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Tullaghmore Wind Farm

Habitat Management Plan (HMP)

Doherty Environmental Consultants Ltd.

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Tullaghmore Wind Farm

Habitat Management Plan

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1 Introduction

Doherty Environmental Consultants (DEC) Ltd. have been commissioned by Tullaghmore Windfarm Ltd. to prepare a Habitat Management Plan (HMP) for the proposed Tullaghmore Wind Farm.

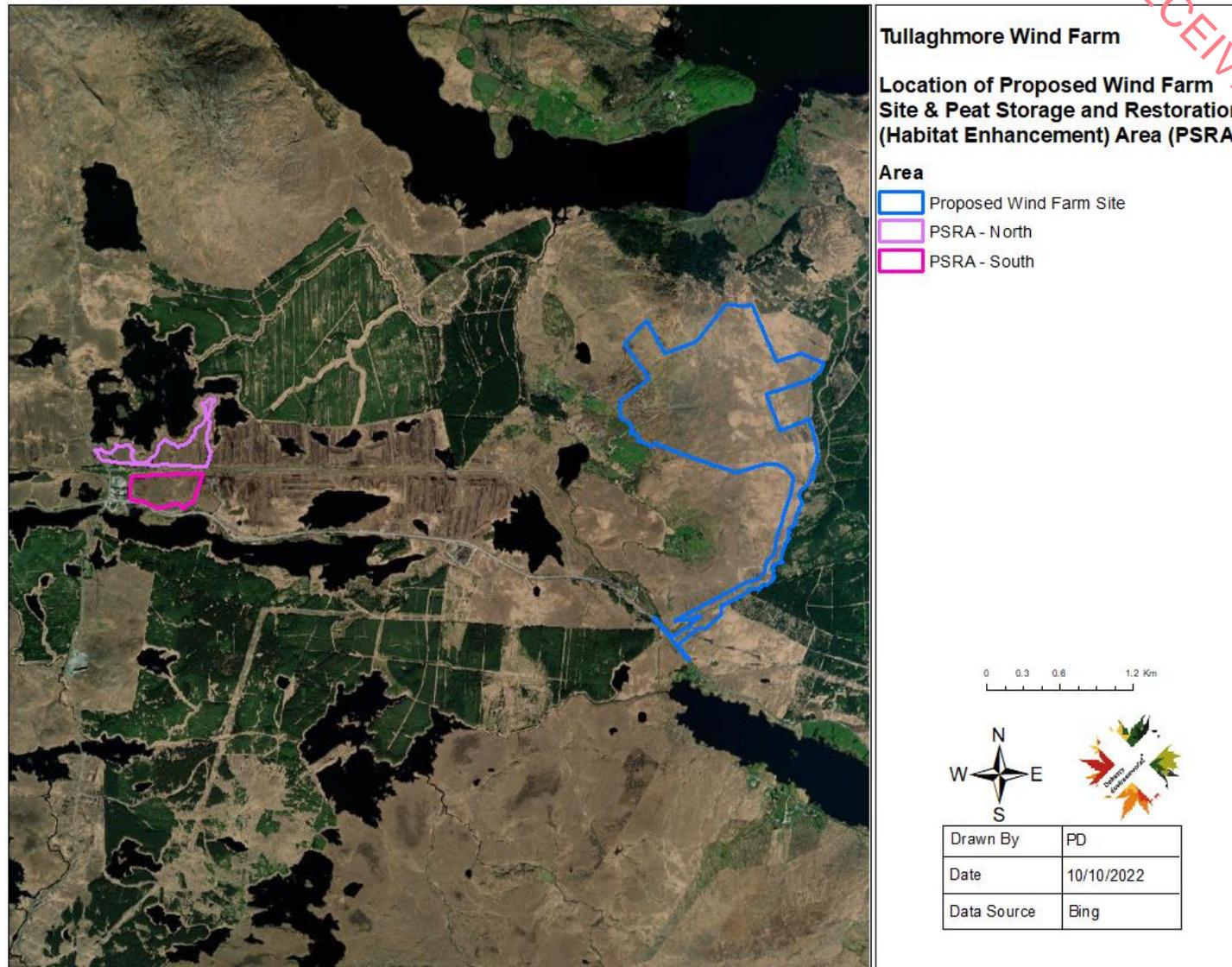
This HMP has been prepared for two parcels of lands associated with the Tullaghmore Wind Farm. These parcels comprise the proposed wind farm site and the proposed peat storage and restoration (habitat enhancement) area. The location of both areas is shown on Figure 1.1.

The land holding occurring within the proposed wind farm site amounts to c. 162 hectares, while the peat storage and restoration (habitat enhancement) area amounts to c. 27 hectares. Both parcels that are subject to the measures outlined in this HMP measure c. 189 hectares. These lands make up the HMP land holding.

The HMP land holding will be managed throughout the lifetime of the wind farm with a view to improving biodiversity throughout the site, managing Annex 1 peatland habitats and implementing measures to deal with sedimentation, peat slide risk, SUDS, hydrology and fisheries. It is noted that none of the lands currently included in the c.189 ha of this HMP land holding are managed under any nature conservation schemes, and thus there are no restrictions to land management practises, which is evident throughout both parcels of land. The implementation of this HMP as part of the overall Tullaghmore Wind Farm project provides an opportunity to manage and conserve the peatland habitats occurring within the HMP land holding for the lifetime of the project.

The wind farm operator will, throughout the lifetime of the wind farm, ensure the implementation of the actions specified within the HMP. Pursuant to the terms and conditions of the lease agreements on site, the landowners must comply with all necessary actions and precautions required by the wind farm operator for the implementation of this HMP.

Figure 1.1: Location of the Proposed Wind Farm Site & Peat storage and Restoration (Habitat Enhancement) Area



2 Purpose of the HMP

The purpose of this HMP is to provide detailed descriptions of the locations, methods and activities of habitat restoration and enhancement that will:

- (a) reinstate peatland habitats around infrastructure elements of the proposed Tullaghmore Wind Farm development; and
- (b) restore and enhance areas of degraded blanket bog outside of the windfarm footprint but on land within the control of Tullaghmore Wind Farm Ltd.

In order for this HMP to be meaningful, the aims and objectives of habitat restoration and management for each part of the site are described. This is necessary to:

- (a) make sure that expectation levels for the quality of legacy habitat are realistic; and
- (b) ensure that post habitat restoration monitoring is adequately prescribed.

3 Scope of HMP

The HMP sets out the following:

1. detailed methodology for sedimentation management during the construction phase;
2. detailed methodology for peat slide risk management during the construction phase;
3. details of SuDS measures to be provided;
4. detailed methods for the management of hydrology during the construction phase;
5. detailed methods for the protection of fisheries during the construction phase;
6. details of regular monitoring of habitat management measures using fixed quadrat locations;
7. appropriate maps, clearly identifying habitat management areas;
8. detailed methodology and prescriptions of habitat management measures, including timescales and with defined criteria for the success of the measures;
9. details of the production of regular monitoring reports to be submitted to the Planning Authority at years 1, 3, 5 & 10 which will include details of contingency measures should monitoring reveal unfavourable results.

4 Description of HMP Lands

4.1 Overview of Location & Existing Land Cover

4.1.1 Proposed Wind Farm Site

The Tullaghmore Wind Farm site comprises an area of c.162ha and is located within a bogland landscape between Maam Cross and Oughterard, Co. Galway. The Site is located approximately 30km northwest of Galway City, and 9km west of Oughterard, Co. Galway. The Site is located within the townlands of Tullaghmore, Tawnaghbeg, and Tullaghboy.

Peatland and heathland habitats dominate the land cover within the wind farm site. Elevations range from c. 60m OD Malin to greater than 200m OD Malin within the site. At lower elevations of flat or gently graded slopes lowland blanket bog is the dominant habitat, whilst at high elevations and on more steeply graded slopes wet heath dominates. Patches of dry heath occur on ridges and near outcrops of rock where a thin layer of peat and free surface water drainage occurs.

Extensive conifer plantation forestry is located to the east and north of the wind farm site, while the N59 national road runs east to west to the south of the site. An expanse of peatland and heathland habitats occur to the west of the proposed wind farm site.

4.1.2 Peat Storage & Restoration (Habitat Enhancement) Area

The peat storage and restoration (habitat enhancement) area are located immediately to the east of Maam Cross in the townland of Lurgan or Shindilla. The area is comprised of two separate plots, one to the north and the other to the south of a remaining section of the Midland Great Western Railway line which is orientated east to west. The northern plot is bounded to the north by Loughanillaun, to the east by intensively cutover and harvested lowland blanket bog and to the west by a small area of intact and uncut lowland blanket bog.

The southern plot is bounded to the west by the scrub habitat that surrounds the eastern boundary of the Peacock Hotel and a storage facility. To the east intensively cutover and harvested lowland blanket bog and existing access tracks occur. The N59 national road is located to the south of the southern plot.

4.2 Existing & Past Site Management

4.2.1 Proposed Wind Farm Site

The dominant land use at the wind farm site is for livestock grazing with both cattle and sheep. Sheep are the dominant livestock on the wind farm site. The wind farm site is comprised of two landownership folios that are separated broadly to the east and west by a fenceline. Land use and livestock grazing in the eastern folio is dominated by low intensity cattle grazing. Historical turbary was also undertaken in this folio adjacent to an existing access track and the Owenwee River.

Land use in the western folio is dominated by sheep grazing which is relatively intensive and evidence of overgrazing on sloping wet heath and flatter areas of blanket bog are apparent in this area of the wind farm site.

4.2.2 Peat Storage & Restoration (Habitat Enhancement) Area

The two plots within the peat storage and restoration (habitat enhancement) area have been used for the harvesting of peat. Evidence of past industrial scale peat harvesting is apparent in the area with significant areas of cutover bog occurring within and surrounding both plots. Machinery and other peat harvesting infrastructure is present on the ground in the vicinity of this area. The large-scale harvesting of peat in this area is evident on aerial imagery from 1995 and is likely to have commenced well before this date.

4.3 Overview of Habitat Condition

4.3.1 Proposed wind farm site

The lowland blanket bog habitat occurring within the proposed wind farm site is representative of active blanket bog which is in turn representative of the priority habitat Active blanket bog* (7130). This habitat is of international importance. Much of the blanket bog habitat occurring within the site has not been subject to extensive drainage or overgrazing. Some examples of overgrazing of this habitat by sheep are apparent in the western landownership boundary of the site. Past turbary activity has been confined to the eastern edge of the bog along an existing access track and adjacent to the Owenwee River.

The wet heath habitat occurring within the project site comprises vegetation communities that are representative of the Annex 1 habitat Northern Atlantic Wet heath with *Erica tetralix* (4010). A habitat map of the proposed wind farm site is provided as Figure 4.1 below.

