APPENDIX 6-5

BIODIVERSITY MANAGEMENT AND ENHACEMENT PLAN

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1. INTRODUCTION

1.1 Background

MKO have prepared a Biodiversity Management and Enhancement Plan (BMEP) to accompany the Environmental Impact Assessment Report (EIAR) for the Proposed Lemanaghan Wind Farm in Co. Offaly (the Proposed Project), which includes 15 no. turbines and all associated infrastructure and works. The full description of the Proposed Project is detailed in Chapter 4 of the EIAR.

The Proposed Project is located in Co. Offaly, approximately 3 kilometres (km) northeast of Ferbane, and approximately 2.5 km southwest of the village of Ballycumber. It is located in a peatland setting, comprising a mixture of bare cutaway peat, re-vegetated bare peat, degraded raised bog, scrub, immature woodland and remnants of high bog. The current primary land use within the Proposed Project site comprises natural recolonisation of cutaway and degraded bog and small areas of active turbary.

This BMEP has been prepared to set out the project-specific measures to be implemented within the Proposed Project site to deliver biodiversity enhancement through habitat creation and enhancement, and to provide ornithological enhancement and mitigation measures to address potential significant effects identified in the EIAR for key ornithological receptors. The BMEP describes the existing ecological baseline, sets out the objectives of the proposed measures, and details the methods for their implementation, monitoring and review.

1.1.1 Habitat Enhancement

The Proposed Project is located within a predominantly cutaway peatland landscape characterised by bare and re-vegetating cutover bog, remnant areas of degraded raised bog, and scrub and early successional vegetation. The current site conditions reflect the legacy of historical peat extraction and extensive drainage.

The BMEP includes habitat enhancement measures intended to improve habitat diversity and ecological function within the Proposed Project site through targeted habitat creation and enhancement within a modified peatland environment.

The habitat enhancement measures have been informed by the ecological baseline described in Chapter 6 of the EIAR and focus on areas where enhancement potential has been identified. These include the enhancement of existing grassland and grassy verge habitats with potential to support marsh fritillary, the creation of new linear habitat features to improve ecological connectivity across the site, and native woodland enhancement within suitable recolonising peatland areas.

Details of the proposed habitat enhancement measures are provided in Section 3.1 of this BMEP.

1.1.2 Ornithological Enhancement and Mitigation

As outlined in Section 7.3 of the EIAR, a diverse assemblage of birds was recorded during surveys of the site and its wider surroundings. Among these were breeding lapwing and winter roosting whooper swan within the site. As outlined in Section 7.5.2 of the EIAR, without intervention, there is the potential for significant effects on these two species if the development is built. Ornithological enhancement and mitigation measures are therefore included within this BMEP to address the potential significant effects identified in the EIAR.

Whooper Swan

Whooper swan are a migratory species and winter visitors to Ireland. They are amber listed in Ireland (BoCCI[1]) and are on Annex I of the EU Birds Directive. The species forages in both terrestrial and wetland habitats but roosts on water bodies. As outlined in Section 7.5.2, there is the potential for a short-term moderate negative effect (EPA, 2022) on whooper swan due to habitat loss and disturbance effects during the construction phase, and long-term moderate negative effect (EPA, 2022) due to displacement during the operational phase, in relation to the identified regularly used roost sites within the Proposed Project site. Measures have been designed to mitigate these potential impacts and are outlined in Section 3.2 below.

Breeding Lapwing

Breeding lapwing are a red-listed species in Ireland (BoCCI) and of high conservation concern. Lapwing is a communal breeding species that favours open habitats in both inland and coastal areas. As outlined in Section 7.5.2 of Chapter 7, there is the potential for a short-term moderate negative effect (EPA, 2022) on breeding lapwing due to habitat loss and disturbance effects during the construction phase, and long-term moderate negative effect (EPA, 2022) due to displacement during the operational phase, in relation to the identified breeding locations within the Proposed Project site. Measures have been designed to mitigate these potential impacts and are outlined in Section 3.2 below.

To offset the significant effects outlined above, the BMEP is proposed. The BMEP outlines the current baseline, sets management objectives, provides a methodology to deliver the objectives and a means of monitoring the delivery of the objectives.

1.2 Existing Draft Rehabilitation and Management Plan

The Proposed Project site is located on lands that are subject to ongoing and future peatland rehabilitation and decommissioning works required under the existing Integrated Pollution Control (IPC) Licence (P0500-01).

These rehabilitation works are mandatory and will proceed irrespective of whether the Proposed Project is permitted/developed, in order to ensure compliance with the IPC Licence. The objectives, scope and implementation of the rehabilitation measures are defined separately within the Draft Cutaway Bog Decommissioning and Rehabilitation Plan (Appendix 2-4 to Chapter 2) and are regulated by the Environmental Protection Agency (EPA).

This BMEP is a standalone, project-specific plan prepared to address biodiversity enhancement and mitigation associated with the Proposed Project. It is distinct from the peatland rehabilitation measures being implemented under the IPC Licence and does not rely on the implementation of those measures to achieve its objectives.

The BMEP has been developed with full cognisance of the fact that rehabilitation and hydrological restoration works will be ongoing within the Proposed Project site. The proposed enhancement measures have been designed to be compatible with anticipated changes in site conditions, including rewetting and habitat succession, and will be implemented in a coordinated manner alongside rehabilitation activities.

Where appropriate, the potential for cumulative biodiversity effects arising from the interaction of the Proposed Project with ongoing peatland rehabilitation works is assessed in Chapter 6 and Chapter 7 of the EIAR.

[1] https://birdwatchireland.ie/app/uploads/2021/04/Irish-Birds-2021-BOCCI-for-web.pdf

1.3 Objectives of the Biodiversity Management and Enhancement Plan

This section sets out the objectives of the BMEP in relation to habitat enhancement measures and ornithological enhancement and mitigation measures proposed as part of the Proposed Project. The overarching objective of the BMEP is to set out the proposed measures and associated implementation methods to be applied within the Proposed Project site to deliver biodiversity enhancement and to address potential significant effects identified in the EIAR, together with monitoring and adaptive management to ensure their effective delivery and long-term success.

