FIELDS FARM SOLAR (PV) FARM

Landscape & Ecology Management Plan

November 2015

Compiled on behalf of:-
Solstice Renewables Ltd.

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EXECUTIVE SUMMARY

This *Landscape and Ecology Management Plan* (LEMP) has been prepared by EnvironGauge on behalf of Solstice Renewables Ltd. for the Fields Farm Solar PV Farm, situated on land situated south west of Cheadle - Nat Grid Ref: SJ 978 414 (centre of the site). It is submitted to Staffordshire Moorlands District Council as part of the planning application for the solar farm.

The LEMP relates to the delivery of landscape and ecological measures as part of the project, particularly in respect of 1) maintaining and enhancing site screening from the surroundings, and 2) optimising the biodiversity value of the site within the context of the location, existing conditions, and nature of the development.

In terms of site screening, the existing hedgerows will be retained and suitably managed. Similarly, all existing trees will be retained. Further to this, over 600m of new hedgerow habitat will be planted along the northern boundary and a south eastern boundary, whilst supplementary planting will be carried out along the hedges of the western boundary in order to enhance screening of the site.

Ecological enhancements will be achieved through a combination of habitat creation (including the hedgerows and species-rich grassland) and on-going management of the existing, and new habitats. The overall approach is for low intensity management of boundary habitats in particular which allows for the natural development and growth cycle of these to take place.

Species-rich grassland (meadow) will be established within the field through either or a combination of sowing a suitable native seed mix and applying 'green hay'. This will transform what has been intensively managed cultivated land into habitat of significantly greater biodiversity value. The aim for the ground between the perimeter fencing and the field boundaries is for a sward with a high wildflower content, and a grass component that is tussocky. An additional enhancement is the provision of barn owl and kestrel nest boxes

Low intensity management of the existing and new hedgerows will be introduced, reducing trimming to a three year cycle. This three year trimming cycle will similarly be applied to the new hedge planting, once established. The aim is to maintain the hedges at ~3m in height. Up to a maximum of 50% of the hedgerows will be cut in any one year.

The primary mechanism of long-term management of the meadow, i.e., within the solar PV fenced area will be late summer / winter /early spring sheep grazing. The sward will therefore have the opportunity to set seed over the summer. Topping may be necessary during the early establishment phase in order to reduce weed burden, and thereafter periodically post-flowering of the sward.

The rough tussocky grassland between the solar PV area perimeter fence and the field boundaries will be cut (no lower than 100mm) with cuttings collected and removed every 2-3 years, with the primary purpose being to prevent scrub encroachment. Up to a maximum of 33% will be cut in any given year. These areas of rough wildflower-rich grassland will increase the biodiversity potential of the site by providing additional foraging habitat resources and shelter for a range of local wildlife.

Annual monitoring of the habitats will be carried out by an Ecologist, or equivalent suitably qualified person for the first five years in order to ensure that the proposed measures are successful, or are adapted to ensure that positive outcomes are achieved.

Thereafter, the new habitats will be monitored once every five years. Further to this, annual surveys for over-wintering birds and breeding birds will be undertaken for the first five years, and thereafter once every five years. Monitoring results will seek to inform any further improvement opportunities. Any substantial change to the measures / methods outlined in this LEMP will be discussed and agreed with Staffordshire Moorlands District Council in advance of implementing the changes.

The LEMP includes management measures which are less intensive than has been practiced at the site, and will ensure that ecological enhancement occurs over the duration of the project (i.e., 25 years). The habitat creation and sympathetic management will increase habitat resources and provide significant new opportunities for local wildlife to benefit from.

1 INTRODUCTION

1.1 This *Landscape and Ecology Management Plan* (LEMP) has been prepared for Fields Farm Solar PV Farm, situated on land situated south west of Cheadle - Nat Grid Ref: SJ 978 414 (approximate centre of the site).

1.2 It has been kept focussed such that its implementation is straightforward and minimises the scope for interpretation. It does however, by necessity retain flexibility in order to address any unforeseen events which potentially may arise in the future and require adaption to. This ensures that it remains relevant in time.

1.3 The LEMP sets out the objectives, and related long-term management measures to achieve these objectives. The overarching aim is to ensure that the landscape and ecological features of value are retained, reinforced and managed in a manner which adds value to the site and location, and benefits local wildlife.

1.4 The LEMP therefore identifies the key constraints and opportunities relating to the location, site and development, and provides details of the measures and methods that will be adopted with respect to habitat retention, creation / enhancement, management and monitoring to enhance site screening and optimise biodiversity gains.

