

Technical Appendix 8.2: GWDTE Assessment

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1.1 Introduction

- 1.1.1 This Technical Appendix provides a summary of Groundwater Dependant Terrestrial Ecosystems (GWDTEs) within the context of the Proposed Development and provides a description of geological and hydrogeological conditions underlying the Site. Characterisation of the Proposed Development area takes into account National Vegetation Classification (NVC) surveying carried out by Alba Ecology in July 2022 and published British Geological Society (BGS) mapping. Hydrogeological assessment of the identified potential GWDTEs is provided with associated mapping.
- 1.1.2 According to SEPA, GWDTE are specifically protected under the Water Framework Directive and are considered sensitive receptors. SEPA specifically state that “Assessment is required to determine whether the potential GWDTE features identified are likely to be dependent on groundwater, either year around or seasonally.” Therefore, assessment of both ecological and hydrogeological conditions should be taken into account in determining the groundwater dependency and sensitivity of vegetation communities.
- 1.1.3 In line with SEPA guidance, the assessment below reviews the hydrological and hydrogeological conditions across the Site at areas where NVC surveying has identified potentially groundwater dependent vegetation communities.
- 1.1.4 This TA is supported by the following appended figures:
- Figure 8.2.1: BGS 1:625,000 Bedrock Geology
 - Figure 8.2.2: BGS 1:625,000 Superficial Geology
 - Figure 8.2.3: BGS 1:625,000 Hydrogeology
 - Figure 8.2.4: Surface Water Accumulation
 - Figure 8.2.5: Topographic Wetness Index
 - Figure 8.2.6: NVC Potential GWDTE Classification
 - Figure 8.2.7: Ramboll GWDTE Assessment
- 1.1.5 The Proposed Development is a renewable energy development comprised of up to eight wind turbines, a Battery Energy Storage System (BESS) and associated infrastructure adjacent to Sullom Voe Oil Terminal (SVT) and the Shetland Gas Plant in Shetland, Scotland. The Proposed Development is described in Chapter 2: Proposed Development (EIAR Volume 2).

1.2 Baseline

Bedrock Geology

- 1.2.1 According to BGS 1:625,000 mapping (Figure 8.2.1: BGS 1:625,000 Bedrock Geology) majority of the Site (approximately 60%) is underlain by bedrock of an unnamed igneous intrusion, late silurian to early devonian - felsic-rock. The remainder of the Site, approximately 30% of the Site in the north-west, is underlain by bedrock of the Yell Sound Psammite Formation.

Superficial Geology

- 1.2.2 According to BGS 1:625,000 mapping (Figure 8.2.2: BGS 1:625,000 Superficial Geology) the Site is underlain by Peat, which has been confirmed through peat surveys carried out at the Site dated April 2025 (Stage 1) and July 2025 and February 2026 (Stage 2).

Hydrogeology

- 1.2.3 BGS 1:625,000 Hydrogeology mapping (**Figure 8.2.3: BGS 1:625,000 Hydrogeology**) shows that the whole site is underlain by geological formations that form Low productivity aquifers with limited groundwater.

Surface Water Features and Surface Water Accumulation

- 1.2.4 OS mapping shows that the Site is characterised by the presence of a number of watercourses as shown in **Figure 8.1: Surface Water Features (EIAR Volume 3a)**. Further assessment has been carried out to more accurately define potential overland surface water flow pathways (**Figure 8.2.4: Surface Water Accumulation**) across the Site (based on preferential topographic routes of flow from sub-catchment areas or zones of contribution where these exceed an area of 500m²) and the relative wetness of different areas of the Site based on definition of a Topographic Wetness Index (TWI) (**Figure 8.2.5: Topographic Wetness Index**) for the Site. These elements have been used to provide hydrological assessment of the likelihood that habitats may result from the accumulation of surface water (rather than the emergence of groundwater).

1.3 National Vegetation Classification of Potential GWDTEs

- 1.3.1 Specific guidance for the assessment of potential GWDTE habitats has been published by SEPA¹ and sets out the principles for determining the groundwater dependency of habitats (and therefore their sensitivity to alterations in groundwater supply). According to the SEPA GWDTE guidance document, GWDTE may be defined as habitats “directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations of substances (and potential pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body.”
- 1.3.2 Therefore, where GWDTE are found to be present there is the potential for direct impacts where habitat may be lost, as well as the potential for indirect impacts as a result of any alteration in the quality or quantity of groundwater supply. Excavation of soil and bedrock during the construction phase of the Proposed Development may cause localised disruption and interruption to groundwater flow. Interruption of groundwater flow would potentially reduce the supply of groundwater water to GWDTEs thereby causing an alteration/change in the quality or quantity of and/or the physical or biological characteristics of the GWDTE. Contamination of groundwater may also cause physical or chemical contamination to the GWDTE.
- 1.3.3 Following identification of potential GWDTEs from NVC mapping data, hydrological and hydrogeological desktop study information has been used to help qualitatively determine the potential sensitivity of each potential GWDTE to alterations in groundwater supply. Hydrogeological assessment considers the

