Volume 3E
Habitat Loss Calculations

1. Introduction

1.1.1 Habitat loss has been estimated using the Phase 1 habitat and National Vegetation Classification (NVC) survey results (Volume 3B) and the layout of the Project. Where there is uncertainty in design layout (dimensions, extent etc.) various assumptions have been made regarding the construction methodology to arrive at realistic "worst case" estimates.

1.1.2 There are three main ways by which habitat features may be affected during the construction and operational phase of the Project:

- Direct loss: to accommodate the Project infrastructure. These losses are considered permanent in the context of this assessment. In light of uncertainties regarding the combined effects during construction and operation phases of PV arrays over peatland habitats (See **Section 1.2**), for the purpose of this assessment a precautionary approach has been adopted such that all bog habitat within the proposed PV parcels is assumed lost (See **Section 1.2**).
- Disturbance: the effects of disturbance are variable in their extent, depending on the nature of the disturbance and sensitivity of the habitat feature. Some disturbance types (for example, temporary habitat loss for the creation of construction areas) result in medium to long-term disturbance which require extended recovery periods. In other cases (for example, installation of cables at the sides of access tracks, traversing of machinery) disturbance is short-term, and certain habitat types are able to recover quickly.
- Indirect effects: these primarily relate to changes in hydrology of wetland habitats in the context of this development, the potential for runoff, erosion and sedimentation, along with pollution which may result in the event of contaminant spillage.

1.1.3 The potential for effects upon the hydrology, and subsequently on bog habitats, water quality, soils and peat as a result of surface and groundwater flows, sediment and contaminant discharges, soil loss, erosion and compaction, are detailed within the Volume 2, Chapter 8: Geology, Hydrology and Hydrogeology of the EIA Report.

1.1.4 Overall potential effects upon the aquatic environment are considered to be highly localised and mitigated through sensitive design, standard best practice construction methods and pollution prevention controls in accordance with current guidance and delivered through a Construction Environmental Management Plan (CEMP). Subsequently indirect effects, such as habitat deterioration through hydrological change, are not discussed further within this assessment.

1.2 Footprint Calculations

1.2.1 The dimensions and extents of the various infrastructure elements for the Project (Figure 6.1, Volume 3F) are provided in Table E.1 below.

Table E.1 Dimensions and Extents of the Proposed Development

Infrastructure	Nature of infrastructure	Number or Length (km)	Maximum Dimensions assumed (m)		Total footprint area (ha)
Haul road	Permanent	1.48km	7m width	10m buffer	2.1
Access tracks	Permanent	2.65km	7m width	-	1.96
PV arrays	Permanent	60,000 solar panels	-	-	34.94
Hydrogen storage compound	Permanent		9,125m^2	10m buffer	1.4
BESS compound	Permanent		100m x 70m	10m buffer	1.1
Temporary storage compound	Temporary		17,400m	4m buffer	2.1
Hydrogen lay down area	Temporary		100m x 30m	4m buffer	0.4
BESS temporary compound	Temporary		70m x 30m	4m buffer	0.3
Cable route (existing access track)	Temporary	2.57km	3m working corridor	-	1.55
Cable route (no access track)	Temporary	5.19km	3m working corridor	-	2
TOTAL AREA					**51.64**

1.2.2 It is considered that ground conditions and vegetation communities within the former conifer plantation within the Whitelee HMA area and also adjacent to existing access tracks would already have been subject to altered hydrological regime on the remnant peatland habitats, therefore no additional indirect effects buffer has been applied beyond the access track and working corridor applied to the cable route proposed through former conifer plantation or where sited adjacent to access track.

1.2.3 The total permanent footprint (that is the area subject to direct habitat loss and which could not be restored for at least the lifetime of the proposed development) has therefore been calculated as 6.56 ha (excluding PV arrays) and 41.5 ha (including PV arrays).

1.3 Approach

Estimating Habitat Loss / Potential Change

1.3.1 Adverse impacts on habitat may include direct losses, e.g. permanent land take for site infrastructure, temporary land-take for construction site compounds, as well as temporary disturbance of habitats within and adjacent to working areas. Adverse impacts can also be indirect, e.g., through disruption of hydrological conditions and habitat fragmentation, overshading and loss of moisture resulting from interception of precipitation. Much of this infrastructure will be permanent, although the temporary construction compound will be restored at the end of the construction phase.

