



ARCUS

OUTLINE LANDSCAPE AND BIODIVERSITY MANAGEMENT PLAN

SWEETBRIAR SOLAR FARM



LIGHTROCKPOWER

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1 INTRODUCTION

Arcus Consultancy Services Ltd ('Arcus') was commissioned by Lightrock Power Ltd ('the Applicant') to develop an outline Landscape and Biodiversity Management Plan (LBMP) based on the results of the Ecological Impact Assessment (EcIA), and Landscape and Visual Appraisal (LVA) undertaken in respect of a proposed solar photovoltaic (PV) array ('the Development') on agricultural land on land 2 km north west of Ulceby, and 6.5 km north west of the centre of Immingham ('the Site'). This document identifies potential mitigation measures that will reduce effects or protect and enhance landscape and biodiversity resources.

This LBMP addresses recommendations set out in the EcIA and thereby aims to ensure that: ecological resources are protected during construction of the Development; enhancement measures are implemented at the beginning of the operational stage of the Development; and existing biodiversity resources and proposed mitigation and enhancement measures are managed appropriately during the operational stage of the Development. The LBMP does not attempt to address all recommendations set out in the LVA which are addressed within the document: *Landscape and Visual Appraisal Sweetbriar Solar Farm*. The measures set out in the LVA assist in addressing the purposes of this report and, where appropriate, the LVA is referenced within the LBMP. The LBMP is produced with reference to existing guidance and best practice^{1,2}.

2 THE DEVELOPMENT

The Development would consist of rows of solar panels known as strings. Each string of panels would be mounted on a rack comprising poles, and between each string, there would be gaps to avoid inter-panel shading. The gaps would be between 2 m and 6 m. The panels would typically be tilted at approx. 20 degrees from the horizontal and would be oriented to face south towards the sun. The panels would be mounted at around 0.8 m from the ground at the lowest point rising to approximately 2.8 m at the highest point, although the maximum height could be up to 3 m.

A full description of the Development is set out in the Planning Design and Access Statement and suite of planning drawings which accompany the planning application. In summary, the scheme consists of the following key elements which are shown on Planning Drawing 2: Indicative Site Layout and Planning Drawing 3 Landscape Mitigation Plan (LMP), Appendix A:

- A Temporary Construction Compound (TCC) - The access to be used for TCC is off Carr Lane and serves Sweetbriar Farm. There will be one TCC that will serve the wider development;
- Solar panels, known as strings, mounted on metal frames driven into the ground in parallel rows tilted 10 to 25 degrees from the horizontal to face south towards the sun. There is a distance of 2-6 meters between strings of panels in order to avoid inter-panel shading, but this distance is influenced by slope and aspect. Each string of panels would be mounted on a rack comprising metal poles anchored to the ground set a maximum of 2.5 m to 3.0 m above ground level and the bottom edge at a height of 0.8 m from the ground (each panel approximately 1.1 m x 2.25 m). Given the nature of the installation, ground excavation is not required for panel installation and the metal frames are likely to be screwed or piled to a depth of between 1-2 m below the ground depending on conditions. There are gaps between the rows of panels and around the perimeter of the panels up to existing field

¹ BRE (2014) *Biodiversity Guidance for Solar Developments* Eds Parker, G.E. and Greene, L.

² Natural England (2011) *TIN101 Solar Parks: Maximising Environmental Benefits*, Natural England.

boundaries, and therefore the area of land directly impacted by the Development, is smaller than the site area;

- A substation compound (26 x 10 m), includes housing for DNO and Client substation. The substation building itself is 22 m x 5.5 m;
- Up to 16 inverters/transformers located around the Site and each located within a Glass Reinforced Plastic (GRP) or container enclosure/kiosk measuring approximately measuring approximately 7 m x 2.5 m x 3 m high;
- Buried cables linking the solar panels to the substation;
- A 2.4 m high timber post and wire mesh security fence (deer proof) erected around the perimeter of the Site;
- A CCTV camera system mounted on 3 m high poles inside the security fence;
- An existing access track leading from Carr Lane and additional tracks within the Site providing access to the inverters. New tracks will be kept to a minimum across the Site and will be approximately 4 m wide, constructed from crushed stone on top of a geotextile membrane. Areas of new hardstanding would be limited to the DNO and client substation and inverter kiosk foundations. Access across the wider Site from the TCC would be via existing field access tracks that will then be extended as needed to reach areas of panels further within the Site; this is to minimise the requirement for new field entrances and reduce traffic on the roads around the Site during the construction period; and
- New tree, shrub and hedgerow planting within and to the perimeter of the Site in conjunction with wildflower grassland and other enhancements (refer to section 7 of the LVA for further details).

All GRP enclosures / containers would be painted in a suitable colour to help integrate them into the landscape and minimise their visual appearance. The final choice of colour would reflect the character of the landscape in which the Development is located and would be agreed with North Lincolnshire Council (NLC) as the determining authority.

The construction period of the Development would last approximately 6 months and the temporary operational period would be for 40 years.

3 POTENTIAL EFFECTS OF THE DEVELOPMENT ON BIODIVERSITY

The EcIA outlines the existing baseline for biodiversity resources at the Development site and assesses the potential effects of the Development. In summary, the Site is considered to be of low sensitivity in relation to potential ecological effects and there are opportunities for enhancement and biodiversity gain throughout the Development.

The LVA outlines the current baseline in respect of landscape resources and details an assessment of the Development and the landscape ability to accommodate the Development and details any subsequent mitigation necessary. In summary, the existing landscape has the capacity to accommodate the Development subject to the proposed mitigation outlined in the LMP (Appendix A) and the LVA.

4 LBMP AIMS

The aims of the LBMP are:

1. To ensure that biodiversity resources are protected during construction of the Development;
2. To ensure that adequate enhancement measures are implemented at the beginning of the operational stage of the Development; and
3. To ensure that existing biodiversity resources and proposed mitigation and enhancement measures are managed appropriately throughout the operational stage of the Development.

5 MANAGEMENT MEASURES

Table 1 summarises the measures to be implemented during construction to protect the existing landscape and biodiversity resources and the actions that will be required to ensure that the measures can be implemented. Table 2 outlines the measures that will be undertaken during the operational stage of the Development to ensure the long-term establishment of mitigation and enhancement of landscape and biodiversity.

Where applicable, Target Habitats and Conditions Assessment criteria have been included in Table 2 for the purposes of long-term monitoring. Target Habitat definitions have been taken from UK Habitat definitions³ and correspond to those identified in the Biodiversity Metric Assessment completed for the project⁴. Conditions assessment criteria have been taken from Natural England Biodiversity Metric 3.0 and the associated Habitat Condition Assessment Sheets (reproduced in Appendix E for reference).

³ <https://ukhab.org/> Accessed 23/11/2021

⁴ Arcus, 2021 Biodiversity Metric Assessment Sweetbriar Solar Farm

Table 1 Construction and Implementation Management Measures

Management Measure	Management Actions	Reason or Justification
Undertake construction in accordance with good practice guidance	Technical documentation to address all environmental and safety issues at the Development site.	To ensure an integrated approach to the management of construction effects and to safeguard ecological features.
Protection of hedgerows and trees	Temporary protective fencing will be installed around trees and hedgerows (where required) following the advice of an arboriculturist and in line with British Standards guidelines. <i>BS 5837:2012 Trees in relation to design, demolition and construction.</i>	To prevent unnecessary damage to hedge and tree roots through compaction of soil.
Protection of wildlife during construction	<p>The solar farm design aims to avoid impacts to protected or notable species. In the unlikely event that these species are identified and may be affected by construction, the advice of an ecologist will be promptly sought.</p> <p>All deep excavations should be securely covered or fenced at night to prevent badgers and other animals (e.g. brown hare, otter and hedgehog) falling into excavations. Check all excavations for the presence of animals before recommencing work.</p> <p>Any pipework required during construction will need to have the ends 'capped' to ensure mammals do not enter them overnight.</p> <p>Aggregates and materials should not be left piled or stacked up prior to use for extended periods of time, to avoid attracting burrowing or sheltering mammals. If this is unavoidable these areas should be securely fenced and/or covered to deter mammals.</p>	To ensure the construction is ecologically sensitive and compliant with legislation and best practice.
Nesting bird protection	<p>If works activity is programmed from March to August inclusive, then pre-construction nesting bird surveys covering the area to be affected by works will be carried out in accordance with best practice.</p> <p>If nesting birds are present in a works area, or it is the opinion of an ecologist that works would cause abandonment of an active nest, then works in that area may not proceed until the nest is vacated.</p> <p>If construction works are scheduled to commence prior to the breeding season, implement measures to discourage nesting birds from construction work areas; e.g. using bird scarers or ploughing work area.</p>	To safeguard nesting birds and avoid legal offences.

