9 Geology, Hydrology and Hydrogeological Assessment

9.1 Introduction

9.1.1 This chapter considers the likely significant effects of the Proposed Development on geology (including peat and soils) and the water environment (hydrology and hydrogeology). The assessment of potential impacts has been made on the basis of the Proposed Development layout as fully described in **Chapter 2**.

9.1.2 It outlines the embedded good practice methods which have been incorporated into the design and will be used during the construction and operation of the Proposed Development to prevent or reduce identified effects and risks. Further mitigation methods to address any potential effects are proposed, where appropriate, and residual effects are assessed.

9.1.3 The assessment has been undertaken by Katy Rainford (BSc (Hons), MCIWEM, FGS) and carried out under the supervision of Gordon Robb (BSc, MSc, MBA, C.WEM, FCIWEM), of SLR Consulting Ltd. He has more than 30 years' experience assessing wind farm in similar site settings. Further details of their experience is provided in **Chapter 1: Introduction**.

9.1.4 The chapter is supported by:

- Technical Appendix 9.1: Peat Landslide Hazard Risk Assessment (PLHRA);
- Technical Appendix 9.2: Peat Management Plan (PMP);
- Technical Appendix 9.3: Schedule of Watercourse Crossings; and
- Technical Appendix 9.4: Private Water Supply Risk Assessment (PWSRA).

9.1.5 Supporting **Figures 9.1 – 9.8** are referenced in the text where relevant.

9.1.6 The assessment uses information and findings presented in **Chapter 7: Ecology** to inform the assessment of potential effects on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTE) which are presented in this Chapter.

9.2 Legislation, Policy and Guidance

9.2.1 The aquatic environment in Scotland is afforded significant protection through key statutes and the regulatory activity of Scottish Environment Protection Agency (SEPA) and the local authorities. Relevant legislation and guidance documents have been reviewed and considered as part of this assessment.

Legislation

9.2.2 Relevant legislation includes:

- EU Water Framework Directive (2000/60/EC);
- EU Drinking Water Directive (98/83/EC);
- The Environment Act 1995;
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations (2017);
- Environmental Protection Act 1990;
- The Flood Risk Management (Scotland) Act 2009;
- The Water Environment and Water Services (Scotland) Act 2003 (WEWS);
- The Water Environment (Controlled Activities) (Scotland) Amendment Regulations, 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.

Planning Policy

9.2.3 National Planning Framework 4 (NPF4) provides planning guidance and polices regarding sustainable development, tackling climate change and achieving net zero. **Chapter 4: Approach to EIA** provides a detailed overview of the relevant planning policy. Policies relevant to this chapter include:

- Policy 2 (Climate Mitigation and Adaptation);
- Policy 4 (Natural Places);
- Policy 5 (Soils);
- Policy 11 (Energy);
- Policy 20 (Blue and Green Infrastructure); and
- Policy 22 (Flood Risk and Water Management).

9.2.4 In addition, Argyll and Bute Council (ABC)'s Local Development Plan 2 (LDP2) provides planning guidance on the type and location of the development that can take place in the region. The LDP presents development policies of which are relevant to this chapter:

- Policy 04: Sustainable Development;
- Policy 06: Green and Blue Infrastructure;
- Policy 30: The Sustainable Growth of Renewables;
- Policy 31: Minerals;
- Policy 55: Flooding;
- Policy 58: Private Water Supplies and Water Conservation;
- Policy 59: Water Quality and the Environment;
- Policy 61: Sustainable Drainage Systems (SUDS);
- Policy 73: Development Impact on Habitats, Species and Biodiversity;
- Policy 74: Development Impact on sites of International Importance;
- Policy 75: Development Impacts on Sites of Special Scientific Interest (SSSIs) and National Nature Reserves;
- Policy 79: Protection of Soil and Peat Resources; and
- Policy 80: Geodiversity.

Guidance

9.2.5 The following guidance is also applicable to the assessment.

9.2.6 Planning Advice Notes (PANs) are published by the Scottish Government. Applicable PANs include:

- PAN 50 Controlling the Environmental Effects of Surface Mineral Workings;
- PAN 61 Planning and Sustainable Urban Drainage Systems (SUDS); and
- Online Planning Advice on Flood Risk (which supersedes PAN 69).

9.2.7 SEPA and NetRegs Guidance for 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;
- GPP06 Working on Construction and Demolition Sites;

- GPP08 Safe Storage and Disposal of Used Oils;
- GPP13 Vehicle Washing and Cleaning;
- GPP21 Pollution Incident Response Planning; and
- GPP22 Dealing with Spills.

9.2.8 Construction Industry Research and Information Association (CIRIA) publications:

- C532 Control of Water Pollution from Construction Sites (2001);
- C648 Control of Water Pollution from Linear Construction Projects – Technical Guidance (2006);
- C741 Environmental Good Practice on Site (2015);
- C753 The SUDS Manual (2015); and
- R179 Ground Engineering Spoil: Good Management Practice (1997).

9.2.9 SEPA Publications[1]:

- Engineering in the Water Environment: Good Practice Guide – River Crossings (2010);
- Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010);
- Groundwater Protection Policy for Scotland, Version 3 (2009);
- Land Use Planning System SEPA Guidance Note 2a, Version 4 – Flood Risk (2018);
- Land Use Planning System SEPA Guidance Note 2e, Version 1 – Soils (2015);
- Land Use Planning System, SEPA Guidance Note 4, Version 9 – Onshore Windfarm Developments (2017);
- Land Use Planning System SEPA Guidance Note 31, Version 3 - GWDTE (2017);
- Position Statement – Culverting of Watercourses (2015); and
- Regulatory Position Statement – Developments on Peat (2010).

9.2.10 Other Guidance:

- Scottish Natural Heritage (now NatureScot), 2013, Constructed Tracks in Scottish Uplands, 2nd Edition;

[1] Several SEPA guidance documents are currently in the process of being reviewed following publication of NPF4.

- Scottish Government, 2017, Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition);
- Scottish Government, 2017, Guidance on Development on Peatland, Peatland Survey;
- A joint publication by Scottish Renewables, Scottish Natural Heritage (now NatureScot), Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland, 2019, Good Practice during Windfarm Construction, Version 4; and
- Scottish Renewables and SEPA, 2012, Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.

9.3 Consultation

9.3.1 Consultation for the Proposed Development was undertaken with statutory and non-statutory bodies as set out in **Chapter 4**.

9.3.2 The outcome of the relevant consultation with regards to geology (including peat) and the water environment is summarised in **Table 9.1**.

Table 9.1: Consultation Responses

Consultee	Summary of Key Issues	Where addressed in Chapter
Energy Consents Unit Scoping Response 28 November 2023	Scottish Water provided information on whether there is any drinking water protected areas or Scottish Water assets on which the development could have any significant effect. Scottish Ministers request that the company contacts Scottish Water (via EIA@scottishwater.co.uk) 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 Water have confirmed that they have no objection and the site is not located within a Drinking Water Protected Area. Therefore additional consultation has not been undertaken.
Energy Consents Unit Scoping Response 28 November 2023	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 provide an assessment of the potential impacts, risks and any mitigation which would be provided.	Potential impacts on private water supplies and proposed mitigation measures, as required, are discussed in **Technical Appendix 9.4 (PWSRA**) and summarised in this chapter.

Consultee	Summary of Key Issues	Where addressed in Chapter
Energy Consents Unit Scoping Response 28 November 2023	Scottish Ministers consider that where there is a demonstrable requirement for peat landslide hazard and 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 Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Second Edition) should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures. Where a PLHRA is not required, clear justification for not carrying out such a risk assessment is required.	Potential impacts on peat and proposed mitigation measures are summarised in this Chapter and discussed in full in **Technical Appendix 9.1 (PLHRA)** and **Technical Appendix 9.2 (PMP).**
SEPA Scoping Response 26 September 2023	To avoid delays and potential objection, the EIA submission must contain a scaled plan of sensitivities for example peat (depth and condition), GWDTE, proximity to watercourses, overlain with the proposed development. This is necessary to ensure the EIA process has informed the layout of the development to firstly avoid, and then reduce then mitigate significant impacts on the environment.	See **Figures 9.1 to 9.8** and **Technical Appendix 9.1 and Technical Appendix 9.2.** Potential impacts on GWDTE are also discussed in **Chapter 7: Ecology.**
SEPA Scoping Response 26 September 2023	In relation to SEPA's interest (fluvial flood risk) it is confirmed that a simple screening of potential flooding sources is acceptable if it is confirmed that any new watercourse crossings are designed to accommodate the 1 in 200 year event plus climate change and other infrastructure is located well away from watercourses.	It is confirmed that watercourse crossings will be sized to pass the 0.5% AEP plus an allowance for climate change and a 50m buffer has been applied to watercourses.
SEPA Scoping Response 26 September 2023	Drainage design (control of rate of surface water runoff) is not a matter SEPA comments on.	Noted.
SEPA Scoping Response 26 September 2023	The EIA should include adequate peat probing information to inform the site layout. As a minimum this should follow the requirements of the Peatland Survey – Guidance on Developments on Peatland (2017). The peatland condition assessment photographic guide lists the criteria for each condition category and illustrates how to identify each condition criteria. This should be used to identify peatland in near natural condition and can be helpful in identifying areas where peatland restoration could be carried out.	Potential impacts on peat and proposed mitigation measures are summarised in this Chapter and discussed in full in **Technical Appendix 9.1 (PLHRA) and Technical Appendix 9.2 (PMP)** and where the results of site-specific peat depth probing are presented. Peat condition is discussed