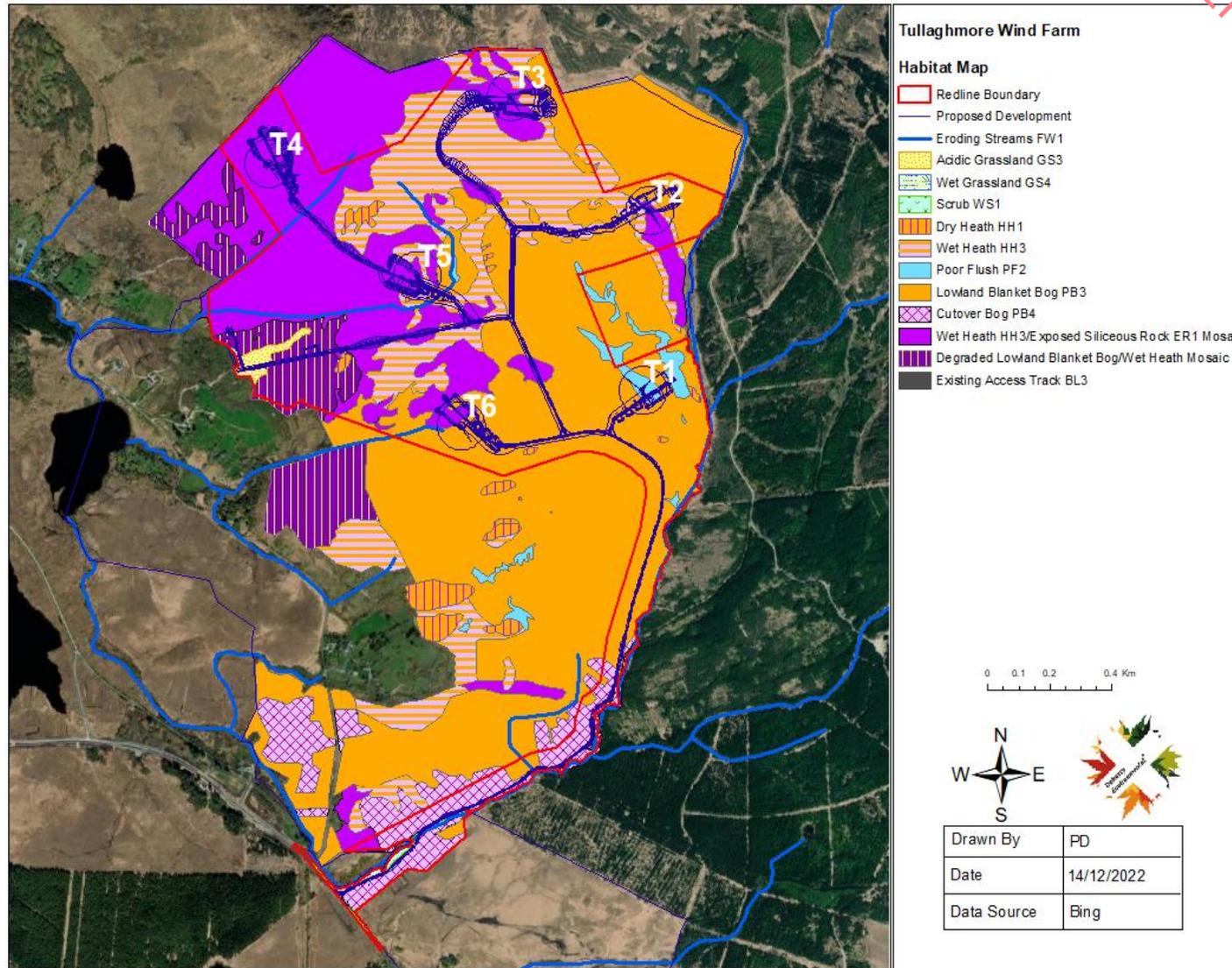
4.3.2 Peat Storage & Restoration (Habitat Enhancement) Area

The examples of degraded/cutover blanket bog occurring within the peat storage and restoration (habitat enhancement) area have links to the Annex 1 habitat blanket bog (7130). However, they are examples of disturbed blanket bog habitat that are not in favourable conservation condition. The bog in these areas have been subject to intensive and industrial scale peat harvesting in the past and ongoing water loss and drainage of these areas is apparent from cutover areas.

Old legacy cutting, where a peat substrate remains in place at lower levels to the original surface level, have been colonised by a typical suite of blanket bog species and are representative of recolonising blanket bog habitat. Areas of uncut but denuded lowland blanket bog habitat also occur in both plots to the north and south of the railway. The surface layer of the acrotelm and associated peat-forming vegetation has been removed from these areas exposing the underlying peat. These areas are now either denuded or support a pioneering sward dominated by *Eriophorum vaginatum* and *Eriophorum angustifolium*.

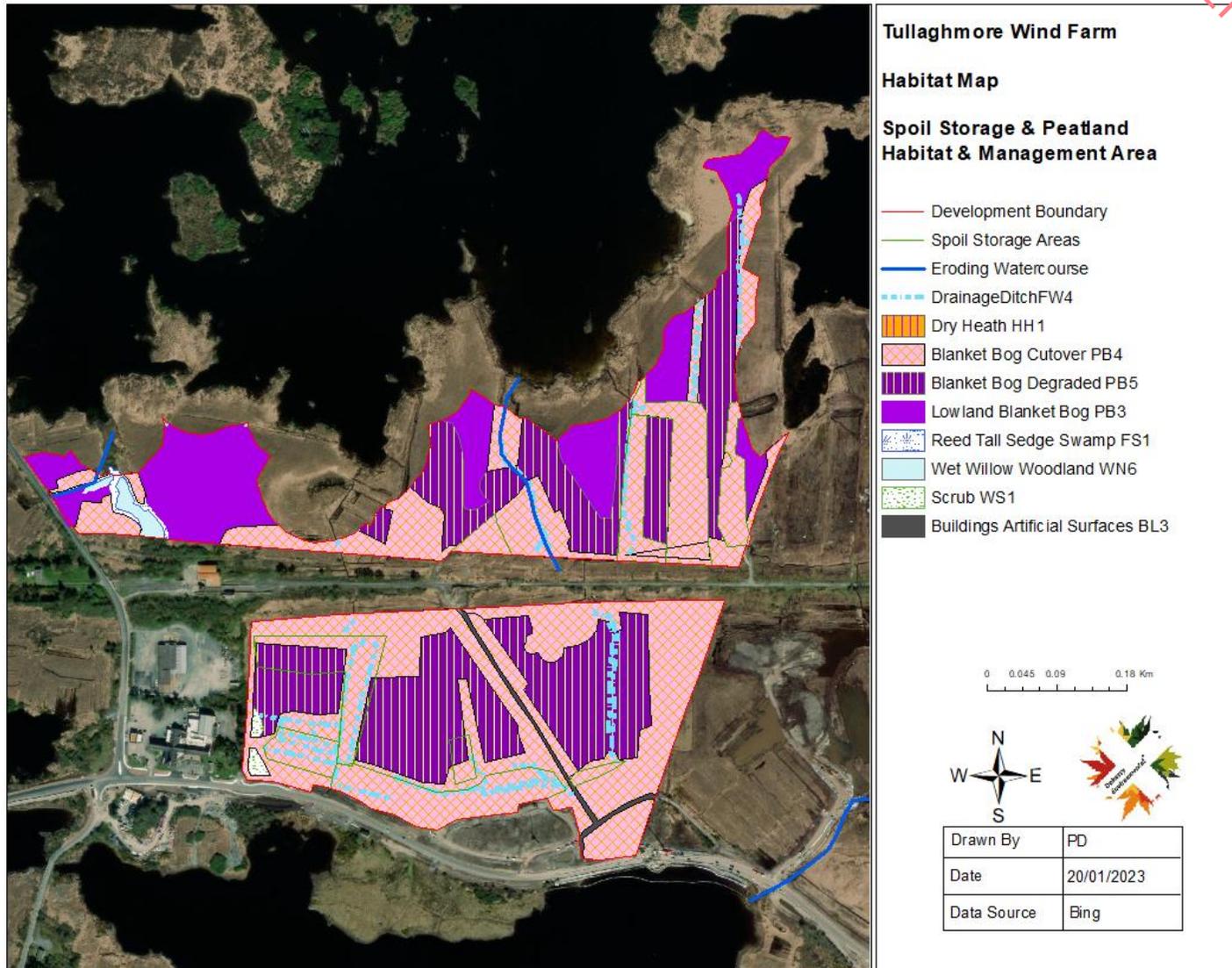
A habitat map of the peat storage and restoration (habitat enhancement) area is provided below.

Figure 4.1: Proposed Wind Farm Habitat Map



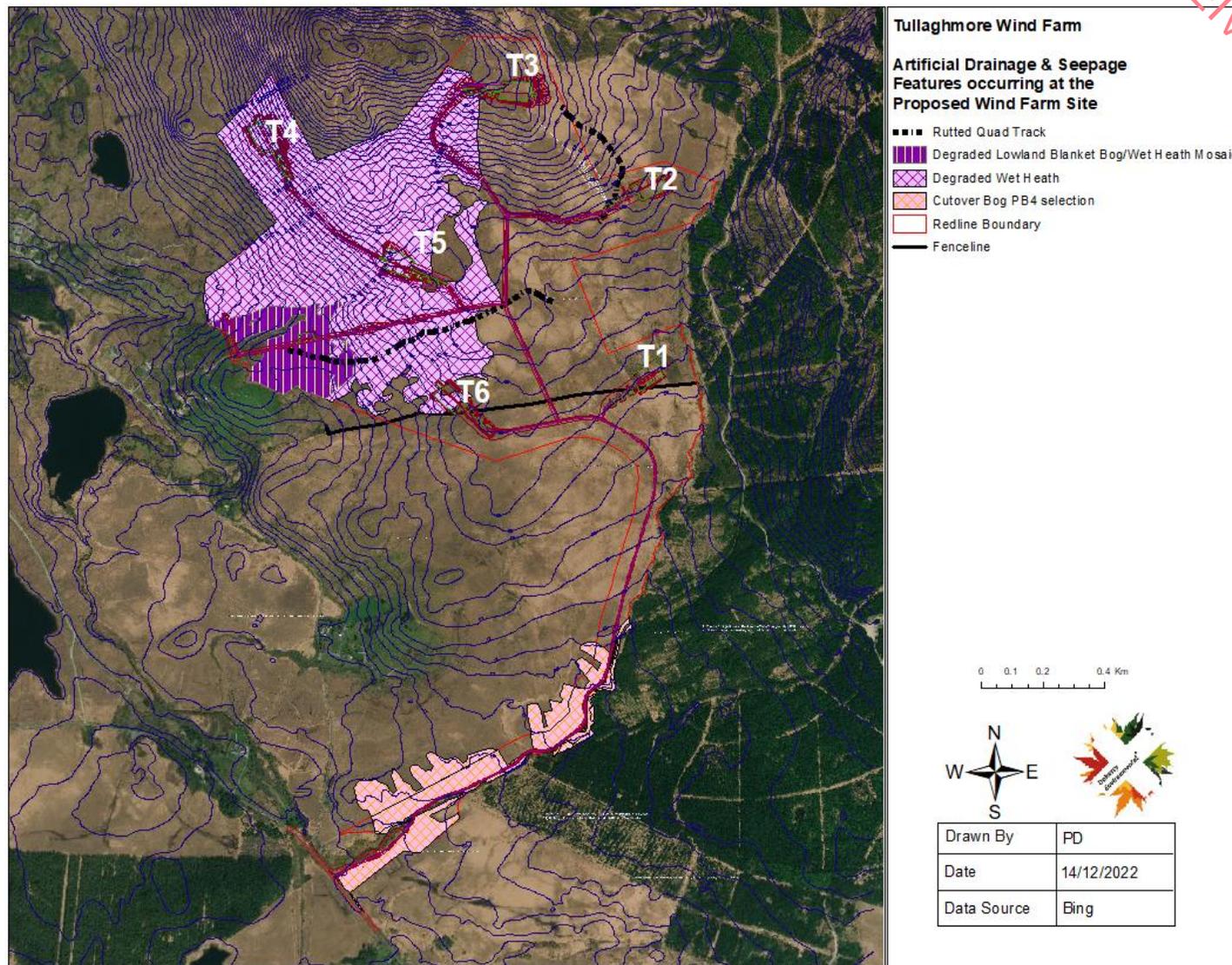
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Figure 4.2: Peat Storage & Restoration (Habitat Enhancement) Area Habitat Map



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Figure 4.3: Degraded Blanket Bog & Heath Habitats at the proposed Wind Farm Site



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4.4 HMP Target Habitats

The HMP target habitats include all peatland and heathland habitats occurring within the site. The extent of each of these peatland and heathland habitats occurring within the HMP Land Holding are outlined in Table 4.1 below. In addition to peatland and heathland habitats, freshwater habitats in the form of eroding watercourses are also included as a HMP target habitat.

