atmos CONSULTING

Environmental Impact Assessment Report

Lairdmannoch Energy Park

Chapter 8: Hydrology, Geology and Hydrogeology

Lairdmannoch Energy Park Limited

wind2

May 2025

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Glossary of Terms

Term	Definition
The Applicant	Lairdmannoch Energy Park Limited
The Agent	Atmos Consulting Limited
Environmental Advisors and Planning Consultants	Atmos Consulting Limited
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of carrying out, in a systematic way, an assessment of the likely significant environmental effects from a development.
Environmental Impact Assessment Regulations	Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ('the EIA Regulations')
Environmental Impact Assessment Report	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
The Proposed Development	Lairdmannoch Energy Park
The Proposed Development Site	The full application boundary as per Figure 1-1
Study Area	The Proposed Development Site plus a 500m buffer.
Solar Development	The area of the Proposed Development that contains the Solar Arrays and associated infrastructure. As shown on Maps 7, 8 and 9 of Figure 3-1.
Wind Development	The area of the Proposed Development that contains the Wind Turbines and associated infrastructure. As shown on Maps 1, 2 and 4 of Figure 3-1.

List of Abbreviations

Abbreviation	Description
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGS	British Geological Survey
CAR	Controlled Activity Regulations
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CIWEM	Chartered Institution of Water and Environmental Management
DGC	Dumfries and Galloway Council
DIA	Drainage Impact Assessment
DWPA	Drinking Water Protected Area
ECoW	Ecological Clerk of Works
ECU	Energy Consents Unit
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EnvCoW	Environmental Clerk of Works
FRA	Flood Risk Assessment
GPP	Guidance on Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystems
LDP2	Local Development Plan 2
NPF4	National Planning Framework 4
NTS	Non-Technical Summary
NVC	National Vegetation Classification
OS	Ordnance Survey
PANs	Planning Advice Notes
PLHRA	Peat Landslide Hazard and Risk Assessment
PMP	Peat Management Plan
PWS	Private Water Supplies
PWSRA	Private Water Supplies Risk Assessment
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SFDAD	Scottish Flood Defence Asset Database
SLR	SLR Consulting Ltd
SSSI	Special Site of Scientific Interest
SuDS	Sustainable Drainage Systems
WTW	Water Treatment Works

8 Hydrology, Geology and Hydrogeology

8.1 Introduction

This Chapter of the EIAR presents an assessment of the likely effects arising from the construction, operation (including maintenance) and decommissioning of the Proposed Development upon hydrology, geology (including soils and peat) and hydrogeology and should be read in conjunction with the following technical appendices and figures in **Volume 3** and **Volume 4**, respectively:

- Technical Appendix 8-1: Peat Landslide and Hazard Risk Assessment (PLHRA);
- Technical Appendix 8-2: Peat Management Plan (PMP);
- Technical Appendix 8-3: Schedule of Watercourse Crossings;
- Technical Appendix 8-4: Private Water Supply Risk Assessment (PWSRA);
- Technical Appendix 8-5: Flood Risk Assessment & Drainage Impact Assessment (Solar);
- Technical Appendix 8-6: Drainage Impact Assessment (BESS);
- Technical Appendix 8-7: Firewater Management Plan (BESS);
- Figures 8-1a&b: Local Hydrology;
- Figure 8-2: Soils;
- Figure 8-3: Superficial Geology;
- Figure 8-4: Peatland Classification;
- Figure 8-5: Bedrock Geology;
- Figure 8-6: Regional Hydrogeology;
- Figure 8-7: Aquifer Classification and Groundwater Vulnerability; and
- Figures 8-8a&b: Potential Groundwater Dependent Terrestrial Ecosystems (GWDTE).

The assessment also uses information and findings presented in **Chapter 6: Ecology** to inform the assessment of potential effects on possible areas of Groundwater Dependent Terrestrial Ecosystems (GWDTEs) which are presented in this chapter.

The assessment has been carried out by SLR Consulting Ltd. Production of this chapter has been reviewed by Brian Dunlop.

Brian is a Technical Director within SLR and is responsible for undertaking and managing hydrological and hydrogeological assessments. He has over 30 years' experience in engineering and environmental consultancy and has acted as water lead on projects in the renewables, infrastructure, built environment and mining sectors both in the UK and internationally. Brian is based in SLR's London office and has provided expert evidence in legal proceedings requiring specialist knowledge of engineering hydrology and stormwater management. He is a Chartered Engineer (C.Eng) and a Member of the Chartered Institute of Water and Environmental Management (CIWEM).

8.2 Consultation

Consultation for the Proposed Development was undertaken with statutory and non-statutory bodies. The outcome of the relevant consultation with regards to hydrology, geology and hydrogeology is summarised in **Table 8-1**.

Table 8-1: Consultation undertaken

Consultee	Summary of Consultee Response	Where addressed within this Report
Dumfries and Galloway Council (DGC) Pre Application 7 April 2021	The response from SEPA has provide a comprehensive list in Annex 1 of the information required to be submitted in support of any application. Site specific comments have been provided advising that a National Vegetation Clarification (NVC) will be required where excavations deeper than one metre are planned within 250m of a sensitive receptor, otherwise Phase 1 would be sufficient. Groundwater Dependent Terrestrial Ecosystems (GWDTEs) should be given a buffer of 100m where excavations are shallower than 1m or 250m where excavations will exceed 1m. Where this cannot be achieved, mitigation such as groundwater monitoring should be set out.	NVC habitat mapping exercise has been conducted as part of the ecology baseline assessment and is discussed in detail within **Chapter 6: Ecology** Potential areas of GWDTE are shown on **Figure 8-8** and their dependency on groundwater is discussed in **Section 8.5** of this chapter. It is confirmed that potential areas of GWDTE are not sustained by groundwater and therefore SEPA buffers need not apply.
DGC Pre Application 7 April 2021	Given the presence of Class 1 and 2 peat, A peat depth survey should be carried out with particular focus on areas where infrastructure is planned and also to map any areas of deep peat found. Excavation of deep peat should be avoided. As much of the site is on peat, it would be expected that the application to be supported by a comprehensive site-specific Peat Management Plan (PMP).	A site-specific peat management plan is presented in **Technical Appendix 8-2**. Site specific peat probing has been completed to inform the assessment which is summarised in **Section 8.5** of this chapter and shown on **Figure 8.1.5.**
DGC Pre Application 7 April 2021	With regard to hydrology, American signal crayfish, which is an invasive non-native species, is present in Woodhall Loch and other near-by water courses and a detailed biosecurity plan for this species should accompany any application. The new watercourse crossings must be designed so as not to cause any impediment to movement of fish.	Noted. No development is proposed within the catchment of Woodhall Loch and therefore no further assessment is required.
DGC Flood Risk Management Team Pre Application 6 November 2020	The Flood Risk Management Team have no objection after reviewing the information provided and held.	Noted.
Energy Consents Unit (ECU) Scoping Response 18 January 2024	Scottish Water provided information on whether there are 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	See Scottish Water response below.

Consultee	Summary of Consultee Response	Where addressed within this Report
	Scottish Water (via EIA@scottishwater.co.uk) and makes further enquires to confirm whether there 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.	
ECU Scoping Response 18 January 2024	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 full in **Technical Appendix 8-4** and summarised in **Section 8.5** of this chapter.
ECU Scoping Response 18 January 2024	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), published at http://www.gov.scot/Publications/2017/04/8868, 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.	A site-specific PLHRA is presented in **Technical Appendix 8-1**.
NatureScot Scoping Response 20 September 2023	NatureScot is happy with the proposed scope for the assessment of Ecological receptors for the proposal. Similarly, the proposed peatland assessment seems appropriate. The interpolated peatland map presented in Figure 11 [of the Scoping Report] shows there is scope for micro-siting of infrastructure to further minimise potential impacts on peatland, which we would expect to see investigated fully in the EIA. We are pleased that restoration options for peatland will be considered both on and off site to ensure that overall positive gain is achieved in terms of carbon management.	The site-specific peat depth probing, potential impacts on peat and carbon rich soils and proposed mitigation measures are summarised in this chapter and discussed in full in **Technical Appendix 8-1** and **Technical Appendix 8-2**. Restoration proposals are provided in **Technical Appendix 6-6**.
SEPA Scoping Response 18 September 2023	All maps must be based on an adequate scale with which to assess the information. This could range from OS 1:10,000 to a more detailed scale in more sensitive locations. Each of the maps below must detail all proposed upgraded, temporary and permanent site infrastructure. This includes all tracks, excavations, buildings, borrow pits, pipelines, cabling, site compounds, laydown	Noted.

Consultee	Summary of Consultee Response	Where addressed within this Report
	areas, storage areas and any other built elements. Existing built infrastructure must be re-used or upgraded wherever possible. The layout should be designed to minimise the extent of new works on previously undisturbed ground. For example, a layout which makes use of lots of spurs or loops is unlikely to be acceptable. Cabling must be laid in ground already disturbed such as verges. A comparison of the environmental effects of alternative locations of infrastructure elements, such as tracks, may be required.	
SEPA Scoping Response 18 September 2023	The site layout must be designed to avoid impacts upon the water environment. Where activities such as watercourse crossings, watercourse diversions or other engineering activities in or impacting on the water environment cannot be avoided then the submission must include justification of this and a map showing: • All proposed temporary or permanent infrastructure overlain with all lochs and watercourses. • A minimum buffer of 50m around each loch or watercourse. If this minimum buffer cannot be achieved, each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse and drawings of which is proposed in terms of engineering works. • Detailed layout of all proposed mitigation including all cut off drains, location, number and size of settlement ponds.	See **Figure 8-1**. Generally, a minimum buffer of 50m to watercourses and waterbodies has been applied, except for water compatible elements within the Solar Development area. The majority of the Proposed Development, including all the proposed turbines, proposed BESS and associated wind infrastructure, is located outwith the watercourse 50m buffer. No development is proposed within 10m of any watercourse or waterbody.
SEPA Scoping Response 18 September 2023	If water abstractions or dewatering are proposed, a table of volumes and timings of groundwater abstractions and related mitigation measures must be provided.	Noted. Best practice regarding water abstractions is presented in **Section 8.8** of this chapter.
SEPA Scoping Response 18 September 2023	Further advice and our best practice guidance are available within the water engineering section of our website. Guidance on the design on water crossings can be found in our Construction of River Crossings Good Practice Guide.	Noted.
SEPA Scoping Response 18 September 2023	Refer to our flood risk Standing Advice for advice on flood risk, Watercourse crossings must be designed to accommodate the 0.5% Annual Exceedance Probability (AEP) flows or information provided to justify smaller structures. If it is thought that the development could result in an increased risk of flooding to a nearby receptor then a Flood Risk Assessment must be provided in support of the submission. Our Technical flood risk guidance for stakeholders outlines the information we require to be submitted as part of an FRA. Please also refer to Controlled Activities Regulations (CAR) Flood Risk	It is confirmed watercourse crossings will be designed to accommodate the 0.5% AEP flows plus an allowance for climate change. A screening of flood risk is presented in **Section 8.5** of this chapter. A flood risk and drainage impact assessment for the