Management Measure	Management Actions	Reason or Justification
<p>Safeguarding ecology (general)</p>	<p>An ecologist should be present to provide an Ecological Clerk of Works (ECoW) supervisory role where works take place close to sensitive habitats or when works activity has the potential to cause disturbance to wildlife. The ECoW will provide advice on avoidance and mitigation best practice measures, resolving ecological issues, providing a 'Toolbox talk' to contractors prior to works, provide input to working documentation focussing on reducing impacts to wildlife, and seek further specialist advice or licences, as necessary.</p>	<p>To ensure the construction is ecologically sensitive and compliant with legislation and best practice.</p>
<p>Grassland creation</p>	<p>Grassland beneath the solar panels and between the rows of panels will be created in accordance with Natural England guidance⁵.</p> <p>Where herbicides are required, the herbicide handbook (English Nature, 2003⁶) provides guidance on appropriate herbicide use in relation to nature conservation works.</p> <p>The specific approaches, including the need for ground preparation and seed sowing, will depend on site-specific factors (e.g. soil type), construction impacts (e.g. degree of soil compaction), and operational constraints (e.g. grazing options). The methods to create and establish grassland will be developed in consultation with a specialist contractor (to be appointed before construction begins). Work is likely to involve the areas to be sown being prepared and harrowed, with weeds removed using repeated surface cultivation or a suitable non-residual herbicide, taking care to avoid buried cables and services. Compacted soils shall be broken up to create a suitable seed bed.</p> <p>Areas will be sown in accordance with the suppliers' instructions, ideally during September or in early spring following the completion of development and underground cabling (although seeding is possible at other times of year when weather conditions are suitable). Seed will be sown by machine or where this is not possible, seed will be broadcast by hand.</p> <p>All seeds used should be of British native origin in order to better represent the genetic diversity and adaptive capacity of wild plants compared with imported stock or commercially bred. Reference to sowing of grassland can be seen in Appendix C.</p>	<p>To enhance floristic diversity of grassland thereby improving resources for bats and birds (and many other animals).</p>

⁵ Natural England (2010) *TIN062–TIN068 Sward enhancement [series of titles]*. Available from: <http://publications.naturalengland.org.uk>

⁶ English Nature (2003) *The Herbicide Handbook: Guidance on the use of herbicides on nature conservation sites*. Natural England, Peterborough.

Management Measure	Management Actions	Reason or Justification
<p>Hedgerow and tree planting</p>	<p>Plant native species-rich hedgerows with trees to connect to existing woodland blocks. Fill in any gaps of the existing hedgerows in accordance with enhancements set out in Section 7 of the LVA.</p> <p>Plant native species-rich woodland blocks to extend the existing woodland block in the central north-west corner and along the eastern boundary of the Site.</p> <p>All planting stock supplied shall be healthy and viable and comply with BS 3936-1 (1992) and the National Plant Specification. Hedgerow planting to include a selection of species that flower, fruit and form nuts year-round.</p> <p>All plants will be packed and transported in accordance with the Code of Practice for Plant Handling as produced by CPSE. Planting will not be carried out when the ground is waterlogged, frost-bound or during periods of cold drying winds. All bare-root planting stock will be kept covered until actually planted to minimise water-loss and prevent roots from drying out.</p> <p>The exact timing of the proposed hedgerow planting will depend on suitable ground conditions (frost free) with planting taking place between the months of October and March, inclusive. The establishment of new hedgerow and tree/woodland planting is detailed in Appendix B.</p>	<p>Improve ecological connectivity between woodland plantation blocks on and offsite.</p> <p>Hedgerow trees provide structural complexity and additional foraging and nesting resources for wildlife.</p> <p>Species-rich hedgerow planting to maximise benefits year-round for a range of foraging fauna.</p> <p>Hedgerows and hedgerow trees create screening in areas where there could be sensitive views affected by the Development. It also creates an ecological habitat of value.</p> <p>The addition and improvement of native species hedges, hedge trees and woodland blocks improves the value of the landscape character.</p>
<p>Creation of wildflower grassland strips</p>	<p>Areas of wildflower grassland strips will be created outside fence lines in accordance with the methods described in Appendix C.</p>	<p>Enhance botanical diversity of wildflower grassland strips to increase biodiversity, which will in turn benefit a range of species including invertebrates, birds and small mammals.</p>
<p>Creation of Bird Cover Crop area</p>	<p>Areas of seed-rich habitat to be created by sowing wild bird cover crops with seed-bearing plants. The Bird Cover Crop will involve establishment and management of a seed mix on an annual, or biannual basis. The mix will include seed-bearing plants to provide foraging resources to farmland birds throughout the year. "Bumblebird", or comparable mix, will be used and managed as per the supplier's specifications.</p>	<p>Enhance botanical biodiversity and provide habitat for foraging wintering birds. Provide seed-bearing crops as forage for birds throughout the year.</p>

Management Measure	Management Actions	Reason or Justification
Lighting	<p>Any lighting during construction needs to follow that detailed within the Institute of Lighting Professionals (ILP) lighting guidance⁷, to avoid impacts to foraging bats and other nocturnal fauna.</p> <p>The use of lighting during construction will be restricted to the hours after dawn to dusk, as required for safety purposes in low light conditions. Therefore, no night-time lighting is required during construction.</p>	<p>To avoid or reduce disturbance to foraging or commuting bats and other nocturnal animals.</p> <p>To minimise landscape and visual effects.</p>
Bird boxes	<p>Ten boxes will be targeted toward tree sparrow, and mounted together (in a small area spanning no more than five posts) on the security fence adjacent to hedgerow habitat, with the location to be determined by an Ecological Clerk of Works (ECoW).</p> <p>Two Kestrel Nest boxes to be installed on Site location to be determined by ECoW.</p> <p>See Appendix A, Figure 3 for specifications.</p>	<p>To provide a net gain in nesting resources for tree sparrows and kestrel associated with the habitats currently present at the Site, which will be incorporated into the Development.</p>
Bat boxes	<p>Four bat boxes will be installed on specific trees that border the Site. Installation locations have been chosen to reflect the prevailing conditions and features, where opportunities for roosting bats are not currently available on Site. They are also designed to be located away from areas of disturbance.</p> <p>Bat boxes will be chosen and installed in accordance with Bat Conservation Trust guidance⁸. See Appendix A, Figure 1 for locations and Figure 2 for specifications.</p>	<p>To provide a net gain in roosting opportunities for bats throughout the Development.</p>

⁷ August 2018. Guidance Note 08/18: Bats and artificial lighting in the UK: Bats and the Built Environment series. BCT/ILP

⁸ Bat Conservation Trust (undated) *Bat Box Information Pack*. Available from: http://www.bats.org.uk/pages/bat_boxes.html

Table 2 Operational Management Measures

Management measure	Management actions	Reason or justification
<p>Hedgerow maintenance</p>	<p>Management actions for trees and hedgerows are outlined in Appendix B.</p> <p>Once established, hedgerow management and timing for cutting needs to ensure that opportunities for nesting and foraging birds are always available within the Development, with cutting every 3 years following a rotational regime.</p> <p>Hedgerows to be maintained to 3 m as outlined in the LVA.</p> <p>Throughout the lifetime of the development, monitoring and management of hedgerows and the hedgerow margins should be undertaken throughout the Site, building in coppicing, laying or re-planting as an ongoing programme.</p>	<p>Ensure long-term success of biodiversity enhancement.</p> <p>Provide sufficient height and density to create a visual screen.</p> <p>Monitoring required:</p> <p>Target Habitat Description: Native Hedgerow and Native Hedgerow with Trees</p> <p>Time to Target: Year 1 as stated in the metrics assessment</p> <p>Conditions Assessment Requirement:</p> <p>To be achieving 'Poor' monitoring against criteria set out in Sheet 8 of Biodiversity Metrics 3.0⁹ by target year.</p> <p>The attributes in the metrics condition assessment use similar favourable condition criteria to the Hedgerow Survey Handbook and the handbook is the recommended source of reference for assessing individual hedgerow attributes¹⁰ to allow conditions assessment to be undertaken.</p>
<p>Tree management</p>	<p>Management actions for trees and hedgerows are outlined in Appendix B.</p>	<p>Ensure long-term success of biodiversity enhancement and landscape character throughout the lifetime of the development.</p> <p>To soften views to the Development.</p> <p>Target Habitat Description: Other Woodland: Broadleaf Woodland – Time to target habitat Year 7 as stated in the metrics assessment.</p> <p>Conditions Assessment Requirement: Achieving 'Poor' with a total score of between <26 (13 – 25) monitoring against the criteria set out in Condition</p>

⁹ Biodiversity Metric 3.0 Habitat Condition Assessment Sheet 8 Hedgerows (Appendix E)

¹⁰ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69285/pb11951-hedgerow-survey-handbook-070314.pdf

Management measure	Management actions	Reason or justification
		Assessment Sheet 24 of Biodiversity Metrics 3.0 ¹¹ by target year. The conditions assessment is based on the England Woodland Biodiversity Group – Woodland Condition Survey Method.
Grassland management	<p><u>Initial Grassland Management:</u> Grassland seed mix to be determined but likely to be Emorsgate EM1 Basic general purpose meadow mixture or EM2 Standard general purpose meadow mixture. To be sown as per the suppliers recommendations.</p> <p>The early stages of grassland management are critical to long-term success but will depend on site-specific factors. The grassland management regime is likely to include, but not be limited to: fertilizer and herbicide application requirements, and grazing.</p> <p>Checks should be made to assess and control annual weeds. If preferable, to avoid the use of herbicides, annual weeds can be managed by topping and mowing prior to setting seed which will encourage lateral development of the grasses. Any topping undertaken between April and July should be no lower than 200mm to prevent harm to any ground nesting birds.</p> <p>Weed control should pay attention to the potential presence of the following five harmful weeds listed within the Weeds Act 1959: common ragwort, creeping thistle, spear thistle, curled dock and broad-leaved dock¹².</p> <p>If early grassland management fails, reseeding should be undertaken where the area of bare ground exceeds 20%.</p> <p><u>Longer Term Grassland Management:</u> Once the grassland has been established, the whole site will be kept grazed by sheep under rotation, for the lifespan of the Development, and so a key management prescription to enhance the sward beneath and between the panels (i.e. excluding the wildflower strips) will be the management of the grazing pressure. Rotation management will be achieved by excluding grazing in different sections and within different periods</p>	<p>To ensure the successful establishment and long-term viability of a diverse grass sward for the benefit of wildlife.</p> <p>Allow the grassland to flourish, promoting flowering plants to benefit pollinators, and allowing annuals to naturally reseed.</p> <p>Protection of ground-nesting bird breeding areas and provide areas suitable for hare ‘forms’.</p> <p>Target Habitat Description: Grassland – Other Neutral Grassland - Time to target 3 years.</p> <p>Condition Assessment Requirement – ‘Poor’ achieving 1 or 2 of the 5 criteria set out in Condition Assessment Sheet 6 of Biodiversity Metrics 3.0¹³ by target year.</p>