Consultee	Summary of Key Issues	Where addressed in Chapter
		in these appendices and in **Chapter 7**.
SEPA Scoping Response 26 September 2023	SEPA agree it is acceptable to not undertake any water quality sampling, establish groundwater monitoring points, surface water monitoring points or undertake leachability trials of any rock as published data can be used to characterise baseline conditions and complete the impact.	Noted.
SEPA Scoping Response 26 September 2023	Please refer to Guidance on Assessing the Impacts on Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for assessment on groundwater abstractions. If the minimum buffer cannot be achieved, a detailed site specific qualitative and/or quantitative risk assessment will be required. Surface water abstractions are not in relation to SEPA's interest.	Noted. Potential impacts on private water supplies are discussed in **Technical Appendix 9.4 (PWSRA)** and summarised in this chapter and required mitigation measures in this chapter. Potential impacts on GWDTE is discussed in this chapter and **Chapter 7**.
SEPA Scoping Response 26 September 2023	It will be required to demonstrate in relation to peat how the development has been developed through iterative process, in accordance with NPF4 policy. In this case, where much of the site is on peat, we expect the application to be supported by a comprehensive site specific peat management plan and habitat management plan.	A PMP is presented as **Technical Appendix 9.2** and an outline Biodiversity Enhancement Management Plan (BEMP)is presented as **Technical Appendix 7.6**.
NatureScot Scoping Response 28 September 2023	The Carbon and Peatland Map (2016) indicates that the open area to the east of the site boundary is underlain by Class 1 peatland and therefore could contain nationally important carbon-rich soils and priority peatland habitats which are likely to be of high conservation value. It appears as though this has been taken into account as part of the Scoping Layout, the majority of turbines look to be sited within currently wooded or recently felled wooded areas, with the exception of Turbine T3 which is located within Class 1 peatland.	An extract of Carbon and Peatland 2016 Map is presented as Figure 9.4. Potential impacts on peat and proposed mitigation measures are summarised in this Chapter and discussed in full in **Technical Appendix 9.1 (PLHRA)** and **Technical Appendix 9.2 (PMP)**.
NatureScot Scoping Response 28 September 2023	The EIA should take note of our recent revised guidance note on 'Carbon-rich soils and priority peatland habitats in development management'. This revised note now includes information on the mitigation hierarchy (including the level of	Noted. An outline BEMP is presented as **Technical Appendix 7.6**.

Consultee	Summary of Key Issues	Where addressed in Chapter
	offsetting we would expect) and enhancement as well as outlining what information we require from developers as part of the EIA Report. To help us assess when a proposal could have a significant effect on priority peatland of national interest, we request that the template (provided in Annex 1 of the guidance above) is provided alongside the EIA Report.	
Argyll District Salmon Fishery Board (ADSFB) Scoping Response 19 September 2023	The Argyll DSFB has a responsibility to conserve and improve stocks of migratory salmonid fish in the lower reaches of the Killean Burn, Tayinloan Burn, Clachaig Water and Carradale Water. These watercourses may also host resident brown trout populations and European eel upstream of obstacles to fish migration from the sea. We urge that all consideration is given to the maintenance of stream habitats and water quality within and downstream of the development site throughout the project's lifetime. We fully expect Scottish Government guidelines to be followed in terms of pre, during and post development monitoring of water quality, macroinvertebrates and fish.	Potential impacts on water quality and proposed mitigation measures are discussed in this chapter. The results of fisheries surveys are included as **Technical Appendix 7.4**.
Campbeltown Community Council Scoping Response 04 October 2023	A decrease in the tree cover could have an impact on the watercourses draining the area and subsequent surrounding land. That together with increasingly wet weather due to climate change may require more detailed checks on possible flooding.	Noted. The area of forest felling and a site-specific flood risk screening assessment is included within this chapter. Changes to potential future baseline conditions are also considered.
Scottish Water Scoping Response 12 September 2023	Scottish Water has no objection to this planning application, however, the applicant should be aware this does not confirm that the Proposed Development can currently be serviced. A review of our records indicates that there are no Scottish Water drinking water catchments or water abstraction sources which are designated as Drinking Water Protected Areas (DWPAs) under the Water Framework Directive (WFD) in the area that may be affected by the proposed activity.	Noted.
West Kintyre Community Council Scoping Response 05 October 2023	SEPA flood maps now and future (2085) have not in the opinion of the residents of Kintyre taken into account the enormous amount of windfarm development in the area and the subsequent amount of concrete foundations, tracks, felling that has taken place to accommodate these developments resulting in their minds significant risk of both Clachaig and Killean watercourses to	Noted. A site-specific flood risk screening assessment is included within this chapter. Potential changes to future baseline conditions and

Consultee	Summary of Key Issues	Where addressed in Chapter
	flood. We believe a specific to the area SEPA flood risk survey should now take place.	potential cumulative effects are considered in this Chapter.

9.4 Methodology

Scope of Assessment

9.4.1 The scope of the assessment has been determined through a combination of professional judgement, reference to relevant policy, standards and guidance documents and consultation with stakeholders.

9.4.2 On the basis of the desk based and survey work undertaken, policy, guidance and standards, the professional judgement of the Environmental Impact Assessment (EIA) team, feedback from consultees and experience from other relevant projects, the following topics have been scoped out of the assessment:

- Detailed flood risk and drainage impact assessment. Published mapping confirms the site is not located in an area identified as being at flood risk. A simple screening of potential flooding sources (fluvial, coastal, groundwater, infrastructure etc.) is presented in the EIA Report (see Section 9.5) and measures that will be used to control the rate and quality of runoff will be specified in the Construction and Environmental Management Plan (CEMP) which will be agreed with ABC prior to construction commencing;
- Water quality monitoring. As the assessment is informed by classification data obtained from SEPA which shows that there are no known sources of potential water pollution, no additional water quality monitoring is considered necessary to complete the assessment. Note that water quality monitoring is proposed prior to, during and post construction if the Proposed Development were to be granted consent. Details of monitoring suites, locations, frequencies and reporting will be specified in the Construction Environmental Management Plan (CEMP);
- Potential effects on geology. With the exception of peat, there are no protected geological features within the application boundary or study area. Furthermore, the nature of the activities during construction,

operation and decommissioning of the Proposed Development will not alter regional superficial or solid geology. Potential effects on peat and carbon rich soils are not scoped out of the assessment and are considered in full; and

- Potential effect on the water environment due to forestry felling. Details of forestry felling for the construction of the Proposed Development are given in **Technical Appendix 2.3: Forestry Report**. **Table 9.2** compares the proposed felling areas to the surface water catchments in which the felling will occur.

Table 9.2: Forestry Felling and Water Catchment Areas

Catchment	Total Water Catchment Area (ha)	Forestry Felling Area (ha)	Percentage of Catchment (%)
Killean Burn	765	35.25	4.61
Clachaig Water	5,953	0.66	0.01
Carradale Water	1,481	4.94	0.33

9.4.3 **Table 9.2** shows that the felling which is required to establish the Proposed Development is very small in extent when compared to the overall surface water catchment areas (less than 5% of the total catchment area).

9.4.4 The area of felling is well below forest best practice felling guidance thresholds (20% of total catchment area where effects might be considered discernible) and therefore no impact on water quality or rainfall-runoff response including flood risk, is anticipated.

Baseline Characterisation

Study Area

9.4.5 The study area is shown on **Figures 9.1 to 9.8** and includes all the proposed site infrastructure and a 500m buffer to the site boundary. Beyond this distance, any effect is considered to be so diminished as to be undetectable and therefore not significant.

9.4.6 The study area for potential cumulative effects uses the catchments in the study area and extends to 5km from the Proposed Development.

Desk Study / Field Survey

9.4.7 There is much existing information that can be used to characterise the site and its setting as a result of a previous studies and assessments

completed in support of a previous wind farm application at the site. This information has been reviewed, and updated, as part of this application so that a contemporary assessment is prepared and presented.

