

APPENDIX 4.3: GWDTE GROUNDWATER DEPENDENCY ASSESSMENT

NVC Survey

- 4.1 An NVC survey was completed as part of the baseline survey for **Chapter 9: Ecology, of the Over Hill ES**. The NVC results have been referenced against SEPA guidance¹ to identify those habitats which may be classified, depending on the hydrological setting, as being Groundwater Dependent Terrestrial Ecosystems (GWDTEs). Potential GWDTE NVC communities recorded within the study area have been assessed if they lie within 250 m of excavations greater than 1 m in depth, and, 100 m of excavations less than 1 m in depth. The habitats are shown in **Figure 6.4** appended to **Chapter 6: Ecology and Ornithology** of this FEI.
- 4.2 The potential GWDTE sensitivity of each polygon containing a potential GWDTE community was classified on a four-tier approach as follows:
- 'Highly-dominant' where potential high GWDTE(s) dominate the polygon;
 - 'Highly – sub-dominant' where potential high GWDTE(s) make up a sub-dominant percentage cover of the polygon;
 - 'Moderately- dominant' where potential moderate GWDTE(s) dominate the polygon and no potential high GWDTEs are present; and
 - 'Moderately – sub-dominant' where potential moderate GWDTE(s) make up a sub-dominant percentage cover of the polygon and no high GWDTEs are present.
- 4.3 Where a potential high GWDTE existed in a polygon, it outranked any potential moderate GWDTE communities within that same polygon.
- 4.4 Initial GWDTE sensitivity has been assigned solely on the SEPA listings and is shown in **Figure 6.4**. However, depending on several factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependent on groundwater.

Hydrological Assessment

- 4.5 The assessment of GWDTE considers two aspects:
- Whether the hydrological and hydrogeological setting provides evidence that the habitat is dependent on surface water features (and therefore is unlikely to be dependent on groundwater); or

¹ Land Use Planning System, Guidance Note 31, version3, SEPA, September 2017

- Whether the sub-surface flow path to a GWDTE will be significantly diverted or reduced by the Proposed Development.

4.6 The contributing factors are described below. These factors are not considered in isolation but become part of a more complex assessment. The assessment process is shown in more detail in **Figure A1** and **A2, Appendix 12.3 of the Over Hill ES**. A1 provides an overview of the assessment process whilst A2 is a working tool included for further reference.

Hydrological and Hydrogeological Setting

4.7 The following factors that are considered when assessing the hydrological and hydrogeological setting are described below.

- **Peat:** Due to the highly porous nature of peat a largely waterlogged environment is created. This waterlogged habitat creates what is often referred to as a perched water table, largely disconnected from the true groundwater table below. Where a GWDTE has been surveyed on peat (greater than 0.5 m in depth) it is scoped out of being an indicator of true groundwater. This occurs at the start of the assessment process. Only those GWDTE on peat less than 0.5 m in depth are therefore shown in **Figure 4.7**. Where peat is less than 0.5 m, it has to be considered as potentially groundwater dependent, and reviewed against the other contributing factors.
- **Watercourses / water bodies:** Where a potential GWDTE traces a surface water feature such as a watercourse or a drain (or network of drains), it is likely to be supported by the fluvial interactions and not dependent on underlying groundwater. An exception to this would be where the potential GWDTE extends beyond the immediate watercourse area. In such cases fluvial and groundwater interactions may be supporting the habitat.
- **Hydrogeology:** Where the aquifer is of low productivity, it is unlikely that potential GWDTE are dependent on groundwater. The potential for groundwater is further decreased where the superficial deposits also yield limited water. GWDTE are not scoped out solely on this basis as in some instances, a spring or flush may occur within a wider unproductive aquifer, and, may be associated with near surface weathered rock or localised faulting.
- **Topographic setting:** Where a potential GWDTE is located at a watershed / topographic high point it can be scoped out of the assessment. At these locations, there will be no areas of higher elevation groundwater that could support the habitat. Localised depressions can also collect water during heavy rainfall and create a wet environment for habitats, with no dependency on groundwater.

Connectivity with the Proposed Development

4.8 The Proposed Development is not considered to have an effect on the GWDTE, if an existing man-made barrier exists between the Proposed Development and the GWDTE i.e. a road. In this instance the natural flow path will already have been modified and likely disconnected the outer groundwater flows to the GWDTE. Local intervening watercourses also create natural barriers and will divert shallow groundwater flows into the channel area. In such instances it is assessed that wider shallow groundwater flows upstream and downstream of the watercourse do not occur.