The objectives of this BMEP in relation to habitat enhancement are:

- To enhance habitat diversity within a modified peatland landscape through the creation and management of additional habitats.
- To provide approximately 6.7 ha of grassland habitat with the potential to support marsh fritillary, through habitat creation and appropriate long-term management.
- To provide native woodland enhancement of approximately 7.8 ha through planting of native species suited to peatland conditions.
- To enhance ecological connectivity within the Proposed Project site through the provision of approximately 6.5 km of native hedgerow planting.
- To set out a management, monitoring and adaptive management framework to ensure the effective implementation and long-term success of the enhancement measures.

The objectives of this BMEP in relation to ornithological enhancement and mitigation are:

- To create replacement whooper swan roosting and lapwing breeding habitat in separate but abutting parcels of land. Each parcel of land will include an area of 10ha, i.e. 20ha total between the two parcels.
- To create a shallow water body of approximately 10ha and 1.5m depth to accommodate winter roosting whooper swan between October and March.
- To create 10ha of good quality breeding lapwing habitat that is defined as having a stable water table, an open aspect throughout, a short sward and reduced predation.
- To ensure these measures are in place before wind farm infrastructure construction works begin.

1.4 Statement of Authority

This BMEP was prepared by Sorcha Shanley (BA, MSc) and Padraig Cregg (MSc) and has been reviewed by Rachel Walsh (B.Sc. Env, MCIEEM). Sorcha is a Project Ecologist with MKO with over 4 years of experience. Padraig is a Principal Ornithologist with MKO and has over 12 years of experience working in environmental consultancies. Rachel is a Senior Ecologist with MKO and has over 5 years' ecological consultancy experience, having worked on Appropriate Assessments and Ecological Impact Assessments for a range of project types, including renewable energy infrastructure, water services infrastructure and transport infrastructure.

2. ECOLOGICAL BASELINE

A programme of desk-based assessment and ecological field surveys, including multidisciplinary walkover surveys, marsh fritillary surveys, badger surveys, bat surveys, bird surveys and invasive species surveys were undertaken by MKO between 2020 and 2025 as detailed within Chapter 6 and Chapter 7 of the EIAR. A high-level overview of habitats and fauna within the Proposed Project site is provided below.

2.1 Habitats and Flora

A detailed account of the habitats, including a habitat map, and associated species recorded within the Proposed Project site is included in Chapter 6 of the EIAR. The following habitats are present within the Proposed Project site:

- Raised Bog (PB1)
- Cutover bog (PB4)
- Cutover bog with secondary heath communities (PB4)
- Bog woodland (WN7)
- Wet grassland (GS4)
- Improved agricultural grassland (GA1)
- Dry meadows and grassy verges (GS2)
- Immature woodland (WS2)
- Hedgerows (WL1)
- Treelines (WL2)
- Scrub (WS1)
- Buildings and artificial surfaces (BL3)
- Other artificial lakes and ponds (FL8)
- Poor fen and flush (PF2)
- Conifer plantation (WD4)
- Depositing/lowland rivers (FW2)

2.2 Fauna

A detailed account of the fauna species (excluding birds) is recorded within the Proposed Project site is included in Chapter 6 of the EIAR. The Proposed Project site is suitable for a range of protected species including mammals, bats, birds, and invertebrates.

A badger sett was recorded within the Proposed Project site, with evidence of activity along the southern boundary leading to agricultural fields beyond the site. Other signs of terrestrial mammals recorded within the Proposed Project site included fox, Irish hare and Irish stoat.

Bat surveys recorded at least six species present within the Proposed Project site, with linear features such as hedgerows, treelines, woodland edges and watercourse corridors providing suitable foraging and commuting habitat.

Targeted marsh fritillary larval web surveys did not record any active larval webs; however, inactive larval webs were recorded in one patch of suitable habitat in 2023. Scattered areas of suitable habitat were identified within the Proposed Project site, primarily associated with grassy verges along access tracks.

While no direct evidence of otter was recorded within the Proposed Project site during surveys, the species is likely to utilise watercourses within and downstream of the site as part of a wider foraging range.

A detailed account of the bird species recorded within the Proposed Project site is included in Chapter 7 of the EIAR. A suite of ornithological surveys undertaken between October 2020 and March 2025 recorded a diverse range of bird species using the Proposed Project site. The site supports regular winter roosting of whooper swan and breeding lapwing.

3. PROPOSED MEASURES

3.1 Habitat Enhancement

3.1.1 Marsh Fritillary Habitat Enhancement

Surveys undertaken within the Proposed Project site identified small, scattered areas of suitable habitat, associated with dry meadows and grassy verges (GS2). No active larval webs were recorded during targeted marsh fritillary surveys undertaken in 2021, 2023 and 2024. However, inactive larval webs were recorded within one patch of suitable habitat during the 2023 surveys, indicating previous use of the site by the species.

Marsh fritillary is known to occur in the wider landscape, with National Biodiversity Data Centre (NBDC) records within the relevant grid square and confirmed populations recorded in bogs within the Boora Bog Group. Marsh fritillary is a species that occurs as a metapopulation, with local presence fluctuating over time depending on habitat availability and condition.

The presence of suitable habitat within the site, together with its location within a wider landscape supporting the species, indicates that the site has the potential to contribute to habitat availability for marsh fritillary through targeted enhancement.

The proposed enhancement measures are therefore intended to increase the extent, quality and connectivity of suitable grassland habitat within the Proposed Project site, with a focus on promoting a structurally diverse sward and increasing the availability of the larval foodplant, devil's-bit scabious (*Succisa pratensis*), to support future use of the site by marsh fritillary.

It is proposed to enhance approximately 6.7 ha of grassland (GS2) habitat to improve its suitability for marsh fritillary by increasing habitat heterogeneity and the abundance and accessibility of devil's-bit scabious. These measures are designed to function as a potential network of habitats within the wider landscape, which is recognised as important for the long-term viability of marsh fritillary metapopulations.

Enhancement will focus on three existing areas of grassland habitat within the Proposed Project site that already exhibit characteristics suitable for marsh fritillary, as shown in Figure 3-1.

