



Breezy Hill Energy Park

Appendix 8.7 Groundwater Dependent Terrestrial Ecosystems Risk Assessment

Breezy Hill Energy Limited

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SLR Project No.: 413.VT2633.00001

14 March 2025

Revision: 1



SLR Project No.: 413.VT2633.00001

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1	14 March 2025	B Narbett, C Marshall	D Nisbet	D Briggs

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1.0 Introduction

1.1 General

This Technical Appendix provides an assessment of potential areas of Groundwater Dependent Terrestrial Ecosystem (GWDTE) identified at the Proposed Development and considers actual groundwater dependency of these habitats, and if relevant, any impact the Proposed Development may have.

This hydrological assessment of identified GWDTEs, follows on from the conclusions of the National Vegetation Classification (NVC) survey report presented within Chapter 6 of the EIAR. The hydrological assessment was undertaken by reviewing desk-based information including topography, watercourses, geology etc. combined with notes and photographs taken during hydrological walkovers of the Site.

The Proposed Development is located approximately 13 km south-east of Ayr, 8.5 km southwest of Cumnock and 4.5 km north of Dalmellington in the East Ayrshire Council (EAC) area (the 'Site'). The approximate centre is at British National Grid (BNG) 247644, 612920.

1.2 Baseline

A detailed NVC survey was completed, as outlined in Chapter 6. From the NVC survey data, communities have been identified that have the potential to be groundwater dependent in accordance with Scottish Environment Protection Agency (SEPA) Guidance on Assessing the Impacts of Developments on Groundwater Dependent Terrestrial Ecosystems (August, 2024).

In accordance with the SEPA guidance note, the following infrastructure buffer zones will be implemented to assess areas for potential GWDTE:

- 10 m radius of all activities;
- 100 m radius of all subsurface activities less than 1 m in depth; and
- 250 m of all subsurface activities deeper than 1 m.

In accordance with guidance, only potential GWDTE communities within infrastructure buffers of 10 m, 100 m and 250 m buffers have been scoped into assessment, as shown in Annex 2 Drawing 1.

Based on the SEPA guidance note, the following potential GWDTE communities were identified:

- M4
- M6;
- M23;
- M28;
- MG9;
- MG10;
- U6;
- U16
- W4; and
- W7.



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Previous assessment of the NVC survey data based on previous SEPA-LUPS-GU31 guidance identified the presence of NVC community M25 as being 'Moderately' groundwater dependent. As this was the guidance at the time of surveys these areas of M25 were identified as potential GWDTEs. These were reviewed by hydrologists on a site-specific basis and were not found to be groundwater dependent, in line with updated SEPA guidance.

A review of the baseline features that may affect the groundwater dependency was undertaken in Chapter 8.

The Site is set primarily within commercial forestry with small areas of open moorland. Historic land use on-site includes opencast mining, with artificial modified surface waterbodies present. The elevation on-site slopes from 420 m Above Ordnance Datum (AOD) in the south of the Site to 220 m AOD in the north-west.

BGS GeoIndex Onshore Mapping shows the Site to be primarily underlain by peat deposits. Devensian till deposits are also mapped on-site, largely in the west and north-west of the Site. Alluvium deposits are present along the Water of Coyle in the centre of the Site. A small, localised area of glaciofluvial deposits comprising gravel, sand and silt is located in north-west of the Site.

BGS GeoIndex Onshore Mapping identified that the Site is predominantly underlain by the Scottish Lower Coal Measures Formation and Scottish Middle Coal Measures Formation, of the Scottish Coal Measures Groups. There are inferred coal seams mapped within the Scottish Lower Coal Measures Formation in the north-west and south-east of the Site. Olivine-Microgabbro and Analcime-Gabbro intrusions of the Midland Valley Carboniferous to Early Permian Alkaline Basic Sill Suite underlie the south-west and centre of the Site. Small, isolated areas of Ayrshire Basanitic and Foiditic Plugs and Vents are mapped in the east of the Site.

