligible

Designated Sites

12.9.35 The controls which would be adopted at Site during the operational phase, and which are in accordance with best practice, will safeguard surface water and groundwater quality, surface water and groundwater flows, and mitigate flood risk. They would ensure that the potential impact on Ben Alder and Aonach Beag SSSI and SAC, and Ben Alder SPA is negligible and thus the significance of effect is Negligible.

12.10 Mitigation

Mitigation During Construction

12.10.1 As there are no predicted likely significant effects under the terms of the EIA regulations during the construction phase of the Proposed Development other than the committed good practice measures no specific mitigation is required

12.10.2 Monitoring has been proposed to confirm that there are no significant effects.

Mitigation During Operation

12.10.3 As there are no predicted likely significant effects under the terms of the EIA regulations during the operational phase of the Proposed Development other than the committed good practice measures no specific mitigation is required.

12.11 Residual Effects

12.11.1 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 12.10.**

Construction Residual Effects

12.11.2 Subject to adoption of best practice construction techniques no significant residual effects are predicted during the construction period of the Proposed Development.

Operational Residual Effects

12.11.3 No significant residual effects are predicted during the operational phase of the Proposed Development.

12.12 Conclusion

12.12.1 An assessment of the potential effects of the proposed development on soils, geology, hydrology, hydrogeology within a defined study area (comprising land within 500 m of the Site boundary) has been undertaken. The GWDTE assessment has considered a buffer of at least 250m from all elements of the Proposed Development.

12.12.2 The assessment has considered the construction and operational phases of the Proposed Development.

12.12.3 Much site investigation has been undertaken and informed the design of the Proposed Development. As a result areas of higher sensitivity, such as areas of deep peat, PWS sources, and watercourse crossings for example, have been avoided where technically feasible.

12.12.4 As a consequence of the embedded mitigation included in the site design and subject to the adoption of mitigation measures including good practice measures, no significant residual effects on soils (including peat), geological, surface water or groundwater receptors, including designated sites and PWS sources are predicted during the construction and operational phases of the Proposed Development.

12.12.5 Confirmatory monitoring is proposed to ensure the construction of the Proposed Development does not impair soils, geology or the water environment during construction.

12.12.6 During the operational phase the transfer of water between Loch Leamhain and Loch Earba will be regulated by SEPA and will include limits on the volume and rate of surface water abstraction and discharge to ensure there are no cumulative or in-combination effects associated with other operational pump storage schemes in the Loch Laggan catchment area. SEPA will also regulate compensation water releases from the Leamhain and Shios dams which will ensure there is derogation of habitat downstream of the dams.

12.12.7 Further the Reservoirs (Scotland) Act will ensure regular inspection and maintenance of the proposed dams.