9.4.8 An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information on soils, geology, hydrology and hydrogeology.

9.4.9 The following sources of information have been consulted in order to characterise the baseline conditions:

- previous assessments and planning applications at the site[2];
- Ordnance Survey (OS) 1:50,000 and 1:25,000 scale mapping;
- UK Centre for Ecology and Hydrology, Flood Estimation Handbook (FEH) webservice[3];
- NatureScot SiteLink[4];
- James Hutton Institute, National Soil Map of Scotland (1:250,000 scale)[5];
- James Hutton Institute, Carbon and Peatland 2016 data[6];
- British Geological Survey (BGS) Onshore Geoindex[7];
- BGS Hydrogeological Maps of Scotland (1:100,000 scale)[8];
- SEPA rainfall data[9];
- SEPA flood maps[10];
- SEPA reservoir inundation map[11];

[2] Killean Wind Farm, Volume 2: Environmental Statement, Chapter 8: Geology, Hydrology and Hydrogeology RES, 2016
[3] UK Centre for Ecology and Hydrology, Flood Estimate Handbook (FEH) Webservice, available online at https://fehweb.ceh.ac.uk/ [Accessed April 2024]
[4] NatureScot, Site Link, available online at https://sitelink.nature.scot/home [Accessed April 2024]
[5] James Hutton Institute, National Soil Map of Scotland, available online at https://soils.environment.gov.scot/ [Accessed April 2024]
[6] James Hutton Institute, Carbon and Peatland 2016 Map, available online at https://soils.environment.gov.scot/ [Accessed April 2024]
[7] British Geological Survey, Onshore Geoindex, available online https://mapapps2.bgs.ac.uk/geoindex/home.html [Accessed April 2024]
[8] British Geological Survey, Hydrogeological maps of Scotland, available online at https://www.bgs.ac.uk/datasets/hydrogeological-maps-of-scotland/ [Accessed April 2024]
[9] Scottish Environment Protection Agency, Rainfall data for Scotland, available online at https://www2.sepa.org.uk/rainfall/ [Accessed April 2024]
[10] Scottish Environment Protection Agency, Flood Maps, available online at https://beta.sepa.scot/flooding/flood-maps/ [Accessed April 2024]
[11] Scottish Environmental Protection Agency, Reservoir Maps, available online at https://map.sepa.org.uk/reservoirsfloodmap/Map.htm [Accessed April 2024]

- SEPA environmental data[12];
- Data requests with SEPA regarding details of registered / licenced abstractions and discharges (November 2023); and
- Data requests with ABC regarding details of historical flooding records and private water abstractions (November 2023).

9.4.10 The project hydrologists, peat specialists, 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.

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

- February 2024 to conduct peat and soil depth probing and characterisation exercise and watercourse crossing survey;
- March 2024 to complete additional watercourse crossing survey and private water supply survey; and
- May 2024 to undertake additional peat depth and condition surveys.

9.4.12 The field work has been undertaken in order to:

- verify the information collected during the desk and baseline study;
- undertake a visual impact 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 potential watercourse crossings and prepare a schedule of potential watercourse crossings;
- inspect rock exposures and establish by probing, an estimate of overburden thickness, peat depth and stability;
- assess the condition of the peat, artificial and natural drainage patterns within the peat, assess for evidence of historic peat landslides and to undertake geomorphological mapping;
- confirm underlying substrate, based on the type of refusal of a peat probe and by coring; and

[12] Scottish Environmental Protection Agency, Environmental Data, available at https://www.sepa.org.uk/environment/environmental-data/ [Accessed April 2024]

- 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.

9.4.13 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.

9.4.14 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 recommended mitigation measures where appropriate.

Assessment Methods

9.4.15 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 change, should that effect occur.

9.4.16 The assessment methodology has also been informed by experience of carrying out such assessments for a range of wind farm and other developments, knowledge of the geology and water environment characteristics in Scotland and cognisance of good practice.

9.4.17 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, such as detailed in the site-specific habitat management plan, peat management plan and peat landslide hazard risk assessment.

9.4.18 The criteria for determining the significance of effect are provided in **Table 9.3, Table 9.4 and Table 9.5**.

Sensitivity Criteria

9.4.19 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment) is defined by 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 as set out in **Table 9.3**. Receptors in the receiving environment only need to meet one

of the defined criteria to be categorised at the associated level of sensitivity.

Table 9.3: Criteria for Assessing Sensitivity of Receptor

Sensitivity	Definition
High	• soil type and associated land use is highly sensitive (e.g. unmodified blanket bog or peatland); • SEPA WFD 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 site; • 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 (DWPA); • groundwater vulnerability is classified as high; and • if a GWDTE is present and identified as being of high sensitivity.
Moderate	• soil type and associated land use is moderately sensitive (e.g. arable, commercial forestry); • SEPA Water Framework Directive Water Body Classification Poor to Moderate; and • moderate classification of groundwater aquifer vulnerability.
Low	• 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); • SEPA Water Framework Directive Water Body Classification Poor or Bad; • receptor is at not at risk of flooding in the future (2080); and • receptor is not used for water supplies (public or private).
Negligible	• receptor would not be affected by the Proposed Development, e.g., lies within a different and unconnected hydrological / hydrogeological catchment.

Magnitude of Impact

9.4.20 The potential magnitude of impact would depend upon whether the potential effect would cause a fundamental, 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.

9.4.21 The criteria that have been used to assess the magnitude of impact are defined in **Table 9.4**. The characteristics of the impacts are described as: direct/indirect, temporary (reversible) or permanent (irreversible), together with timescales (short, medium, and long term).

Table 9.4: Criteria for Assessing Magnitude of Impact

Magnitude of Impact	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 soils habitat (inc. peat) and geology; • 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
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material and short to medium term changes to baseline geology, hydrology, hydrogeology and water quality, such as: • loss of extensive areas of soils and peat habitat, damage to important geological structures/features; • some 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 and peat 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	No perceptible changes to the baseline geology, hydrology, hydrogeology and water quality such as:

Magnitude of Impact	Criteria	Definition
	magnitude to affect the use/integrity	• no impact or alteration to existing important soils (inc. peat) 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 • no alteration to groundwater recharge or flow mechanisms.

Significance Criteria

9.4.22 The sensitivity of the receptor together with the magnitude of impact determines the significance of the effect, which can be categorised into a level of significance as identified in **Table 9.5**.

9.4.23 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 9.5: Significance of Effect

Magnitude of Impact	Sensitivity of Receptor			
	High	Moderate	Low	Negligible
Major	Major	Major	Moderate	Negligible
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

9.4.24 Effects of 'major' or 'moderate' significance, as outlined in **Table 9.5**, are considered to be 'significant' in terms of the EIA Regulations.

Cumulative Effects

9.4.25 The assessment also considers potential cumulative effects associated with other material developments within 5km of the nearest element of the Proposed Development and in the same surface water catchments as the Proposed Development. A cumulative effect is considered to be the effect on a hydrological, hydrogeological or geological receptor arising from the site in combination with other developments which are likely to affect soils or geology, surface water and groundwater.

Mitigation

9.4.26 Any potential effects of the Proposed Development on geology or the water environment identified by the assessment have been addressed and mitigated by the design and the application of good practice guidance to be implemented as standard during construction and operation to prevent, reduce or offset effects where possible. As such a number of measures would form an integral part of the construction process and these have been taken into account prior to assessing the likely effects of the Proposed Development (embedded mitigation). Where appropriate, tailored mitigation measures have been identified prior to determining the likely significance of residual effects.

9.4.27 Good practice measures would be applied in relation to pollution risk, sediment management, peat management and management of surface runoff rates and volumes. This would form part of the CEMP to be implemented for the Proposed Development which would be secured by a planning condition and would be prepared prior to construction commencing.

9.4.28 The final CEMP would include details and responsibilities for environmental management onsite for environmental aspects and would outline the necessary surface water management, oil and chemical delivery and storage requirements, waste management, traffic and transport management and would specify monitoring requirements for wastewater, water supply and all appropriate method statements and risk assessments for the construction of the Proposed Development.

9.4.29 A draft outline Biodiversity Enhancement Management Plan (BEMP) is included in **Technical Appendix 7.6**. The BEMP will deliver benefits to the peatland habitats. It will include enhancement of 17.6 ha. of peatland. This will ensure that habitat losses are offset through an increase in peatland habitat quality and that there will be an overall net gain.

Residual Effects

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

Assumptions, Limitations and Confidence

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

9.4.32 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.

9.5 Baseline

Site Setting

9.5.1 The site is located approximately 2km east of Tayinloan, on the Kintyre Peninsula, centred on Grid Reference E 172624 / N 644941. The site is currently used as commercial forestry plantation and open rough grazing for livestock. See **Figure 9.1**.

9.5.2 Ground elevations vary between 320m Above Ordnance Datum (AOD) within the eastern extent of the site to approximately 10m AOD near the A83 in the west. Elevations generally decrease westwards towards the Sound of Gigha.

9.5.3 SEPA provided precipitation data for the Dippen rain gauge (station number 133077) which is located approximately 8km south-east of the site. In 2023, an annual rainfall of 1,662mm was recorded.

Water Dependent and Statutory Designated Sites

9.5.4 A review of NatureScot SiteLink webpage confirms that there are no statutory designated sites located within the site or within the study area.

9.5.5 Sound of Gigha to the west of the site forms part of the Sound of Gigha Special Protected Area (SPA). The SPA has been designated for non-breeding habitats for several species of birds. The sound and SPA lie beyond the study area and whilst much of the site drains to the Sound of Gigha it will afford significant dilution such that any potential effects would not be discernible. It is not, therefore, considered further in this assessment.

Soils and Geology

Soils

9.5.6 An extract of the National Soil Map of Scotland (1:250,000 scale) is presented as **Figure 9.2**. The principal soil type underlying the site comprises peaty gleys. Small areas of brown earths, mineral gleys and humus-iron podzols are also recorded, particularly within the western extent of the site.

Superficial Geology (including Peat)

9.5.7 BGS mapping (see **Figure 9.3**) indicates that the majority of the site is shown to be absent of any superficial deposits. Superficial deposits, where recorded, generally comprise of glacial till. The western boundary of the site, near the A83 is shown to be underlain by raised marine deposits (comprising sand and gravel). No peat deposits are noted on the superficial mapping.