2 SITE DESCRIPTION

Baseline Context

2.1 Further to the settlements of Cheadle, Drycott in the Moors, and Frosbrook, the local landscape is predominantly agricultural, interspersed by blocks and belts of woodland and plantation to the north east of the site.

2.2 The local topography is comprised of gradually undulating land rising to the north and south of the site. Overall drainage is east, involving an open ditch to the west, which is culverted beneath the site and into the adjacent field to the east.

Site Description - Summary

2.3 The site encompasses the southern and eastern regions of single, irregularly shaped arable field and the associated field boundaries. It straddles the lower region of this field, which rises to the south and north.

2.4 Access into the site is be gained via the farm track (surfaced driveway) leading to the farm buildings. Thereafter a new, gravel track will lead into the site from the north east.

2.5 Existing habitats of the site (and immediate surroundings land) are described within the *Ecological Assessment* report[1], which was based upon a site survey in May 2015 – see Figure 1. Phase I Habitat map (Appendix I).

[1] EnvironGauge (2015). Fields Farm Solar (PV) Site, Near Cheadle, Staffordshire: Ecological Assessment. June 2015. Ref: EVG-15-012-EA

3 AIMS & OBJECTIVES

Aims

3.1 The primary aims of the LEMP are to:

- Maintain and enhance the existing screening of the site from the surroundings
- Guide management of the existing and proposed habitat and ecological features in order to significantly enhance the baseline biodiversity value over the duration of the project – 25 years

Objectives

3.2 There are three main objectives which seek to achieve the above aims. These are:

- Implement a low-intensity management regime for newly created and existing habitats
- Create new habitats by planting and ensuring the successful establishment of supplementary species-rich hedging, trees, and species-rich wildflower grassland (meadow), all of which require limited management intervention
- Carry out ecological monitoring to inform an adaptive management approach

3.3 With regards to site screening, the approach has been to retain all the existing hedgerows and trees which are already of screening value, and carry out supplementary planting of hedgerows and trees. As the new planting develops it will further improve the screening provided by the existing hedgerows and trees, as well as adding landscape value.

3.4 In so far as biodiversity gain is concerned, the overarching approach is to create a set of conditions through initial planting and sowing which are conducive to supporting a range of micro-habitats and associated species that then establish through a combination of natural process of colonisation, and sympathetic, low intensity habitat management. In this respect, the project site will be of significantly greater biodiversity potential than allowed for by the intensive farming (arable mono-culture) which preceded it.

3.5 Habitats will be monitored to ensure that any potentially undesirable trends (such as colonisation by common invasive weed species) are identified and appropriately addressed at an early stage and in an adaptive manner such that habitat development remains aligned with the aims of the LEMP.

3.6 The scope and means of achieving these objectives is presented in the following sections.

4 IMPROVEMENTS

4.1 The main wildlife related improvements associated with the project are habitat creation and management to enhance biodiversity value. This includes:

- Strengthen the connectivity of field boundary habitats though new hedge creation and supplementary planting
- Maintain the low intensity management of the existing hedgerows which are already subjected to infrequent management
- Implement a low intensity management regime to new hedging and existing heavily flailed hedges to encourage flowering and fruiting
- Introduce additional standard trees
- Convert intensively managed land into a long-term grassland
- Establish a species-rich sward, and differentially manage this within and outwith the fenced solar PV area
- Utilise a combination of management methods, including sheep grazing within the solar PV area and periodic topping if necessary
- Encourage the development of habitat mosaic and diversity by allowing rough tussocky grassland to develop outwith the fenced solar PV area

4.2 The solar farm lends itself to the establishment of a permanent species diverse grassland sward – i.e., a meadow. This habitat presents a low risk of interfering with light reaching the solar panels, and can be managed in an extensive rather than intensive manner. The areas of grassland (existing and new) between the fenced solar PV area and the field hedgerows will be infrequently managed so as to increase habitat and structural diversity. The new trees will be left to develop and mature without management.

4.3 The creation of species-rich hedgerows; wildflower grassland (lowland meadow); expanding field margins; in addition to introducing suitable management regimes for these new habitats and the existing related habitats (including the field ponds) is aligned with, and seeks to contribute towards the objectives of the *Staffordshire Biodiversity Action Plan* SBAP (1998, and subsequent editions).

4.4 The 3rd edition concentrates on a landscape level, or ecosystems approach, with the aim of focussing conservation efforts on the areas within the county that will

result in optimum benefit for ecological networks, habitats and species and allow for greater resilience to climate change. It identifies 14 '*Ecosystem Action Plans*' (EAPs) and one Rivers Action Plan. The project site is located with the 'Central Farmland' EAP, which is described as:

> "largely made up of settled or ancient clay farmlands where mixed arable and pastoral farming practices vary from low intensity, still retaining an intact ancient pattern of hedgerows and hedgerow trees, to intensively farmed arable and improved pasture where hedgerows are in decline."
>
> and
>
> "Much of this area is heavily influenced by rivers, tributaries and washlands. It has a high density of field ponds and has numerous small stream corridors along which broadleaved woodlands occur."