A review of the baseline features including topography, underlying geology, and surface water features, was undertaken to determine the groundwater dependency for each group of habitats. This is shown in Table 1 in Annex 1. Following this, identified mosaics of potential GWDTEs were scoped into further assessment.

During the Site walkover observations were noted on the following:

- Ground conditions including surface wetness;
- Peat depth;
- Habitat type;
- Topography;
- Breaks in slope or slumps present; and
- Identification of any springs or flushes.

In addition to these, features identified in SEPA guidance as being indicative of groundwater dependency were also noted if present:

- Habitats associated with springs;
- Where soils are persistently waterlogged on otherwise well drained, steep to moderate slopes, in the absence of surface water sources;
- Upper edge of GWDTE is aligned with concave breaks in slope;
- Diffuse groundwater emergence is often focused along linear geological features (fractures, faults etc);
- Persistent flow even during dry weather;
- Limited variation in temperature; and



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May be base enriched.

These observations combined with the desk-based assessment are shown in Table 2 in Annex 1, with the revised groundwater dependency.

1.3 Mitigation

1.3.1 Embedded Mitigation

Throughout the iterative design process, avoidance of GWDTEs was considered where practicable taking into account other technical constraints, including landscape and visual, ecology, peat depth and peatland condition. No Proposed Development infrastructure is sited on areas assessed as being groundwater dependent.

Best practice mitigation and guidance for protection of surface and groundwater receptors will be followed throughout the construction phase, as outlined in Chapter 8. These measures will include and are not limited to:

- Sediment pollution mitigation measures will be emplaced across the Proposed Development, this may include: drainage; silt fencing; settlement lagoons; and check dams.
- To avoid unnecessary compaction and disturbance to soils, working areas and corridors would be established and demarcated, with construction operatives appropriately inducted and trained to avoid work outside the designated work areas.
- Sufficient and continued dewatering at the turbine foundation excavation until the concrete is cured, to prevent leaching.
- Dewatering at the turbine will be minimised through careful management and reducing the time the excavation is open, including concrete pouring.
- Fuel and chemicals will be stored in impermeable bunded containers at least 110% of the volume stored. All fuelling on-site will occur in a designated location, at least 50 m from watercourses.
- Trackside drainage ditches will be designed to ensure separation of clean water drainage from potentially contaminated drainage.
- Check dams will be employed to slow down the flow of water and decrease erosion within drainage ditches.
- Sumps and settlement lagoons will be used to treat and slow down the flow of water during periods of high rainfall. This will be employed at drainage outlets prior to reaching watercourses.

A Watercourse Crossing Schedule (WCS) has been prepared and included as Technical Appendix 8.5. This provides recommended crossing types for required watercourse crossings. Detailed drainage design will be undertaken prior to construction to account for cross-drainage and culverts required to maintain hydrological connectivity upslope and downslope of the Proposed Development tracks and hardstanding.

A Construction Environmental Management Plan (CEMP) will be in place to control potentially polluting activities to prevent adverse impacts to surrounding receptors. Relevant mitigation measures to be implemented during construction to control water quality and quantity impacts will be outlined within the CEMP.



1.4 Potential Effects

GWDTE habitats identify areas where groundwater emerges and is in close proximity to the surface. The indicator GWDTEs and underlying designated groundwater may be impacted by changes in water quality and quantity. If construction activities of the Proposed Development are undertaken in close proximity to GWDTEs, this can have adverse impacts on underlying groundwater.

The Proposed Development can affect water quality through removal of protective layers of soil and subsoil increasing the vulnerability of underlying groundwater to pollution. The groundwater quality can also be affected from leaks or spills from vehicles, plant or equipment used or from leaching of concrete foundations.

The Proposed Development turbine foundations, borrow pits and linear infrastructure such as roads, tracks and trenches can disrupt or divert groundwater flow. Dewatering below groundworks may also change the quantity of groundwater available in the surrounding area.

1.5 Residual Effects

As outlined within Annex 1: Table 1 and Table 2, all potential GWDTEs identified have been assessed as not being groundwater dependent.