9.5.8 Peatland classification data published by Scottish Natural Heritage (now NatureScot) is shown on **Figure 9.4**. This shows that eastern extent and parts of the southern boundary of the site is underlain by Class 1 and Class 2 peatlands which are considered nationally important carbon-rich soils, areas of deep peat and priority peatland habitats.

9.5.9 The majority of the Proposed Development is underlain by Class 5 peatlands which is not considered priority peatland and no peatland habitats are recorded, however soils may remain carbon-rich with areas of deep peat.

9.5.10 A small area of Class 3 peatland (defined as where occasional peatland habitats are recorded and soils may remain carbon-rich with areas of deep peat, although not considered an area of priority peatland) is noted on the western site boundary whilst an area south of Braids is underlain by Class 0 (mineral soils where peatland habitats are not typically found).

9.5.11 As part of the previous wind farm application on this site, much peat depth data had been collected. This data has been verified on site as part of this assessment and additional peat depth probing and condition assessment has been undertaken. This combined dataset informs the PLHRA and PMP (**Technical Appendix 9.1 and 9.2**). In summary:

- a total of 4,760 peat probes were undertaken across all survey phases;
- all elements of the proposed site infrastructure have benefited from peat probing;

- a programme of peat augering has also been undertaken to assess the characteristics of the peat at the site;
- 80% of all peat probes recorded a peat depth of less than 1m (approximately 60% recorded a depth of less than 0.5m); and
- where encountered, most of the peat is classified as between H3 and H6, using the Von Post classification, showing insignificant to moderate decomposition.

Bedrock Geology

9.5.12 An extract of the regional BGS bedrock geological mapping is presented as **Figure 9.5**, which shows that the site is underlain by several metamorphic bedrock units comprising psammites, pelites, semipelites, metalimestones and metavolcaniclasic rocks.

9.5.13 Several igneous intrusions of the North Britain Palaeogene Dyke Suite (olivine microgabbro) and Neoproterozoic Basic Minor Intrusion Suite (amphibolite and hornblende schist) are also recorded beneath the site.

Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

9.5.14 Extracts of the BGS 1:625,000 scale Hydrogeological Map of Scotland and 1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets are presented in **Figure 9.6** and **Figure 9.7** respectively.

9.5.15 **Figure 9.6** confirms that the Proposed Development is underlain by rocks classified as a low productivity aquifer whereby small amounts of groundwater are expected in near surface weathered zones and secondary fractures.

With reference to **Figure 9.7** a description and hydrogeological classification of the geological units at the site are presented in **Table 9.6**.

Table 9.6: Hydrogeological Classification of Geological Units

Period	Geological Unit	Means of Implementation	Hydrogeological Classification
Pleistocene to Recent	Glacial till	Sand and gravel horizons within this unit are capable of storing groundwater, although their lateral and vertical extent realises a variable and often small groundwater yield.	Intergranular Flow - Not a Significant Aquifer

Period	Geological Unit	Means of Implementation	Hydrogeological Classification
		Clay within this unit acts as an aquitard to the more permeable sand and gravel lenses and will hinder/prevent large scale groundwater movement. Regionally, groundwater flow will be limited by the variability of these deposits and consequently any groundwater yields are normally low.	
	Raised marine deposits	Cobble and gravel horizons within this unit can store groundwater and permit groundwater movement. Their limited extent can hinder their ability to provide reliable groundwater yields.	Intergranular Flow - Low to Moderate Productivity
Neoproterozoic	• Ben Lui Schist Formation (semipelite) • Loch Tay Limestone Formation (metalimestones) • Glen Sluan Schist Formation (psammite and semipelite) • Green Beds Formation (metavolcaniclastic rocks) • Beinn Bheula Schist Formation (psammite and pelites) • Igneous intrusions	Generally, without groundwater except at shallow depths in near surface weathered zones and secondary fractures.	Fracture Flow – Low or Very Low Productivity

9.5.16 Groundwater vulnerability is divided into five classes (1 to 5) with 1 being the least vulnerable and 5 being the most vulnerable. Review of **Figure 9.7** shows that the potential groundwater vulnerability in the uppermost aquifer, and with respect to the Proposed Development, has been ascribed a vulnerability of Class of 4 and 5 and reflects the shallow depth to the weathered bedrock surface and thin or absent superficial geology cover.

Groundwater Levels and Quality

9.5.17 Groundwater recharge at, and surrounding, the site will be limited by the following factors:

- steeper topographic gradients will result in rainfall forming surface water runoff;

- the till deposits inhibit infiltration owing to their generally low bulk permeability; and
- the underlying bedrock displays a low permeability that inhibits groundwater recharge.

9.5.18 SEPA have confirmed that no groundwater level monitoring is undertaken within the study area. In the absence of published information or data held by SEPA, it is anticipated that limited 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.

9.5.19 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.

9.5.20 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 study area is underlain by the Oban and Kintyre bedrock groundwater body (SEPA ID: 150698), which was classified in 2022 (the latest reporting cycle) as having a Good overall status with no pressures identified.

Groundwater Dependent Terrestrial Ecosystems (GWDTE)

9.5.21 A National Vegetation Classification (NVC) habitat mapping exercise was conducted as part of the ecology baseline assessment, and this has been used to identify potential areas of GWDTEs within the study area. The methodology and results of the NVC habitat mapping exercise is discussed in detail within **Chapter 7**. With reference to SEPA LUPS-31 guidance, areas of potential GWDTE are shown on **Figure 9.8**.

9.5.22 The location of potential GWDTE and their likely dependency on groundwater is discussed in **Table 9.7**.

Table 9.7: Groundwater Dependent Terrestrial Ecosystems

NVC Community	GWDTE Potential	Location and Discussion
M15	Moderate	M15 dominate polygons are located across the site, generally on sloped ground near watercourses and lochs and on the slopes of Cruach a'Bhodaidh, across a range of elevations and underlain by various geologies. The habitat is not rare and is presented across large areas of

NVC Community	GWDTE Potential	Location and Discussion
		Scotland. This distribution is typical of that sustained by surface water rather than emergent groundwater.
M23	High	M23 dominate polygons are shown along banks of the watercourses and forest rides within the site and across larger sloped areas within the eastern extent of the site. The habitat is noted across a range of elevations and underlain by various geologies. This distribution is not typical of emergent groundwater and therefore considered to be sustained by rainfall, water logging of soils and surface water runoff.
M25	Moderate	M25 dominate polygon within the site is located within the eastern extent of the site in the upper reaches of the Carradale Water catchment. The polygon is noted on sloped ground adjacent to watercourses where visible smaller channels are noted. This distribution is typical of that sustained by surface water rather than emergent groundwater.
M29	High	M29 dominate polygon is located within the eastern extent of the site in the upper reaches of the Carradale Water catchment. M29 is characteristic of pools within peat and peaty soils. The low permeability of the peat and peaty soils will allow local water logging of soils in response to rainfall rather than being sustained by emergent groundwater. In addition, no development is proposed within 250m of this habitat.
M6	High	M6 dominant polygons largely coincide with watercourse channels or noted immediately adjacent to watercourses. It is therefore considered that these habitats are sustained by surface water, runoff and waterlogging of soils rather than by groundwater.
MG10	Moderate	MG10 dominant polygons are noted within the western extent of the site. The habitat is largely underlain by low permeability glacial till deposits which will facilitate local water logging of soils in response to rainfall and are not therefore sustained by groundwater.
W7	High	W7 dominant polygons are noted within the western extent of the site within the valley of the Killean Burn and some minor tributaries of the burn. It is therefore considered that these habitats are sustained by surface water, runoff and waterlogging of soils rather than by groundwater.

9.5.23 Review of **Table 9.7** shows that the potential high and moderate GWDTE are generally located on sloped ground adjacent to watercourses or within forest rides across the site. This distribution is not typical of a habitat sustained by groundwater but rather it is likely supported by rainfall, surface water runoff and water logging of soils.

9.5.24 Buffers to areas of potential GWDTE specified in SEPA guidance therefore do not apply, but safeguards to maintain these habitats, and the surface water sources to these habitats will need to be maintained during construction and operation of the Proposed Development, details of which are included in Section 9.6.

Hydrology

Local Hydrology

9.5.25 The local hydrology is shown on **Figure 9.1**. The majority of the site is drained by the Killean Burn which is located within the western extent of the site and flows westwards into the Sound of Gigha approximately 700m west of the site. Several tributaries of the Killean Burn rise within the site.

9.5.26 The remainder of the site is drained by the following three catchments:

- The northern extent of the site is located within the Tayinloan Burn surface water catchment. The Tayinloan Burn is located along the northern boundary of the site and also flows generally westwards towards the Sound of Gigha. No development is proposed within the Tayinloan Burn surface water catchment.
- The eastern extent of the site is located within the surface water catchment of the Carradale Water, tributaries of which rise within the eastern extent of the site. The Carradale Water flows generally south-eastwards before discharging into Carradale Bay approximately 9km south-east of the site. The catchment has been designated as a DWPA. No new development is proposed in this catchment but it is proposed to utilise an existing access track within the catchment to provide access to / from the Proposed Development.
- Part of the southern extent of the site is located within upper reaches of the Clachaig Water surface water catchment. The Clachaig Water flows generally south-westwards to the south of the site. Turbines T6 and T7 are located in the headwaters of this catchment.