4.5 The EAP indicates that, since 1945 arable farming has become more intensive, creating large areas of single crops that are of low habitat value for wildlife. Therein lies the opportunity for reduced management intensity, combined with habitat creation so as to improve conditions for local wildlife and result in biodiversity improvement.

4.6 Hedgerow and Arable Field Margins are identified as Priority BAP Habitats within this EAP. The EAP management aims for hedgerows include retaining the existing network; restoring defunct and former hedgerows, and achieve a net increase in the length of hedgerow habitat. The EAP aims for arable field margins are expand these areas to include cultivated low-input field margins, wild bird seed, flower-rich field margins and permanent grass margins.

4.7 Lowland Meadow is identified as BAP habitat within the EAP. In addition to retaining and restoring lowland meadows, the management aims of this BAP habitat type includes the creation of lowland meadows from arable or improved grassland (preferably > 2 ha).

4.8 The 'Make a Meadow' scheme, which Staffordshire Wildlife Trust is involved in, is aligned with this. This scheme seeks to promote the creation of species-rich

native wildflower meadows. This habitat type is of conservation interest and which has in recent decades been adversely affected (significant reduction in extent) by modern agricultural practices. The main advocated method of establishing such grassland is by way of strewing 'green hay' (in preference to the alternative of sowing species-rich grass mixes, albeit this latter approach may be the only option in certain circumstances).

4.9 The project site is dominated by arable acreage, and therein lies the opportunity for creation of meadows so as to improve conditions for local wildlife and result in biodiversity improvement in accordance with aims of the LBAP and the 'Make a Meadow' initiative. Opportunities also exist in relation to hedgerows, field margins and management of neighbouring ponds.

4.10 An addition enhancement measure will be the provision (and annual inspection & maintenance) of barn owl and kestrel nest boxes – two nest boxes for each species.

5 BIODIVERSITY VALUE OF EXISTING & PLANNED HABITATS

5.1 This section outlines the biodiversity value of the existing habitats that will be retained and continue to mature, and proposed habitats that will become established at the site.

Hedgerows & Trees

5.2 Hedgerows and trees in general are of importance to a wide range of species, in that they can provide:

- cover and shelter, particularly for more mobile species such as birds, invertebrates and small mammals
- suitable habitat for many species of plants, particularly those associated with woodlands
- corridors of habitat between isolated habitats, enabling regular movement of mobile species, and more gradual migration or dispersal of others
- foraging habitat resources in the form of flowers, fruits, seeds and foliage

5.3 Aspects such as the structure of a hedge, orientation, shading etc. create a variety of micro-climates that add to the biodiversity potential of hedges. Associated features such as earth banks and ditches add to habitat diversity within hedges.

5.4 The age of hedges and trees can also be a significant factor in the diversity of associated species. Older hedgerows and trees tend to provide continuity and variety of food supply throughout the year, from nectar and fruit in the spring months, through to berries and seeds in the autumn.

5.5 Trees provide foraging habitat resources for a wide range of species, e.g., a mature oak can host over 5000 different species of invertebrate[2], which in turn provide food resources for birds and mammals. The structure of trees also provides opportunities for wildlife, such as bird nesting sites.

5.6 In addition to the shrub component of hedges; hedge banks and field margins often provide the most resources in early spring as the ground cover vegetation develops, exploiting increased light penetration before shrubs set leaf. This ground cover resource of flowers and herbs is an important food resource for wildlife. Structural diversity in the form of tussocky grassland adds to this

[2] Croci S, Butet A, Georges A, Aguejdad R & Clergeau P (2008). Small urban woodlands as biodiversity conservation hot-spot: a multi-taxon approach. Landscape Ecology, 23(10), p1171-86.

resource. These benefits can however be easily lost or prevented from developing as a result of intensive agricultural operations such as the use of fertilisers and pesticides in field margins.

Grassland

5.7 Species-rich grassland is a significantly diminished habitat resource nationally - the majority (an estimated 98%) of such habitat has been lost during the 20th century, primarily as a result of agricultural intensification or neglect. That remaining is often in small (usually less than 2ha) highly fragmented blocks of habitat, which makes the wild flowers themselves, and species that are dependent on them, vulnerable to change. This includes various species of butterflies, bumblebees, and other invertebrates. Re-creation of species-rich grassland is therefore important in an effort to reinforce the remaining unimproved grassland at a landscape scale, and support the associated species.