Measures in the Plan will be specified for the target habitats and those specific to different types of peatland (i.e. lowland blanket bog, cutover blanket bog habitat etc.) will be clearly specified. A description of the measures to be applied to these target habitats is provided under Table 4.1 below.

Project design and construction phase management measures to protect eroding upland rivers are also specified in Section 4.3 of this HMP.

Table 4.1: Extent of Target Peatland Habitats (polygons) occurring within the HMP Lands (proposed wind farm site & peat storage and restoration (habitat enhancement) area (PSRA))

Habitat Type	Location	Area (Ha)	Overview of Habitat Enhancement
Lowland blanket bog	Wind farm	57	<ul style="list-style-type: none"> Ditch blocking of drainage ditches Remove cattle grazing Sheep only grazing at a livestock unit (LU) rate of 0.25 Lu/Ha
	PSRA	4.6	
Cutover blanket bog	Wind farm	8	<ul style="list-style-type: none"> Ditch blocking of drainage ditches Remove cattle grazing Sheep only grazing at a livestock unit (LU) rate of 0.25 Lu/Ha Re-seed with <i>Eriophorum</i> seed <i>Sphagnum</i> inoculation Overseeding with <i>Calluna</i> brash or seed to thicken up the proportion of <i>Calluna</i> in the sward.
	PSRA	12.5	

Habitat Type	Location	Area (Ha)	Overview of Habitat Enhancement
Degraded blanket bog	Wind farm	7.5	<ul style="list-style-type: none"> Remove cattle grazing Sheep only grazing at a livestock unit (LU) rate of 0.25 Lu/Ha Re-seed with Eriophorum seed Sphagnum inoculation Overseeding with Calluna brash or seed to thicken up the proportion of Calluna in the sward.
	PSRA	10	
Poor Flush	Wind farm	2.2	<ul style="list-style-type: none"> Maintain hydrological pathways and connectivity
Wet heath	Wind farm	31	<ul style="list-style-type: none"> Grazing control
WetHeathHH3/Exposed Siliceous Rock ER1 Mosaic	Wind farm	40	<ul style="list-style-type: none"> Grazing control
Dry heath	Wind farm	1	<ul style="list-style-type: none"> Grazing control
Eroding Streams	Wind farm	1	<ul style="list-style-type: none"> Riparian buffers Water quality protection
Total Area		186.6	

5 Habitat Restoration & Enhancement

In addition to prescribing methods for restoring peatland vegetation around infrastructure after construction, this HMP discusses three main habitat enhancement and management activities, based on our inspections and assessment of bog and heathland conditions during the baseline surveys, as follows:

- Ditch blocking to raise water table levels;
- Overseeding areas of degraded and bare peat, using locally collected heather brash or seed from areas of M19 vegetation where the heather is mature to over-mature; and
- Landowner agreements on stock removal/management and to avoid damaging land management practices.

Each of the above activities is described in more detail below, after a description of general good working practices which will be followed throughout all works and phases of the development.

5.1 Good Working Practices During Construction and Habitat Restoration

During construction and habitat restoration works a number of good working practices are proposed, to make sure that areas which are to be protected are not damaged during habitat restoration of other parts of the HMP lands and to ensure that the measures in this HMP are correctly implemented. The following sections describe standard good working measures which will be implemented as part of the development's habitat restoration works.

5.1.1 Ecological Clerk of Works

An Ecological Clerk of Works (ECoW) will be appointed to supervise the works and to ensure that more valuable areas are protected and avoided during the construction phase to ensure that habitat restoration and enhancement activities are implemented as planned, and to advise on any environmental or ecological aspect of the works. The ECoW will inspect habitat and ditches/water courses during the habitat restoration works and will be in charge of water quality monitoring throughout. The ECoW will be the first point of contact with the NPWS if required. A full description of the role and responsibilities of the ECoW is provided below under Section 7.

5.1.2 Access and egress

The existing site entrance and access track will be upgraded and widened and used for access and egress during the construction and operational phase. The track will be left *in situ* after habitat restoration.

The route of the access track will provide a designated controlled route for vehicles and plant and a permissible construction corridor will be designated within which vehicles and plant can operate during the construction works. This corridor will be marked with temporary fencing. The purpose of the controlled construction corridor is to prevent unnecessary vehicle and plant trafficking across parts of the site that support valuable (priority and non-priority Annex 1) habitats that are to be protected.

5.1.3 Laydown and temporary storage of materials

Laydown and temporary storage of materials will take place only within designated areas (which are generally on constructed hard stands, access tracks, etc.). There will be no laydown of any type of materials without first consulting with the ECoW.

Both access and egress routes and laydown of materials will take place only within the construction corridor around the infrastructure footprint and at the temporary construction compound. A plan of temporary storage areas is provided for in Figure 1.2(b) of the EIAR for the proposed wind farm development.

5.2 Habitat Restoration and Enhancement

For the purposes of this HMP, the terms ‘habitat restoration’ and ‘habitat enhancement’ will be used in a specific manner, as follows:

Habitat restoration is used for restoring areas of vegetation that have been impacted by wind farm construction activities, such as the restoration of vegetation along access track verges and around hardstandings.

Habitat enhancement is a benefit of the development and this term is used for activities that are designed to improve the quality of existing degraded habitats on land that is within the control of Tullaghmore Windfarm Ltd. Habitat enhancement targets the blanket bog and heathland communities that have been degraded or damaged by past land management activities. At the wind farm site and the peat storage and restoration (habitat enhancement)

area, these damaging activities are: drainage, peat cutting, stock grazing, trampling/puddling and dunging.

5.3 Restoration of vegetation around the development footprint after construction

In all areas where vegetation is stripped ahead of the construction of access tracks, turbine bases, crane hard standings, and cabling for the Tullaghmore Wind Farm, there is the need to restore vegetation after the construction activities have been completed. The prime aim of the restoration of vegetation within the wind farm footprint is to re-vegetate bare soil and peaty surface soils to stabilise them, prevent erosion and to reinstate peatland or heathland vegetation.

5.3.1 Methods of peatland vegetation restoration

Peatland vegetation cover around the construction footprint will be restored by re-turfing with intact vegetated peat turves, saved at the time of turf stripping. If required, for example if there are areas of bare peat, this can be supplemented by over-seeding using locally collected heather brash or heather seed. The decision on where overseeding of re-turved peatland areas might provide useful enhancement will be made by the ECoW once the initial turf replacement has been completed.

Careful stripping and replacement of turf is usually the best option for restoring around infrastructure because it permits restoration of a near full range of plant community species and possibly elements of the invertebrate fauna. It may also produce more rapid results as it largely involves vegetative regrowth of established plants. The quality of vegetation restoration depends very much on the quality of turf storage and the care taken during the replacement of turves.

Four main activities will be carried out to ensure that the restoration is effective and that vegetation is restored as quickly as possible. These are:

- Careful stripping of vegetation turves;
- Storage of intact turves close to their point of origin for as short a period of time as possible;
- Careful reinstatement of turves, with additional heather seeding where suitable; and
- Monitoring of reinstated vegetation.

Each activity is described in more detail below. Monitoring is described in Section 6.

5.3.2 Careful Stripping of Vegetation Turf

Ahead of the construction of turbine bases and cut sections of access tracks, the vegetation will be stripped in intact turves, ideally in large sections using plant such as the bucket of a tracked excavator. The turves shall be large in area (ideally around 0.5m x0.5m) and as deep as the surface soil organic horizon (peat), but not less than 30cm to ensure that the turves stay moist and intact during handling and storage. This will also assist their successful reinstatement. To ensure careful work, it is proposed that an experienced driver is used for this task and that all drivers are trained to meet this requirement.

For the excavation of cable trenches, the method for turf stripping and peat excavation will ensure that sections of cable trench (e.g. 500m sections) are excavated, laid and restored as quickly as possible and that the cable trench is not left open across the site and restored in one activity. This will allow the most rapid reinstatement of peatland (and other) vegetation and will prevent drying out of both the stored turves and areas of vegetation adjacent to the trench.

5.3.3 Storage of intact turves

Stripped turves shall be stored as close to their point of origin and for as short a period of time as possible. In the case of turbine bases this is likely to be of the order of weeks, but for cable trenches it will be in the order of days.

Locations chosen for the storage of vegetated peat turves shall be located away from any areas of valuable peatland vegetation (lowland blanket bog, poor flush and wet heath as indicated on Figures 4.1 and 4.2 above), particularly areas that are in good condition, within the Tullaghmore wind farm site boundary and the peat storage and restoration (habitat enhancement) area, as agreed by the ECoW. Turf storage areas will be designated in advance and contained so that no soil erosion can runoff the storage area. The method of storage will be such that:

(a) turf stripped from areas of lowland blanket bog; cutover blanket bog; degraded blanket bog; or wet heath and associated mosaic habitats is stored vegetation side up to a maximum of two turf heights, and

(b) turves stripped from areas where the vegetation has been degraded by overgrazing (e.g., in western area of the wind farm site as shown on Figure 4.3), which are likely to be less intact and more easily broken up, are more carefully stripped, transported and stored, vegetation side up, to no greater than two turf layers high. Turf storage areas shall be managed so that the turves can be deposited and lifted with minimal impact on underlying vegetation.

To ensure good conservation and to retain moisture status of turves during storage, particularly in dry weather when desiccation can occur rapidly, they may require periodic watering, or they will be covered (plastic sheeting) as determined by the ECoW, particularly if storage includes any longer spells of hot, sunny and windy weather.

5.3.4 Habitat restoration using stored turves

The aim will be to restore habitat around all construction areas to their original vegetation type using stored turves initially stripped from these areas.

Where the access track is constructed as a 'cut' track, it will be ensured that the access track verges and the cable trench will be constructed in such a way as to minimize the disturbance of stripped vegetation and excavated peat. This approach will involve vegetation restoration on the road verge and over the cable trench as a single process after all the construction work has been completed.

Habitat restoration around batters of turbine bases, crane hardstandings and sections of cut access track will be achieved by

- (a) ensuring sufficiently shallow batter gradients to prevent peat or soil erosion;
- (b) careful levelling and firming of subsoil to the correct density to minimise the risk of uneven settlement; and
- (c) by careful replacement of turves, butted close together and well tamped into place, so that they will not easily erode. Any unavoidable gaps shall be filled with loose peat and well tamped.

The quality of restored areas will be checked by the ECoW immediately after completion to confirm that turf reinstatement has been carried out correctly. Subsequent checks and monitoring of restored areas are described in Section 6.