3.1.1.1 Implementation and Management

Devil's bit scabious is a slow-growing perennial and may take several years to reach maturity and flower. If growing from seed, it can take 5-6 years to germinate. Therefore, plug planting with plants from a certified native source is the preferred planting method[2]. However, seeding of devil's bit scabious may be employed if the availability of plug planting is limited.

The marsh fritillary enhancement measures will be implemented as follows:

- Enhancement areas will be clearly marked to prevent inadvertent encroachment by construction activities and to ensure management actions are confined to the defined areas.
- Planting will be undertaken to increase the abundance and distribution of devil's-bit scabious within the enhancement areas using an appropriate native source.

[2] https://www.plantlife.org.uk/learning-resource/managing-meadows/

- Management will aim to maintain a heterogeneous sward structure, comprising a mosaic of shorter and taller vegetation, rather than a uniform sward. It will also maintain the abundance of devil's-bit scabious within the enhancement areas by preventing competitive exclusion by rank grasses or scrub.
- Where vegetation becomes overly rank or scrub encroachment occurs, targeted and localised management (e.g. selective cutting or clearance) will be undertaken to retain open conditions.
- No fertilisers, slurry, herbicides or pesticides will be applied within the marsh fritillary enhancement areas.
- Field operations such as rush or scrub control should only be carried out November to February when caterpillars are in hibernation and less vulnerable to disturbance.

3.1.2 Native Hedgerow Planting

It is proposed to plant approximately 6.5 km of native hedgerow within the Proposed Project site. The locations of proposed hedgerow planting are shown on Figure 3-1 and have been selected to enhance ecological connectivity across the site by linking existing features such as woodland edges and watercourse corridors and to support commuting routes for bats and other species. All proposed hedgerow planting is located within areas of cutover peat (PB4).

The ideal native hedge is made up of approximately 75% hawthorn (*Crataegus monogyna*) and 25% of at least four other species[3]. When planting new hedgerows, plants will be closely spaced (a maximum of 50cm apart) and planted in a staggered row. The species to be used were identified as being locally present during the detailed habitat surveys or identified as being suitable native species found within the wider local area.

Species composition will comprise approximately 75% hawthorn, comprising a mix of planting stock including whips and selected advanced nursery stock (typically 10–12 cm girth), to increase early structural diversity. The remaining 25% will be made up of a mix of locally appropriate native species, including:

- Hazel (*Corylus avellana)*
- Blackthorn (*Prunus spinosa*)
- Rowan (*Sorbus aucuparia*)
- Elder (*Sambucus nigra*)
- Goat willow (*Salix caprea*)
- Grey willow (*Salix cinerea*)

3.1.2.1 Implementation and Management

The native hedgerow planting and management will be implemented as follows:

- All tree planting will be undertaken by hand by suitably qualified arborist
- Hedgerows will be pit-planted into areas of cleared vegetation, with soil carefully firmed around the root system to ensure stability and successful establishment. This involves using a spade to dig a hole with roots placed in the centre. Soil is then placed around the hedgerow and firmed in, ensuring the tree is upright.
- Riparian hedgerow planting along the Lemanaghan Stream will be carried out by hand only, with care taken to minimise soil disturbance and avoid sediment runoff. Strictly no fertilisers will be used within riparian planting areas.
- Hedgerows will be managed on a 2–3 year cutting rotation, where trimming is required, to promote structural diversity.

[3] *Pollinator-friendly management of Wind Farms. All-Ireland Pollinator Plan, Guidelines 12. National Biodiversity Data Centre*

- Cutting will be undertaken between November and January, avoiding the bird nesting season (March 1st to August 31st) and periods of peak pollinator activity.
- Hedgerows will be developed to an average height of approximately 2.5 m, with an 'A-shape'.
- Ivy (*Hedera helix*) will be retained where it establishes naturally, provided it does not compromise hedge structure.
- Grassy margins adjacent to hedgerows will be retained to allow flowering ground flora to develop and to further enhance habitat value.
- No fertilisers, slurry, herbicides or pesticides will be applied.

3.1.3 Native Woodland Planting

It is proposed to provide approximately 7.8 ha of native woodland enhancement within the Proposed Project site, as shown on Figure 3-1. The proposed woodland area is located within recolonising peatland habitat where natural succession is already occurring, and the enhancement measures are intended to diversify structure and species composition through targeted planting.

For the establishment of woodland on highly modified peat and peaty podzols, the Native Woodland Scheme recommends the establishment of pioneer birch woodland (Scenario 5, highly modified peats and peaty podzols) (Cross, J.R. & Collins, K.D. 2017). Scenario 5 stipulates planting Downy birch (*Betula pubescens*) (45%) and rowan (10%) in pure groups. Scots pine (*Pinus sylvestris*) (20%) and pedunculate oak (*Quercus robur*) (15%) also in pure groups, on free-draining areas. Minor species (10%) to comprise at least two of the following, positioned between the above groups and at edges: holly (*Ilex aquifolium*), hawthorn and hazel. Where wetter conditions occur within the replanting areas, these should be planted with: Downy birch (50%) and grey willow (30%), planted in pure groups. Minor species (20%) should comprise of at least two of the following, positioned between the above groups and at edges: rowan, hazel and alder (*Alnus glutinosa*), and pedunculate oak.

Local variation in ground levels and hydrological conditions within the proposed planting area will be taken into account during implementation. LiDAR topographic data and onsite observations will be used to inform species selection and planting layout, to ensure that planting is appropriate to local conditions. Where lower lying or wetter areas are identified, planting will be adapted accordingly, either through the use of appropriate wet woodland species or by allowing areas to remain as more open or transitional habitats. This approach will ensure that woodland enhancement is aligned with site conditions and allows for the gradual establishment of a structurally diverse woodland/wetland mosaic alongside ongoing peatland rehabilitation.