As defined in detail within Annex 1, the following reasons have been determined to result in potentially groundwater dependent NVC polygons being assessed as being not groundwater dependent:

- Polygons located along watercourses, minor streams, artificial and existing trackside drainage, indicating their dependence on surface water flow rather than groundwater.
- Polygons underlain by low permeability till or peat, which limit vertical and lateral hydrological connectivity to underlying groundwater.
- Polygons located downslope of ombrotrophic habitats of wet modified bog or blanket bog, which are fed by surface water run-off.
- Polygons where no point or diffuse groundwater emergence identified.
- Polygons where local hydrology is heavily modified by artificial drainage, plantation forestry and grazing.

Embedded and committed mitigation measures, as outlined above, will be implemented to ensure protection of groundwater from potential impacts. Following implementation of these measures, no significant adverse effects on indicator GWDTEs, groundwater quality or quantity are anticipated.

1.6 References

BGS (2024) Online GeoIndex Map Viewer. Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html. Accessed on: 10 April 2025.

SEPA. (2017). Land Use Planning System SEPA Guidance Note 31. Available at: https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions.pdf. Accessed on: 10 April 2025.

SEPA. (2023). Online Water Environment Hub and Classification Hub. Available at: https://www.sepa.org.uk/data-visualisation/water-environment-hub/. Accessed on: 10 April 2025.

SEPA (2024) Guidance on Assessing the Impacts of Developments on Groundwater Dependent Terrestrial Ecosystems. Available at: Guidance and advice notes | Scottish Environment Protection Agency (SEPA). Accessed on 10 April 2025.



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2.0 Conclusion

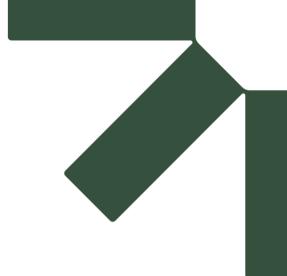
This Stage 1 Outline PMP presents a pre-construction assessment of the expected peat extraction and reuse volumes associated with the works phase of the construction of the Proposed Development. The PMP also provides the guiding principles which would be applied during the construction of the Proposed Development. Peat depth surveys have shown that there are peat deposits across the Proposed Development.

Through a process of continued design refinement (focused on minimising peat excavation volumes) and adoption of best practice working methods, the Proposed Development has been shown to achieve an overall peat balance. Thus, all excavated material will be required for reuse as part of the works and no surplus peat would be generated.

The figures detailed within this report are to be considered indicative at this stage. The total peat volumes are based on a series of assumptions for the layout of the Proposed Development and the results of several phases of peat probing. Such parameters can still vary over small scale areas and therefore topographic changes in the bedrock profile could impact the total accuracy of the volume calculations.

The calculations presented here would be updated and expanded upon as part of detailed design works, taking account of pre-construction site investigations and micro-siting, to confirm actual quantities of arising peat. A detailed, construction phase PMP would be developed, and maintenance by updating this plan in conjunction with a Geotechnical Risk Register. The implementation of the detailed PMP would ensure a robust commitment to excavating, storing and reinstating peat in a manner that follows best practice and ensures the protection of peat throughout the construction and post-construction phases.





ANNEX 1.

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Table 1 – NVC Community Review of Potential Groundwater Dependency