Should there be a requirement to dress batters with stored peat and/or mineral soil in addition to peat turves; the stored peat and/or mineral soil will be replaced first in a layer, with peat typically of approximately 0.3-0.5m, well tamped into place and levelled in order to reduce the potential for peat erosion. Peat turves will then be carefully placed on top, closely butted, and further tamped into place. The peat and turf replacement process will be carried out as one activity and in no case will any replaced loose peat be left as an exposed layer without turf cover, unless under the guidance of the on-site ECoW. In such cases, revegetation of bare peat will be according to the methods to reseed using heather brash or seed, outlined in Section 5.4.4.

Habitat restoration of cable trenches will be completed as soon as sections of trench, 500m long, are completed and back-filled. To ensure successful restoration of vegetation along cable trenches, and to ensure that trenches do not become routes of preferential flow for drainage waters, trenches will be designed with cross dams and back-filling and re-turfing will take place immediately after cables have been laid. Appropriate scale plant will be used for these activities to minimize as much as possible the trafficking of adjacent peat.

Should areas of replaced turf require overseeding to thicken up vegetation regeneration, the method will follow that described in Section 5.4.4 below.

5.3.5 Habitat Restoration of Steep Cut Slopes

Areas of steep cut slopes will be created along sections of the proposed access track on the approach to T3 and along the approach to T4. Baseline conditions along these sections of the proposed access track are characterised by thin peat layers with exposed rock. The vegetation cover in these areas has been subject to ongoing over-grazing. The habitat management objectives for these steeper slopes will be to restore a *Calluna vulgaris* dominated sward. The techniques that can be implemented to achieve the colonisation of these slopes with *Calluna vulgaris* include the application of heather brash/chopper material using a scatter roller; hydroseeding of the slope; and or the application of seed and geojute/netting¹ to stabilise and

¹ Salmon smolt netting has been successfully used for stabilisation of seed during blanket bog restoration in Scotland: see https://www.iucn-uk-peatlandprogramme.org/sites/www.iucn-uk-peatlandprogramme.org/files/file_attach/Session%208%20Combined%20Workshop%20Presentation.pdf

protect the surface during vegetation establishment. Brash/chopper material and seed material to be used for seeding steeper slopes will be harvested from the wind farm site. Harvesting will be undertaken in line with the method outlined in Section 5.4.3 below.

The final approach to be used for the establishment of *Calluna vulgaris* swards on steeper cut slopes will be selected by the ECoW in consultation with a landscape specialist.

5.4 Habitat Enhancement

5.4.1 Introduction

A number of agricultural land management practices have damaged and caused the degradation of both blanket bog and heathland habitats at the Tullaghmore Wind farm site and blanket bog habitat occurring at the peat storage and restoration (habitat enhancement) area. In addition to preventing the occurrence of these damaging management practices in the future, there are a number of habitat enhancement and improvement activities that will be implemented as part of the HMP.

Tullaghmore Windfarm Ltd. will work with the current landowners to manage areas of blanket bog and heathland within the wind farm site and the peat storage and restoration (habitat enhancement) area so as to return it to good conservation status for at least the lifetime of the Tullaghmore Wind Farm Development, which is predicted to be at least 35 years.

The techniques for habitat enhancement and improvement that will be implemented will comprise:

- **Ditch blocking.** Opportunities for blocking drainage features resulting in water loss from peatland habitats have been identified within the wind farm site and the peat storage and restoration (habitat enhancement) area. The blocking of ditches will reinstate higher water table levels which would have been present before artificial drainage and peat cutting.
- **Reinstatement of blanket bog vegetation community.** Areas of degraded blanket bog, badly damaged through drainage, mechanical peat cutting and compaction caused by heavy vehicle trafficking, are targeted for reinstatement.
- **Reprofiling of degraded blanket bog.** Reprofiling of areas of degraded blanket bog in the peat storage and restoration (habitat enhancement) area where the surface

vegetation and upper surface layer of the acrotelm have been removed will be implemented to promote active blanket bog reinstatement.

- **Control stock grazing.** Tullaghmore Windfarm Ltd. will work with landowners to improve general land management and grazing regimes, particularly within areas of NI priority habitat.
- **Fencing.** Fencing will be provided both during the construction and decommissioning phase and the operation phase of the wind farm site to promote peatland restoration and ongoing management.
- **Agreements with landowners** to prevent any ongoing damaging land management practices.

5.4.2 Ditch blocking and infilling

Opportunities for blocking drainage features resulting in water loss from peatland habitats have been identified within both the proposed wind farm site and the peat storage and restoration (habitat enhancement) area. Areas where water loss from blanket bog habitat is occurring either through artificial drainage ditches, erosion gullies or peat cuttings have been identified during a review of orthophotography, satellite imagery and site walkover surveys undertaken between August 2020 and November 2022. Blocking these features will have the potential to reinstate a high water table and promote rewetting of blanket bog occurring within both the proposed wind farm site and the peat storage and restoration (habitat enhancement) area.

The drainage and seepage features shown in Figure 5.1 & 5.2 are artificial and/or a result of erosion brought about from excessive grazing and are causing water loss from peatland habitats. The drainage features to be blocked include artificial drainage ditches, informal drainage channels that have become established along the base of cut peat face banks and drainage pathways through peat cutting on sloping ground. The indicative location of drainage blocking and the type of drainage features to be blocked are shown on Figure 5.3 & 5.4. Plates 1 to 3 below provide examples of the types of drainage features occurring within the HMP area that will be blocked.

It is predicted that, with the blocking of these drainage features the water table in the surrounding area will rise and promote optimal conditions for the maintenance and enhancement of peatland habitats.



Plate 1: Deep cut drain



Plate 2: Drain at base of face bank

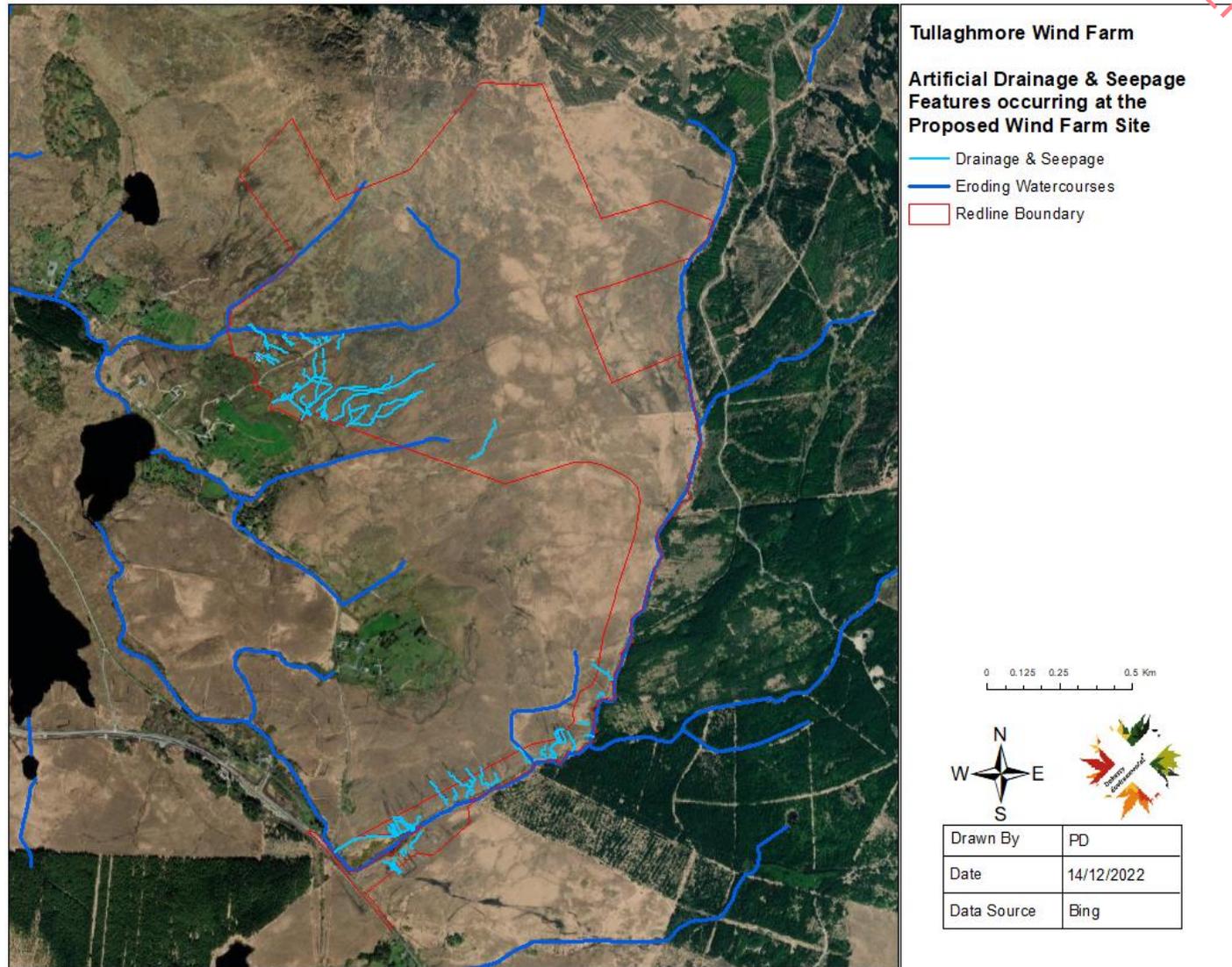


Plate 3: Deep cut drain

5.4.2.1 Methodology of Ditch Blocking

Ditch blocking has been shown in numerous studies to be a highly effective method of raising water tables as a pre-cursor to blanket bog restoration. See, for example, Armstrong *et al.* (2009a) who review the results of 32 ditch blocking programmes in England and Scotland and also provide a drain-blocking best practice guide which advises on methodology (Armstrong *et al.*, 2009b). Typical methods for ditch blocking involve the use of plastic or wooden piling, often accompanied by infilling/backfilling the blocked ditch with peat or heather bales. In some places, for example areas where drainage ditches intercept mineral substrate below, stone dams have been used.