Permanent habitat loss

1.3.2 The main negative effect during the construction phase will be direct permanent habitat loss due to the construction of the Hydrogen storage compound and access tracks. Additionally, for the purposes of this assessment, the presence solar arrays are also considered as permanent habitat loss during construction.

- The access tracks would be floated where the peat depth is greater than 1m. The extent of these floated tracks are expected to extend along 4.13km. Whilst these have the benefit of avoiding peat excavation, the extent of direct habitat loss will be generally similar to excavated tracks whilst the indirect effects on habitats (principally hydrological) are likely to extend over a smaller area.
- The installation and operation of solar photovoltaic (PV) panels is likely to comprise both direct (permanent), temporary disturbance and indirect impacts during construction and operation phase, the additive effects of which are difficult to quantify:
  - During construction, piling of the PV panels will be carried out by mini-piling rigs, which will travel across the vegetated surface along temporary spur tracks resulting in temporary habitat disturbance. Detailed strategic planning will be required at piling stage to ensure minimal passes across bog communities to ensure that disruption and disturbance is kept to a minimum.
  - During construction, each of the solar array panels erected on site will be installed and mounted on fixed ground-mounted frames after piling has taken place on site. This would result in a limited extent of habitat that would be permanently lost to support structures.
  - During operation, annual maintenance visits to the solar arrays would be required, involving a tracked vehicle moving along each of the array rows. Site operatives would follow a tight working footprint with minimal passes across bog communities to ensure that disruption and disturbance is kept to a minimum.
  - During operation, vegetation is likely to persist between and under the edges of panels (with gaps of approximately 3m between PV rows), however, the extent to which the installation and physical presence of PV arrays may result in direct and indirect effects on vegetation growth and community composition of bog habitats is currently unknown. Vegetation response to the presence of PV arrays is considered to be influenced by the following key constraints (Armstrong *et al*. 2018; Beatty *et al*. 2017):
    - Increased overshading/reduced light.
    - Fluctuations in surface temperature/micro-climate.
    - Reduction in soil/peatland/vegetation moisture.

    - Precipitation run-off of from panel edges.

- Whilst vegetation may be likely to persist beneath the PV arrays, what form that cover may take (herbaceous and/or bryophyte cover and the level of species-richness) is not well understood. The current condition of the bog is degraded and considered unlikely to improve significantly; however, further degradation over the lifetime of the scheme is possible.
- Given the current lack of available understanding as to how bog/peatland habitats might respond to a combination of these combined construction and operation phase effects, as a precaution it is assumed that all habitat under the footprint (comprising the outer perimeter of each PV array) will be permanently lost as a result of the Project.

Zone of Influence for Temporary and/or Indirect effects

Temporary habitat loss - Construction Disturbance

1.3.3 As well as direct habitat losses any infrastructure component that would be restored following construction for example temporary laydown areas, construction compounds and cable route. These areas would also include a 4m buffer surrounding infrastructure to allow machinery to work outwith the permanent footprint of any infrastructure component.

Hydrological Change – Indirect effects

1.3.4 Potential impacts on the hydrology of surface waters are addressed in detail in Volume 2, Chapter 8: Geology, Hydrology and Hydrogeology of the EIA Report.

1.3.5 It is expected that any indirect drainage effects would only impact wetland habitats at the Site, including wet modified bog, flushes and marshy grassland. This assessment focuses on terrestrial habitats that are considered to be particularly sensitive to changes to surface water or groundwater hydrology resulting from construction activities associated with the proposed development, focusing on blanket mire communities. Although there may be some construction disturbance experienced by the surrounding drier habitats, such habitats are expected to recover in the short term and, as such, no indirect drainage effects are expected to impact or alter the quality of composition of dry habitats.

1.3.6 The upper layer of peat (the acrotelm) can extend up to 0.5m below the surface and the water table naturally fluctuates throughout the year within this layer. The deeper catotelm layer (usually more than 0.5m below the surface) is located within the water table and is permanently saturated. Unmodified blanket bog vegetation requires a permanently raised water level which is derived directly from rainfall and in the case of peat deposits on slopes also through lateral seepage of rainfall in the acrotelm. The high-water level is maintained by high rainfall and the low hydraulic conductivity at lower levels within the peat profile (hydraulic conductivity, or permeability, is negatively correlated with the degree of peat humification, which decreases with peat depth). Blanket bogs often display complexes of hydrologically connected formations, or landforms, which develop primarily in response to the underlying topography.