NVC Community	Habitat	GWDTE Dominance	Location	Description of Baseline Features	Potential Groundwater Dependency
M6	Acid Neutral Flush, Marsh/Marshy Grassland, Recently Felled Coniferous Woodland, Unimproved Acid Grassland, Wet Modified Bog	Dominant and subdominant	Polygons present across Site.	Largely located along forestry rides or watercourses surrounded by coniferous plantation. Often in larger areas to be ombrotrophic habitats of wet modified bog, often underlain by peat and deep peat. Underlain by low productivity and moderately productive bedrock aquifers. Local hydrology significantly modified by plantation forestry artificial drainage and access tracks.	Located in areas of high surface water run-off, either along artificial drainage of forestry rides, surface watercourses, within or downslope of ombrotrophic bog habitats.
M23	Marsh/Marshy Grassland, Unimproved Acid Grassland, Unimproved Neutral Grassland, Acid Neutral Flush, Recently Felled Coniferous Woodland, Coniferous Plantation Woodland, Wet Modified Bog	Dominant and subdominant	Polygons present across Site.	Located in areas of surface water run-off, along surface watercourses, waterbodies and artificial drainage of forestry rides. Underlain by low and moderately productive bedrock aquifers. Largely underlain by peat or till, with deposits of alluvium along the Water of Coyle.	Located in areas of high surface water run-off, along artificial drainage of forestry rides, surface watercourses, or waterbodies.
M28	Wet Modified Bog	Subdominant	One polygon in the east of the Site.	Noted to be an isolated area of wet modified bog habitat, surrounded by bare ground and grassland, located downslope of existing track. Underlain by moderately productive Scottish Coal Measures Group bedrock aquifer. Noted to be wet underfoot during Site walkover, however, located on gentle slopes underlain by artificial workings on banks of historic mining reservoir.	Located within ombrotrophic habitat in proximity to surface waterbody. Likely fed by overland surface water flow and limited input from near-surface flow within artificial deposits. Local hydrology has been heavily modified by previous mining and construction works.
MG9	Marsh/Marshy Grassland, Unimproved Acid Grassland,	Dominant and subdominant	Polygons present in centre	Underlain by low and moderately productive bedrock aquifers. Largely located in habitats of marsh/marshy grassland in areas of high surface	Located in areas of high surface water run-off, along artificial drainage of forestry rides, surface



NVC Community	Habitat	GWDTE Dominance	Location	Description of Baseline Features	Potential Groundwater Dependency
	Unimproved Neutral Grassland, Recently Felled Coniferous Woodland		and western slopes of Site.	water runoff along surface watercourses, including Water of Coyle. Often located immediately downslope of habitats of ombrotrophic wet modified bog.	watercourses, within or downslope of ombrotrophic bog habitats.
MG10	Marsh/Marshy Grassland, Semi- Improved Acid Grassland	Dominant and subdominant	Polygons present on slopes in the north- west of the Site.	Underlain by moderately productive aquifer of Scottish Coal Measures Group, where groundwater flow is largely through fractures. Underlain by largely low permeability till deposits, partly underlain by peat. Located downslope of plantation forestry, or in grassland modified by grazing.	Further detailed assessment required.
W4	Broad-Leaved Plantation Woodland, Coniferous Plantation Woodland, Marsh/Marshy Grassland	Dominant and subdominant	Seven isolated polygons present across the Site.	Largely underlain by low productivity bedrock aquifer Western Midland Valley Sill, and Ayrshire Basanitic and Foiditic Plugs and Vents. Where underlain by Scottish Lower Coal Measures Formation, no coal seams or underlying faults mapped. Underlain or located downslope of mapped peat deposits. Located on flat-lying areas surrounded by existing forestry access tracks or along surface watercourses.	Not groundwater dependent, underlain by peat or till limiting vertical connectivity, with local hydrology artificially modified by surrounding existing forestry tracks and drainage. Located and fed by surface water runoff to watercourses.
W7	Marsh/Marshy Grassland, Broad- Leaved Plantation Woodland, Mixed Plantation Woodland, Recently Felled Coniferous Woodland, Unimproved Acid Grassland	Largely Dominant	Isolated polygons present across the Site.	Largely located along watercourses and forestry rides. Underlain by mapped superficial deposits of peat and till. Underlain by moderate and low productivity bedrock aquifers.	Further detailed assessment required.



