Coille Beith Wind Farm

Technical Appendix 8.5: Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment

June 2025

Contents

1. Introduction

1.1 Background

1.1.1 This Groundwater Dependent Terrestrial Ecosystems (GWDTE) Assessment has been prepared by Fluid Environmental Consulting (Fluid) on behalf of Coille Beith Wind Farm Limited (the Applicant) to support the Environmental Impact Assessment (EIA) Report for Coille Beith Wind Farm (the 'Proposed Development'). The Site is located near Oykel Bridge, Sutherland. The Site is comprised of predominantly commercial plantation forest with pockets of open habitat in the north and south consisting of wet heath, acid grassland and marshy grassland. Several patches of natural broadleaved woodland are also present, typically on steep ground on the walls of watercourse valleys.

1.1.2 GWDTEs are protected environments under the Water Framework Directive (WFD) legislation and assessments are regulated by the Scottish Environment Protection Agency (SEPA). This technical appendix provides an assessment of areas of potential GWDTEs within proximity of the Proposed Development infrastructure, considering the hydrological/hydrogeological setting, topography, geology, and existing infrastructure.

2. Methodology

2.1 Identification of GWDTEs

2.1.1 A detailed National Vegetation Survey (NVC) survey has been completed and is presented in **Technical Appendix 6.1** (EIA Report Volume 4). A total of 287 polygons and 98 target notes were identified across the Site which includes the western access track option.

2.1.2 Only the western access track option is being considered in this assessment as it represents the worst-case scenario, with the majority of the eastern track option having been assessed previously through the (now consented) Strath Oykel Wind Farm planning permission[1]. This concluded, *it is not considered that the habitats recorded are fed by a groundwater source and are therefore not considered to be groundwater dependent*. It should be noted the Strath Oykel EIAR was completed in 2022 and no recent site visit has been carried out for the eastern access track.

2.1.3 The methodology for the identification of potential GWDTEs is as follows:

- Review of all NVC categories to determine which are potentially groundwater dependent (GWD) in accordance with SEPA Land Use Planning System Guidance[2] and guidance on assessming impacts to GWDTE[3] initially by the ecologists identifying 41 potentially GWDTEs polygons, three Target Notes and a further five notes of groundwater upwelling or sepage associated with potentially GWD features.
- Create relevant buffer zones for GWDTE for all proposed infrastructure (provided expected dewatering rates do not exceed 10 m^3/day) at a distance of:
  - 10 m radius of all activities;
  - 100 m around subsurface activities where excavation would be less than 1 m depth; and
  - 250 m from subsurface activities turbines where excavation could exceed 1 m depth, e.g. turbines and borrow pits.
- The SEPA 2024 guidance presents the NVC categories to be considered as potentially GWD and refers to the UKTAG (2008) List of NVC Communities and Associated Groundwater Dependency Scores, Annex 1 (updated October 2009) for their Scottish scores (which relates to whether they are considered potentially low, moderate or high groundwater dependence). The identified potentially GWDTE polygons and Target Notes within the buffers were then categorised into potentially moderately GWDTEs and potentially highly GWDTEs based on the UKTAG scores. This resulted in the following 24 potential GWDTE polygons and one target note within the buffers (see **Figure 8.5.1**, EIA Report Volume 3a):
  - Two high potential GWDTE polygons;
  - Eight mosaic polygons containing potentially high GWDTEs;
  - Nine mosaics polygons containing potentially moderately GWDTE polygons; and

[1] (https://www.energyconsents.scot/ ECU reference ECU00003246)
[2] SEPA Land Use Planning System Guidance[2] Note 31 (LUPS 31, version 3, 2017
[3] Guidance on Assessing the Impacts of Developments on Groundwater Dependent Terrestrial Ecosystems

  - Seven moderate potential GWDTE polygons.

- Iterative process undertaken to scope out from further assessment habitats that are unlikely to be truly groundwater dependent based on the following criteria:
  - Potential GWDTE Polygons underlain by aquitard superficial geology;
  - Potential GWDTE Polygons underlain by non-aquifer bedrock and / or non-aquifer superficial geology covering a large continuous area with no clear mechanism of groundwater discharge or potential source zones visible from aerial photography; and
  - Potential GWDTE polygons that are associated with surface water features.