Consultee	Summary of Consultee Response	Where addressed within this Report
	Standing Advice for Engineering, Discharge and Impoundment Activities.	proposed solar and BESS areas are discussed in **Technical Appendix 8-5** and **Technical Appendix 8-6** respectively.
SEPA Scoping Response 18 September 2023	The planning submission must a) demonstrate how the layout has been designed to minimise disturbance of peat and consequential release of CO2 and b) outline the preventative/mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches or storage and re-use of excavated peat. There is often less environmental impact from localised temporary storage and reuse rather than movement to large central peat storage areas. The submission must include: • A detailed map of peat depths (this must be to full depth and follow the survey requirements of the Scottish Government's Guidance on Developments on Peatland – Peatland Survey (2017)) with all the build elements (including peat storage areas) overlain to demonstrate how the development avoids areas of deep peat and other sensitive receptors such as Groundwater Dependent Terrestrial Ecosystems. • A table which details quantities of acrotelmic, catotelmic and amorphous peat which will be excavated for each element and where it will be re-used during reinstatement. Details of the proposed widths and depths of peat to be re-used and how it will be kept wet permanently must be included. To avoid delays and potential objection proposals must be in accordance with Guidance on Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste and our Developments on Peat and Off-Site uses of Waste Peat.	Potential effects on peat and carbon rich soils are summarised in this chapter and discussed in full in **Technical Appendix 8-1** and **Technical Appendix 8-2**. Site specific peat probing has been undertaken and is shown on **Figure 8.1.5**. Table of quantities of acrotelmic, catotelmic and amorphous peat which will be excavated for each element and proposed restoration measures are included in **Technical Appendix 8-2**.
SEPA Scoping Response 18 September 2023	Dependent upon the volumes of peat likely to be encountered and the scale of the development, applicants must consider whether a full Peat Management Plan (as detailed in the above guidance) is required or whether the above information would be best submitted as part of the schedule of mitigation.	A site-specific peat management plan is presented in **Technical Appendix 8-2**.
SEPA Scoping Response 18 September 2023	We do not validate carbon balance assessments except in exceptional circumstances where requested by Scottish Government. Our advice on minimising peat disturbance and peatland restoration may need to be taken into account when you consider such assessments.	Noted. A carbon calculator is presented in **Technical Appendix 14-1**.
SEPA Scoping	GWDTE are protected under the Water Framework Directive and therefore the layout and design of	Noted. Potential areas of GWDTE

Consultee	Summary of Consultee Response	Where addressed within this Report
Response 18 September 2023	the development must avoid impact on such areas. The following information must be included in the submission: • A map demonstrating that all GWDTE are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions. If micro-siting is to be considered as a mitigation measure the distance of survey needs to be extended by the proposed maximum extent of micro-siting. The survey needs to extend beyond the site boundary where the distances require it. • If the minimum buffers above cannot be achieved, a detailed site specific qualitative and/or quantitative risk assessment will be required. We are likely to seek conditions securing appropriate mitigation for all GWDTE affected. Please refer to Guidance on Assessing the Impacts on Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for further advice and the minimum information we require to be submitted.	are shown on **Figure 8-8** and their dependency on groundwater is discussed in **Section 8.5** of this chapter. It is confirmed that potential areas of GWDTE are not sustained by groundwater and therefore SEPA buffers need not apply. Potential GWDTE areas are discussed in terms of their ecological value in **Chapter 6: Ecology**.
SEPA Scoping Response 18 September 2023	Excavations and other construction works can disrupt groundwater flow and impact on existing groundwater abstractions. The submission must include: • A map demonstrating that all existing groundwater abstractions are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions. If micro-siting is to be considered as a mitigation measure the distance of survey needs to be extended by the proposed maximum extent of micro-siting. The survey needs to extend beyond the site boundary where the distances require it. • If the minimum buffers above cannot be achieved, a detailed site specific qualitative and/or quantitative risk assessment will be required. We are likely to seek conditions securing appropriate mitigation for all existing groundwater abstractions affected. Please refer to Guidance on Assessing the Impacts on Development Proposals on Groundwater Abstractions for further advice and the minimum information we require to be submitted.	Noted. A review of existing groundwater abstractions within the study area is discussed in **Section 8.5** of this chapter and **Technical Appendix 8-4**. One groundwater abstraction associated with a private water supply is shown within 250m of the Proposed Development and is discussed in full in **Technical Appendix 8-4**.
SEPA Scoping Response 18 September 2023	One of our key interests in relation to developments is pollution prevention measures during the periods of construction, operation, maintenance, demolition and restoration. A schedule of mitigation supported by the above site-specific maps and plans must be submitted.	Noted. Embedded mitigation and good practice, including proposed pollution prevention measures, are discussed

Consultee	Summary of Consultee Response	Where addressed within this Report
	These must include reference to best practice pollution prevention and construction techniques (for example limiting the maximum area to be stripped of soils at any one time) and regulatory requirements. They should set of the daily responsibilities of ECOWs, how site inspections will be recorded and acted upon and proposals for a planning monitoring enforcement officer. Please refer to Guidance for Pollution Prevention (GPPs).	in **Section 8.8** of this chapter. Mitigation measures are also presented in **Chapter 15: Schedule of Mitigation.**
Scottish Water Scoping Response 05 September 2023	Scottish Water has no objection to this planning application; however, the applicant should be aware that this does not confirm that the proposed development can currently be serviced.	Noted.
Scottish Water Scoping Response 05 September 2023	A review of our records indicates that the proposed activity falls within a drinking water catchment where a Scottish Water abstraction is located. Scottish Water abstractions are designated as Drinking Water Protected Areas (DWPA) under Article 7 of the Water Framework Directive. The Ringford Boreholes supply Ringford Water Treatment Works (WTW) and it is essential that water quality and water quantity in the area are protected. In the event of an incident occurring that could affect Scottish Water we should be notified immediately using the Customer Helpline number 0800 0778 778.	Noted.
Scottish Water Scoping Response 05 September 2023	The wind farm development lies within the Ringford well field groundwater risk zone. Surface water from the area where the 9 turbines are proposed all drains initially into Loch Mannoch before entering the outflow watercourse, the Tarff Water. Provided the developer follows standard guidance to minimise and avoid polluting local watercourses there is a low risk of the well field being adversely affected by contamination or turbid water from the turbine zone. This is mainly because Loch Mannoch will act as a primary receptor for all surface water pollution. Turbid water will settle in the loch before entering the Tarff Water outflow which is approximately 4.5 to 5km upstream from the Ringford well field.	Noted. Potential effects on the water environment including Scottish Water assets and DWPAs is included in this chapter.
Scottish Water Scoping Response 05 September 2023	The solar panel development area is located downstream from Loch Mannoch and most of its 2 to 2.5km riverside boundary lies within 100m of the Tarff Water. This represents a much greater risk to water quality in the Tarff Water and is therefore a bigger threat to the well field, particularly during the construction phase. There would be negligible risk during normal operation phase. The alluvial gravel aquifer at the Ringford well field is discontinuous upstream in the Tarff Water valley and so it is not possible for contaminants to travel underground from the solar farm to the well field.	Noted. Potential effects on the water environment including Scottish Water assets and DWPAs are included in this chapter. A programme of baseline and construction phase water quality monitoring is proposed prior to construction, throughout the construction phase

Consultee	Summary of Consultee Response	Where addressed within this Report
	However, it is thought that a proportion of the abstracted groundwater at the well field comes from the Tarff Water as it passes within 50m of the boreholes. Therefore, there is a possibility of any prolonged contamination in the river entering the gravel aquifer and degrading production water quality from the boreholes. It is difficult to quantify this risk from the solar panels during their construction, but it will be vital that the developer arranges an effective monitoring programme for surface water, including an early warning system of any contamination in watercourses. Input to this programme from Scottish Water will be essential.	and immediately post construction. It is anticipated that the monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees, including Scottish Water.
Scottish Water Scoping Response 05 September 2023	Scottish Water have produced a list of precaution for a range of activities. This details protection measures to be taken within a DWPA, the wider drinking water catchment and if there are assets in the area. Please note that site specific risks and mitigation measures will require to be assessed and implemented. These document s and other supporting information can be found on the activities within our catchment page of our website at www.scottishwater.co.uk/slm. We welcome receipt of this notification about the proposed activity within a drinking water catchment where a Scottish Water abstraction is located. The fact that this area is located within a drinking water catchment should be noted in future documentation. Also anyone working on site should be made aware of this during site inductions. We would request further involvement at the more detailed design stages, to determine the most appropriate proposals and mitigation within the catchment to protect water quality and quantity. We would also like to take the opportunity to request that 3 months in advance of any works commencing on site, Scottish Water is notified at protectdwsources@scottishwater.co.uk. This will enable us to be aware of activities in the catchment and to determine if a site meeting would be appropriate and beneficial.	Noted.
Scottish Water Scoping Response 05 September 2023	For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer systems.	Noted.
Balmaghie Community Council Scoping Opinion 12 September	Ensure that there is expansive chemical monitoring, primarily at norther water entry and exit (Tarff) into and out of Loch Mannoch. Monitor changes with time, during construction and through project life. Separately monitor ground	Potential effects on the water environment are included in this chapter. A drainage impact assessment and firewater

Consultee	Summary of Consultee Response	Where addressed within this Report
2025	near battery storage (sands ensure not built in an area that will not flood).	management plan of the proposed BESS is presented in **Technical Appendix 8-6** and **Technical Appendix 8-7** respectively. A programme of baseline and construction phase water quality monitoring is proposed prior to construction, throughout the construction phase and immediately post construction. It is anticipated that the monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees.

8.2.1 Scoped into the assessment

The following potential impacts have been assessed in full in relation to the Proposed Development:

- pollution risk, including potential impacts on surface water and groundwater quality, as well as public and private water supplies during construction, operation and decommissioning;
- impacts on surface water and groundwater quality from pollution from fuel, oil, concrete or other hazardous substances, including fire water runoff from the BESS;
- erosion and sedimentation, which could give rise to potential impacts on surface water and groundwater quality, and public and private water supplies during construction, operation and decommissioning;
- increased flood risk resulting from changes to runoff volumes and rates, and modifications to natural and man-made drainage patterns during operation;
- potential impacts upon the linkage between groundwater and surface water during construction, operation and decommissioning;
- potential impacts on areas of peat during construction, operation and decommissioning;
- potential impacts on areas of GWDTE during construction, operation and decommissioning; and
- potential cumulative impacts during construction, operation and decommissioning.

