Moneystone Quarry

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Further Ecological Information

Outline Habitat Management Plan

FINAL

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Control sheet

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1. Introduction

1.1 This document sets out the management requirements to ensure that areas identified for mitigation and compensation in relation to leisure proposals at Moneystone Quarry, are restored, enhanced and managed to ensure a long term benefit for wildlife. An over-arching plan is included in Appendix 1 of this document to identify all areas of wildlife habitat that will be subject to long term management for wildlife in respect; of planning submissions for Leisure development and Solar PV (SMD/2014/0432); and remaining commitments to minerals restoration. All of the land referred to in this document is currently under the ownership of Laver Leisure.

1.2 This submission should be used to inform the preparation of detailed management prescriptions in the event that outline planning consent is granted and to support any future detailed planning submissions. Any future detailed management plan should be formulated according to the following habitat design and management principles:

- The use of native species, appropriate to the locality using where possible plant material of local provenance.
- Maximising the biodiversity value of all habitats on site, including those designed for amenity use.
- Protection and enhancement of retained habitats.
- Encouragement of natural regeneration of habitats except where succession will lead to a lower value habitat.
- Periodic review of the management plan in order to establish an iterative approach to allow biodiversity opportunities to be explored and optimised.
- Management of visitor access to provide access to the natural environment to minimise disturbance impacts.
- Emphasis on connectivity of habitats in particular ensuring that habitat management sustains and enhances faunal populations including assemblages of amphibians and reptiles.
- Control and eradication of invasive species.
- Protection of and provision of habitat for protected species.

1.3 Through active land management it will be possible to enhance habitats of value, notably lowland neutral grassland (BAP/S41 NERC Habitat), semi-natural broadleaved woodland and heathland (BAP/S41 NERC Habitat). The report provides outline information in relation to the following:

- Grassland habitats
- Woodland habitats
- Heathland habitats
- Aquatic habitats
- Boundary features
- Recreational management and interpretation
- Implementation, monitoring and review

1.4 In terms of potential conflicts between the management and the avoidance of impacts to protected species, great crested newt, reptiles, bats, badger and breeding birds are likely to be the most relevant issues. All management activities will need to be designed and programmed to take account of the protected species interests at the site at that time and will also have to take account of how management affects these species in the longer term.

2. Grassland Habitats

2.1 The aim of habitat creation should be to ensure that Priority BAP habitat (MG5/Lowland Meadow) is established within a 10-15 year period. Land parcels subject to these requirements are shown on the plan at Appendix 1. The key principles which should be employed for future detailed management are:

- To create, restore and enhance lowland meadow (MG5 grassland) within the areas defined on the plan at Appendix 1.
- To protect and enhance wildlife interests of the grassland by maintaining and increasing botanical diversity.
- To maintain floristic composition based around NVC MG5 *Cynosurus cristatus – Centaurea nigra* community.

2.2 The guidance set out in Appendix 3 will be used to assess the success of establishment. Where green hay is used form local sources (e.g. Whiston Eaves SSSI), a further measure of similarity between the donor site and recipient site will be used.

2.3 This section is targeted at the restoration, maintenance and protection of areas of species rich grassland, the importance of which is recognised under the UK Biodiversity Action Plan (UK BAP)/Section 41 of the NERC Act. This option can also contribute to the protection of valuable landscapes and the promotion of good soil conditions.

2.4 The areas of habitat subject to these management requirements[1] are:

- Grasslands to the west of the Quarry (Area A and B)
- SBI species poor grassland to the south of Quarry 3 (Area C)
- Grassland in Quarry 2 (Area D[2])
- Grasslands within Quarry 1 some of which will be subject to leisure uses (Areas E, F and G)

Restoration of species-rich semi-natural grassland – noted as Area A on the plan at Appendix 1

2.5 Aimed at restoring grasslands that may have been species-rich in the past but have suffered from management neglect or have been agriculturally improved.

2.6 These areas of grassland are all considered to be species poor and comprise the following: *Alopecurus pratensis* – Dominant/Abundant, *Phleum pratense* – Frequent, *Rumex acetosa* - Abundant, *Ranunculus repens* – Abundant, *Plantago lanceolata* – Frequent, *Anthoxanthum odoratum* – Occasional and *Dactylis glomerata* – Frequent

2.7 Assuming appropriate soil nutrient status/conditions, or following implementation to create these, diversify the sward in these areas using green hay and seed from appropriate local donor sites. This may include Whiston Eaves SSSI, other SSSI or

[1] Note: these fields may require additional treatments (e.g. soil inversion/stripping/harrowing Soil/seed bed preparation to ensure low fertility, appropriate pH and low available phosphorus. Soil testing required.