3. Hydrogeological Assessment

3.1 Methodology

3.1.1 This assessment is based primarily on the information presented in **Chapter 8** (EIA Report Volume 2). **Figure 8.7** (EIA Report Volume 3a) presents the hydrogeological potential of the bedrock and shows the type and extent of any superficial deposits (including actual peat from Peat Surveys (see **Appendix 8.2**, EIA Report Volume 4), as well as the topographical setting. The particular hydrogeological setting at each location is discussed in relation to the habitat in **Section 4**.

3.1.2 The degree of groundwater dependence of a water body varies from wetland to wetland and is dependent on hydrogeological connectivity. The Sniffer 2007 guidance document 'Wetland Hydrogeomorphic Classification for Scotland' produced a hydrogeomorphic classification for potential wetland areas within the Scottish landscape. The document states that,

'The dependence of wetlands on groundwater bodies is also a result of the hydrological connectivity. The degree of dependency will vary depending upon 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.'

3.1.3 There are three qualitative levels of groundwater dependency depending on whether the wetland is underlain by a low or high productivity aquifer:

- 'high likelihood of groundwater dependency: intergranular high productivity drift aquifer and dominantly intergranular high productivity aquifer;
- moderate likelihood of dependency: intergranular moderate productivity drift aquifer and fractured very low productivity aquifer; and
- low likelihood of dependency: intergranular low productivity drift aquifer and fractured very low productivity aquifer'.

3.1.4 The majority of the Site is underlain by low groundwater productivity metamorphic bedrock of the Altnaharra Psammite Formation. A small part of the southwest of the Site is underlain by Glen Achall Psammite and Semipelite.

3.1.5 The low productivity aquifer underlying the Site means that any groundwater flow will be through secondary porosity and permeability within the upper weathered zone, via fractures, and other discontinuities within the bedrock.

3.1.6 The British Geological Survey (BGS) online mapping (see **Figure 8.4** (EIA Report Volume 3a) shows much of the Site to be underlain by Glacial Till, overlain in parts by peat deposits. There are areas of Alluvium in the north of the Site, as well as significant areas where no superficial deposits are present and some small areas of hummocky glacial deposits in the centre of the Site.

3.1.7 Peat and till deposits are low permeability, while alluvium and hummocky glacial deposits have a higher permeability. The hydrogeological setting therefore suggests that any potential GWDTE in areas of Till and / or Peat deposits should be considered as having a low likelihood of bedrock groundwater dependency. However, when discrete point sources (springs) give rise to small habitats of high base rich floristic content, then a higher level of groundwater dependency must be considered. These are likely to be connected to very specific zones of permeability, fractures or a fault zone, and are unlikely to be common in this Site environment. Areas of Alluvium and hummocky glacial deposits may contain some groundwater resource, the extent of which is dependent on the composition of this layer. This could potentially support GWDTEs in the context of the Site, however, this would be limited to smaller areas. Large continuous areas of moderate potential GWDTE habitat are unlikely to be supported by a groundwater resource present in this layer. However where smaller high potential GWDTE polygons are present or a discrete source such as a spring or flush is present, then a higher likelihood of groundwater dependency has been considered.

4. GWDTE Assessment

4.1 Methodology

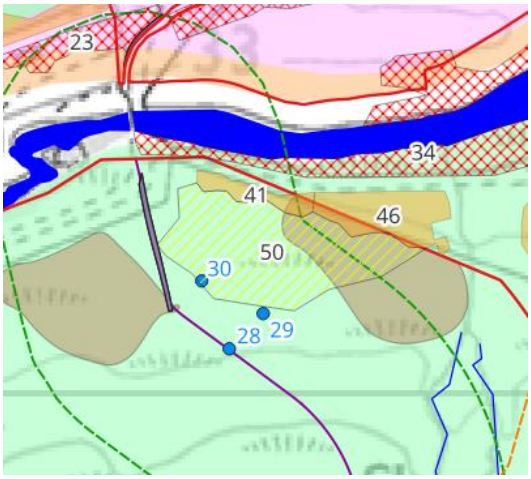
4.1.1 The following section considers the hydrological/hydrogeological setting and the likelihood of effects considering topography, geology and existing infrastructure. **Table 4.1** provides a summary of the results of the iterative process described in **Section 2**, detailing the habitats and polygons considered not GWD on the basis of a combination of the following criteria: being underlain by non-aquifer bedrock or superficial geology; lacking any clear mechanism of groundwater discharge or potential source zones visible from aerial photography; and, being associated with mapped surface water features and therefore considered surface water fed. These features are shown on **Figure 8.5.1**.