¹ SEPA Guidance on Assessing the Impacts of Developments on Groundwater Dependent Terrestrial Ecosystems (2024). Available at: <https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.sepa.org.uk%2Fmedia%2Fa1yh0blq%2Fguidance-on-assessing-the-impacts-of-developments-on-groundwater-dependent-terrestrial-ecosystems.docx&wdOrigin=BROWSELINK>

potential for ground-surface water interactions, and therefore the potential for habitats to be reliant on water supplies from the underlying aquifer.

- 1.3.4 Further details with regard to each potential GWDTE identified are provided below. The sensitivity of each of the potential GWDTE receptors has been classed based upon known best practice, using classifications provided within SEPAs guidance document for assessing the impacts of wind farms (LUPS-GN31)².
- 1.3.5 Several areas of potentially Moderately or Highly GWDTE habitat areas were identified within the Site during NVC surveys conducted by Alba Ecology in July 2022. Further details with regard to each NVC GWDTE habitat identified are provided below and illustrated in **Figure 8.2.6: NVC Potential GWDTE Classification**.
- 1.3.6 Table 8.2.6 sets out the predominant NVC communities encountered across the Site and confirms those with the potential to be a GWDTE which have been assessed further (**Figure 8.2.6: NVC Potential GWDTE Classification**). Only potential GWDTE vegetation communities identified in ecological surveying are included in **Table 8.2.1**. **Table 8.2.2** assesses the likely degree of dependency on the underlying groundwater body, according to site-specific ecological and hydrological conditions. For each area assessed within **Table 8.2.2**, justification of the assessment of potential groundwater dependency is provided.

Table 8.2.1: GWDTE NVC Communities Present, Equivalent UKHAB Classification and their Initial Potential Groundwater Dependency, according to SEPA NVC Classification Only			
GWDTE Potential Habitats Present	GWDTE Potential Habitats Present	GWDTE Potential Habitats Present	Total Area Within Developable Area (m²)
M6	E2.1 – Acid flush / mire + D5 – Wet heath / mire complex	High	24,610
M29	E2.1 – Acid flush / mire	High	628
M15 only	E1.8 – Mire communities + E1.7 – Acid flush / mire + D2 – Wet dwarf shrub heath	Moderate	138,763
MG10 only	B5 – Marshy grassland + B1.1 – Semi-improved / neutral grassland (U6-associated mosaics)	Moderate	60,647
MG10 + M15	B5 – Marshy grassland + D2 – Wet dwarf shrub heath	Moderate	18,729
M6	E2.1 – Acid flush / mire + D5 – Wet heath / mire complex	High	24,610

1.4 Groundwater Dependency Assessment

- 1.4.1 The Proposed Development area is underlain by Low productivity aquifers, and there is therefore a low potential for the emergence of groundwater from the aquifer at the surface.
- 1.4.2 In order to further assess the extent to which NVC communities are likely to be reliant on groundwater (rather than being reliant on direct rainfall, surface water runoff or connection to surface water features), a review has been carried out of flow paths of surface water runoff (flow accumulation) across the Site and assessment of areas at which the accumulation of surface water is likely to be observed (according to the calculated Topographic Wetness Index across the Site).