¹¹ Biodiversity Metric 3.0 Habitat Condition Assessment Sheet 24 Woodland (Appendix E)

¹² https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69296/pb7190-harmful-weed-control.pdf, Accessed 20/10/21

¹³ Biodiversity Metric 3.0 Habitat Condition Assessment Sheet 6 Grassland (Appendix E)

Management measure	Management actions	Reason or justification
	<p>during the spring and summer months to allow some grasses and herbs to flower and/or set seed. Any ungrazed pernicious weeds can be removed either by hand or mechanically cut as required. Grazing stocking densities should be low to allow reseeding and maintain benefit for birds.</p> <p>Sheep grazing management actions are described in Appendix D.</p>	
<p>Wildflower grassland management</p>	<p>Wildflower grassland will be managed through meadow cutting, as described and detailed in the wildflower grassland management plan (see Appendix C).</p>	<p>To ensure the successful establishment and long-term viability of a more diverse grass sward for the benefit of wildlife.</p> <p>Target Habitat Description: Grassland – Other Neutral Grassland – Time to target 5 years as specified in the Biodiversity Metrics Assessment.</p> <p>Condition Assessment Requirement – Moderate - achieving 3 of the 5 of the criteria set out in Condition Sheet 6 of Biodiversity Metrics 3.0¹³ by target year.</p>
<p>Bird Cover Strip Management</p>	<p>Seed-rich grassland habitat to be created by sowing wild bird cover crops with seed-bearing plants in the Autumn and leaving them unharvested over winter until at least mid-February, ideally March, to benefit wintering birds. The ideal time to establish wild bird seed areas is in April or May, by preparing a seedbed and drilling the crop. At the end of its final winter, destroy the cover in late March or early April and re-establish the mix as soon as possible. To be re-seeded every 1-2 years and maintained in accordance with the measures outlined in the supplier’s specifications. Seed ration of 30 kg per ha.</p>	<p>To ensure the successful establishment and long-term viability of seed-bearing plants throughout the winter months for the benefit of wildlife.</p> <p>To provide foraging resources to farmland birds throughout the year.</p> <p>To provide a supply of small seeds through the winter months along with a range of pollen and nectar-rich plants between early and late summer.</p> <p>Target Habitat Description: Seed – rich grassland habitat.</p> <p>Conditions Assessment Requirement – Time to target to be established 2 years after construction and maintained through a programme of management throughout the lifetime of the development.</p>
<p>Mammal gate installation</p>	<p>Install a series of mammal gates within the fencing, at intervals shown on the LMP, Appendix A, suitable specifically for use by badger, hare and otters that are known to use the Site. This will allow the dispersal of wildlife through the Site. See Appendix A, Figure 1 for locations and Figure 4 for an example mammal gate specification.</p>	<p>Ensure that terrestrial habitat connectivity is maintained within the Development for a range of wild mammal species.</p>

Management measure	Management actions	Reason or justification
Bat boxes	Boxes need to be long lasting 'woodcrete' to last 20 to 25 years. Once installed they can be left, however if damaged or no longer attached to a mounted feature, they are either re-affixed or replaced during the duration of the Development. See Appendix A, Figure 1 for locations, with examples of bat box types and installation requirements seen in Figure 2.	To ensure the success and long-term viability of the bat boxes for roosting bats.
Bird boxes	Boxes need to be long lasting 'woodcrete' to last 20 to 25 years. Once installed they can be left, however if damaged or no longer attached to a mounted feature, they are either re-affixed or replaced during the duration of the Development. See examples of bird box types and installation requirements in Figure 3.	To ensure the success and long-term viability of the bird boxes for nesting birds.
Lighting	<p>Any lighting during the operation of the Development needs to follow that detailed within the Institute of Lighting Professionals (ILP) lighting guidance⁷, to avoid impacts to foraging bats and other nocturnal fauna.</p> <p>Security lighting post-construction will be avoided, with the use of infra-red cameras used instead for security purposes.</p> <p>A small security light at the top of the DNO substation will be motion-sensing and will be directed away from potential bat habitats, if compatible with operational Health and Safety procedures. This will be installed to avoid light spill onto sensitive habitats such as nearby hedgerows that may be used by nocturnal foraging and commuting species.</p> <p>The type, design, height, angle and position of luminaires to be installed as determined by a lighting professional in line with appropriate specifications detailed in the ILP guidance⁷.</p> <p>Colour and finish of lighting units to meet visual requirements set out in the LVA.</p>	<p>To avoid or reduce disturbance to bats and other nocturnal animals.</p> <p>To minimise landscape and visual effects.</p>

6 MONITORING

The target habitat types³ that the Development is striving to achieve include the following:

- Grassland – Other Neutral Grassland;
- Seed – rich grassland habitat;
- Woodland and Forest – Other Woodland: Broadleaf Woodland; and
- Hedgerows - Native Hedgerow and Native Hedgerow with Trees.

To ensure the successful establishment and success of the proposed target habitats and to improve biodiversity interest and ensure the success of the landscape mitigation requirements, the Site will be monitored by a suitably qualified ecologist. Monitoring will be based on the Condition Assessment criteria outlined in Table 2.

A walkover survey will be undertaken on years 1, 2, 3, 5, and 10, then every 10 years thereafter up to the 40 years of the Development's operational period. A specific monitoring year for Woodland should be included in year 7 to ensure the habitat has met the condition assessment requirement.

The walkover surveys will include an inspection of the grassland, wildflower meadows, trees, hedgerows, bird cover crop areas and any other ecological features outlined in Table 2 to ensure that the Site is being managed in a manner suitable for the enhancement of wildlife interest. Bird and bat boxes will also be checked and mammal gates will be inspected for working order.

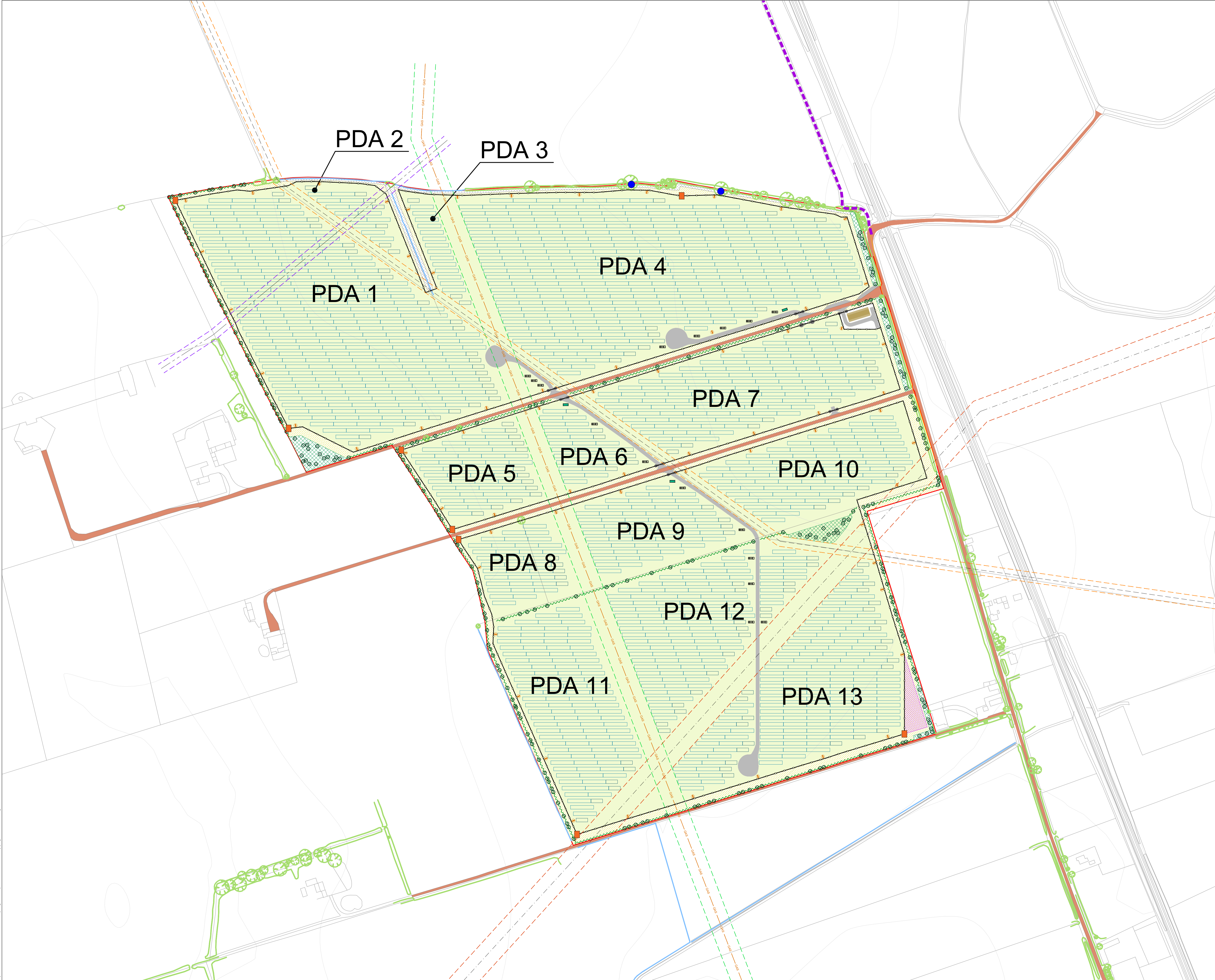
The results of these monitoring surveys will be used to inform future changes in management (e.g. altering stocking densities on sheep grazing) and the need for any maintenance measures such as replacing bat or bird boxes or mammal gates. The LBMP should be a live document and amended as necessary based on the monitoring findings and recommendations with formal document reviews undertaken at monitoring years 5 and 10.