6 CONSTRAINTS

6.1 Key constraints impacting on the LEMP include:

- Habitat creation should be of a scale and nature which is appropriate to the solar farm, its location and immediate surroundings
- Planting should involve native species of local provenance where possible
- There should be no interference with the operation of the solar arrays, i.e., no shading of panels, nor inhibited access for routine maintenance
- The security of the site must not be compromised
- Site enhancements should not be disproportionately onerous in terms of management requirements
- Potential presence of certain protected species (e.g., breeding birds – active nests and eggs/young are legally protected, and thus site maintenance activities would need to avoid causing impact through suitable timing of works)

7 ENHANCEMENT

Habitat Creation & Management

7.1 Landscape and ecological enhancement will include the planting and/or where appropriate, the creation and management of:

- Hedgerows (existing & new)
- Standard trees (new)
- Grasslands (new meadow & rough sward)

7.2 The '*Fields Solar Farm Landscape & Ecology Masterplan*' (August 2015) indicates where these new habitat features will be planted – Figure 2. Appendix I.

8 HEDGEROWS & TREES

8.1 The existing hedgerows (north) and woodland edges in the immediate vicinity offer natural screening, and so adding to these features rather than using different forms of screening is considered most sensible. Hedgerow and tree establishment is readily achievable at this location, although this is dependent upon ensuring the successful planting and aftercare. Suitable management, whether on-going (hedges) or initially (trees) will thereafter ensure the long-term presence of these habitat features.

Hedge Planting

Siting

8.2 A new hedgerow of ~500m in length will be planted along the northern boundary of the site, and a new hedge of ~115m planted along an open boundary in the southern region. In addition to this, supplementary / reinforcement hedge planting will be carried out along the western boundary.

Species

8.3 The new hedging (including the minor section of replacement planting) will be species-rich, and comprised of the following locally occurring species in the respective proportions, size and numbers – Table 8.1.

Table 8.1 New hedgerow planting.

Species	%	Size (cm)	Form	Sundries
Acer campestre (Field maple)	20	80-100	Whip / Bare-rooted	60cm spiral guard & 75cm cane
Sambucus nigra (Elder)	15	60-80	Whip / Bare-rooted	60cm spiral guard & 75cm cane
Crataegus monogyna (Hawthorn)	20	80-100	Whip / Bare-rooted	60cm spiral guard & 75cm cane
Ilex aquifolium (Holly)	2.5	80-100	Container grown	-

Prunus spinosa (Blackthorn)	20	80-100	Whip / Bare-rooted	60cm spiral guard & 75cm cane
Quercus robur (Pedunculate Oak)	7.5	125-150	Whip / Bare-rooted	60cm spiral guard & 75cm cane
Ulex europaeus (Gorse)	15	-	Cell grown plants	

Provenance

8.4 All plants will be sourced insofar as is possible from nursery stock of the Native Seed Zone 403[3].

Plant Spacing

8.5 Hedge plant spacing will consist of triple, staggered rows, 750mm apart at 600mm centres.

Plant Arrangement / Layout

8.6 Planting will involve randomly intermixing all species – i.e., no group planting.

Planting Method

8.7 The hedges will be established upon new hedge banks (~05m high), created by 'topsoil inversion'. This involves creating a hedge bank comprised of topsoil covered by subsoil, resulting in a hedge ditch on one, or both side of the bank. The subsoil provides less favourable conditions for weed establishment, and avoids the need for otherwise potentially intensive hand weeding, or the application of herbicides.

8.8 Plants will be notch planted into the top of the hedge banks where a slit of sufficient size can be created to take roots untrimmed and without unnecessary force being applied. If this is not possible, the plants will be pit planted, with the planting pits being of adequate size to take roots untrimmed and back filled with soil from the pits. Plants will be firmed in so that a gentle tug will not remove them from the soil.

Plant Protection

8.9 Given the known presence of rabbits and potential presence of deer in the location all plants will be protected with a guard immediately after planting. Spiral guards (60cm, green-tinted, with cane) will be used, except for holly.

[3] Forestry Commission: Regions of Provenance of Native Seed Zones.

Guards are however a compromise between the prevention of browsing (if occurring) and plant vigour, and they can encourage spindly growth, and so will be removed as soon as plants are well established – see *Protection & Maintenance Post-Planting* below.

Planting Season

8.10 Planting will be undertaken and completed in full during the first planting season (November to March inclusive, when hedging plants are dormant) subsequent to the construction phase of the project, if feasible, otherwise the next planting season. Planting before the end of January is preferable to allow planted stock more time to establish a network of feeder roots before the onset of spring. Planting will be undertaken under frost-free conditions.