- 1.4.3 The majority of potential GWDTE vegetation communities (High and Moderate) are located in connection to surface water runoff paths, drainage features or are situated on areas of surface water accumulation (underlain deeper peat and characterised by poor drainage). The Site is not characterised by areas indicative of flush habitat, which was confirmed during a site walkover carried out by Ramboll in May 2025.
- 1.4.4 Following identification of habitats with potential to be GWDTEs from NVC mapping data, the hydrological and hydrogeological desktop study information has been used to help qualitatively determine the sensitivity of each potential GWDTE. This has been further supported by the May 2025 hydrology walkover survey of the Site.
- 1.4.5 Where a mosaic of NVC classifications was observed, only the community occupying the largest proportion of the mosaic has been considered as representative of the potential for the mosaic to be a GWDTE.
- 1.4.6 The sensitivity of each GWDTE receptor has been classified in accordance with known best practice, informed by Scottish Environment Protection Agency (SEPA) guidance LUPS – GN31³. The SEPA classification is modified from the UKTAG (2008)⁴ list of NVC communities, which provides the full list for all communities. The relevant UKTAG classification is also provided.
- Ramboll has assessed site-specific conditions in relation to potential GWDTEs considering hydrogeological assessment of groundwater dependency as presented in **Table 8.2.1** and **Figure 8.2.7: Ramboll GWDTE Assessment**. This assessment includes consideration of:
 - The direct hydrological connectivity of a potential GWDTE to surface water sources;
 - Underlying geological conditions including the productivity of bedrock and superficial geology, the presence of peat soils and permeability of upgradient geology;
 - Topography and the presence of rills or runnels indicative of surface runoff;
 - The presence of indicative 'flush' patterns of vegetation communities;
 - Land use; and
 - The relative proportion of NVC communities and the potential dominance of non-GWDTE communities within surveyed areas.
- 1.4.7 In order to assess the hydrological connectivity of the peatland, the Site has been divided into distinct areas—North, Central/East, and South—based on the locations of the Proposed Development, as presented in the table below.

Table: 8.2.2: Assessment of Groundwater Dependency Risk Areas, according to Refined Site-Specific Hydrological and Ecological Conditions				
GWDTE Site Area	GWDTE Classification (SEPA GN 31)	Ramboll Groundwater Dependency Assessment	Justification	Total Shape Area (m²)
Northern Area	Moderate	Not GWDTE	Ephemeral surface water flow paths and connection to north-western tributaries and main watercourse of the Aywick Burn and high TWI. Underlain by Low productivity aquifer.	45,619

² SEPA Land Use Planning System SEPA Guidance Note 31 Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems https://www.sepa.org.uk/media/143868/lupsqu31_planning_guidance_on_groundwater_abstractions.pdf [Accessed 07/04/2026]

³ SEPA, Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems, LUPS – GN31, Version 2, October 2014

⁴ UK Technical Advisory Group - UK environmental standards and conditions: Available at - https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/Environmental%20standards%20phase%201_Finalv2_010408.pdf

Table: 8.2.2: Assessment of Groundwater Dependency Risk Areas, according to Refined Site-Specific Hydrological and Ecological Conditions

GWDTE Site Area	GWDTE Classification (SEPA GN 31)	Ramboll Groundwater Dependency Assessment	Justification	Total Shape Area (m²)
Central-Eastern Area	Moderate	Not GWDTE	Surface water flow paths and connection to north-western tributaries and north of the main watercourse of the Burn of Toft and high TWI. Underlain by Low productivity aquifer	32,648
Southern Area	Moderate	Not GWDTE	Surface water flow paths and connection to north-western tributaries and south of the main watercourse of the Burn of Sandwater, Burn of Grunnavoe. Underlain by Low productivity aquifer.	62,129
Northern Area	High	Not GWDTE	Ephemeral surface water flow paths and connection to north-western tributaries and main watercourse of the Aywick Burn and high TWI. Underlain by Low productivity aquifer.	13,217
Central-Eastern Area	High	Not GWDTE	Surface water flow paths and connection to north-western tributaries and north of the main watercourse of the Burn of Toft and high TWI. Underlain by Low productivity aquifer.	7,213
Southern Area	High	Not GWDTE	Surface water flow paths and connection to north-western tributaries and south of the main watercourse of the Burn of Sandwater, Burn of Grunnavoe. Underlain by Low productivity aquifer.	4,187

- 1.4.8 UKTAG guidance (2004)⁵ recognises that most "water dependent terrestrial ecosystems lie along a continuum between always only groundwater dependent and always only surface water dependent [...]. The source of water supply for some wetlands does not appear to be critical, therefore the task of identifying dependence upon groundwater is sometimes complex".
- 1.4.9 Scotland and Northern Ireland Forum for Environmental Research (SNIFFER (2007) guidance⁶ states that the dependence of wetlands on groundwater bodies is a result of hydrological connectivity. The degree of dependency will vary depending on whether the wetland is underlain by a low productivity or high productivity aquifer and whether there is a hydrological linkage mechanism between groundwater and the surface wetland. Likelihood of dependency is based upon the following:
 - High Likelihood: characterised by intergranular, high productivity drift aquifer and dominantly intergranular, highly productive aquifer;

- Moderate Likelihood: characterised by intergranular, moderate productivity drift aquifer and fractured, very low productivity aquifer; and
- Low Like likelihood: characterised by intergranular, very low productivity drift aquifer and fractured, very low productivity aquifer.