8.2.2 Scoped out the assessment

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 topic areas have been scoped out of the assessment:

- Detailed Flood Risk Assessment (FRA) for the Proposed Development, with the exception of the Solar Development. Published mapping confirms that the majority of the Proposed Development is not located in an area identified as being at significant flood risk. A screening assessment of potential flooding sources (fluvial, coastal, groundwater, infrastructure, etc.) is presented in **Section 8.5** of this chapter, and general measures that would be used to manage flood risk and control the rate and quality of runoff will be specified in the final CEMP at the detailed design stage of the Proposed Development. The proposed Solar Development is shown to be at greater risk of flooding and an FRA for this area is presented in **Technical Appendix 8-5**;
- Drainage Impact Assessment (DIA) for the Proposed Development, with the exception of the proposed Solar and BESS Development. General principles for the design of any watercourse crossings and for the control of runoff from the Proposed Development have been specified in this chapter. It is expected that these would be developed as part of the detailed site design, should the Proposed Development be granted planning permission, and a detailed site-specific drainage plan would be secured by a pre-development planning condition. A DIA for the proposed BESS and Solar Development have not been scoped out and are presented in **Technical Appendix 8-5** and **Technical Appendix 8-6** respectively. A firewater management plan for the proposed BESS has also not been scoped out and is presented in **Technical Appendix 8-7**. These would also be developed as part of the detailed drainage design should planning consent be granted;
- Baseline 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 baseline water quality monitoring is considered necessary to complete the assessment. Note, 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 would be specified in the final CEMP;
- Geomorphological Assessment: As part of the proposed baseline surveys, photographs and records of existing or baseline water features have been recorded and are presented in **Technical Appendix 8-3**. It is not proposed to undertake a geomorphological audit or assess potential compensation flows and effects on geomorphology, as it is expected that this will be undertaken in support of a CAR application, should the Proposed Development be granted planning permission; and
- 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 would not alter regional or solid geology. Potential effects on peat and carbon rich soils are not scoped out of the assessment and are considered in full.

8.3 Legislation, Planning Policy and Guidance

Soils, geology and aquatic environment in Scotland are afforded significant protection through key statutes and the regulatory activity of SEPA and the local authorities. Relevant legislation and guidance documents have been reviewed and considered as part of this assessment.

8.3.1 Legislation

Legislation relevant to this assessment comprises:

- 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;
- Water Environment and Water Services (Scotland) Act 2003 (WEWS);
- The Water Environment (Controlled Activities) (Scotland) Regulations, 2011 (CAR);
- The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017;
- The Water Supply (Water Quality) (Scotland) Regulations, 2001; and
- Private Water Supplies (Scotland) Regulations 2006.

8.3.2 Planning Policy

Chapter 4: Planning Policy and Legislation provides an overview of the relevant planning policy position in full. In summary, National Planning Framework 4 (NPF4) provides planning guidance and policies regarding sustainable development, tackling climate change, and achieving net zero. NPF4 planning policies relevant to this assessment include:

- Policy 1 (Tackling the climate and nature crises)
- Policy 2 (Climate Mitigation and Adaptation);
- Policy 3 (Biodiversity);
- Policy 4 (Natural Places);
- Policy 5 (Soils);
- Policy 11 (Energy);
- Policy 20 (Blue and Green Infrastructure); and
- Policy 22 (Flood Risk and Water Management).

In addition, Dumfries and Galloway Council (DGC) Local Development Plan 2 (LDP2) provides planning guidance on the type and location of development that can take place in the region. The LDP2 presents policies relevant to this assessment, including:

- Policy NE4: Sites of International Importance for Biodiversity;
- Policy NE5: Species of International Importance;
- Policy NE6: Sites of National Importance for Biodiversity and Geodiversity;

- Policy NE11: Supporting the Water Environment;
- Policy NE12: Protection of Water Margins;
- Policy NE14: Carbon Rich Soil;
- Policy NE15: Protection and Restoration of Peat Deposits as Carbon Sinks;
- Policy IN1: Renewable Energy;
- Policy IN2: Wind Energy;
- Policy IN7: Flooding and Development; and
- Policy IN8: Surface Water Drainage and Sustainable Drainage Systems (SuDS).

8.3.3 Guidance

The following guidance documents have been used during the preparation of this assessment:

- Planning Advice Notes (PANs) are published by the Scottish Government. Applicable PANs include:
  - PAN 61 Planning and Sustainable Urban Drainage Systems (SUDS); and
  - Online Planning Advice on Flood Risk (which supersedes PAN 69).
- SEPA guidance for Guidance for Pollution Prevention (GPP)documents including:
  - 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.
- Construction Industry Research and Information Association (CIRIA) publications:
  - C532 Control of Water Pollution from Construction Sites (2001);
  - C741 Environmental Good Practice on Site (2015);
  - C753 The SUDS Manual (2015); and
  - R179 Ground Engineering Spoil: Good Management Practice (1997).
- SEPA publications:
  - Engineering in the Water Environment: Good Practice Guide – River Crossings (2010);
  - Engineering in the Water Environment: Good Practice Guide – Sediment Management (2010);
  - Development on Peat and Offsite Uses of Waste Peat, 2017;
  - Groundwater Protection Policy for Scotland, Version 3 (2009);
  - Land Use Planning System Guidance Note 4, Version 9, (2017);
  - Land Use Planning System SEPA Guidance Note 2a (Flood Risk), Version 2 (2018);
  - Land Use Planning System SEPA Guidance Note 2e (Soils), Version 1 (2015);

  - Technical Flood Risk Guidance for Stakeholders;
  - Guidance on Assessing the Impacts of Developments on Groundwater Abstractions (2024);
  - Guidance on Assessing the Impacts of Development on Groundwater Dependent Terrestrial Ecosystems (2024);
  - Position Statement – Culverting of Watercourses (2015); and
  - Regulatory Position Statement – Developments on Peat (2010).
- Other relevant guidance documents include:
  - Scottish Natural Heritage (now NatureScot), Constructed Tracks in Scottish Uplands, 2nd Edition (2013);
  - Scottish Government, Proposed Electricity Generation Developments: Peat Landslide Hazard Best Practice Guide (2017);
  - Scottish Government, Guidance on Development on Peatland, Peatland Survey (2017);
  - A joint publication by Scottish Renewables, Scottish Natural Heritage (now NatureScot), Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland, Good Practice during Windfarm Construction (2024); and
  - Scottish Renewables and SEPA, Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste (2012).

8.4 Methodology

8.4.1 Study Area

The Study Area is shown on **Figures 8-1** to **8-8** and includes all the Proposed Development infrastructure and a 500m buffer from the Proposed Development Site boundary. Beyond this distance, any effect is considered to be so diminished as to be undetectable and therefore not significant.

The Study Area for potential cumulative effects uses the surface water catchments within the Study Area, with a maximum downstream distance of 5km from the Proposed Development Site.

8.4.2 Baseline Data Collection

An initial desk study has been undertaken to determine and confirm the baseline characteristics by reviewing available information relating to hydrology, geology (including soils and peat), and hydrogeology. The following sources of information have been consulted to characterise and assess the baseline conditions within the Study Area:

- Ordnance Survey (OS) 1:50,000 and 1:25,000 scale mapping;
- NatureScot SiteLink;
- Scottish Natural Heritage (now NatureScot) Carbon and Peatland 2016 Map;
- James Hutton Institute, National Soil Map of Scotland (1:250,000);
- British Geological Survey (BGS) Onshore GeoIndex (1:50,000);

- BGS Hydrogeological maps of Scotland (1,100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets);
- Details of private water supplies provided by Dumfries and Galloway;
- Details of Drinking Water Protected Areas provided by Scottish Water;
- SEPA rainfall data;
- SEPA flood maps;
- SEPA reservoir flooding map;
- SEPA Water Classification Hub;
- SEPA Water Environment Hub;
- SEPA environmental data; and
- The Scottish Flood Defence Asset Database (SFDAD).

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

Detailed site visits and walkover surveys have been undertaken by SLR Consulting Ltd and/or Atmos Consulting (project ecologist/peat probing) on the following dates:

- October 2024 and March 2025 to complete Phase 1 peat probing;
- January to March 2025 to complete Phase 2 peat probing;
- November 2024 to complete a site walkover, conduct watercourse crossing survey, review areas of potential GWDTE and complete a private water supply survey; and
- March 2025 to completed additional watercourse crossing survey and private water supply survey.

The field work has been undertaken in order to:

- verify the information collected during the desk and baseline study;
- undertake a visual assessment of the main surface waters and identify and verify catchments to private water supplies;
- identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- visit any identified potential GWDTE (in consultation with the project ecologist);
- visit any potential watercourse crossings and prepare a schedule of potential watercourse crossings;
- assess peat condition, depth and quality; and
- confirm underlying substrate, based on the type of refusal of a peat probe and by coring.

8.4.3 Assessment Methodology

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

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

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

The criteria for determining the significance of effect are provided in **Table 8-2**, **Table 8-3** and **Table 8-4**.

Sensitivity of Receptor

The sensitivity of the receiving environment (i.e., the baseline quality of the receiving environment) is defined as its ability to absorb an effect without a detectable change and can be considered through a combination of professional judgement and a set of pre-defined criteria which is set out in **Table 8-2**. Receptors in the receiving environment only need to meet one of the defined criteria to be categorised at the associated level of sensitivity.

Table 8-2: 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 Proposed Development Site; • receptor is at risk from flooding in the future (2080s) and/or water body acts as an active floodplain or flood defence; • receptor is used for public and/or private water supply (including DWPAs); • 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 moderately sensitive (e.g. arable or commercial forestry or modified peatland, e.g. by drainage or forestry); • SEPA WFD 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 WFD water body classification: poor or bad; • receptor is not at risk of flooding in the future (2080s) and • receptor not used for water supplies (public or private).
Not Sensitive	• receptor would not be affected by the Proposed Development e.g. lies within a different and unconnected hydrological / hydrogeological catchment.

Magnitude of Effect

The potential magnitude of effect 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 change resulting from the Proposed Development are also determining factors.

The criteria that have been used to assess the magnitude of change are defined in **Table 8-3**. The characteristics of the impacts are described as direct / indirect,

temporary (reversible) or permanent (irreversible), together with timescales (short, medium and long term).