9.5.27 Only a very small extent of the Proposed Development is located within the Carradale Water and Clachaig Water catchments (an area of approximately 0.01% and 0.07% of the total catchment area respectively).

Surface Water Quality

9.5.28 SEPA classifies larger watercourses within the study area as part of its responsibility under the WFD. A summary of the SEPA classifications

reported in 2022 (latest reporting cycle) is shown in **Table 9.8**. It is shown that the watercourses have an overall classification of Good.

Table 9.8: Surface Water Quality

Watercourse (SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical	Hydromorphology	Pressures
Clachaig Water (10240)	Good	Good	High	Good	None
Carradale / Narachan Burn (10241)	Good	Good	High	Good	None
Sound of Gigha (200305)	Good	Good	High	High	None

9.5.29 Smaller watercourses within the site are not monitored nor classified by SEPA.

Fisheries

9.5.30 Fisheries within the area are managed by the Argyll Fisheries Trust (AFT) in partnership with the Argyll District Salmon Fishery Board (ADSFB). Fishery interests are discussed and assessed within **Chapter 7**.

Watercourse Crossings

9.5.31 The Proposed Development has sought to utilise existing tracks and access routes where possible. As a result there are only two new crossings proposed. There are 14 existing crossings associated with existing tracks which are proposed to be upgraded as part of the Proposed Development.

9.5.32 The locations of the proposed crossings are shown on **Figure 9.1** and schedule of these crossing points, which includes photographs and dimensions of each crossing is shown in **Technical Appendix 9.3**.

Flood Risk

9.5.33 SEPA has developed national flood maps that present modelled flood extents for river, coastal, surface water and groundwater flooding. The river, coastal, surface water and groundwater maps were developed using a consistent methodology to produce outputs for the whole of Scotland, supplemented with more detailed, local assessments where available and suitable for use.

9.5.34 Flood extents are presented in three likelihoods:

- high likelihood: A flood event is likely to occur in the defined area on average more than once in every ten years (1:10). Or a 10% chance of happening in any one year;
- medium likelihood: A flood event is likely to occur in the defined area on average more than once in every two hundred years (1:200). Or a 0.5% chance of happening in any one year; and
- low likelihood: A flood event is likely to occur in the defined area on average more than once in every thousand years (1:1,000). Or a 0.1% chance of happening in any one year.

9.5.35 SEPA have also produced reservoir inundation maps for those sites currently regulated under the Reservoir Act 1975.

9.5.36 A summary of the potential sources of flooding and a review of the potential risks posed by each source is presented in **Table 9.9**.

Table 9.9: Flood Risk Screening

Potential Source	Potential Risk to site	Justification
Coastal Flooding	No	SEPA flood maps show that coastal flooding associated with the Sound of Gigha does not extend to the site. The nearest area denoted to be at risk of coastal flooding is shown 300m west of the proposed site entrance. The site is not at risk from coastal flooding.
Fluvial Flooding	Yes (minor)	SEPA mapping shows a low to high risk of fluvial flooding along the banks of the Killean Burn and larger lochs within the site. The mapped floodplain extents are limited, never extending far from the waterbodies or watercourses. The majority of the site is not shown to be at risk from fluvial flooding, however it is noted that the SEPA flood maps are unlikely to show flooding associated with the smaller watercourses within the site. In these instances, floodplains are likely to be limited and confined to the watercourse corridors. With the exception of watercourse crossings, no development is proposed within 50m of the watercourses and waterbodies. It is therefore considered that the site is not at risk from fluvial flooding.
Surface Water Flooding	Yes (minor)	SEPA have identified several areas of surface water flood risk across in the site, which coincides with watercourse corridors. Flood extents are shown to be small, never forming large, linked areas or flow paths. Therefore, surface water is not considered a development constraint.
Groundwater Flooding	No	Review of the SEPA groundwater flood map confirms that the study area is not at risk from groundwater flooding. This concurs with the desk-based assessment whereby limited groundwater is expected.
Flooding due to dam or reservoir failure	No	SEPA has produced reservoir inundation maps for site currently registered under Reservoirs Act 1975. Review of these maps indicates that there are no breach scenarios noted within the

Potential Source	Potential Risk to site	Justification
		study area. Flooding from this source is not considered further.
Flood Defence Breach	No	SEPA indicate there are no Flood Protection Schemes or formal flood defences within the study area.
Flooding from Artificial Drainage Systems	No	The Proposed Development is located within a remote area and no significant drainage systems are present near the Proposed Development.
Historical Flooding	No	ABC have confirmed that they hold no records of historic flood events in the area.

9.5.37 SEPA also publish potential flood extents (2080s) which account for the potential uplift in rainfall depths and intensities as a consequence of climate change. An extract of this mapping is shown on **Figure 9.1** and confirms that no element of the Proposed Development, except for part of an existing track, is located within the predicted floodplain extents.

9.5.38 As reported in the previous application it is understood that there have been recorded instances of flooding occurring on the A83 at Killean.

Private Water Supplies and Licenced Sites

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

9.5.40 SEPA have provided information of Controlled Activity Regulation (CAR) authorisations. Ten authorisations are recorded, the details of which are as follows:

- eight discharges for private sewage;
- one discharge for an existing sewage treatment system (PSTS); and
- one abstraction and impoundment authorisation for the Killean Estate Hydro Project.

9.5.41 The abstraction for the Killean Estate is located from the Killean Burn, downstream of the site, approximately 35m south of the existing access track. The licenced abstraction is therefore considered further in this assessment.

9.5.42 A data request was made to ABC who 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.

9.5.43 The risk that the Proposed Development poses to PWS has been considered as part of this assessment and is presented in **Technical Appendix 9.4**. It confirms that:

- no confirmed PWS sources are potentially at risk from the Proposed Development;
- the distribution pipework associated with one PWS is potentially at risk from the Proposed Development;
- two properties are confirmed to be on mains; and
- the water supply to three properties, including the properties within Killean Estate, have not been confirmed, however, water supplies to these properties, if present, are not considered to be at risk from the Proposed Development as they are hydraulically remote from the Proposed Development.

9.5.44 As no PWS sources have been identified to be at risk from the Proposed Development, potential risks to private water sources are not considered further within this assessment. Required mitigation, to safeguard the distribution pipework to one property and an outline monitoring protocol is outlined within **Technical Appendix 9.4**.

Summary of Sensitive Receptors

9.5.45 **Table 9.10** confirms the receptors identified in the baseline study and field investigation programme, and their sensitivity based upon the criteria contained in **Table 9.3**. These receptors form the basis of the assessment and are used in conjunction with an estimate of the magnitude of effect to determine the significance of any potential effect.

Table 9.10: Summary of Identified Receptors

Receptor	Sensitivity	Reasons for Sensitivity
Water Dependent or Statutory Designated Sites	Negligible	Whilst Sound of Gigha SPA is located downstream of the site, it is located outside of the study area and significant dilution is afforded by the loch such that no effects on the sound and SPA would be discernible.
Peat and Carbon Rich Soils	High	Presence of peat and carbon rich soils have been confirmed by site investigation. These are important carbon stores and need to be safeguarded.
Superficial and Bedrock Geology	Negligible	Deposits have been shown to be common regionally and have no rarity value. No geological designated sites are recorded in the study area.

Receptor	Sensitivity	Reasons for Sensitivity
Groundwater	High	Groundwater has been classified by SEPA as Good and vulnerability is classified as Class 4 and 5.
GWDTE	High	Areas of potential GWDTE have been identified by NVC mapping. It has been shown that the habitats within 250m of the Proposed Development are not sustained by groundwater but by surface water. Measures will be required to sustain existing surface water flow paths to these habitats.
Surface Water	High	Watercourses within the study area have been classified by SEPA as Good. The Carradale Water surface water catchment has also been designated as a DWPA.
Flooding	Moderate	No or very little flood risk (limited to discrete areas of surface water flooding and fluvial flooding along the banks of Killean Burn) has been identified on-site, but the development has potential to alter surface water flow paths and increase flood risk. There are anecdotal reports of previous flooding on the A83 at Killean downstream of the site.
Drinking Water Protected Areas	High	It has been confirmed that a very small extent of the Proposed Development lies within the Carradale Water surface water catchment which has been designated as a DWPA.
Private Water Supplies	Negligible	No private water supplies are considered at risk from the Proposed Development.
Licenced Sites	High	One licenced water abstraction is noted within the study area and abstracts water from the Killean Burn which is hydraulically connected to the Proposed Development.

Future Baseline

9.5.46 Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside higher average temperatures. This is likely to increase pressures on water supplies and lower water levels in summer months in the future.

9.5.47 Additionally, summer storms are also predicted to be of greater intensity. Peak fluvial and surface water flows associated with more extreme summer storm events and wetter winters will increase the volume and velocity of runoff and sea level rise is anticipated.