Figure 5.1: Artificial Drainage & Seepage Features occurring at the proposed Wind Farm Site



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Figure 5.2: Artificial Drainage Features occurring at the proposed Peat Storage & Restoration (Habitat Enhancement) Area

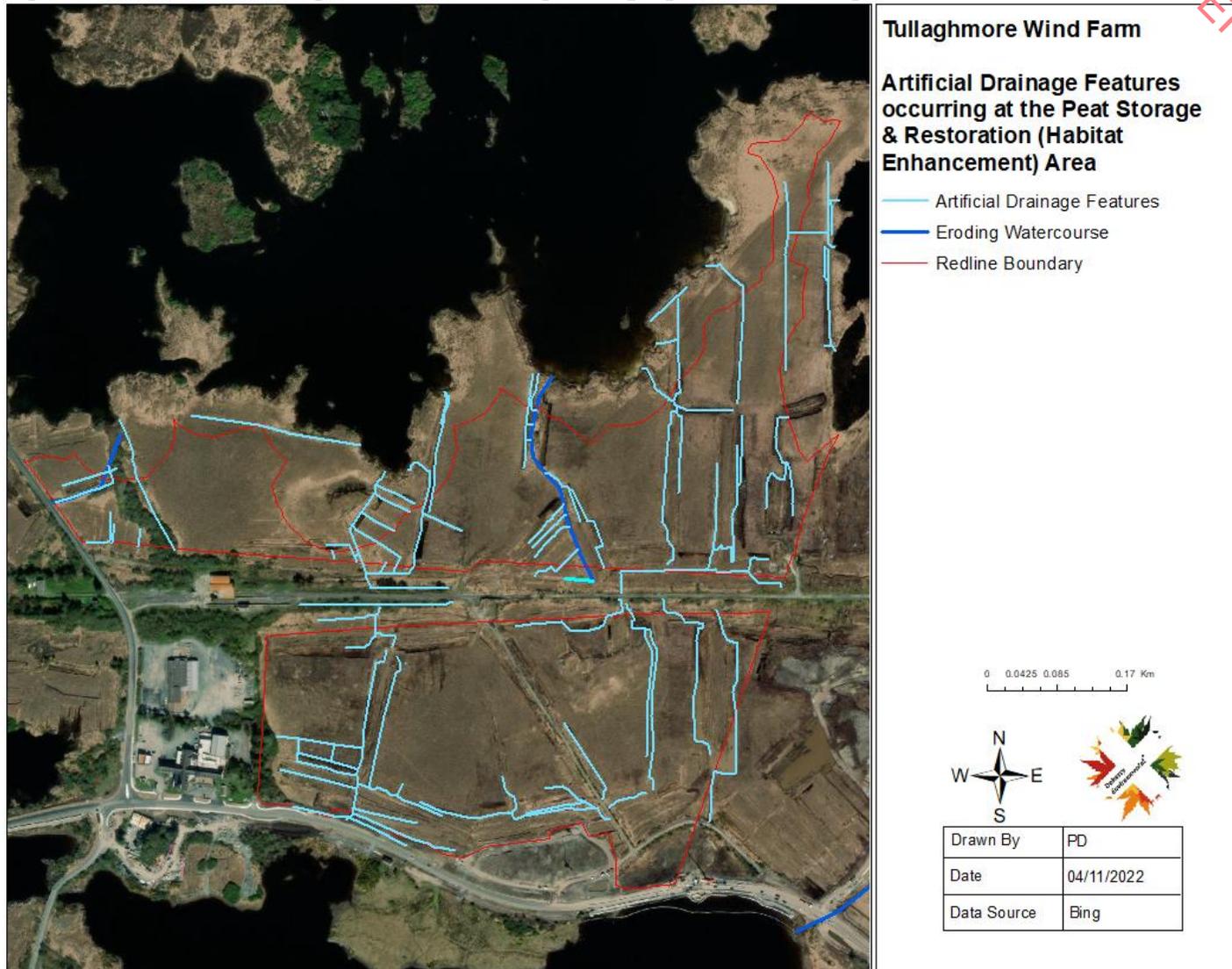


Figure 5.3: Indicative Drain Block Locations occurring at the proposed Wind Farm Site

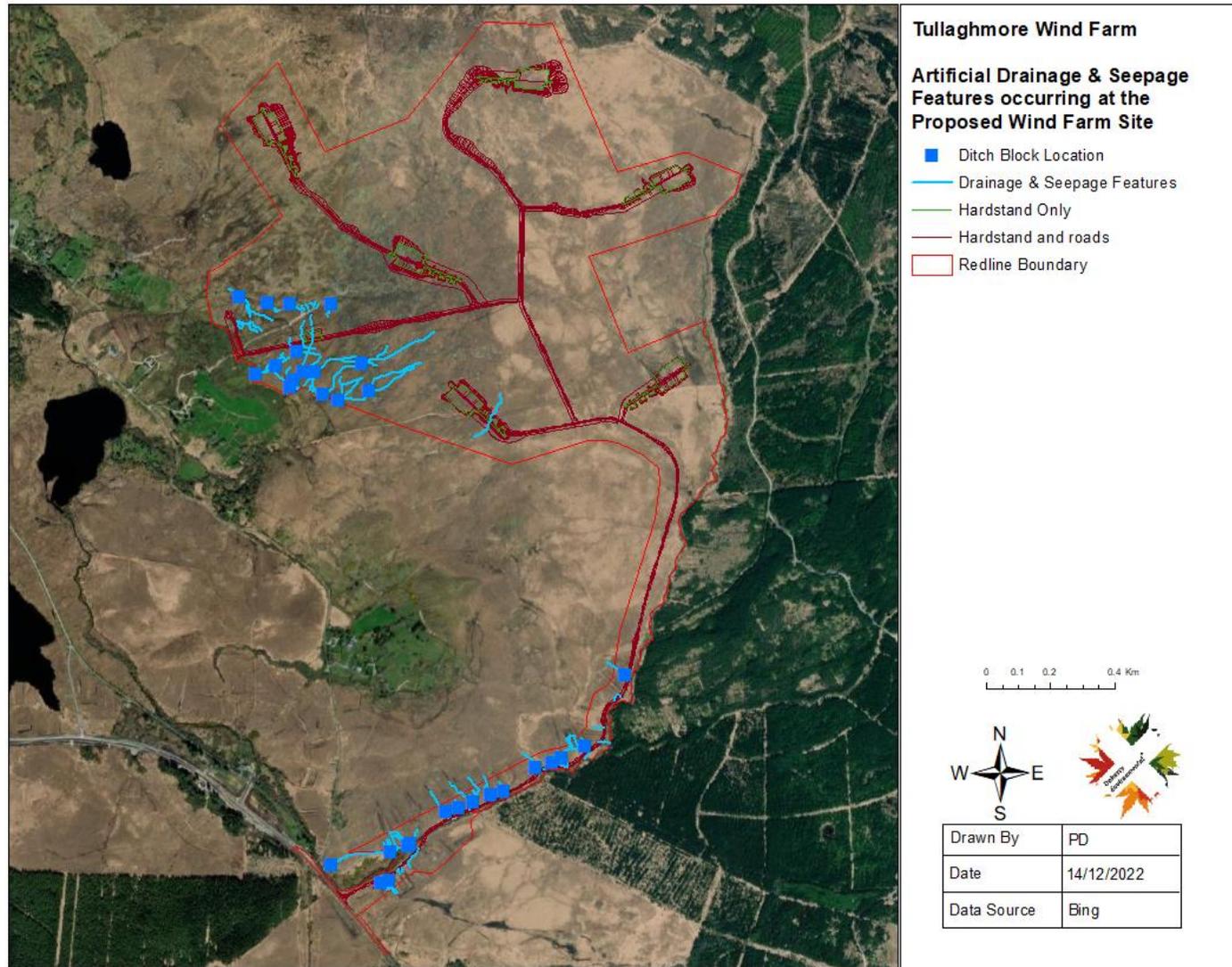
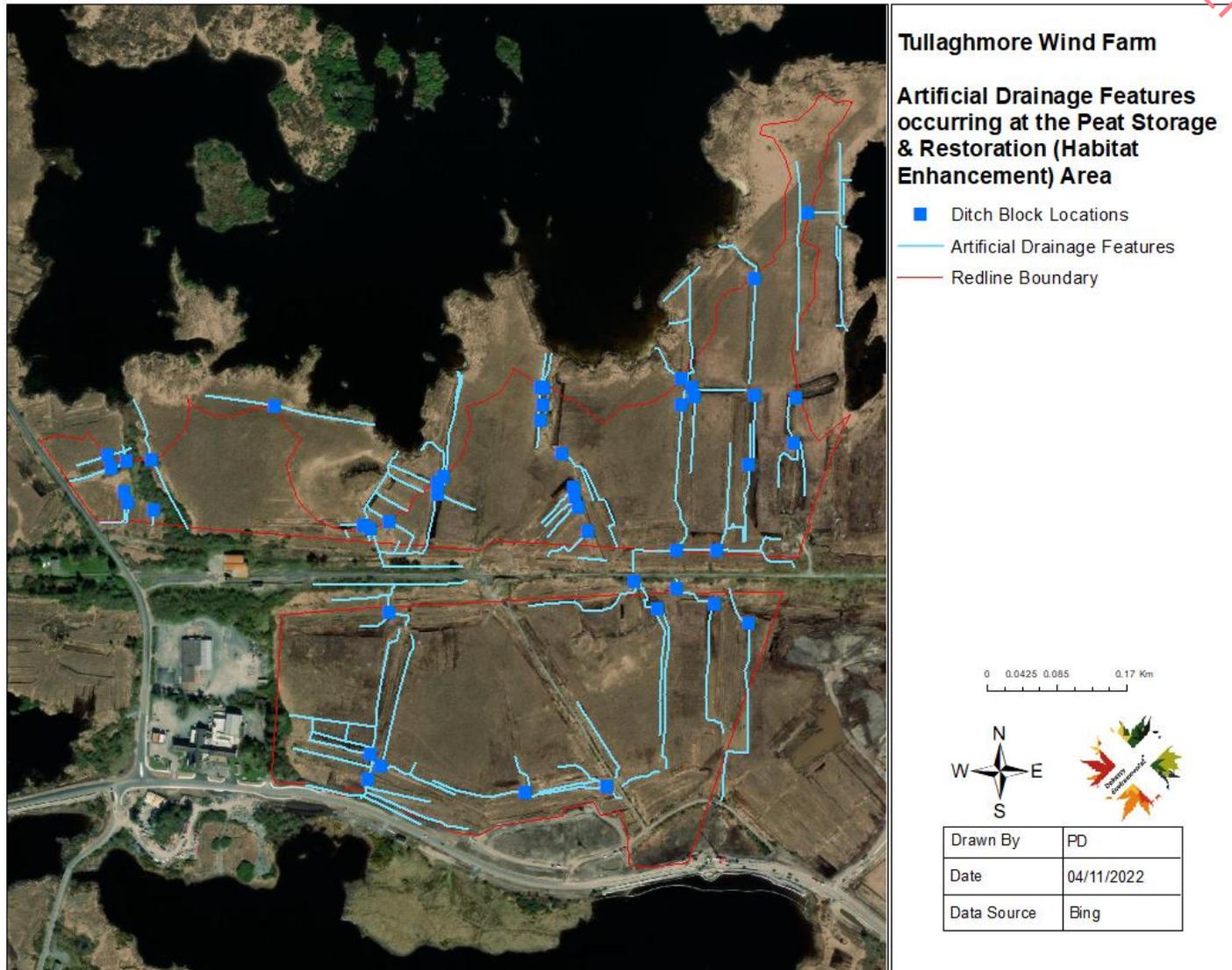


Figure 5.4: Indicative Drain Block Locations occurring at the proposed Peat Storage & Restoration (Habitat Enhancement) Area



A number of techniques can be used for ditch blocking. These include the use of decomposed peat and the creation of “wave dams” or the use of plastic sheet piling; coir rolls or netting. Peat turves are often the most widely used method for damming drainage ditches, since turves are available on site and the method is cheap. The wave damming approach using decomposed peat either side of drains has proved an effective method for drain blocking on wind farms in Scotland.

Plastic piling has been the most widely recommended method for ditch blocking, particularly where there is sufficient peat below the ditch in which to secure the piling. The method for inserting dams to block ditches at Tullaghmore is provided in Appendix A and will consist of very simple, manually-installed plastic piles in addition to backfilling ditches with peat turf. This is the most simple and effective method. The methodology for this is explained in detail in Scottish Natural Heritage’s (SNH) (2014) document entitled “Guidance for land managers installing plastic piling dams” (at <http://www.snh.gov.uk/docs/A1268171.pdf>). While a brief summary is provided in Appendix A, personnel installing plastic piling dams at Tullaghmore will refer directly to the SNH (2014) document. Useful information is provided in that document on: selection of where to put each dam, method of pile insertion, checking that the dams are properly installed, post installation monitoring and repairing dams if they are found to be damaged or not working properly.