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Table 2 – Mosaic Specific Review of Potential Groundwater Dependency

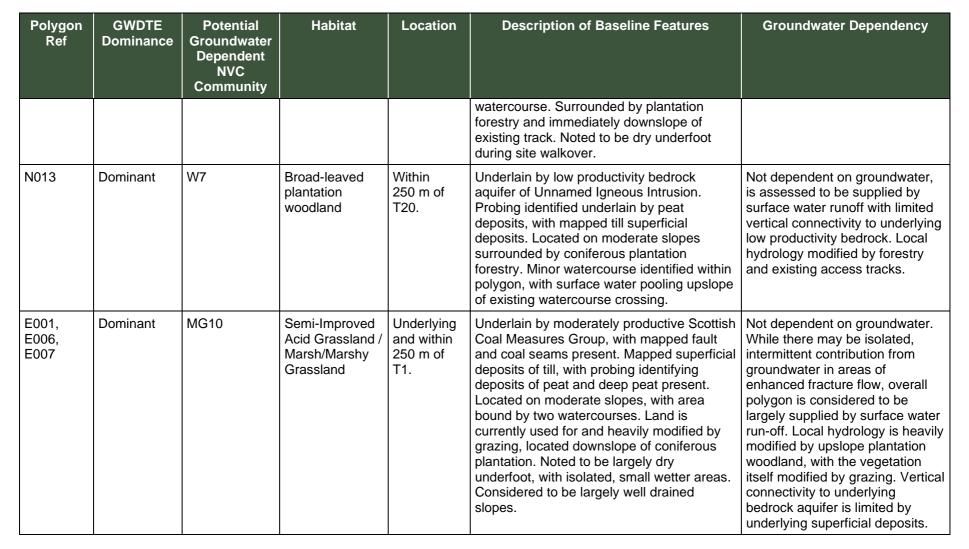
Polygon Ref	GWDTE Dominance	Potential Groundwater Dependent NVC Community	Habitat	Location	Description of Baseline Features	Groundwater Dependency
E008	Dominant	W7	Broad-leaved plantation woodland	Within 100 m of track to T1.	Underlain by moderately productive bedrock aquifer of Scottish Coal Measures Group, with coal seams indicated downslope. No faults present. Underlain by deep peat deposits, with BGS mapping indicating till deposits present. Located on edge of coniferous plantation forestry, on moderate slopes along watercourse.	Not dependent on groundwater. While there may be limited input from moderately productive bedrock, flow is largely through fractures with none mapped underlying polygon. Vertical connectivity will also be limited by deep peat deposits. Likely fed by surface water runoff from artificial drainage upslope, where local hydrology is modified.
E009	Dominant	W7	Broad-leaved plantation woodland	Within 250 m of T1.	Underlain by moderately productive bedrock aquifer of Scottish Coal Measures Group, with coal seams indicated downslope. No faults present. Underlain by deep peat deposits, with BGS mapping indicating till deposits present. Located on edge of coniferous plantation forestry, on moderate slopes along watercourse.	Not dependent on groundwater. While there may be limited input from moderately productive bedrock, flow is largely through fractures with none mapped underlying polygon. Vertical connectivity will also be limited by peat deposits. Likely fed by surface water runoff from artificial drainage upslope, where local hydrology is modified.
E015	Dominant	W7	Broad-leaved plantation woodland	Within 250 m of T1.	Underlain by moderately productive Scottish Lower Coal Measures, and igneous intrusion. Partly underlain by peat, with BGS mapping indicating widespread low permeability till deposits. Located on moderate slopes along watercourse, along	Not dependent on groundwater. Connectivity to underlying bedrock aquifer will be limited by thick clay rich till superficial deposits. Will be largely fed by surface water runoff from artificial