Table 8-3: Criteria for Assessing Magnitude of Effect

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

Magnitude	Criteria	Definition
		• no pollution or change in water chemistry to either groundwater or surface water; and • no alteration to groundwater recharge or flow mechanisms.

Significance of Effect

The sensitivity of a receptor together with the magnitude of the effect determines the significance of the effect, which can be categorised into level of significance as identified in **Table 8-4**.

Table 8-4 provides a guide to assist in decision making. 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 effect.

Effects of 'major' or 'moderate' significance are considered to be 'significant' in terms of the EIA Regulations.

Table 8-4: Significance of Effect

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

Potential Cumulative Effects

The assessment also considers potential cumulative effects associated with other developments within 5km of the application boundary 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 Proposed Development in combination with other developments which are likely to affect soils or geology, surface water and groundwater.

Approach to Mitigation

Any potential effects of the Proposed Development on hydrology, geology and hydrogeology 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.

Good practice measures would be applied in relation to pollution risk, sediment management, peat management and management of flood risk and surface runoff rates and volumes. These would form part of the final CEMP to be implemented for the Proposed Development which would be prepared during detailed design and secured

by a planning condition prior to construction commencing. An Outline CEMP is provided as **Technical Appendix 15-1**.

The final CEMP would also 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.

Identification of Residual Significant Effects

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

Statement of Significance

A statement of significance is provided in the assessment. Effects of 'major' or 'moderate' significance, as outlined in **Table 8-4**, are considered to be 'significant' in terms of the EIA regulations.

8.4.4 Difficulties and Uncertainties

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

It is noted that no permission was granted to survey parts of the proposed access track which is located within Forestry and Land Scotland (FLS) land. Therefore, no field work has been completed in this area, however a detailed desk based assessment has been completed. The existing track will be upgraded to facilitate the Proposed Development as discussed in **Chapter 3: Description of the Development**.

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

8.5 Baseline Conditions

This section outlines the baseline hydrology, geology (including soils and peat), and hydrogeology conditions within the Study Area.

8.5.1 Site Setting

The Proposed Development is located 7km northeast of Gatehouse of Fleet and 10km west of Castle Douglas in Dumfries and Galloway.

Ground elevations across the Proposed Development Site generally range from 60 m Above Ordnance Survey (AOD) at the proposed access point off the B727 and within the south eastern corner of the Proposed Development Site to approximately 240 m AOD within the north western extent of the Proposed Development Site, near the summit of Millae Hill.

SEPA has provided precipitation data for Kirkcudbright rain gauge (station number: 504458), which is located approximately 8.3 km southeast of the Study Area. In 2024, a total precipitation of 1,248.4 mm was recorded.

8.5.2 Statutory Designated Sites

Review of the NatureScot SiteLink website confirms that no water dependent or geological designated sites are located within the Proposed Development Site.

The Laughenghie and Airie Hills SSSI is located approximately 450 m west of the Proposed Development Site at its closest point and is designated for an assemblage of breeding birds and non-breeding hen harrier habitats. No development is proposed within the SSSI and the designated site is located within a different surface water catchment to the Proposed Development. It is therefore not considered further in this chapter. Other potential effects on the SSSI are considered further in **Chapter 6: Ecology**.

8.5.3 Geology and Soils

Soils

An extract of 1:250,000 National Soil Map of Scotland is presented as **Figure 8-2** which indicates that the Study Area is generally underlain by peaty podzols and brown soils. The proposed turbines and the central part of the southwestern access track is shown to be underlain by peaty podzols whilst the remainder of the access track and the proposed solar area is underlain by brown soils.

A small area of the northwestern extent of the Proposed Development Site, including turbines T8 and T9, is shown to be underlain by peat soils.

Peat and Superficial Deposits

An extract of BGS superficial deposit mapping is presented as **Figure 8-3**.

Much of the Study Area is shown to be absent of any superficial deposits.

Areas of peat are located within the northwestern extent of the Study Area whilst glacial till is noted along parts of the southwestern access track. Areas of alluvium and glaciofluvial deposits are also noted across the Proposed Development Site, particularly within the southeastern extent near the banks of the Tarff Water.

An extract of the Carbon and Peatland (2016) Map published by Scottish Natural Heritage (now NatureScot) is shown on **Figure 8-4**, and shows that, with the exception of the north western extent of the Proposed Development Site, the majority of the Proposed Development Site is underlain by mineral soils (Class 0) or Class 4 peatland which are not considered representative of peatland habitats.

The north western extent of the Site is shown to be underlain by Class 1 and 2 peatland areas with small areas of Class 3 and Class 5 peatland. A small area of Class 3 peatland is also shown within the southeastern extent of the Proposed Development Site and along a small section of the southwestern access track.

Class 1 and 2 peatland areas are considered nationally important carbon-rich soils, areas of deep peat and priority peatlands, with potentially high conservation value

and restoration potential. Class 3 and Class 5 are not considered priority peatland areas; however, soils may remain carbon rich with areas of deep peat.

As part of the baseline assessment, a comprehensive peat probing exercise and condition assessment has been conducted and informs the PLHRA (**Technical Appendix 8-1**) and OPMP (**Technical Appendix 8-2**). In summary the site investigations indicate:

- Much of the Proposed Development Site lacks peat, with probed depths <0.5 m;
- The most extensive peat deposits lie in the northwest of the Proposed Development Site where slope gradients are very gentle;
- The deepest peat is located within an area of linear north-to-south aligned troughs that sit between bedrock outcrops in the centre of the Proposed Development Site. Here, peat depths reach close to 4.0 m in depth;
- Almost no peat was recorded east of the proposed borrow pit and no peat is present within the Solar Development area;
- The Proposed Development Site has been extensively drained in its western half with c. 82.5 km of artificial drainage cut into both peat and organic soils – habitats are therefore indicative of drier, drained and modified peatland rather than high quality blanket bog. While the Carbon and Peatland (2016) Map (see **Figure 8-4**) indicates widespread presence of Class 1 and 2 peatland, the depth of peat and quality of vegetation does not support these classifications when compared with other higher quality and deeper sites; and
- There are very few signs of erosion, with no gullying nor large areas of peat, and no observed instability features.

More details are provided in the **Technical Appendix 8-1 PLHRA** and **Technical Appendix 8-2 OPMP**.

Bedrock Geology and Linear Features

An extract of the BGS regional bedrock geological and linear features mapping is presented as **Figure 8-5** which shows that the Study Area is underlain by sedimentary rocks of the Cairnharrow Formation and Kirkmaiden Formation which comprises of greywacke.

Two inferred reverse or thrust fault lines with southwest to northeast trend, are shown to cross the northeastern and southwestern extent of the Study Area. Several other smaller inferred faults with a north to south trend are also noted across the Study Area.

8.5.4 Hydrogeology

Aquifer Characteristics and Groundwater Vulnerability

Extracts of the BGS 1:625,000 scale Hydrogeology of Scotland map and 1:100,000 scale Aquifer Productivity and Groundwater Vulnerability datasets are presented in **Figure 8-6** and **Figure 8-7**, respectively.

Figure 8-6 confirms that the Study Area is underlain by Silurian and Ordovician rocks which have been classified as a low permeability aquifer whereby limited amounts of groundwater may be present within the near surface weathered zone and secondary faults or fractures.

The Aquifer Productivity and Groundwater Vulnerability datasets (**Figure 8-7**) classify the underlying aquifer (superficial and bedrock) according to the predominant

groundwater flow mechanism (fracture or intergranular) and the estimated groundwater productivity and the estimated groundwater productivity. Groundwater vulnerability is divided into five classes (1 to 5) with 1 being least vulnerable and 5 being most vulnerable.

Figure 8-7 indicates that the peat and glacial till superficial deposits within the Study Area are not classified as a significant aquifer.

The glaciofluvial and alluvial deposits are classified moderate to high productivity aquifers which are characterised by intergranular groundwater movement. The sand and gravel horizons within these deposits can store groundwater and permit groundwater movement, however, their limited extent can hinder their ability to provide reliable groundwater yields. Local differences in thickness, material type and sorting can also cause a considerable range in hydraulic conductivity. Given the proximity of these deposits with nearby watercourses, including the Tarff Water, the groundwater within these deposits is likely to be shallow and in hydraulic conductivity with these watercourses.

The bedrock aquifer is confirmed to be a low productivity aquifer generally without groundwater except at shallow depth with flow almost entirely through fractures and other discontinuities.

The potential groundwater vulnerability in the uppermost aquifer within the Proposed Development Site has a vulnerability of Class 5 with smaller areas of Class 4a and 4b. The highest vulnerability is noted where little or no superficial deposits are recorded, and thus where there is little attenuation of potential pollutants prior to entry to groundwater.

Groundwater Levels and Flow

SEPA have confirmed that they do not hold any specific groundwater level data within the Study Area.

Groundwater recharge within the Study Area is limited by the following factors:

- steeper topographic gradients which will result in rainfall forming surface water runoff; and
- the underlying bedrock (where not weathered or fractured) as it generally displays a low permeability that limits groundwater recharge and prevents large scale storage and movement of the groundwater.

Groundwater Quality

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

The current status of groundwater bodies in Scotland have been classified by SEPA in accordance with the requirements of the WFD. SEPA have identified that the majority of the Proposed Development Site is located within the Castle Douglas groundwater body (SEPA ID: 150672) whilst part of the central extent of the southwestern access track is located within the Galloway groundwater body (SEPA ID: 150694).

Both groundwater bodies have been classified in 2023 (the latest reporting cycle) as having Good overall groundwater quality with no pressures identified.

Groundwater Dependent Terrestrial Ecosystems (GWDTE)

A National Vegetation Classification (NVC) habitat mapping exercise has been conducted as part of the ecology baseline assessment, and this has been used to identify potential areas of GWDTE within the Proposed Development Site. The methodology and results of the NVC habitat mapping exercise are discussed in detail within **Chapter 6: Ecology**. With reference to SEPA guidance, areas of potential GWDTE are shown on **Figure 8-8**.

It is noted that the south western access track has not been surveyed as part of the NVC habitat mapping exercise. As works for this track mostly comprises localised upgrades such as widening and resurfacing both within commercial plantation and improved agricultural grasslands this is not considered to be a significant limitation.

The location of potential GWDTE and their likely dependency on groundwater is discussed in **Table 8-5**.