- 4.9 The potential groundwater flow paths supporting the remaining GWDTEs are reviewed against the location of the Proposed Development. Where the Proposed Development infrastructure does not dissect (and therefore divert) the likely groundwater flow path upstream or downstream of the GWDTE, it is considered to have a Negligible effect.
- 4.10 A significant effect is considered where a habitat is assessed as partially groundwater dependent, from flows within the area of infrastructure. In such instances mitigation is required to maintain the sub-surface flow path.

Borrow Pit Search Area

- 4.11 As referenced in the Over Hill ES, those GWDTEs considered to have groundwater potential are located around the existing access track and the proposed borrow pit search area. The borrow pit search area will require new ground excavation. GWDTE ID 24 was identified across the search area; this is a Moderately Dominant habitat indicating a lower likelihood of being influenced by groundwater.
- 4.12 The borrow pit is stated as being underlain by Scottish Coal Measures²; the underlying aquifer is of moderate productivity. However, the cyclic multi-layered aquifer produces low yields from sandstones and higher yields where the land has been mined. **Figure 9.3** of the Coal Mining Risk Assessment identifies areas of historic open cast mining within the Proposed Development Boundary.
- 4.13 The borrow pit has not been subject directly to open-cast operations that would increase the potential groundwater yield from the underlying aquifer. However the area does appear to have been subject to mining related restoration activities, with restored material observed in this area during the peat probing survey. The restored material was observed to be a mix of peat and clays; **Appendix 4.5** provides a detailed consideration of the borrow pit location. Whilst not mined, the area is assessed as heavily modified with superficial deposits creating a waterlogged environment, rather than yielding notable groundwater.
- 4.14 GWDTE have also been identified within 250 m of the borrow pit search area (ID 6); these GWDTEs are again located on heavily modified areas and appear to trace fluvially driven forestry drains. Given the limited potential for those habitats surrounding the borrow pit search area to be groundwater dependent in this setting, the magnitude of an effect is still assessed as **Negligible** and of **Moderate/Minor significance** on the high and moderate sensitivity GWDTE receptors. **This is not significant under EIA regulations and does not require mitigation.** A detailed drainage design for all areas of infrastructure including the borrow pit, will be submitted as part of the CEMP.

Revised Development Layout

- 4.15 The results of the full NVC survey are shown in **Figure 6.4** appended to **Chapter 6: Ecology and Ornithology**. The habitats have been classified as Highly Dominant, Highly Sub-dominant, Moderately Dominant and Moderately Sub-dominant GWDTE.

² BGS GeolIndex,, <http://mapapps2.bgs.ac.uk/geoindex/home.html>, accessed March 2018.

- 4.16 In accordance with SEPA Guidance³, GWDTE have been re-assessed within 250 m of the revised T6, T7, T10 and T11 locations, and, within 100 m of the revised access track layout.
- 4.17 The GWDTE habitats have been reviewed for their likely groundwater dependency in this hydrological setting. GWDTE surveyed on peat (greater than 0.5 m in depth) is scoped out as being an indicator of true groundwater. Where peat is less than 0.5 m, the habitat has been considered as potentially groundwater dependent, and reviewed against the other contributing factors.
- 4.18 Five notable GWDTE polygons have been identified along the new section of access track between the proposed borrow pit and T10. These polygons comprise Highly Sub-dominant habitats (ID 73 and ID 76) and Moderately Sub-dominant habitats (ID 35, ID 46 and ID 61) as shown on **Figure 4.7**. All habitats traverse areas of peat ranging from 0.2 m to 1.5 m. These habitats are in-fact located predominantly on peat between 0.5 m and 1.5 m. In this specific setting, these habitats are considered unlikely to be dependent on true groundwater. Despite the habitats being unlikely to be groundwater dependent, it is noted that the access track will be of a floating design due to the depth of peat present. Floating the track provides mitigation for any potential disruption to groundwater flows and allows hydrological continuity across the area.
- 4.19 Two areas of Moderately Dominant GWDTE (ID 60 and ID 53) are located downslope of T7 and T11 and their associated tracks. A very small area of Highly Dominant GWDTE lies adjacent to ID 60. These three habitats have been reviewed further. The three polygons all align with surface watercourses not evident on Ordnance Survey (OS) mapping but visible on aerial imagery. They occur within the rides of plantation areas and appear to be driven by surface water rather than dependent on groundwater. The underlying hydrogeology has been reviewed. The habitats are underlain by Scottish Coal Measures⁴; the underlying aquifer is stated as being of moderate productivity. The cyclic multi-layered aquifer produces low yields from sandstones whilst it is noted that higher yields occur where the land has been mined. **Figure 9.3** of the Coal Mining Risk Assessment identifies areas of historic open cast mining within the Proposed Development Boundary, however historic mining is not reported as extending to these habitats. Lower yields are therefore anticipated. In addition, the area is overlain by superficial deposits of either shallow peat or glacial till which do not yield notable groundwater.
- 4.20 The access tracks within this area will be of a floating design and will therefore maintain the hydrological continuity. Excavations will be required at T7 and T11; given the limited potential for these habitats to be groundwater dependent in this setting, the magnitude of an effect is assessed as **Negligible** and of **Moderate/Minor significance** on the high and moderate sensitivity GWDTE receptors. **This is not significant under EIA regulations and does not require mitigation.**