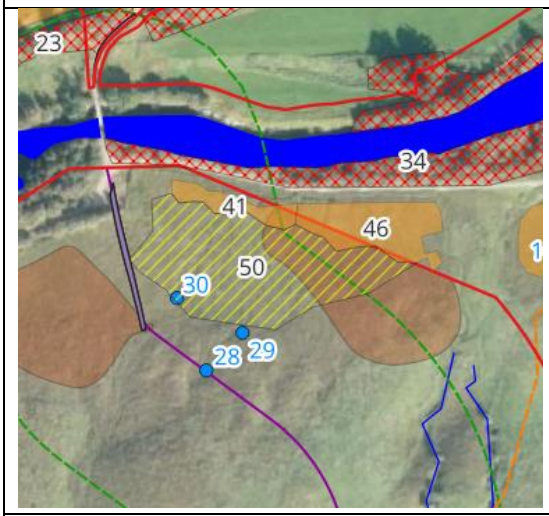
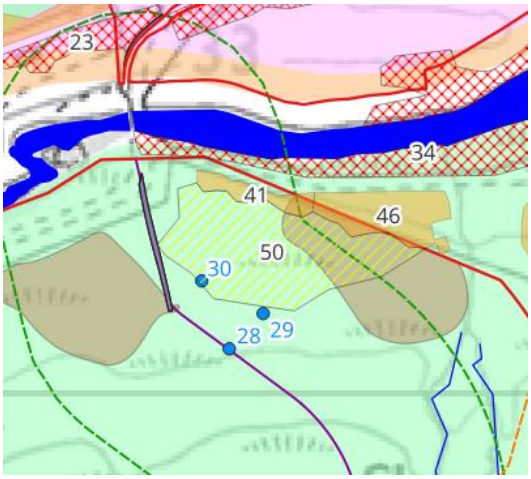
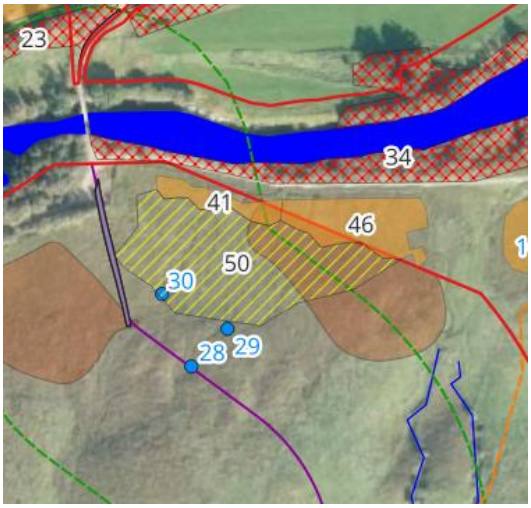
Table 4.1: Polygons and Target Notes Scoped out of Assessment

Rationale	Target Note or Potential GWDTE Polygon FID
Moderate Potential or Mosaic Containing Moderate and/or Potential GWDTE Polygons underlain by aquitard superficial deposits (nine polygons)	A67, A57, A74, A76, 5, 5.1, 15, 19, and 20.
Mosaic containing Moderate and/or High Potential GWDTE Polygons underlain by non-aquifer bedrock or superficial geology with covering a large continuous area with no clear mechanism of groundwater discharge or potential source zones visible from aerial photography (nine polygons)	A89, 2, 3, 10, 11, 12, 50, 51, and 52.
Moderate Potential, High Potential and Mosaic containing High Potential that are associated with surface water features (four polygons)	A34, A64, 22 and 34.

4.1.2 A total of 22 potential GWDTE polygons have been ruled out based on the rationale presented in **Table 4.1**. The remaining habitats are assessed in **Table 4.2**. These are all located within the western access track – no GWDTEs were identified within the main Site. The potentially groundwater dependent target note described a spring encountered during the NVC survey. The spring was noted as appearing to run dry for extended periods of time, and associated vegetation was limited. It is therefore not considered to support any GWDTEs.