3.1.3.1 Implementation and Management

The native woodland planting measures will be implemented as follows:

- Planting areas will be clearly marked prior to works to define the extent of planting.
- Thin stakes or sticks will be used to mark the rows or areas of trees to be planted.
- Trees will generally be planted at approximately 2 m spacing. Shelterbelt planting may be applied by planting up two lines of trees as a staggered row.
- Newly planted trees will be protected as required using appropriate tree guards to prevent browsing by wild animals such as deer.
- New tree planting will be kept weed and litter free until the new plants are established, particularly from ruderal weeds. Healthy growth will be maintained by allowing the plant to occupy as much of the planting areas as possible to allow them to achieve as close their natural form as possible.
- During spring and autumn maintenance periods all trees and plants will be checked and adjusted/replaced as required, soil firmed, and any dead wood present removed back to healthy tissue and mulch added if required. Where tree guards are no longer required these will be removed to avoid damage to the tree.

- During the first growing season, all standard trees/ semi-mature trees will be watered regularly during any prolonged dry periods during the growing season (i.e. in April, May, June, July and August). During the second growing season the trees will be kept well-watered as often as required, particularly during June, July and August.
- Trees will be inspected following the main growing season (i.e. in September) for the first five years of growth, where the requirement for replacement planting will be assessed. If any trees are dead or damaged these will be replaced using the same species within the next planting season. Recommendations for ongoing or remedial management required will be specified within a Monitoring Report (see Section 3.3).

3.2 Ornithological Enhancement and Mitigation Measures

3.2.1 Current Baseline Condition

The current baseline condition of the proposed ornithological enhancement lands, at the time of writing this report, is bare peat previously subject to peat extraction. The approximately 20ha of regular bare peat fields includes bisecting gravity drains. There is little to no scrub encroachment, which is a key facilitating factor that recommends the area for the enhancement measures proposed. This proposed enhancement area is currently of little to no ecological value to either whooper swan or lapwing. This provides an opportunity to create a new resource that would not otherwise have been present.

3.2.2 Methods to Achieve Management Objectives

The proposed ornithological enhancement and mitigation measures will require, among other things, large-scale landscaping, drain blocking, and the creation of embankments. Such works will borrow from established peatland rehabilitation techniques. Bord na Móna (BnM) have considerable in-house expertise in peatland rehabilitation, e.g. cell bunding for the purposes of re-wetting and controlling water levels on their bogs. As a key stakeholder on this project, their practical expertise will be relied upon to implement the proposed enhancement measures. BnM have produced a Methodology Paper for the Enhancement Decommissioning, Rehabilitation and Restoration on BnM Peatlands that has informed this BMEP[4] which outlines the proposed ornithological enhancement and mitigation measures.

Please see EIAR Section 7.5.2 for further detail. An overview of these measures is given below.

3.2.2.1 Whooper Swan

An enhancement area is proposed for whooper swan to replace the loss of roosting habitat to the Proposed Project. As detailed in Section 7.3.7.2 of Chapter 7, roosting was recorded across a total of five areas within the Proposed Project site across the five winter seasons surveyed, with a maximum of four areas being used in any one season.

The c. 10ha area is proposed in the northwest of the Proposed Project site, (please see Figure 3-1 for location details) in an area of bare cutover peat. The measures proposed includes the controlled flooding of an area of approximately 10ha to a depth of approximately 1.5m. This will be achieved by creating an encircling embankment to contain the water. The controlled flooding will be such that water will be present during the winter months when whooper swan are present (October to March). Visual screening from the internal road and car park will be created via planting of native scrub of *c.*3m width.

[4] https://www.bnmpcas.ie/wp-content/uploads/sites/18/2022/11/Methodology%20Report%20v19%20For%20issue.pdf

As previously outlined, the objective is to create a shallow water body of approximately 10ha and 1.5m depth to accommodate winter roosting whooper swan. This will be achieved as follows:

- Wetland creation: the proposed approximately 10ha shallow water body (wetland) will be created with encircling embankments. The internal embankment height will be approximately 2m to ensure the target depth of 1.5m of water can be accommodated. The top width of the embankment should be a minimum of 5m with a slope of 3:1.
    - The embankment is formed using a bulldozer to push the peat into place, which is then shaped by an excavator. As the peat is shaped by the excavator, it should be compacted to make the peat less permeable.
- Water levels will be managed with drop board sluices. Such sluices allow water to be retained in winter to achieve a 1.5m depth for roosting whooper swans. In the summer, the water level will be dropped to encourage revegetation. The water level will be controlled by an appropriate sluice. The following specifications have been provided for example purposes.
    - The sluice unit should consist of a metal sluice frame, with softwood drop boards, twin wall (e.g. 600mm) plastic pipe to create a sealed edge on the boards and a large outflow pipe to allow the water from inside the embankment to flow through the embankment wall without damaging it.
    - A gap is created in the embankment wall with an excavator. The drop board sluice is installed in the outer wall of the embankment, and an outflow pipe is put in position such that it bridges the gap between the sluice and the (future) water body inside the embankment. The sluice structure and pipe are lowered into position with the excavator. The level of the structure will ensure that the required depth of water can be maintained. A laser level should be used to ensure accuracy. Once the sluice and pipe structure is in place, the peat can be backfilled to reinstate the embankment wall. Drop boards can then be added to the sluice frame to the required height. The rubber seals are used to edge the boards to maintain a waterproof seal.
- The top of the embankment, above the target water level of 1.5m, will include overflow pipes to avoid high water levels eroding channels through the top of the embankment.
- To the west of the proposed winter roosting wetland is a proposed car park, Site Entrance 1 and an access road that runs south from the entrance to the wind farm. The proposed car park and road will be screened with a 3m wide native treeline (e.g. birch and willow spp). The planting will abut the road and be planted at a density of 3-5 plants per meter (depending on the age/size of the plants when planted). Slow-release fertiliser will be applied to the area to accelerate the establishment of the screen. The screen will run from the northernmost extent of the car park to the southernmost reaches of the enhancement area, plus 500m.
- Herbicides and pesticides are not permitted within the enhancement area.
- In the event of any invasive species being recorded within the area identified for enhancement measures, an invasive species management plan will be put in place to eradicate any stands of such species. A pre-commencement survey for invasive species will be undertaken as part of preparatory work and if any such species are recorded an invasive species management plan shall be prepared.
- Maintenance is expected to be low. Occasionally, drop boards from the sluice gate may need to be replaced if they are damaged.