Table 8-5: Site-specific Groundwater Dependent Terrestrial Ecosystem Assessment

NVC Community	Site Specific Assessment - Distribution within Study Area and Likely Groundwater Dependency
M15	M15 dominant polygons are recorded across the northwestern extent of the Proposed Development Site, near turbines T3, T4 and T9. The habitats are predominantly located adjacent to existing watercourses and/or where surface water flow paths are shown by SEPA. In addition, the habitat is located across a range of different elevations including local hilltops and is underlain by low permeability peat and sedimentary bedrocks whereby limited groundwater is expected. This distribution is not typical of that which is sustained by emerging groundwater, such as springs or seepage lines. The habitat is not rare and is present across large areas of Scotland. As the habitat is noted adjacent to, or nearby to watercourses, and on land where overland surface water flows are indicated, it is likely that the M15 habitats are predominately sustained by surface water runoff and waterlogging of soils, rather than by groundwater.
M23	M23 dominant habitats are recorded to the north and within the southeastern extent of the Proposed Development Site. The habitats to the north of the Proposed Development Site are located along the banks of the Anstool Burn and are therefore considered to be sustained by waterlogging of soils adjacent to the watercourse rather than groundwater. The M23 habitats in the southeastern extent of the Proposed Development Site are underlain by alluvium deposits near the Tarff Water. Any groundwater within the alluvium deposits will be in hydraulic continuity with Tarff Water and again considered to be sustained by surface water and waterlogging of soils within the alluvium deposits rather than emergent groundwater. It is therefore considered that M23 habitats are sustained by surface water runoff and waterlogging of soils adjacent to the watercourses, rather than by groundwater.

Review of **Table 8-5** shows that the areas of potential GWDTE are generally located on ground adjacent to watercourses or within existing surface water flow routes and underlain by either low permeability peat and bedrock deposits or alluvium deposits which are hydraulically connected to the adjacent watercourses. This distribution is not typical of that which is sustained by emerging groundwater, such as springs or seepage lines but rather it is likely to be supported by rainfall, surface water ponding and water logging of soils adjacent to watercourses or above the low permeability deposits. In addition, no flush features were recorded as part of the NVC survey.

It is therefore considered that the potential GWDTE habitats are not sustained by groundwater. However, safeguards to maintain these habitats, and sustain the surface water flows and preserve water quality to these habitats, will be implemented during construction, operation and decommissioning of the Proposed Development, details of which are included in **Section 8.6**.

It is noted that some M15 habitats would be lost as a result of the Proposed Development. The habitat is not rare and can be found across large areas of Scotland. The effects of the loss of this habitat are discussed further in **Chapter 6: Ecology**.

8.5.5 Hydrology

Local Hydrology

The local hydrology is shown on **Figure 8-1**.

The majority of the Proposed Development Site is situated within the surface water catchment of the Tarff Water. The southwestern access track is partially situated within the Water of Fleet catchment (called Water of Fleet / Big Water of Fleet / Mid Burn in SEPA data) and other smaller watercourses which drain into the Fleet Estuary.

The Tarff Water flows out of the Loch Mannoch, which is located south of the Proposed Development Site, through the southwestern extent of the Proposed Development Site, before continuing southwards to the southeast of the Proposed Development Site. Several tributaries of the Tarff Water and Loch Mannoch rise within the Proposed Development Site, including Anstool Burn and Glengap Burn which drain the central and northwestern extent of the Proposed Development Site respectively.

The Water of Fleet flows southwards to the west of the Study Area before discharging into the Fleet Estuary approximately 2.3km southwest of the proposed access point off the B727. The majority of the southwestern access track is drained by the Barlay Burn, a tributary of the Water of Fleet, which flows westward to the north of the southwestern access track. The southern extent of the southwestern access track is also drained by other minor watercourses that drain into the Fleet Estuary.

The Tarff Water surface catchment has been designated as a DWPA. Consultation with Scottish Water (see **Table 8-1**) indicates that the DWPA supplies the Ringford Water Treatment Works (WTW), which is located approximately 4.5 to 5 km downstream of the Tarff Water outflow from Loch Mannoch.

Surface Water Quality

SEPA classifies the larger watercourses within the Study Area and the watercourses which drain the Study Area as part of its responsibility under the WFD. The quality of watercourses relevant to the Proposed Development Site are presented in **Table 8-6**. Smaller watercourses within the Study Area are not monitored and classified by SEPA.

Table 8-6: Surface Water Classification Data

Waterbody (SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical	Hydro-morphology	Water Quality	Pressures
Tarff Water (ID: 10544)	Good ecological potential	Moderate	High	Moderate	High	Heavily modified waterbody on account

Waterbody (SEPA ID)	Overall Status	Overall Ecology	Physio-Chemical	Hydro-morphology	Water Quality	Pressures
						of physical alterations
Water of Fleet / Big Water of Fleet / Mid Burn (ID: 10539)	Moderate	Moderate	High	Good	High	Unknown causes on ecology
Fleet Estuary (ID: 200006)	Good	Good	Not monitored	High	Not monitored	None

Fisheries

Fisheries within the area are managed by the Galloway Fisheries Trust in partnership with Dee (Kirkcudbright) District Salmon Fishery Board and Fleet (Kirkcudbright) District Salmon Fishery Board. Fishery interests are discussed in more detail and assessed in **Chapter 6: Ecology**.

Watercourse Crossings

The Proposed Development will require eight new permanent watercourse crossings. The locations of the proposed crossings are shown on **Figure 8-1** and a schedule of these crossing points, which includes photographs and dimensions of each crossing is shown in **Technical Appendix 8-3.**

It is noted that the southwestern access track has not been surveyed as part of the watercourse crossing survey due to access issues.

Flood Risk

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.

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 (1:1000), or a 0.1% chance of happening in any one year.

SEPA has also produced reservoir inundation maps for those sites currently regulated under the Reservoirs Act 2011.

SEPA also publish potential future flood extents (2080) which account for the potential uplifts in rainfall depths and intensities as a consequence of climate change. An extract

of this mapping is show on **Figure 8-1** and is considered in the summary of potential sources of flooding presented in **Table 8-7**. Further flooding assessment of the Solar Development is presented in **Technical Appendix 8-5** and summarised in **Table 8-7**.

Table 8-7: Flood Risk Screening

Potential Flood Risk Source	Potential Flood Risk to the Proposed Development	Justification
Coastal flooding	No	The Water of Fleet, to the west of the Study Area is tidally influenced, however, flood extents are not shown to extend to the Study Area. The Proposed Development Site is also located on land at a higher elevation than the Water of Fleet and the Fleet Estuary (at least 60m AOD). The Proposed Development Site is therefore not considered to be at risk from coastal or tidal flooding.
River Flooding	Yes	SEPA flood mapping indicates that the majority of the Study Area is not at risk of flooding from rivers. Localising flooding is shown along the watercourse of the Glengap Burn, Anstool Burn, and Barlay Burn, however, flood extents are shown to be generally confined to the watercourse corridors. The area near the Tarff Water is also shown to be at risk of fluvial flooding. Flood extents are shown to be wider than the immediate watercourse corridor and encroach into the southwestern extent of the Proposed Development Site. A more detailed review of fluvial flooding in this area is presented in **Technical Appendix 8-5**. No development, with the exception of watercourse crossings and the access tracks associated with the crossings, are shown within mapped floodplains. It is therefore considered that fluvial flooding of these watercourses is not a design constraint, however, the watercourse crossings are discussed further in **Section 8.8.**
Surface Water and Small Watercourses Flooding	Yes	SEPA surface water flood mapping for smaller watercourse (<10 km^2 catchments) confirms that there are floodplains and surface water flow paths associated with the smaller watercourses within the Proposed Development Site. Flood extents are generally limited and coincide with existing watercourse corridors or shallow surface water flow paths towards the existing watercourses. Generally, no development is proposed within 50m of the watercourses with the exception of the Solar Development and proposed watercourse crossings. Surface water flooding at the Solar Development is discussed further in **Technical Appendix 8-5**, which confirms that the majority of the Solar Development is not at risk of surface water flooding except for a small part of the proposed access track and within the southern parcel of proposed Solar Development. The maximum flood depth indicated is typically less than 0.3 m during all events, with some small, isolated areas of 0.3 - 1.0 m associated with existing topographic depressions. It is therefore considered that surface water flooding is not a design constraint. At the proposed watercourse crossings, where the development crosses the floodplain flood depths are generally shallow (<0.3m). The watercourse crossings are discussed further in **Section 8.8**.
Groundwater Flooding	Yes (minor)	SEPA groundwater flood mapping confirms the Study Area is not at risk of groundwater flooding. This concurs with the desk-based assessment which has confirmed that the underlying geology

Potential Flood Risk Source	Potential Flood Risk to the Proposed Development	Justification
		beneath the Study Area is unlikely to contain significant quantities of groundwater. **Technical Appendix 8-5** shows that there is potential for groundwater flooding within the southern extent of the Solar Development associated with alluvium deposits adjacent to the Tarff Water. Groundwater within the alluvium will be limited and hydraulically connected to flooding within the Tarff Water. It is therefore considered that any groundwater flooding, if present, will be limited and is not considered a design constraint.
Flooding due to dam failure	No	A review of SEPA's reservoir inundation flood mapping indicates that the Study Area could be at risk of flooding from the two breach scenarios associated with Loch Whinyeon (RES/R/1127940) and Loch Mannoch (RES/R/1127935). Flood extents during a breach scenario within the Proposed Development Site are largely similar to those shown for flooding of the Tarff Water. Under the Reservoirs Act 2011, controlled reservoirs designated as high risk are subject to regular inspections and supervision by a reservoir engineer selected from a Scottish Government approved panel of engineers. It is therefore considered that Loch Whinyeon and Loch Mannoch are maintained to a high level and that the likelihood of a breach, leading to inundation of the Site, is negligible. The Proposed Development is therefore not considered at risk of flooding from dam failure.
Flood Defence Breach (Failure)	No	SEPA flood management mapping confirms that the Study Area is remote from any flood defences. In addition, no formal flood defences are noted on the Scottish Flood Defence Asset Database within the Study Area.
Flooding from artificial drainage systems	No	The Study Area comprises undeveloped open moorland. As such, no artificial drainage systems are present within the Study Area which could present a source of flooding to the Proposed Development Site.

8.5.6 Private Water Supplies and Licenced Sites

Consultation with SEPA and DGC has been undertaken to gather details on private and licenced water abstractions within the study area.

Licenced Sites

SEPA has provided details of Controlled Activity Regulation (CAR) authorisations within the study area which shows that there are 11 CAR authorisations within the study area, the details of which include:

- eight CAR registrations for private sewage discharges;
- two CAR registrations for point source discharges from existing sewage treatment systems; and
- one waste exemption licence.

No licenced abstractions are recorded within the study area.