Establishment Phase

8.11 Maintenance is important to increase the plants prospects for survival and subsequent growth. A maintenance programme will take the form of a five year period from time of planting. Key aspects in this respect are protection and maintenance, and replacement of any failed stock.

Protection & Maintenance Post-Planting

8.12 The design life of spiral guards is a minimum of 3 years (Acorn Planting Products range – rebranded under TUBEX - Fiberweb Geosynthetics Ltd). This period of time generally provides an adequate duration of protection for the establishment of the species and size of specified plants.

8.13 At least twice a year (spring and autumn) such protective sundries of the new hedgerows will be checked for secure fitting, or replaced where necessary. This will apply for the first three years, subsequent to which (and up to year 5), the need or otherwise for replacement guards if missing will be determined (spring / autumn inspection) by whether or not browsing has occurred and by which species. If signs of spindly growth are apparent, then the guards will either be cut back to half height or removed (unless rabbits or other browsing species are obviously problematic). All guards will be removed after year 5, if not before.

8.14 Weed competition at the base of the new plants will be supressed by the stated method of hedge bank construction, however some weeding may be necessary during the first three growing seasons in particular – 'weeded' hedgerows

establish faster and need less maintenance overall. Given the biodiversity value of most 'weeds', the control thereof will however be reviewed and potentially reduced for season 4 and 5, and subsequently cease, provided that the vigour of hedgerow plants is not compromised. Chemical treatment of weeds will be avoided, and there will be no application of fertilizers.

Replacement Planting

8.15 When planting bare-rooted stock it is not unusual for natural losses to occur. Failures will be identified and marked up during the first growing season following planting in order to aid subsequent identification during winter when replacement planting with similar species will take place. The small percentage of failures which may occur during planting will therefore be replaced in the first year. Any subsequent losses within the new hedgerows up to and including year five will be replaced if significant gaps are otherwise likely to develop.

Programme

8.16 Table 9.2 presents a summary of the key maintenance actions to be carried out during the establishment phase of the new hedging, up to and including year 5. Hedgerow management during this period and beyond is specified in *Hedge Management* below.

Table 8.2 Outline maintenance programme to year 5 for new hedgerows.

Years 1-5	
March	Check guards and weed as necessary
July	Check losses (mark up to ease winter identification and replacement) and guard, and weed as necessary
September	Check guards and weed as necessary
November	Replace losses (final November remove all remaining protective spiral guards)

Hedge Management

8.17 This section specifies measures that will be adopted and adapted as necessary in this respect over the lifespan (25 years) of the solar farm. It is not within the scope of this LEMP to specify management beyond this time frame. It relates to the new and existing hedgerows, and includes the not only the woody component, but also the associated vegetation (i.e., ground cover) that forms part of the hedgerow corridors.

Hedge Trimming - Method

8.18 Hedge cutting will be undertaken with mechanical flail. The process will involve as few passes as possible in order to minimise damage/disturbance to the neighbouring buffer zones. The hedgerows will require management to as to avoid them maturing into belts of trees (and loose the biodiversity value of hedgerow habitat).

8.19 Successive cuts will be raised (20-30cm) above the preceding cut in order to encourage branching and height gain. Similarly, hedge width will be increased (10-20cm) on each successive cut. This incremental increase in height and width will allow the hedges to progress naturally through the growth cycle without undue stress, remaining healthy and functional. It will avoid the development of 'knuckles' at the trim line. Periodic heavier cutting will be necessary to re-invigorate hedge growth / form and prevent the development of open hedge bases.

Hedge Trimming – Frequency

Existing Hedgerows

8.20 Successive cuts will be once every three years, but without allowing the hedges to become dominated by vertical growth. The hedgerows will be allowed to develop to at least ~3m in height. Only one side of the new hedge in the north will be trimmed in any one year (i.e., alternate cuts) so that the untrimmed side retains fruit into the winter months (all the other hedges are only accessible on one side by the site operator; the outer sides being in the control of neighbouring farms). A maximum of 50% of the hedgerows will be cut in any one year.

New Hedging

8.21 Apart from a heavy flail in year 2 / 3 (dependent on how well establishment take place) to encourage dense basal growth, the new hedging will only be lightly, but regularly (annually) trimmed until reaching a height of 3m. Thereafter, they will be cut on a 3 year rotation to promote flowering and fruiting.

8.22 The bases of the hedges will also be irregularly cut (only once every 2-3 years) so as to encourage the development of ground vegetation in the form of herbaceous and rough, tussocky grass cover.

Hedge Trimming - Timing

8.23 Hedgerow trimming will be undertaken during late February/ beginning of March, thus prolonging the screening value; availability of hedgerow fruits to wildlife during winter; and avoid the bird breeding season (March – August) when nesting within the hedges may occur.