Polygon Ref	GWDTE Dominance	Potential Groundwater Dependent NVC Community	Habitat	Location	Description of Baseline Features	Groundwater Dependency
					edge of coniferous plantation forestry. Noted to be largely dry underfoot during site visit with isolated pools in furrows.	drains upslope, with local hydrology modified.
E045	Dominant	W7	Broad-leaved plantation woodland	Within 250 m of T3.	Hydrogeology mapping (1:625,000) shows underlain by low productivity bedrock aquifer, however, BGS bedrock geology (1:50,000) shows underlain by Scottish Lower Coal Measures Formation. Probing identified polygon is underlain by peat and deep peat, with widespread mapped till superficial deposits. Located immediately downslope of coniferous plantation, marsh/marshy grassland and wet modified bog habitats. Located on gentle slopes, upslope of surface watercourse.	Not dependent on groundwater, is assessed to be supplied by surface water runoff from artificial drainage in plantation forestry upslope, with limited vertical connectivity to underlying bedrock aquifer due to deep peat deposits. Local hydrology upslope and in surrounding area heavily modified by plantation forestry. Disconnected from nearest turbine (T3) by surface watercourse.
J008, J009	Dominant	W7	Marsh/marshy grassland	Within 250 m of T6 and T7.	Underlain by low productivity bedrock aquifer of Unnamed Igneous Intrusion. Probing identified underlying peat and deep peat deposits, with BGS mapping showing till superficial deposits present. Minor watercourse identified within polygon with surface water runoff from existing track.	Not dependent on groundwater, is assessed to be supplied by surface water runoff with limited vertical connectivity to underlying low productivity bedrock. Local hydrology modified by forestry and existing access tracks.
J047	Dominant	W7	Marsh/marshy grassland	Within 250 m of T6.	Largely underlain by low productivity bedrock, with moderately productive bedrock downslope. Located downslope of probed peat deposits, underlain partly by till superficial deposits. Located on gentle slopes, upslope and along surface	Not dependent on groundwater is assessed to be supplied by surface water along watercourse and surface water runoff. Local hydrology modified by forestry and existing access tracks.



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Polygon Ref	GWDTE Dominance	Potential Groundwater Dependent NVC Community	Habitat	Location	Description of Baseline Features	Groundwater Dependency
E016	Dominant	MG10	Marsh/marshy grassland	Within 250 m of T1.	Underlain by moderately productive Scottish Lower Coal Measures, while no peat deposits identified by probing, BGS mapping shows widespread till deposits present. On-site these till deposits were noted to be clay-rich. Polygon is noted to be associated with an artificially modified drain. Area is used for grazing with drain associated with upslope coniferous plantation woodland.	Not dependent on groundwater. Considered to be supplied surface water run-off from upslope artificial drainage and drain within grazing field. Local hydrology is heavily modified.
E101	Subdominant	MG10	Semi-Improved Acid Grassland	Within 250 m of T3.	Underlain by low productivity bedrock aquifer, with BGS mapping shows underlain by Ayrshire Basantitic and Foiditic Plugs and Vents, underlain by till deposits. Located downslope of peat and deep peat deposits. Watercourse present within polygon.	Not dependent on groundwater. Considered to be supplied by surface water runoff from artificial drainage of plantation forestry upslope and peat deposits. Vertical connectivity to underlying low productivity bedrock aquifer limited by low permeability superficial deposits.
Y008, Y009, Y015	Dominant	MG10	Marsh/marshy grassland	Within 250 m of T1 and T2.	Hydrogeology mapping (1:625,000) shows underlain by moderately productivity bedrock aquifer, however, BGS bedrock geology (1:50,000) shows partly underlain by Scottish Lower Coal Measures Formation and Western Midland Valley Sills. Underlain by mapped till superficial deposits, with peat upslope. Located on moderate slopes, upslope of watercourse.	Not dependent on groundwater. While there may be limited, localised input from groundwater, considered to be largely supplied by surface water runoff. Local hydrology is heavily modified by grazing. Hydrologically disconnected from nearest turbine by surface watercourse.



Polygon Ref	GWDTE Dominance	Potential Groundwater Dependent NVC Community	Habitat	Location	Description of Baseline Features	Groundwater Dependency
					Located downslope of semi-improved acid grassland, with area modified by grazing.	

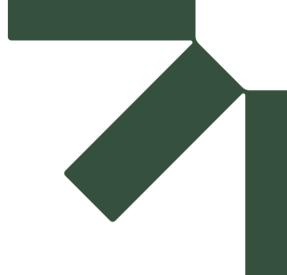
Table 3 GWDTE Photographs





Source Ref	Photograph
E016	





ANNEX 2. Figures

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