3.2.2.2 Breeding Lapwing

An enhancement area is proposed for lapwing to replace the breeding habitat lost to the Proposed Project. As detailed in Section 7.3.7.13 of Chapter 7, lapwing breeding activity was identified within the Proposed Project site, with an estimated two pairs breeding present in the most recent breeding seasons surveyed (i.e. 2023 & 2024).

Lapwing require open habitat in which to breed, and birds avoid fields of less than 5ha (Cramp & Simmons, 1983). While the minimum area of breeding habitat required by one pair of lapwing is 5ha, lapwing regularly breed in loose colonies. Group nesting lapwing nests are typically separated by 10-150m. Therefore, a 5ha plot could host more than a single pair. To calculate the quantum of habitat required by the two potentially impacted breeding pairs from 2023, the area occupied by an average territory was multiplied by two. Therefore, the estimated quantum of habitat required by two breeding pairs of lapwing is 10ha.

The 10ha area is proposed in the northwest of the Proposed Project site adjacent to Site Entrance 1 (see Table 4-9 in Chapter 4), in an area of bare cutover peat (please see Figure 3-1 for location details). This proposed 10ha area will be managed by annual mowing to keep the land open for breeding waders and free of avian predator posts (e.g. through birch scrub encroachment). The annual mowing cycle will be implemented as lapwing prefer a short open sward. This will ensure a suitably diverse sward is maintained as well as avoiding significant disturbance to invertebrate lifecycles. Mowing will also reduce the dominance of rushes, prevent the creation of dense rush swards and allow the establishment of other rhizomatous grasses and sedges, which is more suited to breeding lapwing. Drains would be re-profiled and in-filled to allow unfledged chicks to move between dry and damp areas within the enhancement area. Wader scrapes will be excavated to provide foraging areas for breeding waders and their chicks. Visual screening from the internal road and car park will be provided via planting of native scrub (as previously outlined for whooper swan), although sufficiently removed so as not to provide effective predator perches. Predator-proof fencing will be installed around the perimeter of the 10ha enhancement area (see Plate 3-1 and Plate 3-2 below). The NPWS, as part of recent conservation measures within the Termoncarragh Lake and Annagh Marsh SPA, have provided detailed specifications for permanent predator exclusion fencing for this specific purpose[5]. The proposed permanent predator exclusion fencing within the proposed enhancement and mitigation lands has therefore been designed based on these specifications.

Lapwing show high levels of natal philopatry (i.e. returning to breed in the site where a bird fledged). The enhancement area is considered sufficiently close to act as replacement breeding habitat for any lapwing potentially impacted by the Proposed Wind Farm. The furthest potentially impacted lapwing territories are situated approximately 2.5km from the proposed enhancement and mitigation area. The majority of lapwing (61%) from a British ringing study returned to breed within 10km from where they were ringed as chicks (Thomson *et al.*, 2008).

The existing breeding habitat within 108m of the Proposed Project footprint is fragmented among three areas of 5ha or less. Breeding activity was only recorded during a single breeding season at each of these three areas. The successful implementation of the proposed ornithological enhancement measures will produce more favourable breeding habitat for local lapwing than is currently available within 108m of the Proposed Project footprint.

Furthermore, as outlined above, the approximate 10ha area for whooper swan will be managed through controlled flooding such that water will be present during the winter months and not during the breeding season. This adjacent area will likely provide additional suitable breeding and foraging habitat for lapwing not accounted for above. Adaptive management will be applied to the design of the enhancement areas as part of implementation.

The objective is to create good quality breeding lapwing habitat that is defined as having a stable water table, an open aspect throughout, a short sward and reduced predation. This will be achieved as follows:

[5] *NPWS (2023). Screening for Appropriate Assessment. Adoption of necessary conservation measures within Termoncarragh Lake and Annagh Marsh Special Protection Area in accordance with Regulation 42A EC (Birds and Natural) Habitats Regulations 2011-2021. Available at https://assets.gov.ie/static/documents/2023-11-07-eau-adoption-of-ncm-termoncarragh-lake-23-134.pdf*

- The area will first need to be levelled (re-profiled) to stabilise the water table and facilitate the mowing necessary to maintain the required open aspect. A bulldozer is used to level/remove the camber from the former peat production fields and infill the drains. Drains will be infilled around the perimeter first and as a priority, as the proposed predator-proof fencing would be made ineffectual if mammalian predators could travel under the fence via a drainage channel. If there is not sufficient peat to infill the remaining sections of the drains, the edges will be re-profiled with a tapered edge. This measure will facilitate easy egress for chicks should they fall into a drain. The newly created c.10ha field should be at least the level of the surroundings peat to avoid large areas of pooling water.
- Using an excavator, six wader scrapes will be excavated to a maximum depth of 30-45cm, with gentle sloping edges to provide foraging areas for breeding waders and their chicks. The scrapes will be evenly distributed throughout the c.10ha area and preferentially placed in locations of existing hollows.
- Slow-release fertiliser will be applied, and a grass nurse crop will be sown to accelerate the revegetation of the area in the first growing season. Reapplication as necessary in subsequent years until 60% of the area has revegetated. As revegetation may be uneven, fertiliser application may need to be targeted to the underperforming areas.
- Mowing will not be required until revegetation exceed 60% of the lapwing breeding area to a height of 5cm in late winter (before March 1st) as per BTO recommendations[6] and/or when tree seedlings (e.g. birch seedlings) are recorded within the enhancement area. Once the requirement for mowing is triggered, it will be undertaken annually thereafter.
    - Mowing should be undertaken in late winter before March 1st, before earlier breeding birds arrive in March (Joys & Crick 2004). Mowing will be undertaken with low-pressure tracking machinery to avoid damaging the developing sward. The annual mowing is likely to produce permanent grassland, which is an important foraging resource for breeding lapwing (Galbraith, 1988).
- In areas where mowing is not possible, e.g. around wader scrapes, tree seedlings will be hand-pulled or cut to the ground by hand.
- Herbicides and pesticides are not permitted within the enhancement area.
- Invasive species management will be undertaken as outlined for whooper swan.