[2] Previously included as Area B on SPV application SMD/2014/0432 Proposed 14.3 Ha 6.98MWp Solar, Photovoltaic Array at Moneystone Quarry.

SBI grassland but prior agreement must be sought from Natural England in respect of SSSI.

Maintenance and enhancement of moderately diverse semi-natural grassland, noted as Areas B & C on the plan at Appendix 1

2.8 These grassland are of low-moderate diversity and were previously sampled using quadrats which identified general sward dominance by a mixture of perennial rye grass and crested dog's tail with a number of associated grass and herb species (tabulated quadrat data is included as Appendix 2).

2.9 The approach to managing this area will be to:

- Manage the sward by grazing with cattle during late summer (after the hay is cut on the top of the field) and autumn until the start of October to achieve a sward height of between 3-5cm by the end of the growing season. Ensure that the year's vegetation growth is removed and that litter cover at the base of the sward is no more than 10% so that the following year's wildflower growth is not impeded.
- Remove the cattle at the start of October or when the sward height of between 3-5cm is achieved. Do not allow the ground to become poached.
- No supplementary feeding is permitted.
- Control of undesirable species such as spear thistle, creeping thistle, curled dock, broad leaved dock, common ragwort, nettles so that their cover is <1% of the area.
- Field operations and stocking must not damage the soil structure or cause heavy poaching. Small areas of bare ground up to 5% of the field are acceptable and indeed will be beneficial in creating germination areas for fallen seed. Take particular care where the land is water logged.
- No fertilisers should be applied.
- Monitoring annually for 5 years to be undertaken annually to inform the need and implementation of any further measures such as harrowing and over-seeding/green hay spreading if species diversity does not increase. The criteria in 9.5 and Appendix 3 will be used to measure success.

Maintenance and enhancement of moderately diverse semi-natural grassland, noted as Areas E, F and G on the plan at Appendix 1

2.10 These areas comprise diverse MG6 grassland MG5 grassland, detailed information was provided within Appendix 9.1 of the ES. Floristic tables are provided at Appendix 2.

2.11 The approach to managing this area will be to:

- Leave long areas of grassland around the periphery of areas E and F to form a gradual transition between woodland and amenity use areas. A low intensity cutting regime or rotational cutting regime will be implemented. All arisings to be removed.
- Ensure that that litter cover at the base of the sward is no more than 10% so that the following year's wildflower growth is not impeded.
- Control undesirable species such as spear thistle, creeping thistle, curled dock, broad leaved dock, common ragwort, nettles so that their cover is <1% of the area.

Creation of diverse semi-natural grassland, noted as Area D on the plan at Appendix 1

2.12 Area D in Q2 is currently bare ground and former quarry works. The intention for this area is to create MG5/species rich grassland by introducing green hay. The methodology for this will follow: Natural England Technical Information Note TIN063[3] and will be agreed through the detailed scheme submission.

2.12 This will require sourcing of suitable green hay (and/or locally harvested seed if timing means that green hay cannot be used|) with landowner consent (and Natural England consent if within SSSI) from a suitable site.

2.13 The approach to managing this area will be to:

- Manage the sward by grazing as per 2.9 above. If grazing is not possible or practical in this area then the vegetation should be cut (mown / strimmed) in late summer with all arsing removed. Consideration should be given to the provision of appropriately (e.g. outside of the bird nesting season) mown paths in this area to provide visitor access.
- Control of undesirable species such as spear thistle, creeping thistle, curled dock, broad leaved dock, common ragwort, nettles so that their cover is <1% of the area.
- Field operations and stocking must not damage the soil structure or cause heavy poaching. Small areas of bare ground up to 5% of the area are acceptable and indeed will be beneficial in creating germination areas for fallen seed. Take particular care where the land is water logged.
- No fertilisers should be applied.
- Monitoring annually for 5 years to be undertaken annually to inform the need and implementation of any further measures such as harrowing and over-seeding/green hay spreading if species diversity does not increase. The criteria in 9.5 and Appendix 3 will be used to measure success.

[3] Natural England Technical Information Note TIN063 Sward enhancement: diversifying grassland by spreading species-rich green hay. Natural England Second edition 22 June 2010.

3. Woodland Habitats

3.1 Land parcels subject to these requirements are shown on the attached plan. The key principles which should be employed for future detailed management are:

- To ensure the valuable and irreplaceable areas of ancient woodland and re-planted ancient woodland habitat is retained and protected.
- To protect sensitive ancient woodland soils and ancient woodland indicator species (ground flora).
- To maintain the area of ancient woodland in a state of low recreational disturbance by managing formal and informal recreation.
- To control invasive/ornamental species which could become established and compromise the biodiversity value of the ancient woodland and encourage public responsibility for this area.
- To protect and enhance habitats for native fauna within woodland.
- To provide high quality interpretative facilities to ensure the biodiversity value of woodland is recognised.