³ Land Use Planning System SEPA Guidance Note 31, Version 3, SEPA, September 2017.

⁴ BGS GeolIndex, <http://mapapps2.bgs.ac.uk/geoindex/home.html>, accessed March 2018.

Table A4.3 GWDTE listed as located from the borrow pit to T7

ID	NVC Community/ Groundwater Dependency	Nearest Infrastructure (Distance (m) and Direction)	Hydrological Characteristics affecting Potential Groundwater Dependency and Spatial Connectivity	Risk from the Proposed Development
6	M6c/M25a Highly dominant	Existing access track (45 m west) Borrow pit	Peat greater than 0.5 m; only a small area of less than 0.5 m. Polygon aligned with tributary to Wee Glen Burn. <i>Assessed as surface water dependent</i>	Negligible Low groundwater potential Drainage design submitted in CEMP to promote diffuse movement of water around the borrow pit area.
24	MG10a Moderately dominant	Existing access track & borrow pit (Borrow pit located over habitat)	Peat less than 0.5m Restored material with mixed peat and impermeable clays	Negligible Low groundwater potential Drainage design submitted in CEMP to promote diffuse movement of water around the borrow pit area.
35	M25a Moderately dominant	Proposed access track located over habitat	Predominantly on peat greater than 0.5 m in depth	Negligible Low groundwater potential, floating track design maintain hydrological continuity.
46	M25b / MG10a Moderately dominant	Proposed access track (70 m north west)	Localised area of felled plantation subject to forestry drainage.	Negligible Low groundwater potential, floating track design maintain hydrological continuity.
73	M25a/ MG10 /U5/ M6c Highly sub - dominant	Proposed access track located over habitat	Predominantly on peat greater than 0.5 m in depth	Negligible Low groundwater potential, floating track design maintain hydrological continuity.
76	M19a/ U4a/ MG10a/ M6c Highly sub - dominant	Proposed access track located over habitat	Predominantly on peat greater than 0.5 m in depth	Negligible Low groundwater potential, floating track design maintain hydrological continuity.
61	M25a Moderately dominant	Proposed access track adjacent to habitat	Predominantly on peat greater than 0.5 m in depth	Negligible Low groundwater potential, floating track design maintain hydrological continuity.

Table A4.3 GWDTE listed as located from the borrow pit to T7

ID	NVC Community/ Groundwater Dependency	Nearest Infrastructure (Distance (m) and Direction)	Hydrological Characteristics affecting Potential Groundwater Dependency and Spatial Connectivity	Risk from the Proposed Development
60	CP Moderately dominant	Proposed access track located over habitat and T11 30 m to north	Predominantly on peat greater than 0.5 m in depth and aligned with fluvial features.	Negligible Low groundwater potential, floating track design maintain hydrological continuity.
53	CP Moderately dominant	Proposed access track located over habitat and T7 120 m to north	Aligned with fluvial features, likely mixed dependency including surface water. <i>Assessed as surface water dependent</i>	Negligible Low groundwater potential, floating track design maintain hydrological continuity.
124	MG10a/ M23a/ M6c/ M25a/ M6d Highly dominant	Proposed access track (111 m north)	Small area of GWDTE. Aligned with fluvial features, likely mixed dependency including surface water. <i>Assessed as surface water dependent</i>	Negligible Low groundwater potential, floating track design maintain hydrological continuity.