Private Water Supplies

As part of this assessment, details of Private Water Supply (PWS) sources within the Study Area were obtained from DGC. In addition, a programme of site investigation has been undertaken to confirm the location of PWS sources.

The risk the Proposed Development poses to PWS has been considered as part of this assessment and is presented as **Technical Appendix 8-4**. It confirms that:

- one PWS source is considered to be at risk from the Proposed Development;
- the distribution pipework to one PWS is considered to be at risk from the Proposed Development;
- two PWS sources are not at risk from the Proposed Development; and
- five properties are confirmed or thought to be supplied by mains.

8.5.7 Summary of Sensitive Receptors

Table 8-8 outlines the receptors identified as part of the baseline studies, and their sensitivity based upon previously detailed criteria contained in **Table 8-2**. These receptors form the basis of the assessment, and as per the methodology, are used in conjunction with a magnitude of effect to determine significance.

Table 8-8: Summary of Identified Receptor Sensitivity and Justification

Receptor	Sensitivity	Reason for Sensitivity
Water dependent statutory designated sites	Not sensitive	There are no statutory designated sites within the same hydrological catchment as the Proposed Development.
Peat and Carbon Rich Soils	High	NatureScot mapping indicates that Class 1 and Class 2 priority peatland is present at the site, although it has been shown that peat within the site indicative of drier, drained and modified peatland rather than high quality blanket bog. Areas of peat and carbon rich soils have been confirmed by site investigation. These are important carbon stores and need to be safeguarded.
Soils and Geology	Not sensitive	The superficial and bedrock geology is common regionally and has no specific rarity value.
Groundwater	High	Groundwater beneath the Proposed Development Site has been classified as Good and vulnerability is classified as High. All of Scotland's groundwater bodies have been designated as DWPAs.
GWDTE	High	Areas of potential GWDTE have been identified by NVC mapping. Whilst it has been shown that the habitats 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 and drained by the Study Area have been classified by SEPA as Good to Moderate overall status.
DWPA	High	Tarff Water surface water catchment has been designated a DWPA associated with the Ringford WTW, as confirmed by Scottish Water (see **Table 8-1**).
Flood risk receptors downstream of the Proposed	High	Parts of the proposed access track, associated with proposed watercourse crossings, will cross the functional floodplain of Glengap Burn, Anstool Burn, and Tarff Water. The Proposed

Receptor	Sensitivity	Reason for Sensitivity
Development		Development also has the potential to alter surface water flow paths and could alter the depth and extent of flooding locally.
PWS	High	Properties within the Study Area have been confirmed to be supplied by a private water supply and one PWS source is considered to be at risk of the Proposed Development. The distribution pipework to one PWS is also considered to be at risk.
Licenced Abstractions	Not sensitive	No licenced abstractions have been recorded within the Study Area.

8.5.8 Future Baseline

Climate change studies predict a decrease in summer precipitation and an increase in winter precipitation alongside slightly higher average temperatures. This suggests that there is likely to be greater pressures on water supplies and water levels in summer months in the future. In addition, summer storms are predicted to be of greater intensity. Therefore, peak fluvial flows associated with extreme storm events may also increase in volume and velocity. These potential changes are considered in the assessment of effects.

Whilst there is uncertainty surrounding the future baseline environment, there are no other anticipated changes on the soils or geology, hydrological or hydrogeological environment throughout the anticipated lifetime of development or without the Proposed Development proceeding, besides climate change.

8.6 Embedded Mitigation

8.6.1 Design Iterations

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, to avoid and/or minimise potential effects on receptors where possible. This has included using existing access tracks, avoiding areas of peat and carbon rich soils, watercourses and areas of potential flooding, and GWDTE where practical.

8.6.2 Peat Identification and Avoidance

The potential presence of peat within the Proposed Development Site formed a key consideration in the layout of the Proposed Development. Informed by the extensive programme of peat probing undertaken across the Proposed Development Site, the design has avoided areas of deeper peat (typically greater than 1 m) and limited development to areas of peat less than 1 m where possible or where peat is absent.

8.6.3 Buffer to Watercourses

In accordance with wind farm construction best practice guidance and SEPA consultation advice, generally a 50m buffer of has been applied to watercourses (as shown on OS 1:10,000 mapping) where technically feasible.

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.

The majority of the Proposed Development, including all the proposed turbines, proposed BESS and associated infrastructure, is located outwith the watercourse 50m buffer, however, as shown on **Figure 8.1**, the following areas are located within the buffer:

- proposed watercourse crossings and proposed upgrades of the existing southwestern access track; and
- solar panels within the southeastern extent of the Proposed Development Site.

It is noted that no development, except the proposed watercourse crossings, is proposed within 10m of watercourses. It is recognised that if significant works are proposed within the watercourse buffer there is a need for increased monitoring and management of the works, and this is discussed in **Section 8.9**.

8.6.4 Groundwater Dependent Habitats

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

It has been shown (see **Table 8-5**) that areas identified as potentially groundwater dependent within the Proposed Development Site are likely to be sustained by incident rainfall and local surface water runoff rather than groundwater. Accordingly, the buffers proposed in SEPA's GWDTE guidance do not apply.

Measures have been proposed to safeguard existing surface water flow paths and maintain existing water quality (see **Section 8.8**). It is considered therefore that the water dependent habitats identified by the NVC mapping can generally be sustained as per their current baseline condition. This would be confirmed, in accordance with good practice, by the Ecology / Environmental Clerk of Works (ECoW/EnvCoW) at the time of the construction of the Proposed Development.

8.7 Potential Effects

8.7.1 Construction Effects

Peat and Carbon Rich Soils

Without appropriate mitigation and sensitive handling of peat and carbon rich soils, there is potential for the Proposed Development to degrade habitats, the carbon store and the hydrological function of the peatlands at the Proposed Development Site. Degradation may occur through local lowering of the water table following excavations associated with construction works and the concentration of surface water flow as a result of construction of the Proposed Development. Construction in unstable areas could potentially increase ground instability resulting in peat slides.

Pollution Risk

During the construction phase there is potential for a pollution event to affect surface water catchments and groundwater bodies, impacting their quality. This would have a negative impact on these receptors, potentially leading to adverse effects on associated aquatic life, GWDTE areas and DWPAs abstracting from the watercourses and groundwater.

Pollution may occur from excavated and stockpiled materials during site preparation. Contamination of surface water runoff from machinery, leakage, and spills of chemicals from vehicle use and the construction of hardstandings also has the potential to affect surface and groundwater bodies. Potential pollutants include sediment, oil, fuels, and cement.

Erosion and Sedimentation

Proposed Development Site traffic during the construction phase has the potential to cause erosion and increase sediment loads in receiving watercourses. This has the potential to adversely impact water quality, increase turbidity levels, reduce light and oxygen levels and affect aquatic ecology including fish populations.

Excavation of borrow pits, material stockpiles and construction of access tracks, watercourse crossings, solar panels and hardstanding areas associated with the Proposed Development are all potential sources of erosion and sediment generation.

Flood Risk

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

It is noted that the construction of the solar panels is considered to have a limited effect on flood risk as runoff from each solar panel would continue to infiltrate into the underlying soils locally, in much the same way as existing conditions.

Infrastructure and Man-Made Drainage

Excavations associated with construction works (e.g. 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.

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.

Water Abstraction

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. Without mitigation this could result in local lowering of the water table, affecting local peat deposits, and reducing flows in the local river network which supply public and private supplies.

Private Water Supplies and Drinking Water Protected Areas

The baseline assessment has confirmed that the majority of the Proposed Development is located within the Tarff Water surface water catchment which designated as a DWPA and supplies the Ringford WTW.

As discussed, Loch Mannoch will provide suitable attenuation and provide a buffer to the well field so that the pollution risk from the construction of the proposed turbines is considered to be low, however, the Solar Development presents a greater risk to the DWPA.

The alluvial gravel aquifer at the Ringford well field is discontinuous upstream in the Tarff Water valley and so it is not possible for contaminants to travel underground from the Solar Development to the well field. However, it is thought that a proportion of the abstracted groundwater at the well field comes from the Tarff Water as it passes within 50 m of the boreholes.

Potential construction effects outlined above, including impacts to water quality and quantity, specifically for the Tarff Water, could potentially impact the public water supply at Ringford and the Tarff Water DWPA.

As discussed in **Technical Appendix 8-4,** in the absence of good practice measures to protect the water supply, one PWS source is potentially at risk from the Proposed Development. Again, the potential construction effects outlined above could potentially impact the private water supply quantity and quality.

8.7.2 Operational (Including Maintenance) Effects

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

It is noted that potential effects will be similar to potential construction effects but likely to be on a smaller more localised scale.

Peat and Carbon Rich Soils

No excavation, movement or storage of peat or carbon rich soils is anticipated during the operational life of the Proposed Development and therefore potential impacts on peat during operation is likely to be limited and is not considered further within this assessment.

Pollution Risk

The possibility of a pollution event occurring during operation is very unlikely. There will be a limited number of vehicles required onsite for routine maintenance and for the operation of the Proposed Development. Storage of fuels/oils onsite will be limited to the hydraulic oil required in turbine gearboxes.

The lithium within the batteries in the BESS has the potential to catch fire and release contaminants into the adjacent water environment. Firewater is therefore considered a potential risk to water quality of surface water and groundwater receptors downstream of the BESS. This is further discussed in **Technical Appendix 8-7 Firewater Management Plan.**

Erosion and Sedimentation

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.

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 impacts 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.

Flood Risk

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 and an increase in runoff rates. Runoff rates and volumes may also increase from the introduction of permanent hardstanding areas and, without appropriate drainage measures, could increase flooding downstream of the Proposed Development.

Infrastructure and Man-Made Drainage

Operation of the Proposed Development will require limited activities relative to the construction and decommissioning phases.

The magnitude of a potential effect on groundwater and sub-surface flows as a result of permanent hardstanding and associated drainage would be limited on the overall groundwater body due to the dispersed nature of the proposed hardstanding.

Drinking Water Protected Areas

Potential operation effects outlined above, including impacts to water quality and quantity could potentially impact the public water supply at Ringford and the Tarff Water DWPA.

8.7.3 Decommissioning Effects

Potential decommissioning effects are expected to be the similar to potential construction effects.

8.7.4 Cumulative Effects

The assessment also considers potential cumulative effects associated with other developments within 5 km of the Proposed Development Site 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.

No other developments are noted both within 5 km of the Proposed Development and within the same surface water catchment as the Proposed Development. Therefore, cumulative effects are not anticipated as a result of the Proposed Development and are not considered further in this assessment.

8.8 Additional Mitigation Measures

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

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 final CEMP or by an appropriately worded condition post determination, as required. An outline CEMP is provided in **Technical Appendix 15-1**.