1.3.7 Hydrological changes including fluctuations in water levels, flows and quality and physical disturbance of the peat, leading to derogation and/or pollution of groundwater and surface water and disruption and breakdown of peat structure supporting blanket mire communities can occur for a variety of reasons:

- Soil compaction and the introduction of areas of hardstanding during construction and throughout operation reducing recharge and groundwater levels.

- Dewatering during construction associated with the excavation of the turbine foundations and borrow pits leading to a decline in groundwater levels.
- Site activities during construction, operation and decommissioning resulting in the release of pollutants and the subsequent contamination of groundwater.
- Physical disturbance of the peat and groundwater throughflow could occur as a result of excavation works.
- Disruption of flow paths and changes to drainage regime during construction and throughout operation can be associated with increases in runoff and less on-site water retention.
- Disruption of ground during construction leading to increased sediment loading; dewatering and/or drainage during construction disrupting groundwater support (baseflow) to watercourses.
- Site activities during construction and operation/maintenance resulting in the release of pollutants and the subsequent contamination of surface waters.

1.3.8 Some habitats adjacent to the zone of physical construction disturbance, particularly those sensitive to changes in surface hydrology such as blanket mire communities, will be indirectly affected due to hydrological changes associated with excavations for Hydrogen storage compound foundations and access tracks etc.

1.3.9 For the purposes of this assessment a 10m hydrological disturbance zone around all other hard infrastructure comprising access tracks, substations, compounds, storage and laydown areas.

1.3.10 Effects would be further minimised through the implementation of good practice measures (Table 6.9, Volume 2, EIA Report), including proposals for full habitat re-instatement or restoration of temporarily disturbed habitat and the re-use of excavated peat within the Site.

1.3.11 Hydrological changes can occur through the excavation of soil and bedrock during the construction of cable trenches, where localised disruption to groundwater flow can occur. This can impact on associated groundwater abstractions (especially shallow sources, i.e., springs and wells) or on potential GWDTEs. Discharge of groundwater/surface water contaminated during excavation may cause physical or chemical contamination to terrestrial habitats and nearby watercourses. An example of this is when blanket bog has new drainage ditches created adjacent to it resulting in a lowering in the water level and losses of bog specialist plant species being replaced by species that can tolerate drier conditions. This change over time is regarded as an indirect loss or degradation of habitat.

1.4 Results

Direct Habitat Loss

1.4.1 Table E.2 provides the total estimated direct, temporary and indirect habitat loss from the construction of the proposed development (excluding habitats beneath solar arrays) divided across different Phase 1 habitat types.

1.4.2 Table E.3 provides the total estimated direct habitat loss from the solar arrays (habitats beneath solar arrays).

1.4.3 1.4.1 Table E.4 provides the permanent habitat loss within Whitelee HMA.

Table E.2 Predicted Effects to habitats from Project Infrastructure (excluding solar arrays)

Phase 1 habitat	NVC Community	Permanent habitat loss		Temporary habitat loss /disturbance (4m buffer)	Indirect habitat loss (10m buffer)	Total area of habitat affected (ha)
		Access tracks (ha)	Associated permanent infrastructure (Hydrogen Production Facility) (ha)			
Recently felled coniferous plantation woodland	-	0.83	0	0.05	0	**0.88**
Marshy grassland	M23	1.11	0	0.03	1.11	**2.29**
Semi-improved acid grassland		0.95	0	0.95	1.18	**3.08**
Wet modified bog	M19, M20, M25	2.56	1.44	0.51	3	**7.51**

Table E.3 Predicted loss/shading of habitat from solar arrays (outside Whitelee HMA)

NVC Community	Phase 1 habitat type	Habitat under solar arrays (ha)
M6d	Acid flush	**0.31**
M19a	Wet modified bog	**3.52**
M20a		**5.98**
M25a		**3.65**
M23b	Marshy grassland	**5.02**
U4b	Semi-improved acid grassland	**12.29**
U4b-M23b	Semi-improved acid grassland/marshy grassland mosaic	**11.43**

Table E.4 Permanent habitat loss within Whitelee HMA

Phase 1 Habitat Type	Access track (ha)	Habitat under solar arrays (ha)	Hydrogen Storage (ha)	Total areas of direct habitat loss (ha)
Wet modified bog	1.59	2.57	1.44	**5.62**
Marshy grassland	0.38	7.3	0	**7.68**
TOTAL	1.97	9.89	1.44	**13.3**