Tree Planting

8.24 This section outlines species to be planted and methods. All the existing trees will be retained.

Species

8.25 The new trees will involve three species in equal proportions and typical of the location - Table 8.3.

Table 8.3 New tree planting.

Species	Size (cm)	Form	Sundries
Quercus robur (Pedunculate Oak)	400-450	Root Balled	60cm spiral shelter tree guard and stake
Sorbus aucuparia (Rowan)	250-300	Root Balled	60cm spiral shelter tree guard and stake
Acer campestre (Field maple)	250-300	Root Balled	60cm spiral shelter tree guard and stake

Provenance

8.26 The trees will be sourced in so far as is possible from nursery stock of the Native Seed Zone 403[4].

Plant Spacing & Methods

8.27 Trees will be planted in locations identified in the '*Fields Solar Farm Landscape & Ecology Masterplan*' (August 2015) – Figure 2. Appendix I. The three species will be randomly planted in these locations.

8.28 The trees will be planted into pits of sufficient size to accommodate the root mass and result in the trunk/root zone being level with the surrounding ground. Excavated earth will be used to backfill any remaining space in the pit and firmly pressed down. The trees will be fitted with spiral tree guards, staked and bases

[4] Forestry Commission: Regions of Provenance of Native Seed Zones.

surrounded with wads of straw to control weed growth. Planting will take place during the appropriate season as per hedgerow planting above. Monitoring and replacement of any failed trees will be carried out as appropriate. Monitoring will take place during the hedgerow monitoring as per Table 8.2.

9 GRASSLAND & HEDGE BANKS

Establishment Phase

9.1 The cultivated extent of the field will be sown to species-rich grassland (meadow) upon completion of the construction phase. The approach to establishing this grassland involves either or a combination of sowing a species-rich seed mix, and strewing 'green hay' – the latter approach is very much dependent upon availability of such 'hay' and timing of the end of the construction phase. The new hedge banks will be sown with a wildflower hedgerow mix.

Seeding

Seed Mix

9.2 A species-rich (target of at least 15 species / m2) grassland mix of herbs and fine grasses of local provenance will be used, i.e., a meadow mix. Seed will be sourced from a suitable supplier listed by Flora Locale, such as *Forestart* (http://www.forestart.co.uk/) – e.g. '*Enhanced Meadow Mix*' – to be determined in due course depending on seed availability. Soil pH will be tested prior to seed selection to ensure suitability. A species-rich wildflower hedgerow mix will similarly be selected.

Ground Preparation

9.3 The key elements for successful establishment are:

- Removing or controlling unwanted vegetation and 'weeds' which may compromise results
- Creating conditions in which seedlings can establish and grow

9.4 The construction phase will leave areas of disturbed ground, which if heavily rutted (e.g., by vehicle movements) or uneven, will be levelled as best as practically possible. The surface will be left in a 'harrowed' state in order to provide the microclimatic conditions for sown seed to be protected from drying

out etc., and successfully germinate. The chosen grass mixes will be sown directly onto this ground.

9.5 Similarly, the new hedge banks (created by way of 'topsoil inversion') will be shaped but not smoothed off in order to provide gaps and rough surfaces that the sown seed will lodge in. This will ensure a more even establishment of plants along the hedge banks.

9.6 The proposed swales will also be sown to grassland. The ground conditions created by the swales and possible temporary water retention will give rise to varying micro climate, and associated botanical composition.

Sowing

9.7 Sowing is best undertaken in autumn (September/October), or late winter/spring (March-May). The timing will depend on when the solar farm is constructed.

9.8 The seed will be sown by surface broadcasting, at rates specified by the supplier. Rolling is not usually needed for autumn applications as the weather will settle the seed to the soil – most wild seed requires light to germinate, so completely burying it is not necessary and can be detrimental.

'Green Hay'

Sourcing

9.9 Enquiries will be made with local conservation organisations and landowners as to the availability of local potential sources of 'green hay'. Identifying a donor site that is nearby and well in advance of the construction phase is important to allow careful planning. Collected green hay needs be transported and spread (strewn) as quickly as possible (certainly less than half a day) once collected otherwise there is a risk of the seed becoming unviable. A recipient site / area requires donor site of approximately 1/3 its size, i.e., the donor site is smaller than the recipient site.

Ground Preparation

9.10 The ground will be harrowed in order to provide the microclimatic conditions for seed from the green hay to be protected from drying out etc., and successfully germinate.

9.11 Bare ground (which will potentially be the case when the construction phase commences) presents the opportunity for weeds to establish, and which would need to be controlled (e.g., re-harrowing).