The spacing between dams will be determined by the slope of the land, the width of the ditch and the rate of water flow. No generic criteria can be provided for damming in terms of spacing aside from the general rule that the spacing between dams should exhibit a ‘top to toe’ effect whereby the raised water table stretches from one dam up to the next one upslope. Dam location will be finalised by the ECoW in consultation with a peat/hydrology expert during the construction phase.

There will be a number of key requirements imposed on the construction contractor during ditch blocking and dam construction, including:

- planning access and egress routes to minimise as much as possible the compaction of peat around drainage ditches;
- use of plant (if required, since much of this work can be done by hand) with low pressure bearing tyres or suitably wide tracks to reduce compaction around the construction areas;

- careful backfilling with originally excavated peat from ditches, so as to cause as little disturbance to the ditch banks as possible and to leave original underlying bankside vegetation intact; and
- peat must be carefully and sufficiently tamped and keyed into the bottom and sides of the drain and dam to avoid undercutting or leakage. This is particularly true where piles intercept both peat and underlying mineral substrates.

Monitoring of the success of drain blocking will be undertaken by:

- a. vegetation analysis using quadrats immediately adjacent to blocking locations;
- b. the monitoring of dipwells/piezometers adjacent to blocking locations; and
- c. also through a detailed photographic log of the blocking location during ongoing operation phase monitoring.

5.4.3 Heather Seeding

To the north of the northeast of the proposed turbine T4, near the summit of Ceapach na Lara Báine, Calluna-dominated vegetation community is in generally good conditions and supports stands of mature heather. These areas will also act as donor areas of heather seed for re-seeding and over-seeding other habitat enhancement areas within the wind farm site.

Under the guidance of the ECoW, small areas with mature *Calluna vulgaris* will be selected for mowing. This will involve an inspection of the area to select the best and most easily accessible areas as donor locations for collection of heather seed for re-seeding elsewhere. These areas will display signs of mature and ‘leggy’ heather stands in need of regenerating and display good seed production.

Heather seed is very small and can be produced in great abundance. Heather seed does not ripen until about October, depending on weather conditions. Germination requires light, warmth and moisture, so seed collected in the autumn is best sown in the spring. Most germination usually occurs in mid to late summer. If conditions are unsuitable, seed will remain dormant and can persist in the seedbank for decades although viability varies greatly according to site conditions.

In order to use locally-sourced heather seed for both revegetating areas of bare peat and enhancing re-turved areas, a programme of heather seed collection, using brush harvesters, will

be conducted on suitable areas of heather moorland in the north-eastern part of the site. Brush harvesters can be deployed as rear and side-mounted brush harvesters, tractor-trailed, ATV-trailed and pedestrian brush harvesters. For the purposes of heather seed collection at Tullaghmore, the equipment to be deployed will be a combination of either quad bike ATV-trailed harvesters and pedestrian harvesters. This will avoid the use of heavy machinery on site and the compaction of underlying peat enroute to donor locations.

A number of component tasks will be carried out and managed by the ECoW. These tasks will include as a minimum:

- Inspection of all areas of heather moorland in the north-east of the site to identify and select suitable donor locations for heather seed. Likely areas suitable for seed collection will be accessible and will display signs of mature and ‘leggy’ showing good flowering characteristics. This inspection and selection will be carried out by the ECoW;
- Plan suitable storage facilities for both heather brash and heather seed (if required) so that harvested materials can be suitably conserved until it is deployed in habitat restoration works; and
- If there are any bare patches in restored areas within the Tullaghmore wind farm site boundary, implement heather seed spreading on a location-by location basis, as indicated below and as directed by the ECoW.

Ahead of peatland habitat restoration/enhancement works elsewhere on site, the ECoW will plan and supervise a targeted heather seed collection programme in the northeast of the site in line with the requirements of the Wildlife Act and the breeding bird season heather flailing must not be carried out during the period 1st March to 31st August to protect ground-nesting birds.

Donor seed will be harvested at the optimum time of year, from October through to December.

Suitable dry storage facilities for both heather brash and heather seed will also be planned so that harvested materials can be suitably conserved and protected from wet conditions until they are deployed in habitat restoration works.

5.4.3.1 Seed Application & Management

Heather reseedling shall take place in late spring (late April to May) to allow warmth and moisture conditions of early summer to optimise germination. A sowing rate of 15 – 17kg per

hectare, with repeated applications over several years, will be required as part of the habitat restoration.

Regrowth of competitor vegetation must be reduced during the establishment phase by one or a combination of the following management actions:

- Topping
- Controlled grazing; and/or
- Weed wiping

The areas within the wind farm site that will be treated with heather seed will be areas of bare peat occurring within the degraded peatland and heath habitats occurring within the wind farm site as shown on Figure 4.3. These areas have been subjected to overgrazing by sheep. Seeding of these areas with heather seed, along with the combined treatment of stock reduction will contribute towards the re-establishment of heath vegetation in these areas of the Tullaghmore Wind Farm site.

5.4.4 Stock management

Stock management of both sheep and cattle will be agreed between Tullaghmore Windfarm Ltd and landowners. The whole site will benefit from stock management, particularly the following areas in the western part of the wind farm site, to the west of the south west to northeast orientated fenceline that bisects the wind farm site.

5.4.4.1 Cattle Management

The complete removal of cattle will occur during the construction phase of the development and for the first three years following light overseeding. Thereafter, the rate of grazing will be restricted to a stocking rate of 0.075 livestock units per hectare between 1 March to 31 October. No grazing will be permitted outside of this period.

Over the period of the wind farm lifetime (35 years) it is considered that stock removal followed by reduction in grazing density will result in a very significant improvement of sward structure and biodiversity of degraded blanket bog/heathland in this area.

5.4.4.2 Sheep

The complete removal of sheep will occur during the construction phase and for the following three years. Thereafter, the rate of sheep stocking will be restricted to a sheep-only stocking rate of 0.25 livestock units per hectare between 1 March to 31 October. No grazing will be permitted outside of this period.

Records will be kept of initial habitat condition, current and historical stocking densities will be compiled and maintained throughout the operational life of stock management and grazing restrictions.

5.4.5 Management agreements with landowners

A number of land management practices are damaging to blanket bog and peatland. Under the terms of their lease with the respective landowners, Tullaghmore Windfarm Ltd. will prevent ongoing damaging land management practices during the lifetime of the development. In this respect, there will be:

- no peat cutting;
- no overgrazing (grazing on site will be in line with the stocking rates specified in Section 5.4.5 above);
- no new drainage and no maintenance of existing drains, with the exclusion of drains designed to protect the development's infrastructure;
- no flailing or mowing (with the exception of any flailing or mowing designed specifically for habitat enhancement as part of the wind farm development); and
- no burning.

5.4.6 Peat storage & Restoration (Habitat Enhancement) Area – Restoration of Bog Levels

Areas of cutover bog within the peat storage and restoration (habitat enhancement) area that now present themselves as cut cells below the original ground level of surrounding blanket bog will be infilled with surplus peat spoil material from the proposed wind farm site. The surplus peat spoil material will be deposited to a depth of 1.5m. This will allow the total estimated amount of spoil to be stored taking into account a bulking factor of 10% (total of approximately 93,236m³). Works associated with the deposition of surplus peat and infilling of existing cut cells will involve the machinery similar to that used for peat excavation at the proposed wind farm site. A 40-60 tonne 360 degree long reach hydraulic excavator and tractors and trailers will

be used to place the spoil in areas of cut away to create level surface. Where these areas are less than 1.5m deep (expected to be the majority), they will be filled with peat to the adjoining ground level and then a containment berm will be created to create cells. The cells will be bermed and will measure approximately 30m x 30m and have outfalls blocked with overflow management including the creation of drainage channels for excess water.

Two approaches will be taken to restoring active peat-forming vegetation on the surface of the deposited peat substrate within the cut cells. The approach to be used will be dictated by the existing condition of the cut cell, which are presentative of either a) cut cells that support rehabilitating blanket bog habitat; and b) cut cells that are dominated by bare peat and do not support rehabilitating blanket bog habitat.

5.4.6.1 Cells Supporting Rehabilitating Blanket Bog Vegetation

Where the cut cell that is to receive surplus peat materials currently supports a vegetation community that is typical of rehabilitating blanket bog habitat, the vegetation will be removed from the cell as turves in advance of the deposition of surplus peat material. The removal of the vegetation as turves will follow the approach detailed for the wind farm site in Section 5.3.2 above. The turves will be stored on degraded blanket bog adjacent to the cut cell. The storage of the turves will follow the approach set out in Section 5.3.3 above. Once surplus peat has been deposited, the turves supporting the blanket bog vegetation community will be re-laid on top of the deposited surplus peat material. The turves will be applied as the finish layer to the infilled cut cell as per the approach set out in Section 5.3.4 above.

The following sequence of works will be implemented for cut cells supporting existing rehabilitating blanket bog vegetation:

- a) Existing drains resulting in water loss from the cell, generally at a cell outfall location will be blocked.
- b) The existing peat forming vegetation in the cut cell will be removed as turves.
- c) The surplus peat will be deposited to existing ground level.
- d) A berm will be provided around the cell.
- e) The surface turves will be re-laid on the surface of the infilled cell within the berm.

5.4.6.2 Cells Dominated by Bare Peat/Not Supporting Rehabilitating Blanket Bog Vegetation

Where the cut cell that is to receive surplus peat materials is currently dominated by bare peat or does not support a vegetation community that is typical of rehabilitating blanket bog habitat, the surplus peat will be deposited on to the existing surface.

Once all material is applied the surface of the cell will be profiled so that that it forms a slightly concave profile with the centre lying slightly lower than the edges at the surrounding berm. This profile will be provided so that the cell will hold a shallow film of water within the cell.

The cell surface will be inoculated with *Sphagnum* and *Eriophorum* seed collected from donor locations within the peat storage and restoration (habitat enhancement) area.

The following sequence of works will be implemented for cut cells supporting existing rehabilitating blanket bog vegetation:

- a) Existing drains resulting in water loss from the cell, generally at a cell outfall location will be blocked.
- b) The surplus peat will be deposited to existing ground level.
- c) The cell will be profiled to a shallow concave shape.
- d) A berm will be provided around the cell.
- e) The cell surface will be inoculated with donor *Eriophorum* seed and *Sphagnum*.

5.4.6.2.1 Identification of Donor Areas

During the construction phase of the wind farm, the ECoW will continually inspect peat storage and restoration (habitat enhancement) area to determine when there is a good cover of *Eriophorum vaginatum* cotton seed heads in areas of degraded blanket bog. The entire area will be mown and bog cotton seed collected, following the approach to seed collection outlined in Section 5.4.3 above. The seed collection will be supervised by the ECoW to provide advice at the time of harvesting. The ECoW will ensure in advance that bagging and dry storage facilities are available so that seed can be collected and stored for later use. Since the bog cotton seed is so light and easily airborne, it is imperative for maximum success that this work is carried out on a dry day with still weather conditions.

Immediately after collection of *Eriophorum* seed, the donor cells will be re-seeded.

Bog cotton seed and *Sphagnum* will be spread by hand to ensure that all areas of bare peat are adequately covered. There is no guidance on application rates for bog cotton seed and *Sphagnum* inoculation, so the ECoW will specify the application rate once the quantity harvested above has been determined. The aim in this part of the site will be to encourage the regeneration of patchy bog cotton and *Sphagnum* cover, to produce an embryonic peat-forming community. Once established, both *Eriophorum* and *Sphagnum* will naturally spread through the sward to form a more mature blanket bog community.