Predator-proof Fencing

The fence specification has been chosen in order to successfully exclude ground predators potentially present in this area (e.g. Red Fox, Badger, Otter, American Mink, Irish Stoat and Pine Marten). The NPWS, as part of recent conservation measures within the Termoncarragh Lake and Annagh Marsh SPA, have provided detailed specifications for permanent predator exclusion fencing for this specific purpose. The proposed permanent predator exclusion fencing within the enhancement lands has therefore been designed based on these specifications, as detailed below. Images of example permanent predator exclusion fencing to a comparable specification are provided in Plates 3-1 and 3-2 further below for illustrative purposes.

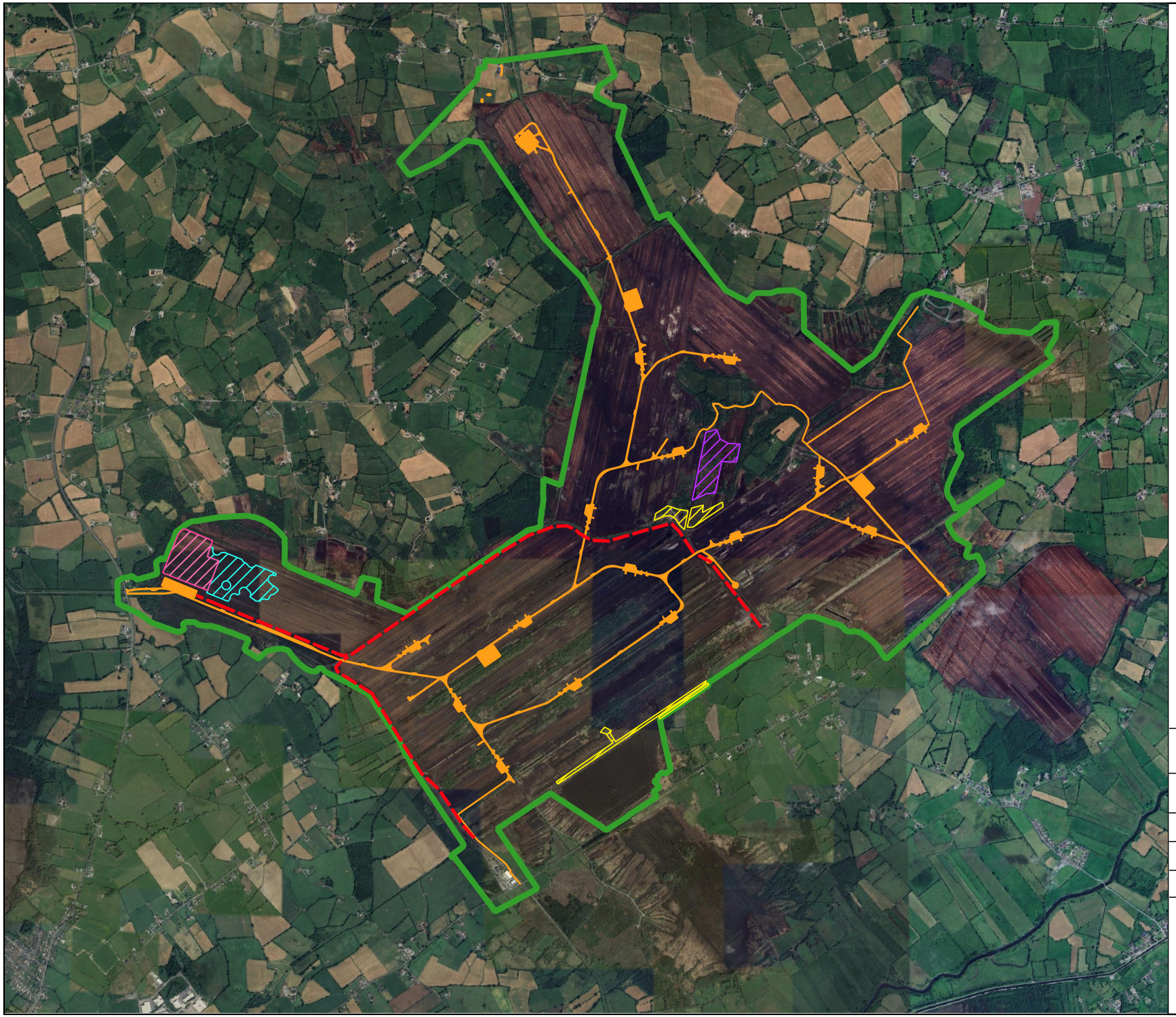
- The fence will be installed immediately after the works associated with the bulldozer and excavator.
- The fencing will be installed around the perimeter of the c. 10ha breeding lapwing area.
- Strainer posts shall be a minimum of 3.5m long, have a minimum diameter of 15cm and shall be driven a minimum of 90cm into the ground. Strainers shall be placed at the beginning and end of every length of fencing and at ever change of direction where the angle is greater than 30°. Strainers must also be used to accommodate any significant change in gradient and be strutted in the line of the fence. Strainers on 90° corners must be H framed and strutted. Maximum distance between strainer posts shall not exceed 100m. Strainers shall be incised (posts to be treated in accordance with IS 436);