7 Summary

The management and maintenance measures outlined in Tables 1 and 2 (supported by further detail in Appendices A – E) will ensure that landscape and biodiversity is protected, enhanced and monitored throughout the lifetime of the Development. The LBMP is a live document and should be reviewed and revised before and during construction, as well as during the operational stage of the Development (as per the requirement of Section 6), to ensure that it remains fit for purpose.

Appendix A – Figures

Figure 1: Landscape Mitigation Plan



KEY

	Planning Application Boundary
	Existing Overhead 33kV Powerline
	6m Buffer of Existing Overhead 33kV Powerline
	Existing Overhead 400kV Powerline
	14m Buffer of Existing Overhead 400kV Powerline
	Existing Underground 11kV Powerline
	6m Buffer of Existing Underground 11kV Powerline
	Existing Gas Pipe
	12m Buffer of Existing Gas Pipe
	Existing Track to be Retained
	Existing Public Rights of Way
	Existing Vegetation to be Retained
	Existing Grass Verges to be Retained
	Existing Drainage
	Proposed Native Species Tree
	Proposed Native Species Hedgerow with Tree
	Proposed Native Species Woodland Mix
	Proposed Native Species Grass and Meadow Mix for Sheep Grazing (located around and under solar panels)
	Proposed Native Species Grass and Wildflower Meadow Mix
	Proposed Track
	Proposed Fence
	Proposed Entrance Gate
	Proposed Half Table of Solar Panels
	Proposed Full Table of Solar Panels
	Proposed Inverter
	Proposed CCTV
	Proposed Substation Compound
	Indicative Bat Box Location
	Indicative Mammal Gate Location
	Bird Cover Crop
	Visibility Splay

1:2,000 Scale @ A1
 0 40 80m
 Produced By: WM Ref: 4157_DR_LAN_101A
 Checked By: WW Date: 08.12.2021

Reproduced from Ordnance Survey digital map data © Crown copyright 2022. All rights reserved. Licence number 100046606
 N:\CAD\4157 SWEET BRIAR FARM\01-WORKING\01_01-DRAWINGS\4157_DR_P_0005A

Figure 2: Bat Boxes

Schwegler 1FF Large Bat Box



The Schwegler 1FF is a large and solid bat box that can be affixed to trees or buildings at a height of 4 to 5 m, facing in a south to east direction. It is built from woodcrete which is long lasting. Typically attracts Pipistrelle and Noctule species.

The open underside allows bat droppings to fall cleanly away from the box, so no cleaning is required.

Dimensions: 43 x 27 x 14 cm Weight: 9.5 kg.

Schwegler 2F Bat Box



Bat box to be installed on trees.

20 - 25 years lifespan.

Best positioned at a height of between 3 to 6 m. Bat boxes should ideally be sited in open sunny positions and in groups of 3 to 5 boxes facing different directions from south to east to provide a variety of micro-habitats. Please note that once bats have inhabited a roost site they may only be disturbed by licenced bat workers.

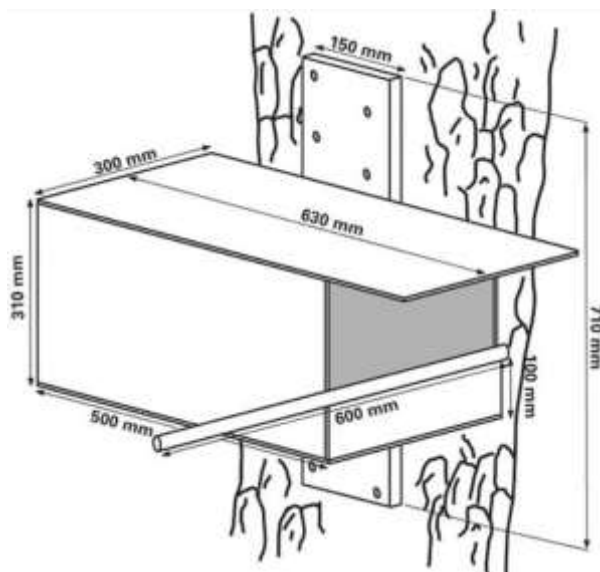
Figure 3: Bird Boxes



1B Schwegler Bird Box

The 1B nest box will attract a wide range of species and is available with different entrance hole sizes to prevent birds from competing with each other for the boxes. The nest box can be attached to the tree or wall using an aluminium nail or by hanging over a branch. The front panel is removable for inspection and cleaning.

The 32 mm entrance hole will attract great, blue, marsh, coal and crested tit, redstart, nuthatch, collared and pied flycatcher, wryneck, tree and house sparrow.



Kestrel Bird Nest Box

RSPB nestbox¹⁴ design can be fixed either to trees, poles or buildings in undisturbed locations close to grassland and with good visibility.

¹⁴ <https://www.rspb.org.uk/birds-and-wildlife/advice/how-you-can-help-birds/nestboxes/nestboxes-for-owls-and-kestrels/kestrel-nestboxes/>

Figure 4 – Mammal Gate Specification



Small mammal gate openings (of approximately 250 mm wide) will be installed in the perimeter fence to enable badger and other mammals (e.g. hedgehog and brown hare) to retain their current resources once the Development is operational. Up to fourteen mammal gates will be installed within areas of known mammal activity which are shown on Figure 1, Appendix A. The above image shows a mammal gate (circled) which has been constructed within a Solar Farm¹⁵.

¹⁵ Mammal gate Image. Solar farm at Yelverton, Lightsource Renewable Energy Ltd. Available from: <https://www.geograph.org.uk/photo/4538154> [Accessed: 29.03.2021]

Appendix B – Hedgerow, Hedgerow Tree and Woodland Planting

Choosing Species

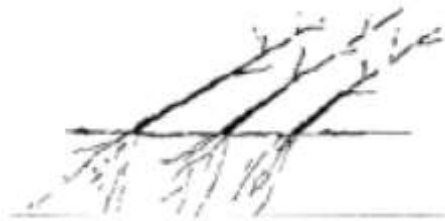
Tree and hedgerow planting should be composed of species characteristic of the locality and the community that is most abundant for example W8¹⁶ *Fraxinus excelsior* – *Acer campestre* – *Mercurialis perennis* woodland is common to this locality and comprises species such as Ash, Hazel and Field Maple. Climate, altitude and geology should always be considered when choosing plant species for planting. If the hedgerow is a boundary for grazing land, damage can be prevented by planting a dominance of thorny species e.g. blackthorn (*Prunus spinosa*), dog rose (*Rosa canina*) and field rose (*Rosa arvensis*). Choice in species composition can also be decided upon by identifying local, rare invertebrates or mammals within the area, via county conservation groups and biological record centres, and planting their food or egg-laying plant e.g. brown hairstreak butterfly lays eggs on blackthorn.

Useful fact: Holly (Ilex aquifolium) and dogwood (Cornus sanguinea) grow well in shade and, therefore, are good to plant next to hedgerow trees.

Buying Hedgerow Stock

Buy plants grown from indigenous, preferably local seeds or root stocks, in order to prevent erosion of the genetic integrity of our native species. Also, indigenous species are more likely to establish successfully.

Bare root whips (plants up to 80cm tall) will establish better than large plants. It is important that the roots of the whips are protected at all times; to ensure this, keep them in plastic bags until the moment of planting. If the whips cannot be planted immediately, temporarily heel them in as quickly as possible (see picture below).



Preparing the site

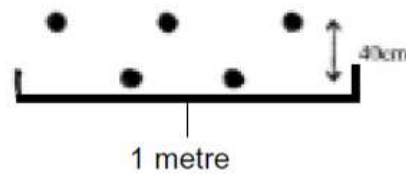
Dig over your selected site, removing weeds and roots, where possible, and mix in well-rotted manure or other organic matter. If the soil is heavy clay, add some grit and sand to improve drainage further.