1.4.10 The underlying bedrock aquifer is assessed by the BGS to be of Low productivity. Where superficial deposits of peat are present within the Site, while these soils may have a relatively high moisture content, peat generally has low hydraulic conductivity. Therefore, it is assumed that there is low likelihood of groundwater dependency for all the GWDTEs within the Site (**Table 8.2.2**). As areas of potential GWDTE are not considered as dependant on groundwater, these areas would be considered ombrogenous (rain fed) peat as affirmed by surface water accumulation analysis.

1.4.11 The UKTAG (2004) guidance provides criteria for identification and inclusion of GWDTEs in the risk assessment process, based on complementary ecological and hydrogeological assessments. These criteria have been used to produce the following matrix (**Table 8.2.3**), which provides an identification of sensitive and potentially sensitive GWDTEs that require a qualitative assessment to ascertain the significance of the risks the Proposed Development poses to them.

Table 8.2.3: Matrix for Identification of Sensitive GWDTEs from Ecological and Hydrogeological Assessments				
		Hydrogeological Assessment Groundwater Dependency Level		
		High Likelihood	Moderate Likelihood	Low Likelihood
Ecological Assessment of NVC Communities	Highly groundwater dependent	Sensitive GWDTE	Potentially sensitive GWDTE	Potentially sensitive GWDTE
	Moderately groundwater dependent	Potentially sensitive GWDTE	Potentially sensitive GWDTE	Not sensitive
	Not groundwater dependent	Potentially sensitive GWDTE	Not sensitive	Not sensitive

1.4.12 Since the likelihood of groundwater dependency is considered to be Low for all of the potential GWDTEs across the Site, in line with underlying hydrogeological conditions, where potential GWDTE areas are identified in the site-specific assessment of NVC communities as being not groundwater dependent, habitats are considered not sensitive (**Table 8.2.2**) and have, therefore, been excluded from further assessment.

1.5 Mitigation and Further Assessment

- 1.5.1 Hydrological and hydrogeological assessment shows that habitats identified through NVC surveying are situated on areas assessed not to be GWDTE. As such, specific mitigation with respect to groundwater supplies are not considered to be applicable.
- 1.5.2 It is considered that the maintenance of quality and quantity in surface water distribution across habitats will be important, particularly on areas of bog and peatland habitats. Suitable drainage and surface water measures would be used to maintain hydrological connectivity in peatland and wetland habitats and prevent deleterious impacts on surface water distribution, which would be addressed in a Construction Environment Management Plan (CEMP) for the construction of the Proposed Development. The CEMP