9.5.48 These potential changes are considered in the assessment of effects.

9.6 Assessment of Potential Effects

9.6.1 The assessment of effects is based on the Proposed Development description outlined in **Chapter 2** and is structured as follows:

- details of embedded mitigation included in the development design and good practice methods which will be adopted;
- construction effects of the Proposed Development;
- operational effects of the Proposed Development; and
- decommissioning effects of the Proposed Development.

9.6.2 The effects have been identified with reference to relevant guidance, through consultation and project team discussions, through targeted research on hydrological and water quality effects and by considering the information provided by the project engineers on infrastructure and construction methods.

Embedded Mitigation

Design Iterations

9.6.3 The Proposed Development has undergone extensive design iterations and evolution in response to the constraints identified as part of the baseline studies and field studies so as to avoid and/or minimise potential effects on receptors where possible, as outlined in **Chapter 3: Design Evolution and Alternatives**. This has included areas of peat and carbon rich soils, geological, hydrological, and hydrogeological constraints which include slope stability, watercourse locations, areas of potential flooding, and GWDTEs. Details of the embedded mitigation are given below.

Peat Occurrence and Avoidance

9.6.4 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, typically the design has avoided areas of deeper peat (>1 m) and where possible limited development to areas of peat less than 1 m or where peat is absent.

Buffer to Watercourses

9.6.5 In accordance with wind farm construction best practice guidelines and SEPA consultation advice, a 50m buffer has been applied to watercourses (as shown on OS 1:25:000 mapping) where technically feasible.

9.6.6 The design has strived to minimise the number of locations where infrastructure does encroach within the buffer. The layout of the access tracks was also designed to minimise the requirement for additional watercourse crossings and existing crossings and tracks have been used where technically feasible.

9.6.7 The majority of the Proposed Development is located outside of this buffer (see **Figure 9.1**) with the exceptions of parts of the existing access track which are scheduled to be upgraded as part of the development.

Groundwater Dependant Habitats

9.6.8 SEPA's wind farm planning guidance states a NVC survey should be undertaken to identify wetland areas that might be dependent on groundwater. If potential GWDTE are identified within (a) 100 m of roads, tracks, and trenches, or (b) within 250 m of borrow pits and foundations, then it is necessary to assess how the potential GWDTE may be affected by the Proposed Development.

9.6.9 It has been shown that areas identified as potentially highly or moderately groundwater dependent within the site are likely to be sustained by incident rainfall and local surface water runoff rather than groundwater.

9.6.10 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 water dependent habitats identified by the NVC mapping can be sustained. This will be confirmed, in accordance with good practice, by the Ecological / Environmental Clerk of Works (ECoW) at the time of the construction who will ensure existing surface water flow paths and water flushes are maintained.

Good Practice Methods

9.6.11 Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes. These will form part of the final CEMP.

9.6.12 Key good practice measures are stated below. In undertaking the assessment of potential effects from the Proposed Development, good practice measures are assumed to be embedded mitigation. As

appropriate, these mitigation measures will be outlined within the CEMP or by an appropriately worded condition post determination, as required.

9.6.13 Any further specific mitigation which may be required to reduce the significance of a potential effect is identified in the assessment of likely effects during the construction, operation, and decommissioning phases.

General Measures

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

9.6.15 Prior to construction, a site-specific drainage plan will be produced. This will consider any existing local drainage which may not be mapped and incorporate any site-specific mitigation measures identified during the assessment.

9.6.16 Measures will be included in the final CEMP for dealing with pollution/sedimentation/flood risk incidents and will be developed prior to construction. This will be adhered to should any incident occur, reducing the effect as far as practicable.

9.6.17 The final CEMP will contain details on the location of spill kits, will identify 'hotspots' where pollution may be more likely to originate from; provide details to site personnel on how to identify the source of any spill; and state procedures to be adopted in the case of a spill event. A specialist spill response contractor will be identified to deal with any major environment incidents.

9.6.18 A wet weather protocol will be developed. This will detail the procedures to be adopted by all staff during periods of heavy rainfall. Tool box talks will be given to engineering /construction /supervising personnel.

9.6.19 Roles will be assigned to site staff and the inspection and maintenance regimes of sediment and runoff control measures will be adopted during these periods. In extreme cases, this protocol will dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow.

Ecological / Environmental Clerk of Works

9.6.20 To ensure all reasonable precautions are taken to avoid negative effects on the water environment, a suitably qualified 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 on-site 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.

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

Safeguarding of Carbon-rich Soils and Peat

9.6.22 The peat depth probing data has been used 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 **Technical Appendix 9.2**) which details the volume of acrotelmic and catotelmic peat which will be disturbed and how this will be safeguarded and reused on site. Further, the condition of the peat, and areas of peat that would potentially benefit from restoration have been identified and are discussed in **Chapter 7** and **Technical Appendix 7.6 (BEMP)**.

9.6.23 As shown in Technical Appendix 9.1 (PLHRA) and **Technical Appendix 9.2 (PMP)** measures have been proposed to ensure the stability of peat and carbon rich soils and that peat and soils that will 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; further details are provided below.

Peat Management

9.6.24 A detailed review of the distribution and depth of peat at the site is contained in **Technical Appendix 9.2**. The site design has largely avoided areas of deep peat and where peat will be encountered by the Proposed Development it can be readily managed and accommodated within the site layout without significant environmental impact. No surplus peat will be generated and the volumes of peat / peaty soil generated from the proposed excavations will be used to reinstate track verges, turbine bases, crane hardstandings and restoration of onsite borrow pits.

Peat Landslide Hazard

9.6.25 The site specific PLHRA (**Technical Appendix 9.1**) confirms, regarding peat stability, that there are very few areas of peat instability risk across the Proposed Development and the hazard impact assessment concluded that, with the employment of appropriate mitigation measures, all of the areas of peat instability can be considered as an insignificant risk.

9.6.26 A Design and Geotechnical Risk Register will be compiled to include risks relating to peat instability, as this will be beneficial to both the developer and the Contractor in identifying potential risks that may be involved during construction.

9.6.27 Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits are identified in **Technical Appendix 9.1**. 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 will be required;
- careful micrositing of turbine bases, crane hardstandings and 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 will require minimal maintenance; and

- developing drainage systems that will not create areas of concentrated flow or cause over/under-saturation of peat habitats.

9.6.28 Notwithstanding any of the above good construction practices and methodologies, detailed design and construction practices will 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 will be appointed as a supervisor, to provide advice during the setting out, micrositing and construction phases of the Proposed Development.

Water Quality Monitoring

9.6.29 Water quality monitoring before and during the construction phase will be undertaken for 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 will be carried out at a specified frequency (depending upon the construction phase) on these catchments.

9.6.30 Monitoring will continue throughout the construction phase and immediately post construction. Monitoring will be used to allow a rapid response to any pollution incident as well as to assess the impact of good practice or remedial measures. Monitoring frequency will increase during the construction phase if remedial measures to improve water quality were implemented. Water quality monitoring plans will be developed during detailed design. Scottish Water, SEPA, ABC, NatureScot, AFT and ADSFB will be consulted on the plans which will be contained within the final CEMP.

9.6.31 It is also proposed that the licenced abstraction that serves Killean Estate, as discussed in **Technical Appendix 9.4**, is included as part of the monitoring programme.

9.6.32 The performance of the good practice measures will 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.

Pollution Risk

9.6.33 Good practice measures in relation to pollution prevention will include the following:

- refuelling will take place at least 50m from watercourses and where there is no risk that oil from a spill could directly enter the water environment;
- foul water generated on-site will be managed in accordance with best practice and be drained to a sealed tank and routinely removed from site;
- a vehicle management plan and speed limit will be strictly enforced onsite to minimise the potential for accidents to occur;
- drip trays will be placed under stationary vehicles which could potentially leak fuel/oils;
- areas will be designated for washout of vehicles which are a minimum distance of 50m from a watercourse;
- washout water will also be stored in the washout area before being treated and disposed of;
- if any water is contaminated with silt or chemicals, runoff will not enter a watercourse directly or indirectly prior to treatment;
- water will be prevented as far as possible, from entering excavations;
- procedures will be adhered to for storage of fuels and other potentially contaminative materials in line with the CAR, to minimise the potential for accidental spillage; and
- a plan for dealing with spillage incidents will be designed prior to construction, and this will be adhered to should any incident occur, reducing the effect as far as practicable. This will be included in the final CEMP.

9.6.34 Site investigation (e.g., trial pitting and/or boreholes) will be undertaken prior to any construction works where excavation will be required to establish the wind farm and it will inform detailed design and construction methods to ensure pollution risk is further considered prior to construction. These methods will be specified in the final CEMP.