Strewing

9.12 Given the infrastructure comprising solar farms (predominantly rows of panels), it is most likely that the only practical opportunity for using the 'green hay' method will be between the rows of panels and around the perimeter of fields. If the 'green hay' is round baled, the bales can be unrolled and spread by hayfork manually, or pulled off the back of a trailer as this moves steadily along between the rows of panels. Given the scale of the site it is probable that only a proportion of it will be treated as such, possibly focussed around the perimeter of the fields (spreading seed in between the rows of panels and beneath the panels would be a simpler process).

Grassland Management

Meadow Grassland

9.13 Further to sowing, the successful establishment of new swards is dependent upon aftercare and on-going maintenance. The two aspects can be considered separately.

9.14 Meadow mixtures (seed mixes or 'green hay') are composed mainly of perennial species which can take at least a full year to establish properly. Aftercare therefore essentially relates to the first year after sowing. During this period the main management priority is the control of weeds. Regular topping in the first year may be necessary.

9.15 The early years of a sown meadow (years 2/3 from sowing) can be characterised by the more quickly establishing pioneer perennials with vigorous growth. The meadow will be monitored for tall weed species, and these will be kept in check, particularly within the solar PV area. Sheep grazing will be introduced to this area as a late summer / winter management measure. Depending on how successful a 'green hay' approach is, it may be necessary to keep livestock off these areas altogether for the first season.

9.16 Sheep stocking rates on grassland in the UK can vary significantly from year to year, depending on for instance, rainfall, and timing of rainfall. Therefore, since

the sward is expected to be agriculturally productive (as well as of biodiversity value), the grazing tenant will be best placed to determine the appropriate stocking density and intensity from year to year.

Rough Grassland

9.17 The existing and new sward between the security fencing and field boundaries will be encouraged to develop into rough, tussocky grassland.

9.18 In these areas a high wildflower content seed mix will be used, and or 'green hay'. After the first year of establishment, management will be reduced to a late summer / autumn cut, no shorter than 100mm, once every 2-3 years (dependent on degree of scrub encroachment, if any). No greater than 33% of the grassland will be cut in any one year, with all cuttings collected and removed.

9.19 The primary objective of the rough tussocky sward is to increase wildflower diversity and create conditions which are suitable for a diverse invertebrate fauna and a range of small mammals such as voles, which represent a food resource for birds such as kestrel and barn owl.

9.20 If any heavy weed infestation occurs, these areas will be topped as necessary prior to seed setting.

Hedge Wildflower Management

9.21 The wildflower component of the new hedgerows will be left to establish and develop once sown. Management intervention will be minimal; possibly only management of weeds if establishing.

10 MONITORING

Hedgerows & Trees

10.1 An Ecologist or equivalent suitably qualified person will assess the growth and condition of the planted stock on an annual basis for the first 5 years to determine whether replacement planting is necessary, and adjustment of the management regime (hedgerows) is necessary, taking into account the overall aims of these features, particularly in relation to maintaining and enhancing the site screening (see *Hedge Trimming – Frequency* above) and biodiversity value. Thereafter, the hedges will be monitored every five years to reassess the most appropriate management regime / actions.

10.2 With respect to new hedging, growth rates of between 20 and 45cm are possible after the first year of establishment however this is strongly dependent upon species and soil/weather conditions, and can be very variable. It is not practical to set target growth rates, but rather to monitor plant condition and check for any localised poor performance which requires attention (for example, further mulching, and replacement planting of any failed stock).

Grassland

10.3 As indicated above, the grassland, i.e., within the fenced area of the solar farm will be managed by the grazing tenant. This will involve late summer / winter stocking in order to enable summer seed setting. It may occasionally be necessary to cut / top the grassland or take a hay crop (at least between the solar arrays).

10.4 The primary objective of rough grassland outwith the fenced area is to enhance habitat diversity, both structurally and in terms of species composition, such that this presents conditions (including high wildflower content) that will provide new shelter and foraging habitats resources for wildlife in general. Accordingly, the Ecologist (or equivalent suitably qualified person) will undertake annual monitoring for the first five years and thereafter every 5 years, and advise on adaptation of the management approach if the desired outcomes are not being achieved, and / or identify further opportunities which may arise in time. Methodology for monitoring will involve recording a species list of plants present and their abundances using the DAFOR scale. Above all, monitoring will seek to identify where improvements can be made or corrective action is needed to ensure positive outcomes. This equally applies to the wildflower hedge banks.

Bird Activity

10.5 The barn owl and kestrel nest boxes will be inspected and maintained, or replaced as appropriate, annually during winter months (i.e., outside of the main breeding season).