[6] https://www.bto.org/sites/default/files/lapwing-habitat-guide.pdf

- Intermediate posts shall be around 2.5m long, have a minimum diameter of 10cm and shall be driven a minimum of 60cm into the ground.
- Intermediate posts shall be spaced at no more than 2.5m intervals and be H framed on every change of direction. Posts shall be incised (posts to be treated in accordance with IS 436);
- High tensile 1580mm Tornado badger wire R15/158/5, to a height of 130cm off the ground forms the main body of the fence; the bottom 28cm is to be buried;
- The Tornado badger wire is to be overlain with 16-gauge, hot dipped galvanised 25mm square weld mesh (clipped to the top of the badger wire using hog rings) and both are to be dug in (by pulling back and relaying the sod) to prevent animals digging under the fence.
- Four strands of high tensile 12-gauge electric wire, tensioned and placed along the outside of the fence at 3cm, 15 cm and 25cm height above the top of the badger wire using UV resistant screw insulators. A fourth strand to be attached above these via 20cm UV resistant offset insulators to give total fence height of around 170cm. All strands connected to a single circuit although the second line at 15cm is an Earth wire. An additional live wire, connected to the single circuit, to be attached using UV resistant screw insulators on the inside of the fence at around 100cm to stop stock rubbing on posts;
- All wire to be connected using Gripple wire joiners;
- All access gates should be a minimum of 3.6m wide and at least 1.2 m high. All steel gates shall be hot dip galvanised in accordance with EN 1461 and 12 be overlain with 16-gauge, hot dipped galvanised 25mm square weld mesh, square cornered at bases and with hot dipped galvanised 45° angled brackets attached at top and overlain with same hot dipped galvanised weld mesh. Hot dipped galvanised gate post, concreted in, to be used and these to be independent of any strainer / fence post (two gates already have galvanised gate posts, and these can remain and be used). Gates to be hung using suitably sized proprietary gate hangers and the gate base shall be around 3cm above the ground. The gates also must be fitted with an adequate system which shall securely keep the gate closed. Handle openings must be secured against predators. Each gate to have a poured concrete apron buried (25- 30cm) under the gate to prevent digging;
- Insulated underground cable (IB5) is to be buried under each gate, connecting the electric wires either side and ensuring the fence remains live when gates are opened;
- There are no watercourse flow points within the proposed predator exclusion fence area. However, at any gullies or other similar depressions where deemed required, dams to prevent otter / mink access whilst maintaining flow through will be installed. To use a 300mm twin wall corrugated unperforated drainage pipe and 10-15cm or similar crushed rock. Ensure to incorporate buried Tornado badger wire above. At each pipe ends use hot dipped galvanised 25mm square weld mesh in a frame secured to the pipe to prevent animals gaining access but at same time allows for the mesh to be removed easily to clear debris. In addition, fix a section of Tornado badger wire across the watercourse width, around 5m upstream of the drainage pipe to act as a catch point to keep most debris away from the 25mm square weld mesh panel at the pipe end; and,
- Supply and installation of a solar panelled fencer (PEL Unigizers - High Power Solar Fencers - PE406S or similar) and 4 x 1.5m earth bars.

Plate 3- 1 Example predator-proof fencing broadly in-line with proposed specifications (for illustrative purposes only) .

Plate 3- 2 Example predator-proof fencing and access gate broadly in-line with proposed specifications (for illustrative purposes only. source - as per above).



Map Legend

- EIAR Site Boundary
- Permanent Infrastructure Footprint
- Marsh Fritillary Enhancement
- Native Woodland Enhancement
- Native Hedgerow Planting
- Lapwing Semi-Grassland Enhancement and Mitigation Area
- Wetland Enhancement and Mitigation

Drawing Title

Proposed Enhancement and Mitigation

Project Title

Lemanaghan Wind Farm, Co Offaly

Drawn By	Checked By
SS	RW
Project No.	Drawing No.
200804	Figure 3-1
Scale	Date
1:35,500	2026-03-20

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3.3 Implementation

The BMEP will be implemented prior to the initiation of construction works. The BMEP measures will be implemented as follows.

1. *The Applicant will employ a suitably qualified contractor(s) to carry out the measures as detailed in Section 3.1 and 3.2 above.*
2. *The Applicant will engage a suitably experienced contractor to supply and install the fence to the specifications detailed in Section 3.2.*
3. *A meeting will be held with the contractor to outline the general aims, objectives and requirements of the BMEP.*
4. *The Applicant will engage a suitably qualified ecologist to confirm that the management objectives are in place and in line with the required timelines.*

The Applicant will be responsible for overseeing the implementation of the BMEP, which will be in strict accordance with measures outlined in Sections 3.1 and Section 3.2 above. The Applicant will also be responsible for engaging a suitably qualified ecologist to undertake the monitoring of the Proposed Project site, determining if the measures are achieving the desired results and, where necessary, amending the BMEP to achieve the required results. The monitoring programme will be in place for the lifetime of the Proposed Wind Farm.

The Applicant or their agents will also be responsible for ensuring compliance with planning conditions and engaging with statutory bodies and advisory agencies as required.

4. MONITORING

A site-specific monitoring programme will be implemented to assess the effectiveness of the biodiversity enhancement measures and the ornithological enhancement and mitigation measures set out in this BMEP, and to ensure their effective delivery over the operational lifetime of the Proposed Project.

Monitoring will provide an evidence base to assess progress towards the objectives of the BMEP, to inform adaptive management where establishment or habitat condition does not meet the intended outcomes, and to verify that the approved measures are being implemented as required.

Monitoring will be undertaken by a suitably qualified ecologist and will focus on the enhancement measures provided for marsh fritillary habitat, native hedgerow planting, native woodland enhancement and habitat creation for ornithology enhancement. Results will be documented within a Monitoring Report, which will identify any shortcomings, recommend corrective actions or amendments where required, and inform updates to management measures.

Monitoring of habitat enhancement will be carried out annually until the proposed habitats have been sufficiently established and have given consistent results for 3 consecutive years after the establishment phase. During this time the Project Ecologist will ascertain whether the establishment methodology needs to be adapted. Once the habitats been successfully established, monitoring can be carried out every other year (years 5, 7, 10, 15 and 20 post-establishment) as deemed appropriate by the Project Ecologist. Monitoring of ornithological enhancement and mitigation measures will be carried out annually for the lifetime of the Proposed Wind Farm. A review of the requirement to continue with annual monitoring should be undertaken after the fifth operational year. Any change to the annual monitoring requirement will require sign off from the National Parks and Wildlife Service and An Coimisúin Pleanála.

The BMEP will be regularly updated and amended where necessary to improve the efficacy of the prescribed works. Monitoring of enhancement measures will take account of changes in hydrological conditions and vegetation structure associated with ongoing peatland rehabilitation works. Where site conditions evolve differently to those anticipated at the time of preparation of this BMEP, enhancement measures will be reviewed and adapted, where necessary, to ensure continued ecological function.