Erosion and Sedimentation

9.6.35 Good practice measures for the management or erosion and sedimentation will include the following:

- all stockpiled materials will be located outwith a 50m buffer from watercourses, including on up gradient sides of tracks and battered to limit instability and erosion;
- stockpiled material will either be seeded or appropriately covered, minimising the area of exposed bare ground;
- monitoring of stockpiles/excavation areas during and after significant rainfall events;
- water will be prevented as far as possible, from entering excavations through the use of appropriate cut-off drainage;
- where the above is not possible, water that enters excavations will pass through a number of settlement lagoons and silt/sediment traps to remove silt prior to indirect discharge into the surrounding drainage system. Detailed assessment of ground conditions will be required to identify locations where settlement lagoons will be feasible;
- clean and dirty water on-site will be separated and dirty water will be filtered before entering the water environment;
- if the material is stockpiled on a slope, silt fences will be located at the toe of the slope to reduce sediment transport;
- the amount of ground exposed, and time period during which it is exposed, will be kept to a minimum and appropriate drainage will be in place to prevent surface water entering deep excavations, specifically borrow pit excavations;
- a design of drainage systems and associated measures to minimise sedimentation into natural watercourses will be developed - this may include silt traps, check dams and/or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales will 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 will avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor will carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

Fluvial Flood Risk

9.6.36 Sustainable Drainage Systems (SuDS) shall be incorporated as part of the Proposed Development.

9.6.37 SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at site prior to development. Good practice in relation to the management of surface water runoff rates and volumes and potential for localised fluvial flood risk will include the following:

- drainage systems will be designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse;
- on-site drainage will 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;
- appropriate drainage will attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk;
- where necessary, check dams will be used within cable trenches in order to prevent trenches developing into preferential flow pathways and trenches shall be backfilled with retained excavated material; and
- as per good practice for pollution and sediment management, prior to construction, site-specific drainage plans will be developed and construction personnel made familiar with the implementation of these.

Water Abstractions

9.6.38 For any water for construction activities good practice that will be followed in addition to adherence to the CAR regulations includes:

- water use will be planned so as to minimise abstraction volumes;
- water will be re-used where possible;
- abstraction volumes will be recorded; and
- abstraction rates and volumes will be agreed with SEPA to prevent significant water depletion in any third party water source.

Watercourse Crossings

9.6.39 Two new watercourse crossings and 14 existing crossings which will be upgraded as part of the development are required for the Proposed Development as detailed within **Technical Appendix 9.3** and shown on **Figure 9.1**.

9.6.40 The crossings will be designed to pass the 200-yr flood event plus an allowance for climate change and their design and construction details will be agreed with SEPA and ABC as part of the final CEMP.

Construction within Watercourse Buffer

9.6.41 It is recognised during construction within the watercourse buffer there is a need for increased monitoring and management of the works. Specific drainage management plans, methods statements, monitoring, and pollution incident response plans relevant to the works at these locations are required and need to be agreed with statutory consultees, including SEPA.

9.6.42 Examples of the additional safeguards that will be deployed at these locations and included in the management plans, subject to agreement with consultees, include, but are not limited to the following:

- increased induction and training for staff highlighting sensitivities;
- a wet weather working protocol and provision to cease works during prolonged rainfall or periods of high runoff (pluvial or fluvial);
- reduction in extent of working area to minimise the potential to disturb ground;
- additional passive water quality control measures, such as temporary water diversion ditches, silt fences and silt traps to control and treat runoff from working areas;
- daily inspection of works and watercourses and full-time supervision of construction and restoration and works;
- deployment of real-time water quality monitoring telemetry with predetermined water quality trigger levels based on baseline water quality data (e.g. for pH, dissolved oxygen and electrical conductivity); and
- documentation that clearly identifies responsibilities and actions and contact details should a pollution event be recorded.

Construction Effects

Peat and Soils

9.6.43 It has been shown (see **Technical Appendix 9.1** and **Technical Appendix 9.2** and Embedded Mitigation Section) that the disturbance of peat and soils as a result of the construction of the Proposed Development can be minimised and the peat deposits and carbon rich soils safeguarded.

9.6.44 Peat is a high sensitivity receptor. With the identified safeguards and proposed good practice methods, the potential impact on deposits of

carbon rich soils and peat is assessed as negligible and thus the significance of effect is negligible and therefore not significant.

Pollution Risk

9.6.45 During the construction phase, there is the potential for a pollution event to affect surface and ground waterbodies impacting on their quality. This will have a negative impact on these receptors, potentially resulting in degradation of the water quality which will impact on any aquatic life and private, public and licenced water abstractions from the watercourses and groundwater.

9.6.46 Pollution may occur from excavated and stockpiled materials during site preparation and excavation of borrow pits. Contamination of surface water runoff from machinery, leakage, and spills of chemicals from vehicle use and the construction of hardstandings also have the potential to affect surface and ground waterbodies. Potential pollutants include sediment, oil, fuels, and cement.

9.6.47 The risk of a pollution incident occurring will be managed using industry standard good practice measures as detailed in the preceding section. Many of these practices are concerned with undertaking construction activities away from watercourses, sensitive peat and vegetation habitats and identifying safe areas for stockpiling or storage of potential pollutants that could otherwise lead to the pollution.

9.6.48 The baseline assessment has shown that the watercourses surrounding the Proposed Development and groundwater beneath the Proposed Development (including licensed water supplies and Carradale Water DWPA) are considered High sensitivity receptors.

9.6.49 The Good Practice Measures (to be set out in the CEMP) will minimise the risk of a pollution event occurring to negligible and there are measures which will be put in place in the case of an accident occurring to mitigate pollution risk. The magnitude of impact associated with a pollution event is considered negligible and thus significance of effect is negligible and not significant.

Erosion and Sedimentation

9.6.50 Site traffic during the construction phase has the potential to cause erosion and increase sedimentation loading during earthworks, and due to increased areas of hardstanding and such features as stockpiles, tracks,

and excavations etc., which could be washed by rainfall into surface water features. This has the potential to reduce surface water quality, increase turbidity levels, reduce light and oxygen levels, and affect ecology including fish populations.

9.6.51 Excavation of borrow pits, construction of hardstandings, diversion of drainage channels and the construction of water crossings associated with the Proposed Development are the key sources of erosion and sediment generation. Adherence to good practice measures will ensure that any material generated is not transported into nearby watercourses, to groundwater, or onto areas of peat or GWDTE.

9.6.52 The implementation of location specific good practice measures will form part of the final CEMP and will be used to minimise the potential for erosion and sedimentation.

9.6.53 After consideration of good practice measures, the magnitude of impact associated with erosion and sedimentation is assessed as negligible. Peat, GWDTE, groundwater and surface water (including licensed water supplies and Carradale Water DWPA) are considered high sensitivity receptors. The level of effect is therefore assessed as negligible and not significant.

Flood Risk

9.6.54 Construction of hardstandings including the substation compound, construction compound and turbine bases will create impermeable surface areas which could increase runoff rates and volumes.

9.6.55 Adherence with good practice measures including appropriate drainage design and compliance with the final CEMP will limit potential impacts to being local and short duration and so of negligible magnitude.

9.6.56 It is proposed that any rainwater and limited groundwater ingress which collects in the turbine excavations during construction will be stored and attenuated prior to controlled discharge to ground adjacent to the excavation.

9.6.57 Attenuation of runoff generated within the proposed turbine excavations will allow settlement of suspended solids within the runoff prior to discharge in accordance with 'Site control' component of the SuDS 'management train'.

9.6.58 The potential level of effect on flood risk, which is considered to have a moderate sensitivity, is therefore assessed as being negligible and not significant.

9.6.59 The magnitude of the increase in the impermeable area is not sufficient to have a measurable effect on groundwater levels, as the extent of the impermeable area is insignificant compared to the extent of the underlying geology and groundwater.

Infrastructure and Man-Made Drainage

9.6.60 Excavations associated with construction works (e.g. cut tracks, turbine bases foundations, cable trenches, borrow pits etc.) can result in local lowering of the water table. This is an important consideration in areas of peat deposits, where the water table is characteristically near the ground surface.

9.6.61 Dewatering associated with construction of turbine foundations is temporary and will not be required post construction. Cable laying, without appropriate mitigation measures, can also lower high groundwater levels and provide a preferential drainage route for groundwater movement that can lead to local and permanent drying of soils, superficial deposits and/or water supplies.

9.6.62 The design of the Proposed Development has avoided areas of high ecological or habitat interest, including GWDTE, wherever possible.

9.6.63 Location specific good practice measures will form part of the final CEMP and will be used to minimise the potential for drainage and dewatering effects. However, as discussed in Section 9.5, the geology at site has a low bulk hydraulic conductivity which means the extent of any dewatering will be very small when compared to surface and groundwater catchments and the potential magnitude of temporary groundwater ingress will be small.

9.6.64 The sensitivity of the receptor (groundwater and habitat that may be dependent on groundwater) has been assessed as being High. The magnitude of impact is assessed as negligible and therefore the potential significance of effect of changing groundwater levels and flow due to dewatering is considered negligible and not significant.

Water Abstraction

9.6.65 During the construction of the Proposed Development, water may be abstracted for uses such as dust suppression, vehicle washing, batching

plant activities and welfare facilities. The volume of water and mitigation required will be regulated through a CAR abstraction licence which will be agreed with SEPA. The magnitude of impact on groundwater-surface water interactions is considered negligible. The significance of effect is therefore negligible, and not significant.

Licenced Abstractions and DWPAs

9.6.66 It has been shown that a small extent of the Proposed Development is located within the Carradale Water DWPA and a licenced abstraction for Killean Estate abstracts water from the Killean Burn downstream of the Proposed Development. To ensure that the licenced abstraction and DWPA are not impaired it will be necessary to sustain existing surface water flows and quality shed from the Proposed Development.