Planting the hedgerow

Plant between end of October to end of March when the weather is not freezing and ground is not waterlogged (preferably before January). If the soil is heavy clay it may be best to wait until beginning of March as heavy frost can cause frost heave and expose roots.

¹⁶ Joint Nature Conservation Committee, 2004, *National Vegetation Classification: Field guide to woodland*

Plant a double staggered row hedge, at a width of at least 40cm between each row, with 4 to 6 plants to be planted per metre (see diagram below).



Randomly plant the less numerous species first and fill in the gaps with the main species. Optimally, plant the hedgerow tree species, at whips of 0.8 to 1.5 metres tall, at the same time as the hedgerow plants. It is advised that the hedgerow trees are brightly labelled to reduce the likelihood of them being cut during flailing. Apply mulch immediately after planting. All plants to be supplied bare root and will be protected with 0.6 m high plastic spiral guards supported by bamboo canes.

If rabbits or hares are a problem, erect rabbit guards. For protection from larger mammals, stock fencing and/or netting are optimal, with stock fencing erected in order to allow the hedgerow to grow at least 1.5 m wide.

Hedge Tree Planting and Management

Hedgerow trees should be planted within new and existing hedges as marked on the LMP. Trees should be planted as informal linear groups, with each group containing 3-9 plants spaced at 10-20 m intervals. Trees will include the mix outlined in the table below and should be planted as light standard trees (6-8 cm girth; 2.5-3.0 m high; rootballed) with timber stake supports and protected with 0.6 m high plastic spiral guards. New trees should be avoided during hedge trimming.

New Hedgerow Management

During the first 2 to 3 years of a hedgerow being planted, it should be cut annually to ensure the development of bushy growth low down in the hedge. Dead plants should also be replaced in autumn, over the first few years.

After the first 2 to 3 years it is optimal to cut on a two or (preferably) a three year cycle, as most tree or shrub flowers are produced on year old twigs, which annual cutting removes, resulting in no flowers, berries or nuts being produced.

It is best to cut in January or February and if this is not feasible, cut as late as possible in autumn. The bird breeding season from 1st March to 31st July should always be avoided.

Where viable, different wildlife likes different sizes and shapes of hedge, so create a variety, though favouring large, dense, infrequently cut hedges.

It is advised that to ensure losses are minimised hedgerows are watered where required in the first summer and weeds controlled by spreading a layer of mulch.

When cutting a hedgerow in rotation, allow the height of the trim to increase a little each time (e.g. 10 cm). If a hedgerow is cut back at the same height repeatedly, after some years a hard knuckle will start to form.

It is important to note that cutting on a 2-3 year cycle can result in faster growing species, such as willow (*Salix sp.*) and ash (*Fraxinus excelsior*), to consist of thicker shoots than is recommended for an average flail. Therefore, more powerful cutting heads may be required e.g. a shaping saw or flails suitable for cutting greater than 38mm thick shoots.

At Year 5 of operation, it is anticipated that the hedgerows will have reached a height of between 2.3 m and 2.5 m assuming a conservative growth rate of 0.3 m each year. Thereafter, they will be maintained at a height of approximately 3 m.

Existing Hedgerow Management

In addition to new hedge planting, existing hedgerows within and on the Site boundaries will be managed to a minimum height of approximately 3.0 m in order to screen the solar panels in views from the immediate surrounding area. Any gaps within existing hedgerows will also be planted using species selected from the mix identified in Table 3 below.

Hedgerow Species Mix

Table 3 outlines the species mix and proposed planting percentage for new hedgerow:

Table 3: New Hedgerow Proposed Species Mix

Common name	Latin name	% mix	Size of plants when planted
Blackthorn	<i>Prunus spinosa</i>	50	0.8 m–1.5 m
Oak	<i>Quercus robur</i>	15	0.8 m–1.5 m
Hazel	<i>Corylus avellana</i>	10	0.8 m–1.5 m
Field Maple	<i>Acer campestre</i>	5	0.8 m–1.5 m
Elder	<i>Sambucus nigra</i>	2.5	0.8 m–1.5 m
Bramble	<i>Rubus fruticosus</i>	2.5	0.8 m–1.5 m
Holly	<i>Ilex aquifolium</i>	2.5	0.8 m–1.5 m
Ivy	<i>Hedera helix</i>	2.5	0.8 m–1.5 m
Ash	<i>Fraxinus excelsior</i>	5	0.8 m–1.5 m

Hedgerow Margins (Countryside Hedgerows)

Ideally hedgerow margins should be at least 2 m in length and no less than 1 m wide. Optimally the management of a margin should be cut in two halves; whereby the closest half to the hedgerow is allowed to grow tussocky, by cutting once every few years, and the other half should be cut annually, after mid-July. This will provide a soft ecotone between the hedgerow and the grassland habitats, and provide cover for wildlife.

Prevent weed growth of the ground flora margin by excluding fertilisers and sowing an appropriate seed mix, which is suited to the site's climate, altitude and geology.

Optimally, create an arable field margin which meets the NERC Act, 2006 Priority Habitat criteria.

Table 4 outlines options for hedgerow wildflowers that can be sown alongside new hedgerow.

Table 4: Hedgerow Wildflower Options

Common Name	Latin Name
Yarrow	<i>Achillea millefolium</i>
Wild basil	<i>Clinopodium vulgare</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Common Knapweed	<i>Centaurea nigra</i>
Lesser celendine	<i>Ficaria verna</i>
Red dead nettle	<i>Lamium purpureum</i>
White dead nettle	<i>Lamium album</i>

Common Name	Latin Name
Hedge Bedstraw	<i>Galium album</i>)
Wood Avens	<i>Geum urbanum</i>
Perforate St John's Wort	<i>Hypericum perforatum</i>
Oxeye Daisy	<i>Leucanthemum vulgare</i>
Ribwort Plantain	<i>Plantago lanceolata</i>
Cowslip	<i>Primula veris</i>
Selfheal	<i>Prunella vulgaris</i>
Red Campion	<i>Silene dioica</i>
Hedge Woundwort	<i>Stachys sylvatica</i>

New Woodland Planting

There are areas of native species woodland proposed to the eastern boundary of the Site and a small group to the central western boundary (see Appendix A Landscape Mitigation Plan for location). Woodland species should be planted at 2.0 m centres as informal groups, with each group containing 5-50 plants of the same species. The proposed species mix, size and number of plants is shown in Table 5 below. All plants will be supplied bare root and will be protected with 0.6 m high plastic spiral guards supported by bamboo canes.

At Year 5 of operation, it is anticipated that woodland planting should reach heights of between 1-5 m. At Year 10, woodland planting will have reached heights of between 2 and 7 m.

Table 5: Proposed New Woodland Species Mix

Common name	Latin name	% mix	Size of plants when planted (cm)
Ash	<i>Fraxinus excelsior</i>	5	125-150
Field Maple	<i>Acer campestre</i>	5	125-150
Honeysuckle	<i>Lonicera perclymenum</i>	10	40-60
Hawthorn	<i>Crataegus monogyna</i>	25	125-150
Blackthorn	<i>Prunus spinosa</i>	30	100-125
Hazel	<i>Corylus avellana</i>	15	100-125
Holly	<i>Ilex aquifolium</i>	5	40-60
Sycamore	<i>Acer pseudoplatanus</i>	5	100-125

New Woodland Management

To ensure a reasonable level of establishment, newly planted areas of the Site should be monitored and maintained for a period of 10 years following completion of planting works associated with each stage of work. This should be followed by a long-term management plan for the lifespan of the Development as outline in Section 6 of this document.

Trees and shrubs should be monitored for any deadwood and crossing branches, and should be pruned accordingly to encourage healthy, strong growth.

Trees with clear stems should be maintained as such with any lower branches removed as required.

Tree stakes and guards should be inspected twice yearly to ensure they are secure and in place and ties should be adjusted as required to allow for growth. The contractor should ensure that the protective guards do not impede the natural growth of the plant.

Plant guards and stakes should be removed and responsibly disposed of away from site once the plant has fully established or at the end of the fifth growing season, whichever is sooner.

A depth of 75 mm of coarse bark mulch should be maintained at the base of each newly planted tree or shrub. This should be topped up on an annual basis or as required.

Should any trees or shrubs planted as part of the landscape scheme, within a period of five years after planting, be removed, die or become seriously damaged or diseased, they are to be replaced in the first available planting season with specimens of the same species and size as those originally planted. All proposed tree planting works should be implemented in the first available planting season (October-March) following the completion of the Development works.

Appendix C – Wildflower Grassland Management Plan

Background

The Development will result in the permanent loss of a very small amount of semi-improved / improved grassland due to the construction of a substation, tracks, pilings and other permanent ground works. However, it is likely that the majority of the grassland beneath and between the solar panels, as well as grassland beyond the solar panel footprint, will be retained and improved for wildlife.

The retention and improvement of grassland will be achieved through controlled management aimed at improving the sward structure by sowing wildflower seeds into it and by improving biodiversity through proposed grassland enhancement prescriptions. This change in use is likely to result in the development of a grassland habitat of greater species diversity and greater value to wildlife.

Within the proposed 10 m buffer zone, semi-natural habitat such as wildflower and shaded grassland habitat between the Development's proposed fence line and Site boundary should be allowed to develop; strips of wildflower planting are shown on Figure 1, Appendix A.