Table 4.2: Assessment of Potential GWDTEs with Infrastructure Buffer Zones

NVC or Target Note Area	GWDTE Assessment
Area A41 	NVC Category: M15a/b *Trichophorum germanicum – Erica tetralix* wet heath. Classification: Moderate potential for GWD. Assessment: This area was observed at a break in slope and showed floristic evidence of base-enrichment during the NVC survey. It is therefore considered to be groundwater dependent for these reasons. Given the relatively impermeable bedrock geology underlying the habitat, the habitat is likely to have some dependency on shallow perched groundwater within the hummocky glacial deposits and seepage that has infiltrated a short distance. This habitat being lower on the hill slope will also be dependent on surface water.

NVC or Target Note Area	GWDTE Assessment
	
Area A50  	NVC Category: M25a / M15a *Trichophorum germanicum* – *Erica tetralix* wet heath. Classification: Mosaic containing Moderate potential for GWD. Assessment: This habitat has been assessed due to the presence of upgradient mapped groundwater upwellings immediately upgradient of the habitat. Given the relatively impermeable bedrock geology underlying the habitat, the habitat is likely to have some dependency on shallow perched groundwater within the hummocky glacial deposits and seepage that has infiltrated a short distance. This habitat being lower on the hill slope will also be dependent on surface water.
Note: Red line – Site boundary; blue line and fill = watercourse; orange fill = moderate potential GWD polygon; yellow cross hatch = Mosaic containing moderate potential GWD polygon; red cross hatch =mosaic containing high potential GWD polygon; red fill = high potential GWD polygon; blue points = groundwater upwellings.	

5. Conclusion

5.1.1 The analysis above has considered the hydrological/hydrogeological setting and the likelihood of effects considering topography, geology, and existing infrastructure.

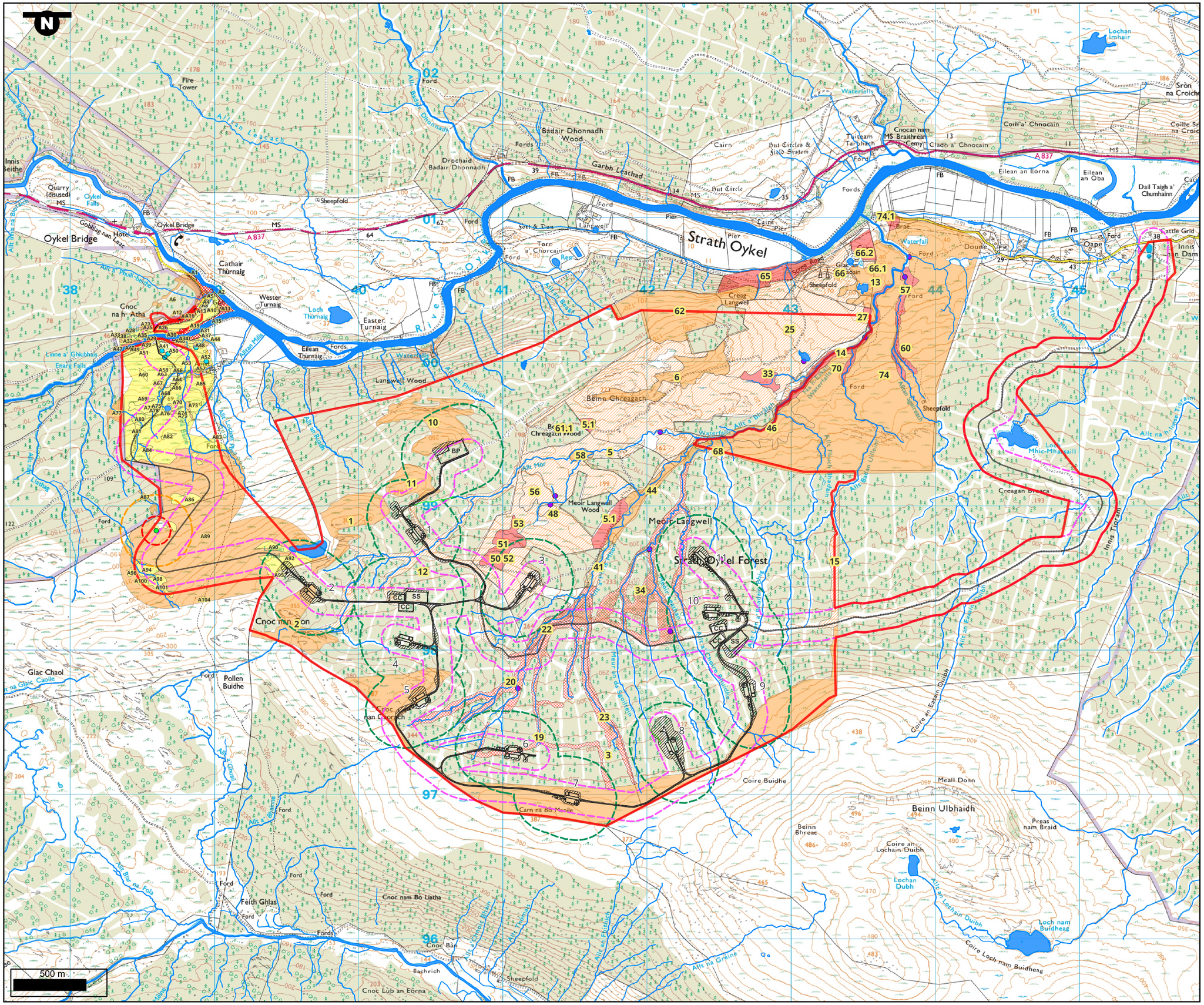
5.1.2 The low productivity of the underlying bedrock and superficial deposits across the Site means that groundwater dependence is unlikely for the vast majority of NVC-mapped habitats. There may be very minor shallow groundwater flow in the upper weathered layer of bedrock but this is likely to be very limited and insufficient to support any large areas of habitat and is only likely to reach the surface where there are no peat or glacial till aquitard deposits.