4.1.1 Marsh Fritillary Habitat Enhancement

Following establishment of devil's bit scabious in enhancement areas, marsh fritillary habitat condition assessments will be undertaken to assess the habitat suitability. Habitat condition assessments will include surveying for the presence and abundance of devil's bit scabious as well as recording the vegetation height and any grazing evidence within the study site, based on methodology and recording sheets designed by the NBDC[7]. Monitoring will be carried out between August and September when devil's bit scabious is in flower. The habitat suitability condition assessments will be carried out in Years 1, 3, 5, 7, 10, 15 and 20 of the BMEP.

Monitoring surveys will also include presence/absence surveys for marsh fritillary larvae. These will be carried out in accordance with best practice guidance (TII, 2009) and the NBDC Marsh Fritillary survey methodologies for larval web surveys[8] during the optimum survey period (August and September in sunny conditions). Any occupied larval webs will be recorded.

The results of habitat condition and larval web surveys will inform whether adaptive management measures are required to improve habitat structure, foodplant availability or overall suitability for marsh fritillary.

[7] https://biodiversityireland.ie/app/uploads/2021/11/Marsh-Fritillary-Habitat-Condition-Form.pdf
[8] https://biodiversityireland.ie/app/uploads/2021/11/Marsh-Fritillary-Larval-Survey-Form.pdf

4.1.2 Hedgerow and Native Woodland Planting

Monitoring of newly planted native hedgerows and woodland will be undertaken to assess establishment success, structural development and species composition.

Monitoring will include:

- Survival rates of planted stock
- Identification of failed planting requiring replacement
- Assessment of early structural development
- Confirmation that management measures are being implemented as intended

Any replacement planting or remedial management identified through monitoring will be implemented during the appropriate planting season and documented within the Monitoring Report.

Hedgerows and woodland planting will be inspected annually as outlined in Section 3.3. Monitoring frequency may be reduced where planting has successfully established, subject to the recommendations of the Project Ecologist.

4.1.3 Ornithological Enhancement and Mitigation

4.1.3.1 Monitoring Delivery of Objectives

Full details on the proposed ornithological monitoring measures are provided in Appendix 7-7 of the EIAR. In summary, the annual monitoring measures at the Proposed Project site will include:

Bird Surveys of Enhancement Area

- The areas proposed for enhancement will be the subject of ongoing monitoring during the operational phase of the Proposed Wind Farm to ensure it is offering supporting habitat for breeding lapwing and roosting whooper swans. The ongoing monitoring will take place during the breeding bird season (March to August) for lapwing and winter (October to March) for whooper swans. The monitoring will seek to identify whether these species are utilising the areas under active management and will be conducted by way of vantage point surveys. These surveys will be undertaken once a month March to August and October to March inclusive, each year. This is discussed in detail in Appendix 7-7.
- The area will be monitored as follows. The existing vantage point location VP6 is situated adjacent to, and overlooks, the proposed enhancement lands. Similarly, the existing breeding and winter walkover transects include this area. As such, these surveys will provide information on the usage of the proposed enhancement lands by whooper swan and lapwing.
- **Mapping**: the proposed ornithological enhancement lands will be accurately mapped and monitored annually to check that the areas so covered have not altered in size and identify any issues, e.g. embankments are intact, whether there are signs of erosion etc. As well as mapping, this monitoring will be recorded by means of fixed-point photography.
    - A monitoring visit will be carried out each year to assess the condition of the fence and identify any areas for repair / replacement.
    - Annual monitoring of the sluice gate to assess the condition of the drop board etc and replacing or repairing equipment as needed.
- The requirement for mowing in the breeding lapwing area will be informed by monitoring.

- **Vegetation sampling**: Twenty fixed relevé sites will be set up in the breeding lapwing area. Data will be recorded prior to the commencement of the BMEP activities and annually in late winter thereafter. The character of each relevé will be recorded (e.g. species proportions present using Domin scale, vegetation height and percentage bare ground) and photographs will be taken of each relevé from a fixed point.
- The combination of the results from relevé and fixed-point photography will be used to inform when mowing is required in the breeding lapwing area. Thresholds are set in the methodology section above.
- These relevés will then be re-examined annually following the commencement of the BMEP to establish the extent of habitat improvement resulting from management practices.

The efficacy of the measures employed will be reviewed annually following the commencement of the BMEP. Analysis of the data collected will be the basis for a review of the measures and techniques employed. Should any adjustments to the measures be deemed necessary or advisable, these will be undertaken in consultation with the NPWS prior to any alterations to the BMEP.

Monitoring Reports detailing the monitoring works carried out, the results obtained and a review of their success, along with any suggestions for amendments to the BMEP will be prepared and submitted to the planning authority annually following commencement of the BMEP. This report will fulfil an auditing function.

4.1.3.2 Auditing

The Applicant will ultimately be responsible for the implementation of the management measures and audits. Audits will be required to ensure the effectiveness of the BMEP. They are essential to ensure adequate plan quality, compliance, and control. Audits will be based on a field inspection and the assessment of the success of the implemented measures, as per Section 3.3 above.

The BMEP will be audited each year. The audit will assess:

- Objectives of the plan;
- Implementation of the plan; and
- Adherence to the requirements of the plan.

The enhancement plans will be reviewed annually and as previously outlined, any requirement for amendments will be submitted to the planning authority.

5. CONCLUSION

This BMEP sets out the measures to be implemented to provide habitat enhancement and ornithological enhancement and mitigation within the Proposed Project site, having regard to the existing ecological baseline and the nature of the Proposed Project.

The BMEP provides for the enhancement of approximately 6.7 ha of grassland habitat with potential to support marsh fritillary, the planting of approximately 6.5 km of native hedgerow, and planting of approximately 7.8 ha of native woodland within recolonising peatland habitats. These measures are intended to increase habitat diversity, improve habitat structure and enhance ecological connectivity within the Proposed Project site.

In addition, the BMEP sets out ornithological enhancement and mitigation measures for winter roosting whooper swan and breeding lapwing to address potential significant effects identified in the EIAR and to maintain the availability of suitable habitat for these species within the Proposed Project site.

This BMEP also sets out the implementation, management and monitoring requirements associated with the proposed enhancement measures. The success of the measures will be evaluated through a programme of monitoring and reporting by a suitably qualified ecologist, with provision for adaptive management where required to ensure that the objectives of the BMEP are achieved over the operational lifetime of the Proposed Project.

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