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.

8.8.1 General Measures

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, details are given below.

Prior to construction, site-specific drainage plans would be produced. These would consider any existing local drainage which may not be mapped and incorporate any site-specific mitigation measures identified during the assessment.

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

The final CEMP would contain details on the location of spill kits, would 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 would be identified to deal with any major environment incidents.

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

Roles would be assigned to site staff and the inspection and maintenance regimes of sediment and runoff control measures would 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.

8.8.2 Ecological/Environmental Clerk of Works

To ensure all reasonable precautions are taken to avoid negative effects on the water environment, a suitably qualified ECoW/EnvCoW 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/EnvCoW will be required to be present onsite during the construction phase and will carry out monitoring of works and briefings with regards to any ecological and hydrological sensitivities on the Proposed Development Site to the relevant staff of the Principal Contractor and subcontractors.

With respect to the water environment, the ECoW/EnvCoW will also have responsibility for advising on the maintenance of surface water flow paths and the quality of surface water supporting water dependant habitats such that they are sustained and protected during all phases of the Proposed Development.

8.8.3 Safeguarding of Peat and Carbon Rich Soils

The peat depth probing data compiled as part of the baseline assessment has been used to determine the volume of peat which will be disturbed by the Proposed Development.

Technical Appendix 8-1 provides an assessment of potential landslide risks associated with the Proposed Development. The assessment considers baseline landslide likelihoods across the Proposed Development Site (which are generally low) and provides an assessment of floating track stability. Five potential source zones for instability are identified in association with infrastructure footprints. Runout analysis indicates that any potential landslide debris generated from these sources would not reach watercourses, and therefore that calculated risks for these receptors (the highest value receptors on the Proposed Development Site) are Low. No cultural heritage features would be affected by landslide.

Technical Appendix 8-2 describes the excavation and reuse of peat and soils in association with the Proposed Development. The OPMP uses a peat model generated from detailed peat depth probing and infrastructure footprints to calculate the volume of peat that requires permanent excavation (and therefore must be reused elsewhere) and temporary excavation (which can be reinstated in its original location). Reuse opportunities are identified for the permanently excavated materials, comprising

borrow pit reinstatement and restoration of a possible peat cutting. These measures provide sufficient reuse opportunity to achieve a peat mass balance. Surplus (non-peat) soils are to be reused in landscaping infrastructure, principally earthworks.

As shown in **Technical Appendices 8-1** and **8-2,** 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 appropriately re-used onsite. The Policy aims of NPF4, regarding soils and peat, are therefore met; further details are provided below.

Peat Management

A detailed review of the distribution and depth of peat at the Proposed Development Site is contained in **Technical Appendix 8-2**. The Proposed Development design has minimised overlap with peat wherever possible, taking into account other constraints, 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 for restoration of the onsite borrow pit.

Peat Landslide Hazard

The site-specific PLHRA (**Technical Appendix 8-1**) confirms that the potential for peat instability across the Site is Low and that calculated risks associated with a small number of potentially unstable areas are Low. With the employment of appropriate mitigation measures, risks associated with these areas of peat instability could be reduced to Negligible and are therefore not significant.

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 Principal Contractor in identifying potential risks that may arise during construction.

Good construction practice and methodologies to prevent peat instability within areas that contain peat deposits are identified in Technical Appendix 8-1. 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 micro-siting 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);
- 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.

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 refinement and construction phases of the Proposed Development.

8.8.4 Water Quality Monitoring

Water quality monitoring before and during the construction phase will be undertaken for the surface water catchments that drain from the Proposed Development 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.

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 assess the impact of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality were implemented. An example water quality monitoring plan is included in **Technical Appendix 8-4**. Detailed water quality monitoring plans would be developed during detailed design. The monitoring programme would be secured by a pre-development planning condition to be agreed with statutory consultees.

It is also proposed that one private water supply source (PWS04) and Tarff Water is included in the detailed monitoring programme to mitigate against impacts to the PWS source and Tarff Water DWPA.

The performance of the good practice measures would be kept under constant review by the water monitoring schedule, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

8.8.5 Buffer to Watercourses

Specific drainage management plans, methods statements, monitoring, and pollution incident response plans relevant to the works at these locations are required and will be agreed with statutory consultees, including SEPA.

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.

8.8.6 Pollution Risk

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

- refuelling would take place at least 50 m from watercourses and where possible it would not occur when there is risk that oil from a spill could directly enter the water environment;
- foul water generated onsite would 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 would be strictly enforced onsite to minimise the potential for accidents to occur;
- drip trays would be placed under stationary vehicles which could potentially leak fuel/oils;
- areas which would be designated for washout of vehicles are a minimum distance of 50 m from a watercourse;
- washout water would also be stored in the washout area before being treated and disposed of;
- no direct or indirect discharges to watercourses without prior treatment in buffer zones or adjacent to proposed infrastructure using appropriate SuDS measures. These measures would be included in the formal drainage management plan and the final CEMP;
- water would be prevented as far as possible, from entering excavations;
- procedures would 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 would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP.

Site investigation (e.g., trial pitting and/or boreholes) will be undertaken at the detailed design stage, prior to any construction works, where excavation will be required to construct the Proposed Development. The site investigation will inform detailed design and construction methods of the Proposed Development to ensure pollution risk is further considered and minimised prior to construction.

Details of the proposed firewater management associated with the proposed BESS is outlined in **Technical Appendix 8-7**.

As part of this investigation works, the ground conditions will be assessed to inform the concrete design which will be used to facilitate the Proposed Development in accordance with best practice. The design of the concrete will ensure that the concrete specification used is appropriate for the environment to minimise degradation and leaching into the surrounding soil and water environment. If necessary, the excavations would incorporate an adequate barrier to prevent the

movement of any on-site pollutants to the underlying soils, groundwater and surface water environment.

These methods will be specified in the final **TA 15-1 CEMP** and the proposed concrete design will be agreed with SEPA prior to construction.

8.8.7 Erosion and Sedimentation

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

- all stockpiled materials would be located out with a 50 m buffer from watercourses, including on up gradient sides of tracks and battered to limit instability and erosion;
- where possible, stockpiled material would either be seeded or appropriately covered, minimising the area of exposed bare ground;
- monitoring of stockpiles/excavation areas during extreme rainfall events;
- water would 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 would 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 would be required to identify locations where settlement lagoons would be feasible;
- clean and dirty water onsite would be separated and dirty water would be filtered before entering the water environment;
- if the material is stockpiled on a slope, silt fences would 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, would be kept to a minimum and appropriate drainage would 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 would be developed - this may include silt traps, check dams and/or diffuse drainage;
- silt/sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
- construction personnel and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.

8.8.8 Sustainable Drainage Systems (SuDS)

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

In summary, 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 Proposed Development 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;
- onsite 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 would be used to prevent ditches developing into preferential flow pathways and ditches 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.

An outline drainage concept for Solar Development and the proposed BESS is discussed in **Technical Appendix 8-5** and **8-6** respectively.

The drainage system at the BESS will also be sized to manage firewater, should, in the unlikely event of a fire, fire water and fire retardants be used to extinguish a fire. Details of the proposed firewater management strategy associated with the proposed BESS is outlined in **Technical Appendix 8-7**.

Further information on ground conditions and drainage designs will be provided in the final CEMP.

8.8.9 Water Abstractions

If water abstraction for construction activities is required a potential source will be identified at the detailed design stage of the project and following site investigation. An application for a CAR authorisation would then be made to SEPA and managed through the regulation of the CAR. Should a suitable source not be identified, a water bowser would be used.

Good practice that would be followed in addition to the CAR regulations includes:

- planning of water use so as to minimise abstraction volumes;
- re-use of water where possible;
- recording of abstraction volumes; and
- control of abstraction rates to prevent significant water depletion in a source.

8.8.10 Watercourse Crossings

Eight new watercourse crossings are required to facilitate the Proposed Development, as detailed within **Technical Appendix 8-3** and shown on **Figure 8-1**.

The crossings will be designed to pass the 200-year flood event, including an allowance for climate change, and their design and construction details will be agreed with SEPA and DGC as part of the final CEMP.

In accordance with SEPA Technical Flood Risk Guidance and Good Practice Guidance for river crossings, a detailed flood risk assessment of the access track and watercourse crossings which cross the mapped floodplains will be undertaken at the detailed design stage of the project. The assessment will establish accurate baseline flood extents and flood depths and provide suitable parameters for the design of the access road and the crossing to ensure that they are capable of passing the 200-year plus climate change peak flow without adversely impacting peak flood extents and flood depths upstream or downstream of the crossing. The results of the flood risk assessment will be included in the final CEMP. If any land raising is proposed within the floodplain, appropriate flood compensation will be incorporated within the design of the access track and agreed with statutory consultees prior to construction.

8.8.11 Distribution Pipework

Technical Appendix 8-4 has confirmed that the proposed southwestern access track will cross the distribution pipework for a private water supply (PWS03). As part of the detailed design stage of the project, the location of the pipework at these locations will be confirmed and necessary protection implemented to ensure that the integrity of the infrastructure is maintained.

Where water distribution pipework is crossed by the Proposed Development this will be marked, and structural analysis competed. A site investigation will be undertaken to review and confirm the location of the pipework, review the condition of the pipework and provide any additional mitigation measures that would be required to safeguard the pipework. If required, additional protection to pipework will be put in place for the duration of works / traffic movement as required.

If damaged, the distribution pipework would be repaired, and reinstated, to its previous condition at the time of construction, as a minimum.

8.8.12 Solar Panel Construction

It is typically assumed that solar panels would intercept precipitation and shed this onto the ground along the lower edge of each array (the 'drip-line'). Runoff from each solar panel would continue to infiltrate into the underlying soils locally, in much the same way as existing conditions. It is therefore considered that solar panels will generally not impact floodplain storage or increase peak runoff rates and volumes. The risk of flooding at the Solar Development area will be mitigated through the measures discussed in **Technical Appendix 8-5** which include:

- Existing watercourses/drainage ditches should be retained;
- No development should occur within 8 m of existing watercourses/drainage ditches;
- Flood pathways associated with surface water runoff and runoff associated with existing drainage ditches should not be obstructed by the PV power stations. The lower edge of PV solar panels is typically set at a minimum of 0.8 m above ground level and, as such, should not obstruct overland flow pathways and no restrictions should be applied to the siting of the panels;
- New access crossing over Tarff Water should be designed to maintain existing conveyance capacity within the channel and on the floodplain, with no structures erected in the watercourse or the mapped flood extent (see **Section 8.8.10**);
- Any other new access crossings on existing drainage ditches should be designed to maintain existing conveyance capacity;

- If flooding of the access to the Proposed Development Site occurs during construction or operation, this should not be utilised until such time as water levels have receded, unless safe to do so. This should be addressed as part of the final CEMP and site operation details/plans; and
- The area under the solar panels should be seeded with a suitable grass mix to prevent rilling and an increase in surface water runoff rates as a result of the concentration of runoff under the drip line.