5.1.3 Two polygons were identified (Areas A41 and A50) that have a potential for groundwater dependence. These are both NVC community M15 and are located within the western access track option. M15 is listed as a priority habitat under the biodiversity action plan, however it is considered to be of local importance within the context of the Site. Given the relatively impermeable bedrock geology underlying the habitat, the habitat is likely dependent on shallow perched groundwater and seepage that has infiltrated a short distance within the hummocky glacial deposits.

5.1.4 The habitats are unlikely to be significantly impacted by the Proposed Development, as the track location is unlikely to impede groundwater flow towards the habitat due its location and orientation together with the relatively impermeable geology. Best practice methods such as drainage management will allow shallow groundwater and surface water flow to continue between upgradient and downgradient of the access track.

5.1.5 In addition to the assessed habitats, a spring was observed during the NVC survey and is displayed on **Figure 8.5.1**. The spring was noted as appearing to run dry for extended periods of time, and associated vegetation was limited. It is therefore not considered to support any GWDTEs. In summary, the results of this analysis are that two areas have been identified within the infrastructure buffers that are considered have some groundwater dependency. These are not considered likely to be significantly impacted by the Proposed Development.

5.1.6 No further areas or target notes have been identified within the infrastructure buffers that are considered to be groundwater dependent and therefore there will be no additional requirement for the design of specific mitigation measures, or a residual risk of impact on potentially groundwater fed wetland features.



Legend

- Site Boundary

Infrastructure

- Turbine Locations
- Infrastructure Layout
- Earthworks
- CC Construction Compound
- SS Substation
- BP Borrow Pit
- 100m Track Buffer
- 250m Infrastructure Buffer

Potential GWDTEs

- High
- Moderate
- Low
- Mosaic Containing High
- Mosaic Containing High and Moderate
- Mosaic Containing Moderate
- Target Notes
- Groundwater Upwellings
- Spring
- 100m Spring Buffer
- 250m Spring Buffer

Hydrology

- OS-Mapped Watercourses
- Non Existent Watercourse
- Standing Surface Water

Figure Title
Potential GWDTEs

Project Name
Coille Beith Wind Farm

Project No./Filery ID
1620016742 / REH2024N00315

Date	Figure No.	Revision
June, 2025	8.5.1	1.0

Prepared By	Scale
EM	1:25,000

Client
Statkraft

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