Ground Preparation

Ground preparation prior to solar panel installation is necessary to establish a clean seed bed into which a grass seed mix can be sown. It is assumed that large-scale, mechanical ground preparation will not be as practicable once the solar arrays are installed.

The site will be sprayed with herbicide and cultivated to a depth of >100 mm during late summer. Repeated treatments may be necessary to exhaust weeds (perennial weeds such as docks or thistles). The surface shall be raked/harrowed smooth to a fine, firm tilth creating around 50% bare soil, after which a repeated application of herbicide may be required. Soil testing may be undertaken, at the discretion of the appointed contractor/ecologist, following ground preparation to determine other preparatory and management requirements.

Construction

Grassland will be established by directly sowing a wildflower seed mix into the prepared ground. The following measures will take place as part of, or immediately after, construction.

Construction activities have the potential to disturb the seed bed and so it may be necessary to repeat the pre-construction ground preparation to establish a suitable seed bed. Similarly, if the seedbed lies dormant following construction but before autumn sowing, then further ground preparation may be required.

Timing

Autumn (August to mid-September) sowing is preferred because this favours species that germinate in autumn and species that require a period of cold to break their dormancy before they germinate in spring. Sowing must take place when conditions are warm and moist, and so winter and drought periods must be avoided.

Seed mix

The seed mix will be selected based on the results of the soil testing, however, at this stage it is envisaged that Emorsgate *EM3 – Special General Purpose Meadow Mixture*¹⁷ will be suitable. The mix is diverse and is suitable for sites where soil conditions vary across a site or where soil and site characteristics have not been established before sowing.

¹⁷ <https://wildseed.co.uk/mixtures/view/4>

Table 6: Proposed Grassland Mix outside of Fenceline

%	Scientific name	Common name
Emorsgate EM3 – Special General Purpose Meadow Mixture		
Wildflowers		
0.5	<i>Achillea millefolium</i>	Yarrow
2.4	<i>Centaurea nigra</i>	Common Knapweed
1	<i>Centaurea scabiosa</i>	Greater Knapweed
0.6	<i>Daucus carota</i>	Wild carrot
0.6	<i>Filipendula ulmaria</i>	Meadowsweet
0.8	<i>Galium verum</i>	Lady's Bedstraw
1.5	<i>Knautia arvensis</i>	Field Scabious
0.3	<i>Leontodon hispidus</i>	Rough hawkbit
1	<i>Leucanthemum vulgare</i>	Oxeye daisy
1	<i>Lotus corniculatus</i>	Bird's-foot trefoil
0.1	<i>Origanum vulgare</i>	Wild Maroram
1	<i>Plantago lanceolata</i>	Ribwort Plantain
0.5	<i>Plantago media</i>	Hoary plantain
1.8	<i>Poterium sanguisorba</i>	Salad burnet
0.5	<i>Primula veris</i>	Cowslip
1	<i>Ranunculus acris</i>	Yellow rattle
0.6	<i>Rumex acetosa</i>	Common sorrel
1	<i>Silene dioica</i>	Red campion
0.2	<i>Silene flos-cuculi</i>	Ragged robin
1	<i>Silene vulgaris</i>	Bladder campion
0.1	<i>Trifolium pratense</i>	Wild red clover
0.5	<i>Vicia cracca</i>	Tufted vetch
Grasses		
8	<i>Agrostis capillaris</i>	Common bent
40	<i>Cynosurus cristatus</i>	Crested dog's-tail
28	<i>Festuca rubra</i>	Slender-creeping red-fescue
4	<i>Phleum bertoloni</i>	Smaller cat's-tail

Sowing

The seed mix will be sown at a rate of 15 kg/ha (1.5 g/m²). The seed must be surface sown and can be applied by machine or by hand. Once sown, the seed should be lightly pressed into the seedbed by rolling or treading.

Monitoring

An ecologist will visit the site before seed is sown to check that ground conditions are suitable and following seed sowing to check that seed has been sown correctly. Remedial actions will be communicated to the Operator at the earliest opportunity.

After Care: First Year Management**Weed Control**

A flush of weeds is to be expected in the first season after sowing and these can be managed by a short period of intensive grazing (see below). It is likely that some pernicious weeds will persist following the ground preparation and can be treated by hand pulling or spot treatment with herbicides.

Mowing

Once the wildflower seeds have been sowed, the grassland sward height needs to be managed through a meadow cut. To achieve this, and dependent on the vigour of the grassland sward growth, a late summer cut of the wildflower grassland areas will need to take place, with the arisings topped at circa 100 mm to allow developing flowering plants beneath this height to be able to grow through and flower and seed later in the growth season. The option of an earlier late spring/summer cut needs to be considered, should the sward growth be particularly vigorous earlier in the growth season. A cut in late September is recommended to ensure the wildflower grassland maximises benefits for pollinator species. It is recommended that arisings are taken away for baling, as feed or for composting.

For the purposes of this plan it is assumed that wildflower grassland will be managed by mowing as a preference rather than grazing. Further detail on sheep grazing of other grassland areas are described in Appendix D.

Monitoring

An ecologist will visit the site in spring (May) and summer (July/August) Y1 to check the establishment of seed mix and weeds. Remedial actions will be communicated to the Operator at the earliest opportunity.

Management Once Established

Assuming that the seed mix has established successfully after Y1, an ecologist will visit the site in late-spring (May) in years 2, 3 and 5 – a critical period for grassland establishment – to assess the success of wildflower management.

After 5 years, the wildflower grassland will continue to be maintained as per requirements described above.

Appendix D - Sheep Grazing



Sheep grazing is the ideal choice for solar farms, being generally small enough to pass beneath the rows of panels. The sheep will be moved on a rotational basis within sections of the Site during March to September to give the sown species an opportunity to flower and set seed at different times during the extent of the botanical growing season. This approach will provide a practical balance between reducing the impact of shading on solar panels and providing biodiversity benefits. This ensures the safeguarding of ground-nesting birds and any reptiles that may have dispersed into these areas. The timings and stocking densities will need to be reviewed dependent on prevailing conditions, with advice sought from a suitably qualified ecologist in consultation with a contractor. The grassland underneath and between the solar panels will be grazed year-round at a low density (3-5 sheep/ha) to manage the flush of annuals, but grazing will not commence until a sward is established. It may be necessary to increase stocking density at certain periods for pulse grazing (e.g. in late summer) to control vigorous flushes of annuals before they die back, set seed and collapse in order to reveal the developing wildflower mixture and give it the space it needs to develop. Patches of pernicious weeds that remain ungrazed will be mechanically controlled through spot maintenance.

**Appendix E - Habitat Conditions Assessments Sheets 6, 8 & 24 – Biodiversity
Metric 3.0**

Condition Assessment Sheet 6 – Grassland (Medium, High and Very High Distinctiveness)

Condition Sheet: GRASSLAND Habitat Type (medium, high & very high distinctiveness)	
UKHab Habitat Type(s)	
Grassland - Lowland calcareous grassland Grassland - Lowland dry acid grassland Grassland - Lowland meadows Grassland - Other lowland acid grassland Grassland - Other neutral grassland Grassland - Tall herb communities* Grassland - Upland acid grassland Grassland - Upland calcareous grassland Grassland - Upland hay meadows Sparsely vegetated land - Calaminarian grassland	
Habitat Description	
See UKHab * Note Tall herb habitat that does not meet the definition of Annex 1 habitat 'Tall herb communities (H6430)' should be recorded as "Other neutral grassland"	
Condition Assessment Criteria	
1	The appearance and composition of the vegetation closely matches characteristics of the specific grassland habitat type (see UKHab definition). Wildflowers, sedges and indicator species for the specific grassland habitat type are very clearly and easily visible throughout the sward.
2	Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20 per cent is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small mammals to live and breed.
3	Cover of bare ground between 1% and 5%, including localised areas, for example, rabbit warrens.
4	Cover of bracken less than 20% and cover of scrub (including bramble) less than 5%.
5	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981). Combined cover of undesirable species ¹ and physical damage (such as excessive poaching, damage from machinery use or storage, damaging levels of access, or any other damaging management activities) accounts for less than 5% of total area.
Condition Assessment Result	
Passes 5 of 5 criteria	
Passes 3 or 4 of 5 criteria	
Passes 0, 1 or 2 of 5 criteria	
Condition Assessment Score	
Good (3)	
Moderate (2)	
Poor (1)	
Notes	
Footnote 1 - Species considered undesirable for this habitat type include: Creeping thistle <i>Cirsium arvense</i> , spear thistle <i>Cirsium vulgare</i> , curled dock <i>Rumex crispus</i> , broad-leaved dock <i>Rumex obtusifolius</i> , common nettle <i>Urtica dioica</i> , creeping buttercup <i>Ranunculus repens</i> , greater plantain <i>Plantago major</i> , white clover <i>Trifolium repens</i> , cow parsley <i>Anthriscus sylvestris</i> .	

Condition Assessment Sheet 8 – Hedgerows

UKHab Habitat Type	
Native hedgerow Native hedgerow - associated with bank or ditch Native hedgerow with trees Native hedgerow with trees - associated with bank or ditch Native species rich hedgerow Native species rich hedgerow - associated with bank or ditch Native species rich hedgerow with trees Native species rich hedgerow with trees - associated with bank or ditch	
Habitat	Description
See Chapter 8 of User Guide	
Condition Assessment Criteria	

A series of ten attributes, representing key physical characteristics, are used for this assessment. The attributes, and the minimum criteria for achieving a favourable condition in each, are defined. The attributes use similar favourable condition criteria to the Hedgerow Survey Handbook and the handbook is the recommended source of reference for assessing individual hedgerow attributes.