5.4.7 Peat Storage & Restoration (Habitat Enhancement) Area—Restoration of Degraded Bog

Where the storage is on areas of non-cutover peat, then the cells will be provided on the surface of the existing degraded/de-vegetation peat surface. The width of the cell, in an east to west orientation will be dictated by the width of the existing areas of cutover blanket bog either side of the degraded/de-vegetated area, but will not be wider than 45m in width. The length of the cells along their broadly north to south axis will not be longer than 60m in length.

Once all material is applied the surface of the cell will be profiled so that that it forms a slightly concave profile with the centre lying slightly low than the edges at the surrounding berm. This profile will be provided so that the cell will hold a shallow film of water within the cell.

The cell surface will be inoculated with *Sphagnum* and *Eriophorum* seed collected from donor locations within the peat storage and restoration (habitat enhancement) area.

The following sequence of works will be implemented for degraded areas of blanket bog where surplus peat will be deposited:

- a) Existing drains adjacent to the degraded area receiving surplus peat will be blocked.
- b) A berm will be provided around the edge of the cell.
- c) The surplus peat will be deposited subsequent to the establishment of the berm.
- d) The cell will be profiled to a shallow concave shape.
- e) The cell surface will be inoculated with donor *Eriophorum* seed and *Sphagnum*.

5.4.8 Peat Storage & Restoration (Habitat Enhancement) Area – Treatment of Cell Berms

All berms enclosing cells that are to receive surplus peat material from the proposed wind farm site will be treated as a heath habitat. As the berms will sit proud of the surrounding peat substrate they will be subject to drier conditions. The aim will be to establish heather-clad berms

enclosing the areas of blanket bog within cells. The berms will be seeded with *Calluna vulgaris* seed.

During the construction phase the ECoW will identify suitable donor areas for heather seed collection. The seed will be collected and applied in line with the approach set out under 5.4.3 above.

5.4.9 Protection of Restored Areas

Since stock management at Tullaghmore will remove grazing animals from the site during construction and for the first three years after habitat restoration and enhancement activities, restored and enhanced areas will not require any special protection against livestock grazing. It may, however, be necessary to use heather brash or other brash to secure applied heather seed, to protect seedling growth and to prevent surface peat erosion. Other methods to protect seedling growth on areas of steeper fill, such as along the access track approach to the proposed turbine T3 and T4 will require the application of geojute or netting. The ECoW will routinely inspect enhanced areas and will instruct any necessary action that may be required for the ongoing protection of areas that are subject to restoration and enhancement by way of seedling application.

6 Habitat Management Action Plan

Table 6.1 outlines an Action Plan for the promotion and implementation of management actions to manage and enhance peatland habitats within the HMP Area.

The responsibility for the completion of actions are outlined in Table 6.1. The implementation of actions during the construction phase will be completed by the main civil contractor.

6.1 Monitoring

To ensure that management actions outlined in Table 6.2 are achieving the required objectives for each target, regular monitoring is required. Table 6.2 below lists the monitoring required for each target, the measurement to be recorded, timing and frequency of monitoring and the personnel who shall carry out each task.

This monitoring programme covers the construction period in addition to (as a minimum) years 1, 2, 3, 5, 7 & 10 following the completion of the construction period. Baseline surveys exist

for the entire site, and these will be complemented by confirmatory surveys completed through the construction phase.

Habitat monitoring will be undertaken using quadrats, fixed point photography and dipwells/piezometers.

Monitoring during the early years of the operation phase will be particularly important for evaluating the success or otherwise of management actions to achieve favourable conservation status for peatland habitats.

The Favourable Conservation Status of Peatland Habitats will be based upon the attributes and targets outlined in Table 6.1.

Table 6.1: Attributes, Measurements and Targets for Achieving Favourable Conservation Status

Attribute	Measurement	Target
Blanket Bog		
Vegetation Composition	Relevé	Number of positive indicator species present ≥ 7 .
	Relevé	Cover of bryophyte or lichen species, excluding <i>Sphagnum fallax</i> $\geq 10\%$
	Relevé	Bare peat cover $< 10\%$
	Relevé	Cover of each of the following species: <i>Calluna vulgaris</i> , <i>Eriophorum vaginatum</i> , <i>Eriophorum angustifolium</i> , <i>Molinia caerulea</i> , <i>Schoenus nigricans</i> , <i>Trichophorum germanicum</i> , <i>Eleocharis multicaulis</i> individually $< 75\%$
	Relevé	Cover of the following negative indicator species: <i>Agrostis capillaris</i> , <i>Holcus lanatus</i> , <i>Phragmites australis</i> , <i>Pteridium aquilinum</i> , <i>Ranunculus repens</i> collectively $< 1\%$
	Relevé	Cover of non-native species $< 1\%$
	Local vicinity	Cover of non-native species $< 1\%$
Local vicinity	Cover of scattered native trees and scrub $< 10\%$	
Vegetation Structure	Relevé	Crushed, broken and/or pulled up <i>Sphagnum</i> species $< 10\%$ of <i>Sphagnum</i> cover
	Relevé	Last complete growing season's shoots of ericoids, <i>Empetrum nigrum</i> and <i>Myrica gale</i>

Attribute	Measurement	Target
		showing signs of browsing collectively < 33% (Assess a minimum of 10 shoots distributed across the plot)
	Local vicinity	No signs of burning into the moss, liverwort or lichen layer or exposure of peat surface due to burning
	Local vicinity	No signs of burning inside boundaries of sensitive areas
Physical Structure	Relevé	Cover of disturbed bare ground < 10%
	Local vicinity	Cover of disturbed bare ground < 10%
	Local vicinity	Area showing signs of drainage resulting from heavy trampling or tracking or ditches or peat cutting < 10%
	Local vicinity	Cover of erosion gullies and eroded areas within the greater bog mosaic ‡ < 5%
Hydrology	Dipwell/Piezometer	Water table is less than 15cm below the surface at monitoring points.
Heath		
Vegetation composition	20m radius	<i>Calluna vulgaris</i> and/or other ericoid species (<i>Erica tetralix</i> , <i>Erica cinerea</i>) present
	Relevé	Cover of positive indicator species ≥ 50%
	Relevé	Total cover of <i>Cladonia</i> species, <i>Sphagnum</i> species, <i>Racomitrium lanuginosum</i> and <i>Pleurocarpus</i> mosses ≥ 10%
	Relevé	Cover of ericoid species and/or <i>Vaccinium myrtillus</i> ; <i>Empetrum nigrum</i> ≥ 15%
	Relevé	Cover of the following negative indicator species: <i>Agrostis capillaris</i> , <i>Holcus lanatus</i> , <i>Phragmites australis</i> , <i>Ranunculus repens</i> collectively < 1%
	Relevé	Cover of non-native species < 1%
	Local vicinity	Cover of non-native species < 1%
	Local vicinity	Cover of scattered native trees and scrub < 20%
	Local vicinity	Cover of <i>Pteridium aquilinum</i> < 10%
	Local vicinity	Cover of <i>Juncus effusus</i> < 10%

Attribute	Measurement	Target
Vegetation Structure	Relevé	Crushed, broken and/or pulled up Sphagnum species < 10% of Sphagnum cover
	Relevé	Last complete growing season's shoots of ericoids, <i>Empetrum nigrum</i> and <i>Myrica gale</i> showing signs of browsing collectively < 33% (assess a minimum of 10 shoots distributed across the plot)
	Local vicinity	No signs of burning into the moss, liverwort or lichen layer or exposure of peat surface due to burning
	Local vicinity	No signs of burning inside boundaries of sensitive areas
Physical Structure	Relevé	Cover of disturbed bare ground < 10%
	Local vicinity	Cover of disturbed bare ground < 10%
	Local vicinity	Area showing signs of drainage resulting from heavy trampling or tracking or ditches or peat cutting < 10%

Management Actions and techniques outlined in Sections 5 above aim to achieve favourable conservation status of peatland and heathland habitats within the HMP area.

Where management actions are not deemed to be successful in achieving the targets for favourable conservation status of peatland and heathland habitat, as outlined in Table 6.1 above, then the implementation of remedial measures will be required. Examples of these remedial measures are provided in Section 5 above. It is noted that the nature of the remedial action to be applied will be dependent upon which attributes are not meeting the targets of favourable conservation status.

6.1.2 Ongoing Monitoring – Meeting Targets

If a habitat fails to meet one of the targets, then management action as listed in Table 6.2 will be undertaken.

6.2 Reporting of Monitoring

Table 6.2 specifies the timing of monitoring for each HMP Action.

The ECoW will produce a final report documenting the implementation of Habitat Management Plan Actions (as well as environmental and ecological effects – see Section 7) of the construction period. The report will be made available to the Owner, Contractor, Planning Authority, NPWS and other external agencies where appropriate (e.g. Inland Fisheries Ireland).

A report detailing the results of all actions requiring implementation during the construction phase will be furnished to the Planning Authority within 12 months of the completion of construction activity, and subsequently in years 2, 3, 5, 7 & 10.

6.2.1 Quadrats & Fixed-Point Photography

Habitat surveys during the monitoring programme will be based on fixed quadrat surveys. Each quadrat will be surveyed using the DOMIN Scale so that individual vegetation communities are identified. Fixed quadrat monitoring locations will be identified by the ECoW during the construction phase.

Quadrats will be located within all areas of the proposed wind farm site and the peat storage and restoration (habitat enhancement) area that are subject to the habitat management measures outlined in Section 5 above.

Fixed point photographs will be taken of the vegetation at all quadrats and of the surrounding area during each round of monitoring. The grid reference of the initial fixed point photograph location will be recorded during the initial round of monitoring and the direction of view of photographs recording the surrounding area will also be recorded.

6.2.2 Water Level Monitoring

Monitoring of water levels within blanket bog habitat will also be undertaken using dipwells/piezometers. The location of dipwells/piezometers will be selected by the ECoW during the construction phase. A quadrat will be posited at each dipwell/piezometer location.