10.6 Annual over-wintering bird surveys and breeding bird surveys will be carried out at the site in order to determine which species benefit most from the new habitats as these develop. The surveys will be conducted annually for the first 5 years and thereafter every five years. The survey results will seek to identify

where any improvements can be made to management to benefit priority bird species.

Concluding Statement

10.7 Habitat enhancement does not have any particular end point and it is important in this respect that the project is provided with a good prospect of achieving success. This can only be achieved by adopting a flexible approach that can be adapted where and when necessary - monitoring is a fundamental part of this process, especially during habitat establishment. If any substantial change to the measures described in this LEMP is required during the lifetime of the project, then this will be discussed and agreed with Staffordshire Moorlands District Council in advance of implementing the changes.

APPENDIX I

Figure 1. Phase I Habitat Map

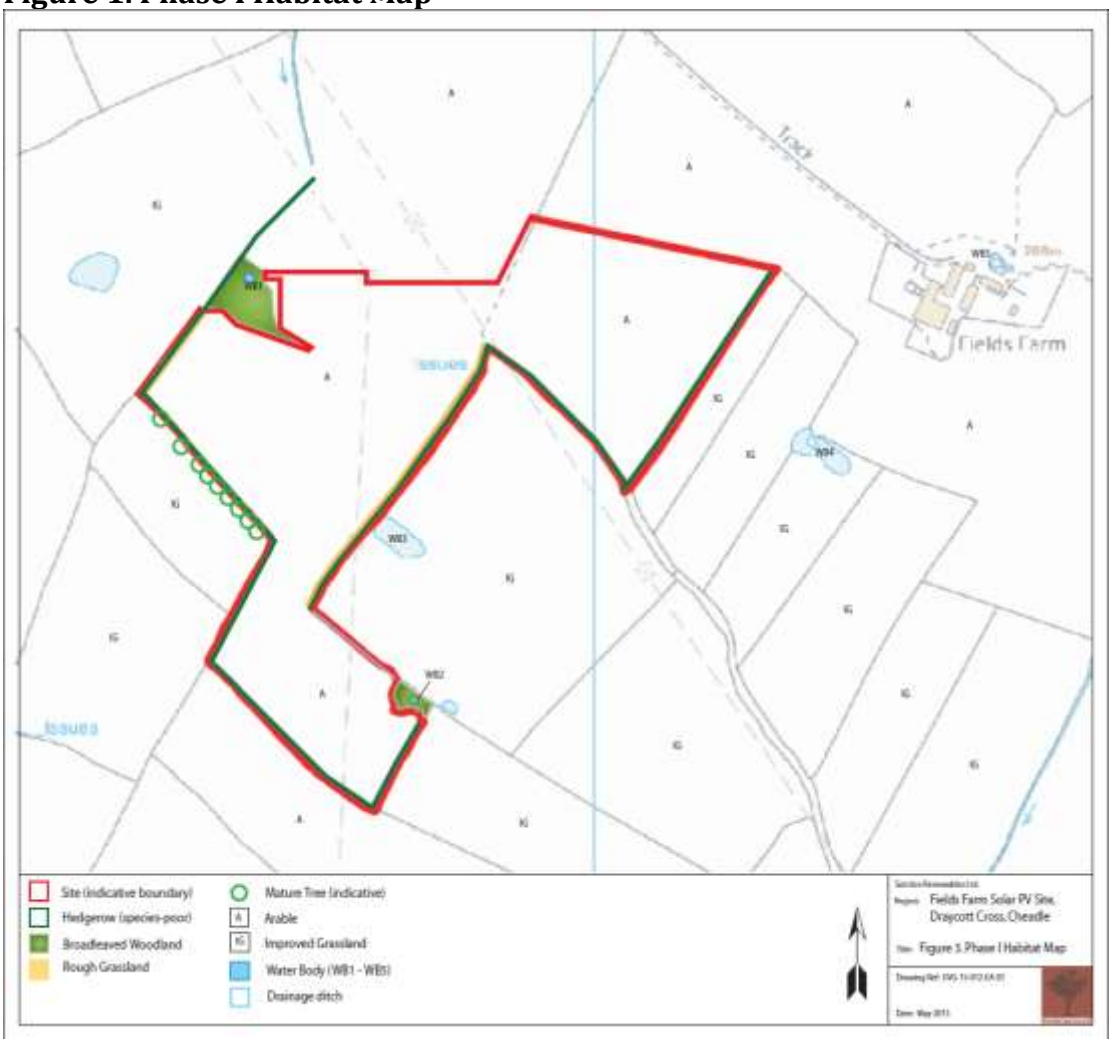

Figure 2. Fields Solar Farm Landscape & Ecology Masterplan (August 2015)

[Separate document]