Hedgerow favourable condition attributes		
Attributes and functional groupings (A, B, C, D & E)	Criteria (the minimum requirements for 'favourable condition'	Description
Core groups - applicable to all hedgerow types		
A1. Height	>1.5 m average along length	<p>The average height of woody growth estimated from base of stem to the top of shoots, excluding any bank beneath the hedgerow, any gaps or isolated trees.</p> <p>Newly laid or coppiced hedgerows are indicative of good management and pass this criterion for up to a maximum of four years (if undertaken according to good practice).</p> <p>A newly planted hedgerow does not pass this criterion (unless it is > 1.5 m height).</p>
A2. Width	>1.5 m average along length	<p>The average width of woody growth estimated at the widest point of the canopy, excluding gaps and isolated trees.</p> <p>Outgrowths (e.g. blackthorn suckers) are only included in the width estimate when they >0.5 m in height.</p> <p>Laid, coppiced, cut and newly planted hedgerows are indicative of good management and pass this criterion for up to a maximum of four years (if undertaken according to good practice⁴).</p>

B1.	Gap - hedge base	Gap between ground and base of canopy <0.5 m for >90% of length (unless 'line of trees')	This is the vertical gappiness of the woody component of the hedgerow, and its distance from the ground to the lowest leafy growth. Certain exceptions to this criterion are acceptable (see page 65 of the Hedgerow Survey Handbook).
B2.	Gap - hedge canopy continuity	<ul style="list-style-type: none"> · Gaps make up <10% of total length and · No canopy gaps >5 m 	This is the horizontal gappiness of the woody component of the hedgerow. Gaps are complete breaks in the woody canopy (no matter how small). Access points and gates contribute to the overall gappiness, but are not subject to the >5 m criterion (as this is the typical size of a gate).
C1.	Undisturbed ground and perennial vegetation	<p>>1 m width of undisturbed ground with perennial herbaceous vegetation for >90% of length:</p> <ul style="list-style-type: none"> · measured from outer edge of hedgerow, and · is present on one side of the hedge (at least) 	This is the horizontal gappiness of the woody component of the hedgerow. Gaps are complete breaks in the woody canopy (no matter how small). Access points and gates contribute to the overall gappiness, but are not subject to the >5 m criterion (as this is the typical size of a gate).
C2.	Undesirable perennial vegetation	Plant species indicative of nutrient enrichment of soils dominate <20% cover of the area of undisturbed ground	The indicator species used are nettles (<i>Urtica</i> spp.), cleavers (<i>Galium aparine</i>) and docks (<i>Rumex</i> spp.). Their presence, either singly or together, should not exceed the 20% cover threshold.
D1.	Invasive and neophyte species	>90% of the hedgerow and undisturbed ground is free of invasive non-native and neophyte species	Neophytes are plants that have naturalised in the UK since AD 1500. For information on neophytes see the JNCC website and for information on invasive non-native species see the GB Non-Native Secretariat website.
D2.	Current damage	>90% of the hedgerow or undisturbed ground is free of damage caused by human activities	This criterion addresses damaging activities that may have led to or lead to deterioration in other attributes. This could include evidence of pollution, piles of manure or rubble, or inappropriate management practices (e.g. excessive hedge cutting).
Additional group - applicable to hedgerows with trees only			
E1.	Tree age	At least one mature tree per 30m stretch of hedgerow. A mature tree is one that is at least 2/3 expected fully mature height for the species.	This criterion addresses if there are sufficient mature trees (within the scope of planning timescales) which are of higher value to biodiversity.
E2.	Tree health	At least 95% of hedgerow trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	This criterion identifies if the trees are subject to damage which compromises the survival and health of the individual specimens.

Each attribute is assigned to one of five functional groups (A – E), as indicated in Table TS1-2 and the condition of a hedgerow is assessed according to the number of attributes from these functional groups which pass or fail the ‘favourable condition’ criteria according to the approach set out in Table TS1-3.

The hedgerow condition assessment generates a weighting (score) ranging from 1-3, which is used within the biodiversity metric 3.0. The scores for each are set out in tables TS1-3 and TS1-4 below.

TABLE TS1-3: Hedgerow condition assessment and weighting

Condition categories for hedgerows without trees		
Category	Maximum number of attributes that can fail to meet ‘favourable condition’ criteria in Table TS1-2	Weighting (score)
Good	No more than 2 failures in total; AND No more than 1 in any functional group.	3
Moderate	No more than 4 failures in total; AND <u>Does not fail both attributes</u> in more than one functional group (e.g. fails attributes A1, A2, B1 & C2 = Moderate condition).	2
Poor	Fails a total of more than 4 attributes; OR <u>Fails both attributes</u> in more than one functional group (e.g. fails attributes A1, A2, B1 & B2 = Poor condition).	1
Condition categories for hedgerows with trees		
Category	Maximum number of attributes that can fail to meet ‘favourable condition’ criteria in Table TS1-2	Weighting (score)
Good	No more than 2 failures in total; AND No more than 1 failure in any functional group.	3
Moderate	No more than 5 failures in total; AND <u>Does not fail both attributes</u> in more than one functional group (e.g. fails attributes A1, A2, B1, C2 & E1 = Moderate condition).	2

Poor	Fails a total of more than 5 attributes; OR Fails both attributes in more than one functional group (e.g. fails attributes A1, A2, B1 & B2 = Poor condition).	1
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UKHab Habitat Type

Native hedgerow

Native hedgerow - associated with bank or ditch

Native hedgerow with trees

Native hedgerow with trees - associated with bank or ditch

Native species rich hedgerow

Native species rich hedgerow - associated with bank or ditch

Native species rich hedgerow with trees

Native species rich hedgerow with trees - associated with bank or ditch

Habitat Description

See Chapter 8 of User Guide

Condition Assessment Criteria

A series of ten attributes, representing key physical characteristics, are used for this assessment. The attributes, and the minimum criteria for achieving a favourable condition in each, are defined. The attributes use similar favourable condition criteria to the Hedgerow Survey Handbook and the handbook is the recommended source of reference for assessing individual hedgerow attributes.

Hedgerow favourable condition attributes		
Attributes and functional groupings (A, B, C, D & E)	Criteria (the minimum requirements for 'favourable condition')	Description
Core groups - applicable to all hedgerow types		
A1. Height	>1.5 m average along length	<p>The average height of woody growth estimated from base of stem to the top of shoots, excluding any bank beneath the hedgerow, any gaps or isolated trees.</p> <p>Newly laid or coppiced hedgerows are indicative of good management and pass this criterion for up to a maximum of four years (if undertaken according to good practice).</p> <p>A newly planted hedgerow does not pass this criterion (unless it is > 1.5 m height).</p>
A2. Width	>1.5 m average along length	<p>The average width of woody growth estimated at the widest point of the canopy, excluding gaps and isolated trees.</p> <p>Outgrowths (e.g. blackthorn suckers) are only included in the width estimate when they >0.5 m in height.</p> <p>Laid, coppiced, cut and newly planted hedgerows are indicative of good management and pass this criterion for up to a maximum of four years (if undertaken according to good practice⁴).</p>
B1. Gap - hedge base	Gap between ground and base of canopy <0.5 m for >90% of length (unless 'line of trees')	<p>This is the vertical gappiness of the woody component of the hedgerow, and its distance from the ground to the lowest leafy growth.</p> <p>Certain exceptions to this criterion are acceptable (see page 65 of the Hedgerow Survey Handbook).</p>

B2.	Gap - hedge canopy continuity	<ul style="list-style-type: none"> · Gaps make up <10% of total length and · No canopy gaps >5 m 	<p>This is the horizontal gappiness of the woody component of the hedgerow. Gaps are complete breaks in the woody canopy (no matter how small).</p> <p>Access points and gates contribute to the overall gappiness, but are not subject to the >5 m criterion (as this is the typical size of a gate).</p>
C1.	Undisturbed ground and perennial vegetation	<p>>1 m width of undisturbed ground with perennial herbaceous vegetation for >90% of length:</p> <ul style="list-style-type: none"> · measured from outer edge of hedgerow, and · is present on one side of the hedge (at least) 	<p>This is the horizontal gappiness of the woody component of the hedgerow. Gaps are complete breaks in the woody canopy (no matter how small).</p> <p>Access points and gates contribute to the overall gappiness, but are not subject to the >5 m criterion (as this is the typical size of a gate).</p>
C2.	Undesirable perennial vegetation	Plant species indicative of nutrient enrichment of soils dominate <20% cover of the area of undisturbed ground	The indicator species used are nettles (<i>Urtica</i> spp.), cleavers (<i>Galium aparine</i>) and docks (<i>Rumex</i> spp.). Their presence, either singly or together, should not exceed the 20% cover threshold.
D1.	Invasive and neophyte species	>90% of the hedgerow and undisturbed ground is free of invasive non-native and neophyte species	Neophytes are plants that have naturalised in the UK since AD 1500. For information on neophytes see the JNCC website and for information on invasive non-native species see the GB Non-Native Secretariat website.
D2.	Current damage	>90% of the hedgerow or undisturbed ground is free of damage caused by human activities	<p>This criterion addresses damaging activities that may have led to or lead to deterioration in other attributes.</p> <p>This could include evidence of pollution, piles of manure or rubble, or inappropriate management practices (e.g. excessive hedge cutting).</p>
Additional group - applicable to hedgerows with trees only			
E1.	Tree age	At least one mature tree per 30m stretch of hedgerow. A mature tree is one that is at least 2/3 expected fully mature height for the species.	This criterion addresses if there are sufficient mature trees (within the scope of planning timescales) which are of higher value to biodiversity.