It is also proposed that filter drains, attenuation basins and catchpits will be positioned within and around the perimeter of the solar panel land parcels to help intercept and slow down any overland flows to provide betterment to the existing hydrological regime, as discussed in **Technical Appendix 8-5**.

Further information drainage designs will be provided in the final CEMP.

8.9 Assessment of Residual Effects

8.9.1 Construction Effects

Peat and Carbon Rich Soils

It has been shown (see **Technical Appendix 8-1**, **Technical Appendix 8-2** and **Section 8.6.2**) that the disturbance of peat and carbon rich soils as a result of the construction of the Proposed Development can be minimised and the peat deposits and carbon rich soils safeguarded.

In addition, the Applicant is committed to delivering habitat management and biodiversity plan. An outline of the proposed habitat management and biodiversity plan is presented in **Technical Appendix 6-6** which outlines the proposed peatland habitat restoration and enhancement measures. The final details will be provided and agreed with consultees prior to construction commencing, and these will be secured by a condition of consent. Habitat management works will be undertaken in accordance with the best practice detailed in this chapter and which would mitigate potential effects on peat and carbon rich soils.

Carbon rich soils and peat in modified condition are medium sensitivity receptors. With the identified safeguards and proposed good practice methods, the magnitude of effect on deposits of carbon rich soils and peat is assessed as no greater than low and therefore the significance of effect is minor and therefore not significant.

Pollution Risk

The risk of a pollution incident occurring will be managed using industry standard good practice measures (see **Section 8.8**). 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 materials that could otherwise lead to the pollution.

The baseline assessment has shown that the watercourses within the Study Area and groundwater beneath the Proposed Development are considered high sensitivity receptors. GWDTEs and DWPAs which are sustained by the local water environment are also considered high sensitivity receptors.

The good practice measures described in **Section 8.8**, that will also be set out in the final CEMP, will minimise the risk of a pollution event occurring. These measures will also include an emergency response plan which will be triggered in the case of an accident occurring to minimise pollution risk. The magnitude of effect associated with a pollution event is therefore considered negligible and thus the significance of effect is negligible and therefore not significant.

Erosion and Sedimentation

Location specific good practice measures will form part of the final CEMP and would be used to minimise the potential for erosion and sedimentation.

After consideration of good practice measures, the magnitude of effect associated with erosion and sedimentation is assessed as negligible. The Tarff Water DWPA, peat,

GWDTEs, groundwater and surface water are considered high sensitivity receptors. The significance of effect is therefore assessed as negligible and not significant.

Flood Risk

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

Attenuation of runoff generated within the excavations will allow settlement of suspended solids within the runoff prior to discharge in accordance with 'Site control' component of the SuDS 'management train'. An outline drainage concept for Solar Development and the proposed BESS is discussed in **Technical Appendix 8-5** and **8-6** respectively which will be developed at the detailed design stage of the project and included in the final CEMP. Subject to the adoption of suitable drainage designs, there would be no adverse impacts on flooding to the Proposed Development Site or adverse impacts on flood risk elsewhere.

As discussed in **Section 8.8.10**, a detailed flood risk assessment of the access track crossing of the mapped floodplains, including the Tarff Water, will be undertaken at the detailed design stage of the project. This will be included in the final CEMP to ensure that in providing suitable flood free access and egress from the Proposed Development there is no adverse impact on peak flood extents and flood depths upstream or downstream.

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.

The significance of effect on flood risk receptors downstream of the Proposed Development, which are considered to have a high sensitivity, is therefore assessed as negligible and not significant.

Infrastructure and Man-Made Drainage

The design of the Proposed Development has avoided areas of high ecological or habitat interest, including peat and GWDTE, wherever possible. Furthermore, the superficial and bedrock deposits have little groundwater and therefore limited or little dewatering is likely to be required. There remains potential however, for local dewatering of soils near cable trenches, turbine bases, substation, BESS and borrow pits, without incorporation of mitigation measures.

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. This will include suitable SuDS methods as outlined in **Section 8.8**, **Technical Appendix 8-5** and **8-6**.

The sensitivity of the receptor (groundwater and habitats and water supplies that may be dependent on groundwater) has been assessed as being high. Taking into consideration of the embedded mitigation and good practice measures, the magnitude of impact is assessed as negligible and therefore the significance of effect of changing groundwater levels and flow due to dewatering is considered negligible and not significant.

Water Abstraction

The volume of water and mitigation of any required water abstractions would be regulated through a CAR abstraction licence which would be agreed with SEPA. With this safeguard, the magnitude of effect on groundwater-surface water interactions is considered negligible. The significance of effect is therefore negligible, and not significant.

Private Water Supplies and Drinking Water Protected Areas

The controls which would be adopted for the Proposed Development in accordance with best practice and discussed in **Section 8.8** would be used to ensure water resources are not adversely affected and significant erosion and sedimentation does not occur.

PWSs and DWPAs are considered high sensitivity receptors. With the best practice construction techniques to protect the quality and quantity of surface water and groundwater receptors, in combination with the proposed monitoring programme (see example in **Technical Appendix 8-4**) the magnitude of effect is assessed as negligible, and the resultant significance of effect is assessed as negligible and not significant.

8.9.2 Operational (Including Maintenance) Effects

Should any maintenance be required onsite during the operational life of the Proposed Development which would involve construction type activities, mitigation measures would be adhered to along with the measures in the final CEMP. These would be adopted through a longer-term operational management plan, to avoid potential significant effects.

Pollution Risk

The good practice measures, as detailed in **Section 8.8** (to be set out in the final CEMP and will be adopted through a longer-term operational management plan), will minimise the risk of a pollution event occurring to negligible. Measures will also be put in place in the case of an accident occurring to contain pollutants and minimise the impacts of a spill.

At the BESS a firewater management plan will be adopted (see **Technical Appendix 8-7**) to ensure that firewater runoff can be fully contained.

It is therefore anticipated that the magnitude of effect of a pollution event during the operational phase of the Proposed Development is assessed as negligible. Therefore, the significance of effect for a pollution event during the operational phase of the Proposed Development is predicted to be negligible for all receptors and not significant.

Erosion and Sedimentation

The likelihood, magnitude and duration of a potential erosion and sedimentation event occurring would be negligible following adherence to good practice measures. The magnitude of impact is therefore considered negligible and thus the significance of effect on identified receptors (which are all considered as high sensitivity receptors) is negligible and not significant.

Should any non-routine maintenance be required at the sections of track crossing wet areas (defined visually onsite 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). This will be sought were required.

Flood Risk

In accordance with good practice, routine inspection and clearing of watercourse crossings at the Proposed Development will be undertaken, reducing the likelihood of a blockage occurring.

The SuDS drainage measures deployed across the Proposed Development 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 offsite.

The magnitude of effect is therefore assessed as negligible, and thus the significance of effect is assessed as negligible and not significant.

Infrastructure and Man-Made Drainage

Operation of the Proposed Development will require limited activities during the operational phase.

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

Private Water Supplies and Drinking Water Protected Areas

The controls which would be adopted at the Proposed Development during the operational phase, and which are in accordance with best practice outlined in **Section 8.8**, will safeguard surface and groundwater receptors including the private water supplies and River Tarff DWPA. The magnitude of effect if assessed as negligible and the resultant significance of effect is assessed as negligible and not significant.

8.9.3 Decommissioning Effects

Decommissioning the Proposed Development 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 Proposed Development. Methods for decommissioning and mitigation measures to be employed at decommissioning stage will follow best practice measures and guidance at that time.

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

8.9.4 Cumulative Effects

No other developments are noted both within 5 km of the Proposed Development and within the same surface water catchment as the Proposed Development. Therefore, cumulative effects are not anticipated as a result of the Proposed Development.

8.10 Monitoring Requirements

As all the predicted effects are negligible and therefore not significant in the context of the EIA Regulations, no additional mitigation during construction, operation or decommissioning is required other than the embedded good practice measures that the Applicant will implement as standard (see **Section 8.8**). The good practice measures will be adopted through the final CEMP and a longer-term operational management plan.

It has been recognised in this assessment that a programme of water monitoring would be required prior to any construction activity, during construction and immediately post construction of the Proposed Development. The monitoring programme would be agreed with statutory consultees and is expected to include monitoring of the watercourses which drain from the site, including the Tarff Water and a PWS source to ensure there are no impacts to PWS's or the Tarff Water DWPA (see **Technical Appendix 8-4**).

As detailed in **Technical Appendix 8-1**, it is proposed that a geotechnical risk register is maintained during the construction and post-construction phase of the Proposed Development, and secured by an appropriately worded predevelopment condition of consent.

As detailed in **Technical Appendix 8-2**, 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/EnvCoW and the Applicant. This would be specified in the site-specific CEMP and would be secured by an appropriately worded predevelopment condition of consent.

8.11 Opportunities for Enhancement

The Applicant is committed to delivering a habitat management and biodiversity plan. **Technical Appendix 6-6** outlines the proposed peatland habitat restoration and enhancements. The final details will be provided and agreed with consultees prior to construction commencing, and it is anticipated that these will be secured by a condition of consent. Habitat management works will be undertaken in accordance with the best practice detailed in **Section 8.8** of this chapter and will mitigate potential effects on peat and carbon rich soils.

8.12 Summary

An assessment of the potential effects of the Proposed Development on geology, hydrology, hydrogeology and peat within a defined Study Area (comprising Proposed Development Site plus land within 500 m of the boundary) has been undertaken. The assessment has considered the construction, operation and decommissioning phases of the Proposed Development.

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 extensive watercourse buffer areas. In addition, a site-specific CEMP as well as detailed design of infrastructure and associated mitigation will be implemented to protect groundwater and surface water resources from pollution, manage flood risk and minimise changes to the hydrological environment. An outline version of the CEMP (**Technical Appendix 15-1**) supports this application, which will be expanded as more site-specific information and ground investigation results are provided post-consent.

The impact assessment has taken into account the soil, geological and hydrological regime, highlighting the principal effects that will occur during the construction, operational and decommissioning phases. Following the successful design and implementation of mitigation measures the significance of effects on all identified receptors are considered negligible and are not defined as being significant.

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, DGC and other engaged stakeholders, will result in an effect that is considered to be not significant in the context of the EIA Regulations.

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