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Table 6.2: Habitat Management & Monitoring Action

HMP Action Ref. No.	Management Measure	Target	Method	Measurement	Timing	Entity Responsible
1.	Protect Water Quality in Eroding Upland Rivers	No decrease in water quality in eroding upland rivers during the construction phase.	Implementation of all project design and construction phase management measures as specified in the EIAR for the proposed development.	ECoW to review and monitor construction phase to ensure implementation of design measures and construction phase management measures.	Throughout the construction phase	Construction Contractor
2.	Grazing Control	Promote grazing regimes as outlined in Section 5	Implementation of livestock numbers specified in Section 5	Monitor grazing and liaise with landowner to check that livestock numbers and grazing regime are adhered to. The success of the grazing regime in terms of contributing to peatland and heathland restoration will be monitored using permanent fixed quadrats. A photographic log of all quadrats and areas subject to grazing control will be maintained.	Throughout lifetime of the HMP. Monitor during Years 1, 2, 3, 5, 7 & 10 of the operation phase	Operator

HMP Action Ref. No.	Management Measure	Target	Method	Measurement	Timing	Entity Responsible
4.	Block Drainage Ditches	Improve water balance in areas adjacent to Drainage Ditches	Drainage blocking will follow the techniques outlined in Section 5.4.2 above.	The success of drainage blocking will be monitored using permanent fixed quadrats and dipwells/piezometers to measure water table depth. A photographic log of all quadrats and areas subject to drainage blocking and re-wetting will be maintained.	Install blocking during construction phase Monitor during Years 1, 2, 3, 5, 7 & 10 of the operation phase	Construction Contractor /Operator
5.	Sensitive removal of peatland vegetation from areas of the construction footprint as turves	Sensitively remove peatland vegetation as turves under the footprint construction site, maintain turves in good condition so that they can be reinstated in temporary construction areas.	Remove peat as turves excavated to a depth of at least 50 cm, thus allowing for full protection of the roots. This layer will be stored as turves and kept viable by irrigation if necessary because peat is prone to shrinkage and drying.	Construction Contractor's ECoW monitoring of peatland turving and condition during the construction phase.	Construction phase – vegetation clearance.	Construction Contractor
6.	Re-instate turves in Re-instatement Areas	Re-instate turves and restore peatland vegetation in the re-instatement areas.	Re-instate turves following the management techniques outlined in Section 5.3.4	The success of turve re-instatement and peatland restoration will be monitored using permanent fixed quadrats and dipwells/piezometers. A photographic log of all quadrats and areas subject to turve reinstatement will be maintained.	Re-instate turves during the Construction stage. Monitor during Years 1, 2, 3, 5, 7 & 10 of the operation phase.	Construction Contractor

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HMP Action Ref. No.	Management Measure	Target	Method	Measurement	Timing	Entity Responsible
7.	Restore Active Blanket bog at Peat Storage & Restoration (Habitat Enhancement) Area	Restore active blanket bog conditions within the Peat Storage and Restoration (Habitat Enhancement) Area	Restore condition in line with the methods set out under Section 5.4.7 and 5.4.8 above.	The success of turve re-instatement and peatland restoration will be monitored using permanent fixed quadrats and dipwells/piezometers. A photographic log of all quadrats and areas subject to turve reinstatement will be maintained.	Complete restoration works during the Construction stage. Monitor during Years 1, 2, 3, 5, 7 & 10 of the operation phase.	Construction Contractor
8.	Control competitive non-indicator peatland species	Non-indicator peat species should be kept to a minimum of <10% of the vegetation in the HMP area priority habitats	Removal of Competitive Species. Remove spreading conifer trees.	Quadrat monitoring and photographic log will be undertaken to measure the extent of non-indicator species.	Control on an annual basis. Monitor during Years 1, 2, 3, 5, 7 & 10 of the operation phase.	The Construction Contractor /Operator
9.	Restrict turbary	No commercial turbary extraction throughout the lifetime of the HMP	Restrict turbary activity as outlined under Section 5.4.5	Monitoring of site for any signs of turbary activity. Liaise with landowner to ensure no commercial turbary activity is undertaken throughout the lifetime of the plan.	Throughout the lifetime of the HMP	Operator

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HMP Action Ref. No.	Management Measure	Target	Method	Measurement	Timing	Entity Responsible
10.	Prevent certain land use practices	Prevent certain land use practices to ensure favourable conservation status of peatland habitats.	Prevent the following activities throughout the lifetime of the HMP: <ul style="list-style-type: none"> The reclamation, fertilisation or drainage of the HMP area will be restricted. The application of slurry, lime, herbicides, pesticides, insecticides, fungicides will be restricted. Scrub will be prevented from establishing on peatland and heathland habitats through ongoing removal. 	Quadrat monitoring Photographic log	Implement throughout lifetime, and monitor/report 1, 3, 5, & 10.	Operator

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HMP Action Ref. No.	Management Measure	Target	Method	Measurement	Timing	Entity Responsible
11.	Identification of Areas within the Peatland Management Area Requiring Remedial Active Re-Seeding/Brashing	Actively re-seed areas of the Peatland Management Area where surface turves have failed to knit together or where peatland vegetation has failed to establish.	Collect seeds/brash from priority peatland habitats during the autumn of the year when any areas of the Peatland Management Area are identified as failing and seed/brash identified areas during the next spring season.	The success of seeding/brashing (if required) will be monitored using permanent fixed quadrats and dipwells within remedial areas as described above. It is noted that as areas that may require seeding/brashing are as yet unknown, additional quadrats, will be required to monitor areas subject to this HMP Action. A photographic log of all quadrats and areas subject to seed/brash remediation will be maintained.	Identification of areas requiring seeding during the ongoing monitoring. Areas requiring seeding/brashing as a remedial measure will be monitored during the summer months following the application of seed/brash. Further monitoring will be undertaken in the subsequent year.	Operator

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7 Ecological Clerk of Works

7.1 Background

An appropriately qualified Environmental/Ecological Clerk of Works (ECoW) will be employed for the duration of the Civil Works Contract. This person will be known as the Tullaghmore Wind Farm ECoW. The ECoW must be a member of the Chartered Institute of Ecology and Environmental Management (CIEEM) or equivalent body. The ecologist performing the ECoW role will attend the site on a weekly basis to ensure that all works are being completed to the appropriate standards.

As the delivery of this HMP is highly dependent on the roles and responsibilities of the ECoW, some detail is provided here regarding this position.

7.2 Term of Appointment

The ECoW will be on site for minimum 1 day per week during the construction works; provision will be made for an initial briefing to all contractors, and a final visit to report on the ecological aspects of construction. Some office time is also required for weekly reporting.

7.3 ECoW Tasks

Overview

The provision of an ECoW helps to ensure that ecological protection aspects of the Environmental Statement, HMP, Construction Environmental Management Plan (CEMP) and Construction Method Statements (CMS) are fully adhered to during construction. It also allows any issues arising to be dealt with in an appropriate manner.

Taking account of the requirements set out in this HMP, the following are deemed to be required services of the ECoW:

- a) Construction surveys.
- b) Monthly measurement of water levels in dipwells.
- c) Selection of sites for blanket bog re-wetting, supervision of dam installation, monitoring of works.
- d) Monitoring SuDS stilling pond construction to ensure appropriate wildlife habitats are incorporated into their design (including briefing of digger drivers).
- e) Maintaining records of checks and issues.

- f) Providing a report detailing the implementation of the HMP Management Actions during the construction phase.
- g) Survey the site for sensitive and protected species prior to construction (due diligence survey).

Pollution Prevention Plan

- a) Review, agreement and approval of Contractor's pollution prevention plan prior to commencement of work.
- b) Conduct weekly inspection of site pollution prevention measures (silt traps, etc.) and visually assess their effectiveness. This will include inspection of water management measures installed by Contractor such as excavation pumping and diversion channels, as well as containment of silt away from watercourses and advice on micro-siting of mitigation measures.
- c) Maintain a Pollution Prevention Measures Register of the weekly inspections, to include an inventory of all measures on the site, their effectiveness, as well as any advice provided.
- d) Collation of water sampling results (collected and analysed by third parties) for presentation in weekly reports.
- e) Suspension of work where potential risk from pollution is identified and agreed safeguarding measures, as specified in the CEMP or method statements are not in place, or where construction methods and mitigation measures are not specified in construction method statements and/or plans as agreed at commencement of works.
- f) Provide advice and recommendation to the wind farm owner and its contractors regarding the above.

Waste Management

- a) Review, agreement and approval of the Contractor's Site Waste Management Plan
- b) Review of the Contractor's records for all inspections of fuel, oil or chemical storage areas, including the integrity of storage facilities.

Drainage Management

- a) Review, agreement and approval of the Contractor's Site Drainage Management Plan
- b) Inspection of drainage management works.
- c) Liaison with Planning / NPWS inspecting the works.
- d) Agreement of monitoring standards to be applied by Contractor's personnel.

- e) Confirmatory survey in advance of habitats and species for ground to be affected by drainage management.
- f) Review of Contractor's records for plant inspections, evidence of contamination and checks made after extreme weather conditions.
- g) Liaison, field discussion and agreement of drainage management works with Planning Authority, IFI, NPWS when required by consultees and when considered necessary by ECoW.
- h) Agreement of frequency and location of drainage ducts installed beneath floated roads.
- i) Agreement of drainage management associated with temporary peat storage and reinstatement works in advance of such works commencing.

Watercourse Crossings

- a) Review, agreement and approval of the Contractor's Site Watercourse Crossing Plan.
- b) Confirmatory survey in advance of watercourse condition and protected mammals for all ditch and stream crossings, using established specialist if necessary.
- c) Review the Contractor's records for plant inspections, evidence of contamination and checks made after extreme weather conditions.

Water Quality Monitoring

- a) Review, agreement and approval of the Contractor's and independent Site Water Quality Monitoring Plans where undertaken.
- b) Inspection of Contractor's records for water environmental monitoring and comparison of those records with independent records.
- c) Presentation of independent water environmental monitoring results at weekly site meetings.

Excavated Materials and Reinstatement

- a) Review, agreement and approval of the Contractor's Spoil Management and Reinstatement Plan.
- b) Marking working areas and route corridors, in consultation with the Geo-technical/Civil Designer and/or Archaeologist as necessary.
- c) Granting permission to work off hard ground using low ground pressure machines, including specification points for entry and return, and the route to be taken.
- d) Agreeing proposals for side casting and temporary storage areas as development proceeds.
- e) Agreeing timing of restoration and reinstatement of access track sides.
- f) Monitoring the condition of stored turf.

- g) Agreeing any required hydroseeding specification, including seed mix and fertiliser quantities.
- h) Issuing instruction to cease work if unexpected risks arise, until an agreed alternative solution is identified and risks are avoided or minimised.

7.4 Recording

The ECoW will keep a record of the following:

- a) notable animal sightings and signs (including birds, in addition to other site ornithological monitoring);
- b) The Pollution Prevention Measures Register (as detailed above);
- c) The habitats and soil (including peat depth) of ground to be developed via survey at least a week in advance of construction work;
- d) record of tasks carried out;
- e) written record of all oral advice given

The ECoW will maintain a GIS database of key recordings made during the construction period. ECoW weekly site visit notes will be made available for all personnel on site to consult and will incorporate the following:

- Monitoring of requirements listed under HMP
- Monitoring of requirements listed under the CMS
- Pollution Prevention Measures Register

7.5 On-Site Communication

The success of ECoW appointment is largely dependent on well-defined lines of communication. In theory, robust construction method statements will incorporate many of the areas of ECoW concern into the daily activities of construction personnel. However, the ECoW will always inform the Civil Contractor and their Designer of areas of particular concern, who will then make a decision as to the subsequent action.

The ECoW will be involved in the delivery of biodiversity-related Toolbox Talks as part of the site induction process. Toolbox talks will be given to the work force at regular intervals to highlight the environmental issues that are unique to the wind farm located at Tullaghmore. The ECoW will inform the staff of the following:

All staff working onsite and personnel visiting the site are briefed on the importance of the protection of key biodiversity receptors occurring onsite.

All staff will be informed of obligations to restrict construction operations to the construction footprint.

Restrictions on plant machinery traversing into sensitive habitats outside of the construction footprint.

The responsibility of all construction staff to ensure that sensitive peatland habitats occurring outside the construction footprint are not tampered with, removed, damaged or breached by any field operators or others visiting the site.

7.6 Incident Response

If an ecological incident occurs on site, the following protocol should be implemented:

- The ECoW shall be contacted immediately;
- Ensure appropriate corrective measures are put in place;
- Implement actions to prevent reoccurrence/further incidents; and
- Identify responsibilities and timescales for implementation.

7.7 Liaison with Consultees

The ECoW will provide a liaison between NPWS and IFI if this is required.

7.8 Final Report

The ECoW will produce a final report documenting the environmental and ecological effects of the construction period. The evidence for effects will be based on findings included in the minutes of weekly meetings, together with other recording information maintained by the ECoW. The report will be made available to the Owner, Contractor, the relevant Planning Authority, NPWS and other external agencies where appropriate (e.g., IFI).