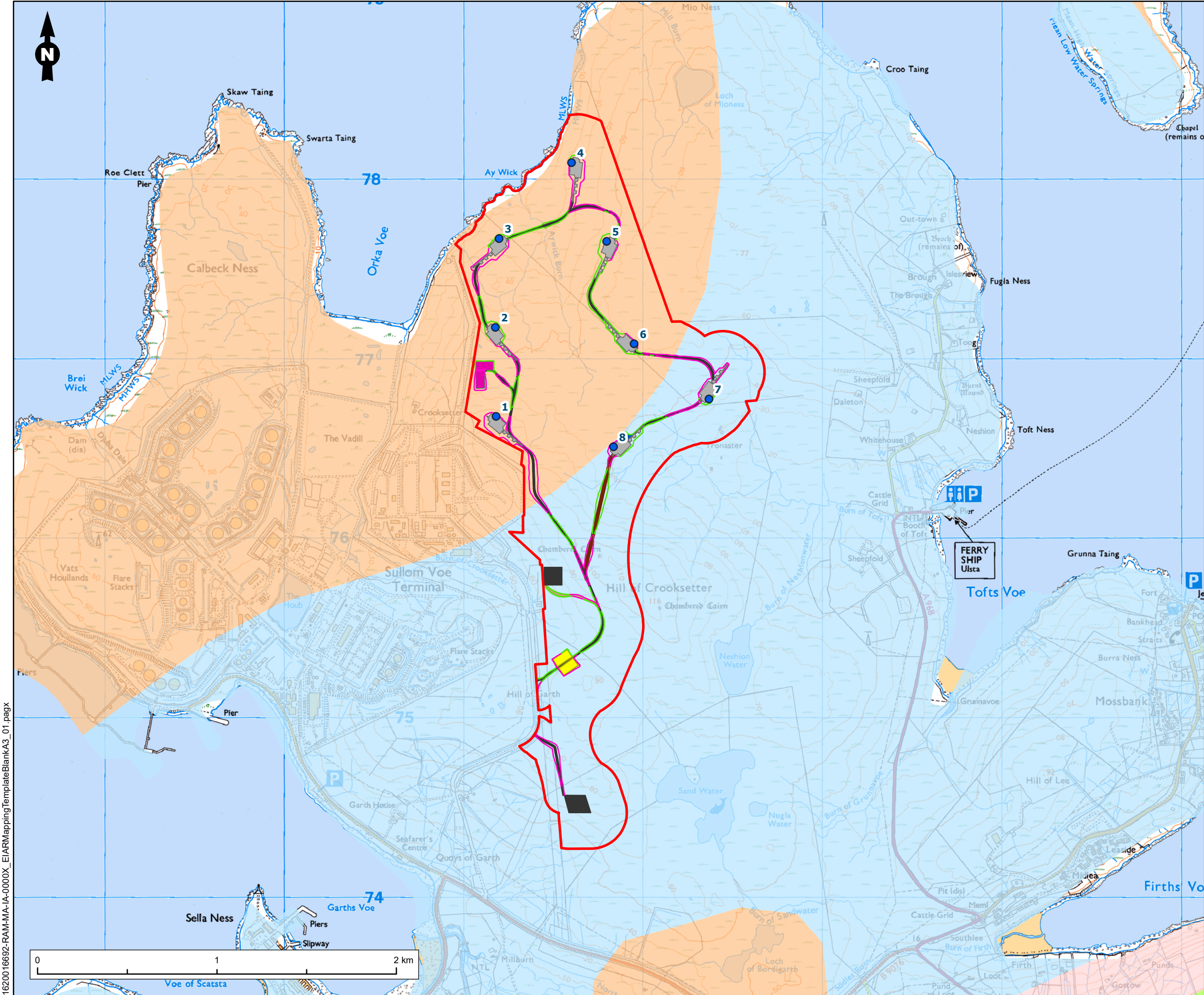
⁵UKTAG 2004, Guidance on the identification and risk assessment of groundwater dependent terrestrial ecosystems (21/01/04) Version 5 https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Risk%20assessment%20of%20terrestrial%20ecosystems%20grounwater_Draft_210104.pdf [Accessed 07/04/2026]

⁶ SNIFFER (2007) WFD66 – Wetland Hydrogeomorphic Classification for Scotland. Edinburgh: SNIFFER

would be developed by the Principal Contractor at the stage of detailed design. Embedded mitigation measures would include the following:

- Avoidance of direct impacts by construction activity in such areas;
- Implementation of Sustainable Drainage System (SuDS) measures to maintain quality of water supply;
- Maintenance of flow paths/ redistribution of water where diverted; and
- Implementation of pollution control measure.

- 1.5.3 Based on the assessment of surface water flow paths carried out for this Technical Appendix, it is identified that access tracks, run across areas where surface water flows are to the south upslope of an area of vegetation likely to be reliant on surface water supplies. Therefore, the tracks could reduce or constrain the distribution of surface water runoff to the south. Cross drainage of the track should ensure that surface water supplies are distributed to the south through the provision of a number of culverted cross drains at this location.
- 1.5.4 Further detail on measures that would be taken to ensure continued cross-drainage and water supply to peatland habitats are provided in **Chapter 8: Hydrology, Hydrogeology, Geology and Soils (EIAR Chapter 2)** and **Technical Appendix 8.3: Watercourse Crossing Assessment (EIAR Volume 4)**



Application Boundary

Proposed Turbine

Proposed Hardstanding

Earthworks - Cut

Earthworks - Fill

Proposed Substation, BESS and Lidar Area

Proposed Construction Compound

Proposed Access Tracks

Proposed Turning Head

Proposed Borrow Pit Search Area

Proposed Temporary Borrow Pit Access Track

Proposed Operation and Maintenance Access Track

UNNAMED IGNEOUS INTRUSION, LATE SILURIAN TO EARLY DEVONIAN - FELSIC-ROCK

APPIN GROUP - GRAPHITIC PELITE, CALCAREOUS PELITE, CALCSILICATE-ROCK AND PSAMMITE

BOUNDARY ZONE COMPLEX - GNEISSOSE SEMIPELITE AND GNEISSOSE PSAMMITE

MOINE SUPERGROUP - GNEISSOSE PSAMMITE AND GNEISSOSE SEMIPELITE

Figure Title

BGS 1:625,000 Bedrock Geology

Project Name

Neshion Energy Park

Project No./Fily ID

1620016691 / REH2024N00248

Date

April 2026

Figure No.

8.2.1

Revision

1.0

Prepared By

KR

Scale

1:20,000 @A3

Client

Neshion Ltd

RAMBOLL

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