E2.	Tree health	At least 95% of hedgerow trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	This criterion identifies if the trees are subject to damage which compromises the survival and health of the individual specimens.
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Each attribute is assigned to one of five functional groups (A – E), as indicated in Table TS1-2 and the condition of a hedgerow is assessed according to the number of attributes from these functional groups which pass or fail the ‘favourable condition’ criteria according to the approach set out in Table TS1-3.

The hedgerow condition assessment generates a weighting (score) ranging from 1-3, which is used within the biodiversity metric 3.0. The scores for each are set out in tables TS1-3 and TS1-4 below.

TABLE TS1-3: Hedgerow condition assessment and weighting

Condition categories for hedgerows without trees		
Category	Maximum number of attributes that can fail to meet ‘favourable condition’ criteria in Table TS1-2	Weighting (score)
Good	No more than 2 failures in total; AND No more than 1 in any functional group.	3
Moderate	No more than 4 failures in total; AND <u>Does not fail both attributes in more than one functional group</u> (e.g. fails attributes A1, A2, B1 & C2 = Moderate condition).	2

Poor	<p>Fails a total of more than 4 attributes; OR</p> <p><u>Fails both attributes</u> in more than one functional group (e.g. fails attributes A1, A2, B1 & B2 = Poor condition).</p>	1
Condition categories for hedgerows with trees		
Category	Maximum number of attributes that can fail to meet 'favourable condition' criteria in Table TS1-2	Weighting (score)
Good	<p>No more than 2 failures in total; AND</p> <p>No more than 1 failure in any functional group.</p>	3
Moderate	<p>No more than 5 failures in total; AND</p> <p><u>Does not fail both attributes</u> in more than one functional group (e.g. fails attributes A1, A2, B1, C2 & E1 = Moderate condition).</p>	2
Poor	<p>Fails a total of more than 5 attributes; OR</p> <p><u>Fails both attributes</u> in more than one functional group (e.g. fails attributes A1, A2, B1 & B2 = Poor condition).</p>	1

Condition Assessment Sheet 24 – Woodland (Medium, High and Very High Distinctiveness)

Condition Sheet: WOODLAND Habitat Type					
UKHab Habitat Type(s)					
<p>Woodland and forest - Lowland beech and yew woodland Woodland and forest - Lowland mixed deciduous woodland Woodland and forest - Native pine woodlands Woodland and forest - Other coniferous woodland Woodland and forest - Other Scot's pine woodland Woodland and forest - Other woodland; broadleaved Woodland and forest - Other woodland; mixed Woodland and forest - Upland birchwoods Woodland and forest - Upland mixed ashwoods Woodland and forest - Upland oakwood Woodland and forest - Wet woodland</p>					
Habitat Description					
<p>See UKHab</p> <p>This condition sheet is based on the England Woodland Biodiversity Group (EWBG) Woodland Condition Survey Method, available here: https://woodlandwildlifetoolkit.sylva.org.uk/assess</p>					
Condition Assessment Criteria					
	Indicator	Good (3 points)	Moderate (2 points)	Poor (1 point)	Score per indicator
1	Age distribution of trees ¹	Three age classes present	Two age classes present	One age class present	
2	Wild, domestic and feral herbivore damage	No significant browsing damage evident in woodland ²	Evidence of significant browsing pressure is present in 40% or less of whole woodland	Evidence of significant browsing pressure is present in 40% or more of whole woodland	
3	Invasive plant species ³	No invasive species present in woodland	Rhododendron or laurel not present, other invasive species < 10% cover	Rhododendron or laurel present, or other invasive species > 10% cover	
4	Number of native tree species	Five or more native tree or shrub species found across woodland parcel	Three to four native tree or shrub species found across woodland parcel	None to two native tree or shrub species across woodland parcel	
5	Cover of native tree and shrub species	> 80% of canopy trees and >80% of understory shrubs are native	50-80% of canopy trees and 50-80% of understory shrubs are native	< 50% of canopy trees and <50% of understory shrubs are native	

6	Open space within woodland⁴	10 – 20% of woodland has areas of temporary open space, unless woodland is <10ha in which case lower threshold of 10% does not apply	21- 40% of woodland has areas of temporary open space	More than 40% of woodland has areas of temporary open space	
7	Woodland regeneration⁵	All three classes present in woodland; trees 4-7cm dbh, saplings and seedlings or advanced coppice regrowth	One or two classes only present in woodland	No classes or coppice regrowth present in woodland	
8	Tree health	Tree mortality less than 10%, no pests or diseases and no crown dieback	11% to 25% mortality and/or crown dieback or low risk pest or disease present	Greater than 25% tree mortality and or any high risk pest or disease present	
9	Vegetation and ground flora	Ancient woodland flora indicators present	Recognisable NVC plant community present	No recognisable NVC community	
10	Woodland vertical structure⁶	Three or more storeys across all survey plots or a complex woodland	Two storeys across all survey plots	One or less storey across all survey plots	
11	Veteran trees⁷	Two or more veteran trees per hectare	One veteran tree per hectare	No veteran trees present in woodland	
12	Amount of deadwood	50% of all survey plots within the woodland parcel have standing deadwood, large dead branches/ stems and stumps	Between 25% and 50% of all survey plots within the woodland parcel have standing deadwood, large dead branches/ stems and stumps	Less than 25% of all survey plots within the woodland parcel have standing deadwood, large dead branches/ stems and stumps	
13	Woodland disturbance⁸	No nutrient enrichment or damaged ground evident	Less than 1 hectare in total of nutrient enrichment across woodland area and/or less than 20% of woodland area has damaged ground	More than 1 hectare of nutrient enrichment and/or more than 20% of woodland area has damaged ground	
Total score (out of a possible 39)					
Condition Assessment Result				Condition Assessment Score	
Total score >32 (33 to 39)				Good (3)	
Total score 26 to 32				Moderate (2)	
Total score <26 (13 to 25)				Poor (1)	

Notes

Footnote 1 - See EWBG method INDICATOR 1 for more information. If tree species is not a birch, cherry or Sorbus: 0 – 20 years (Young); 21 - 150 years (Intermediate); and >150 years (Old). A recognisable age class should be a consistent recognisable layer across the woodland or stand being assessed. Presence of a few saplings would not indicate that the woodland has an 'age class' of young trees.

Footnote 2 - See EWBG method INDICATOR 2 for more information. Browsing pressure is considered to be significant where >20% of vegetation visible within each survey plot shows damage from any type of browsing pressure listed.

Footnote 3 - See EWBG method INDICATOR 3 for more information. Check for presence of the following invasive non-native species: American skunk cabbage *Lysichiton americanus*; Himalayan balsam *Impatiens glandulifera*; Japanese knotweed *Fallopia japonica*; Cherry Laurel *Prunus laurocerasus*; Shallon *Gaultheria shallon*; Snowberry *Symphoricarpos albus*; Variegated yellow archangel *Lamiastrum galeobdolon subsp. argentatum*; and Rhododendron *Rhododendron ponticum*.

Footnote 4 - See EWBG method INDICATOR 6 for more information. Open space within woodland in this context is temporary open space in which trees can be expected to regenerate (e.g. glades, rides, footpaths, areas of clear-fell). This differs from permanent open space where tree regeneration is not possible or desirable (e.g. tarmac, buildings, rivers). Area is at least 10m wide with less than 20% covered by shrubs or trees.

Footnote 5 - See EWBG method INDICATOR 8 for more information. This indicator measures regeneration potential of the woodland by considering three classes: seedlings; saplings; and young trees of 4-7 cm DBH. All three classes would fall in the 'young' category of the 'age distribution of trees' indicator, the regeneration indicator is gathers additional information by considering regeneration potential i.e. if seedlings, saplings and young trees are all present that means natural regeneration processes are happening.

Footnote 6 - This indicator is looking at structural diversity and is useful to understand in conjunction with the age of trees in a woodland. Vertical structure is defined as the number of canopy storeys present. Possible storey values are: 1) Upper; 2) Complex: recorded when the stand is composed of multiple tree heights that cannot easily be stratified into broad height bands (such as upper, middle or lower); 3) Middle; 4) Lower; and 5) Shrub layer.

Footnote 7- See EWBG method INDICATOR 12 for more information. All ancient trees are veteran trees, but not all veteran trees are ancient. A veteran tree may not be very old, but it has decay features, such as branch death and hollowing. These features contribute to its biodiversity, cultural and heritage value. Veteran trees can be classified if they have four out of the five following features:

1. Rot sites associated with wounds which are decaying >400 cm²;
2. Holes and water pockets in the trunk and mature crown >5 cm diameter;
3. Dead branches or stems >15 cm diameter;
4. Any hollowing in the trunk or major limbs;
5. Fruit bodies of fungi known to cause wood decay.

Footnote 8 - See EWBG method INDICATOR 15 for more information. Examples of disturbance are: significant nutrient enrichment; soil compaction from trampling, machinery or animal poaching; litter.