9.6.67 Both the Killean Estate licenced abstraction and Carradale Water DWPA are considered high sensitivity receptors. With the best practice construction techniques to protect surface water and groundwater receptors outlined above, in combination with the proposed monitoring programme (see example in **Technical Appendix 9.4**) the magnitude of impact is assessed as negligible, and the resultant significance of effect is assessed as negligible and not significant.

Operational Effects

9.6.68 During the operational phase of the Proposed Development, it is anticipated that routine maintenance of infrastructure and tracks will be required across the site. This may include work such as maintaining access tracks and drainage and carrying out maintenance of turbines.

9.6.69 Should any maintenance be required on-site during the operational life of the Proposed Development which will involve construction type activities, mitigation measures will be adhered to along with the measures in the final CEMP to avoid potential effects.

Peat and Soils

9.6.70 No excavation, movement or storage of peat or soils is anticipated during the operational life of the Proposed Development.

9.6.71 Peat is a high sensitivity receptor. The potential impact on deposits of soil and peat is assessed as negligible and the significance of effect as negligible, and not significant.

Pollution Risk

9.6.72 The possibility of a pollution event occurring during operation is very unlikely. There will be a limited number of vehicles required on-site for routine maintenance and for the operation of the Proposed Development. Storage of fuels/oils on-site will be limited to the hydraulic oil required in turbine gearboxes and this will be bunded to prevent fluid escaping.

9.6.73 The Good Practice Measures (to be set out in the final CEMP) will minimise the risk of a pollution event occurring to negligible and there are measures which will be put in place in the case of an accident occurring to mitigate pollution risk. The magnitude of a pollution event during the operational phase of the Proposed Development is assessed as negligible, as no detectable change will likely occur. Therefore, the significance of effect for a pollution event during the operational phase of the Proposed Development is predicted to be negligible and not significant.

Erosion and Sedimentation

9.6.74 During the operation of the Proposed Development, it is not anticipated that there will be any significant excavation or stockpiled material beyond the clearing of SuDS features to maintain their efficiency, reducing the potential for erosion and sedimentation effects.

9.6.75 Immediately post-construction, newly excavated drains and track dressings may be prone to erosion as any vegetation will not have matured. Appropriate design of the drainage system, incorporating sediment traps, will 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 will remain and be maintained to slow runoff velocities and prevent erosion until vegetation becomes established.

9.6.76 The magnitude and impact associated with a short duration erosion and sedimentation event will be negligible following adherence to good

practice measures. Therefore, the potential significance of effect on identified receptors is negligible and not significant.

9.6.77 Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually on-site by a contractor or operational personnel) there will be potential for erosion and sedimentation effects to occur due to the existence of disturbed material. Should this type of activity be required, then the good practice measures as detailed for the construction phase will be required on a case by case basis. Extensive work at water crossings/adjacent to the water environment may require approval from SEPA under the CAR (depending upon the nature of the activity).

Fluvial Flood Risk

9.6.78 The risk of an effect on fluvial flood risk arises as a result of a potential restriction of flow at a permanent watercourse crossing following intense rainfall. In accordance with good practice routine inspection and clearing of watercourse crossings at the site will be undertaken, reducing the likelihood of a blockage occurring.

9.6.79 The SuDS drainage measures deployed alongside access tracks and turbine bases etc. during construction will be maintained and used to locally collect, treat and discharge incident rainfall runoff. These measures will also attenuate the rate of runoff and mitigate the potential for flood risk to be increased off-site.

9.6.80 In the unlikely event of a blockage, any flooding will be localised and the magnitude of impact is assessed as negligible, and thus the significance of effect is assessed as negligible and not significant.

Infrastructure and Man-Made Drainage

9.6.81 Operation of the Proposed Development will require limited activities relative to the construction phase.

9.6.82 The magnitude of a potential effect on groundwater and sub-surface flows as a result of permanent hardstandings and associated drainage will be negligible on the overall groundwater body due to the dispersed nature of the proposed hardstanding. The significance of effect is negligible and not significant.

Licenced Abstractions and DWPAs

9.6.83 With the best practice techniques to protect surface water and groundwater receptors outlined above the magnitude of impact is assessed as negligible and the resultant significance of effect is assessed as negligible and not significant.

Decommissioning Effects

9.6.84 Potential decommissioning effects are expected to be the similar to potential construction effects. Decommissioning the wind farm and its associated infrastructure will be carried out in accordance with an approved decommissioning plan which will be expected to include the same safeguards as those provided during the construction stage of the project.

9.6.85 The magnitude of impact for decommissioning the Proposed Development is therefore considered negligible and the potential effect on identified receptors is negligible and not significant.

9.7 Mitigation

9.7.1 The Developer is committed to the implementation of the good practice measures described above. On this basis, there are no predicted significant effects and under the terms of the EIA Regulations no specific mitigation measures during construction are required.

9.7.2 It has been recognised in this assessment that a programme of water monitoring will be required prior to any construction activity and during construction of the Proposed Development. The monitoring programme will be agreed with Scottish Water, SEPA, NatureScot, ABC, AFT and ADSFB and it is expected to include monitoring of the watercourses which drain from the site.

9.7.3 As detailed in **Technical Appendix 9.1**, it is proposed that a geotechnical risk register is maintained during the construction and post-construction phase of the Proposed Development. It is expected that this will be maintained by the Developer, and again, secured by an appropriately worded predevelopment condition of consent.

9.7.4 As detailed in **Technical Appendix 9.2**, during and following construction the drainage measures deployed at the site (temporary and permanent) will be subject to routine inspection by the dedicated site ECoW and the

Developer. This will be specified in a site-specific CEMP and will be secured by an appropriately worded predevelopment condition of consent.

9.8 Assessment of Residual Effects

9.8.1 No significant residual effects on soils and peat, geology, surface water or groundwater receptors are predicted during the construction, operational and decommissioning phases of the Proposed Development.

9.9 Assessment of Cumulative Effects

9.9.1 The following proposed, operational and consented wind farms are located within 5km and in the same water catchments as the Proposed Development:

- Clachaig Glen revised scheme (in planning) in the Clachaig Water catchment;
- Deucheran Hill (operational) in the Carradale Water catchment; and
- Coalashee (scoping) in the Killean Burn catchment.

9.9.2 These developments have either been developed or are yet to be consented and developed. They have or will, therefore, adopt current industry standard guidelines and be managed in accordance with best practice, industry standards and relevant legislation, planning policy and guidance regulated by statutory consultees. These standards ensure, with respect to soils, geology and the water environment, potential impacts are mitigated and controlled at source.

9.9.3 The magnitude of cumulative impact is therefore considered negligible and the potential effect on identified receptors is negligible and not significant.

9.10 Summary

9.10.1 An assessment has been carried out of the likely impacts of the Proposed Development on the hydrological, hydrogeological, geological environment within a defined study area (comprising land within 500 m of the site boundary). The assessment has considered site preparation, construction, operation and decommissioning of the Proposed Development.

9.10.2 Following the identification and assessment of the key receptors, taking into account the potential effects listed above, a comprehensive suite of embedded mitigation and good practice measures has been incorporated into the design, including avoidance of areas of deep peat and inclusion of extensive water buffer areas. In addition, a site-specific CEMP as well as detailed design of infrastructure and associated mitigation will be implemented to protect the groundwater and surface water resources from pollution and minimise changes to the hydrological environment.

9.10.3 The impact assessment has taken into account the hydrological regime, highlighting that the principal effects will occur during the construction phase. Following the successful design and implementation of mitigation measures the significance of construction effects on all identified receptors are not defined as significant. The assessment of predicted operational effects has determined that the significance of effects on all receptors to be of no significance.

9.10.4 Good practice design and construction of the Proposed Development delivered through a skilled team of competent workers, with mitigation and compliance monitored in collaboration with SEPA, ABC and other engaged stakeholders, will result in a risk that is considered to be not significant in terms of the EIA Regulations.

9.10.5 A summary of assessed effects and identified mitigation measures required to reduce the potential effects to acceptable levels are identified in **Table 9.11**.

Table 9.11: Summary of Residual Effects

Potential Effect	Mitigation	Means of Implementation	Residual Effect
Degradation of peat and carbon-rich soils.	Mitigation by design and good practice measures.	CEMP to be submitted for the written approval of the ABC, SEPA and NatureScot prior to construction commencing. Geotechnical Risk Register. Implementation of PMP and PLHRA	Not significant.
Generation of pollution impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	CEMP to be submitted for the written approval of the ABC, SEPA and NatureScot prior to construction commencing. Confirmatory water quality monitoring which will be agreed with Scottish Water, SEPA, NatureScot, ABC, AFT and	Not significant.

Potential Effect	Mitigation	Means of Implementation	Residual Effect
		ADSFB prior to construction commencing.	
Erosion and sedimentation impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	CEMP to be submitted for the written approval of the ABC, SEPA and NatureScot prior to construction commencing.	Not significant.
Drainage and dewatering impairing surface water, groundwater, habitat and water supplies.	Good practice measures.	CEMP to be submitted for the written approval of the ABC, SEPA and NatureScot prior to construction commencing.	Not significant.
Flood Risk	Good practice measures	Commitment to deploy SuDS and prepare a detailed drainage design as part of the final CEMP.	Not significant.