3.2 Woodland habitats at the site are summarised in the following table:

	Description	**Issues**
W1 S.W. side of Q1.	A small area is designated as re-planted ancient woodland. Canopy is dense and dominated by Scot's pine and sycamore with a dense shrub layer of holly, elder and bramble. A range of ancient woodland indicator species noted; wood sorrel, remote sedge, opposite leaved golden saxifrage, sanicle and pignut.	Groundlayer is becoming dominated by bramble. Potential for access/leisure activity
W2 Semi-natural broadleaved woodland is also present on the south-eastern boundary of the site.	Canopy comprises turkey oak, common oak and sycamore over occasional hazel, hawthorn, holly and yew. The groundflora includes stands of great woodrush, wavy hair grass, honeysuckle, hard fern, bilberry, angelica and Himalayan balsam. Areas of this woodland are designated as ancient woodland.	Presence of invasive/non-native species.
W3 Mature woodland/tree belt along Whitson Eaves Lane.	Canopy consists of a mixture of Scot's pine, horse chestnut, ash, oak and sycamore over a shrub layer of hawthorn, holly and hazel. The ground flora is generally species poor consisting of creeping soft grass, ivy and bramble.	Dense shading, limited groundflora development.
W4 Dense scrub/secondary woodland east side of Q2.	Mix of Scot's pine, silver birch and sycamore. The groundlayer is patchy with bare areas and occasional dominance by, dryopterid ferns, *Polytrichum commune* and patchy bluebell, creeping soft grass, broad buckler fern, foxglove. Rhododendron is present with the woodland. Patchy heather present.	Invasive species. Scrubbing over of heather areas.
W5 Woodland on western side of Q2	Area of woodland consisting of silver birch and European larch. Groundflora consists of wood sorrel and bluebell.	

3.3 The following section identifies the broad management principles for woodland at the site. These principles apply to all areas of woodland unless otherwise indicated by reference to a specific woodland parcel/s.

3.4 Management activities within these woodland areas will be the minimum required in order to achieve the management aims and maximise the biodiversity value of each area. No maintenance activities other than those agreed within any future detailed plan will be undertaken without prior discussion/guidance from an advising ecologist and arboriculturalist.

3.5 No formal footpaths will be established within the ancient woodland areas (**W1** and **W2**). Informal paths and the use of cycles within the ancient woodland will be discouraged by the careful placing of felled timbers to block desire lines. Any informal paths which become established will be blocked by the use of log piles, planting of native thorny species (e.g. blackthorn) of local provenance.

3.6 There will be no import of soils/materials into the ancient woodland for landscaping and management purposes.

3.7 A buffer zone of 10m around will be created around ancient woodland areas (**W1**), where the ancient woodland is bordered by other woodland habitat, in which similar low intervention management practices are undertaken. Prior to any vegetation clearance or development that may lead to disturbance an ecologist will carry out a survey of the site to clearly identify where buffers are to be established, this will be carried out in conjunction with contractors. A plan showing buffer areas will be provided to the LPA. Buffer zones will be de-marked by installation of high visibility fencing and suitable signage (e.g 'Woodland Buffer Area', 'Ancient Woodland Buffer').

3.8 Natural regeneration will be encouraged, in order to improve woodland structure by allowing a shrub layer to develop. If required, any newly established trees and shrubs will be fitted with tree guards to protect from rabbit and deer grazing, which will be removed when growth is sufficiently advanced.

3.9 The removal and control of non-native scrub species (**W2** and **W4**) will be undertaken using chainsaws and hand saws. Where possible, stumps and roots will be removed by hand digging. Any remaining stumps or roots which are too large to be removed by hand will be treated with a herbicide (20% Glyphosate solution). The herbicide will be applied using a hand held applicator. All cuttings will be burned on site. Treated areas will be monitored and further eradication will be undertaken where the initial treatment has not been successful.

3.10 Mapping areas of heather within **W4** and subsequent removal of established trees and shrubs (e.g. pine, birch) to create open heathland areas. See 3.9 above regarding removal and treatment of woody vegetation.

3.11 Stands of Himalayan balsam (**W2**) should be managed by mechanical methods – either hand pulling or strimming larger stands. This has to be undertaken early in the year (April/May) and prior to flowers appearing. Treatment should be repeated annually until this species is eradicated.

3.12 Woodland soils will be protected from compaction and damage by completing management activities by hand wherever possible. Designated and pre-determined access routes will be used for management activities. The smallest plant suitable for the task should be used. Works will not be undertaken in very wet weather when risk of damage to soils is greatest. No excavation of previously undisturbed soils will be undertaken.

3.13 Consider resuming traditional treatments. Coppicing and pollarding of suitable species e.g. ash and hazel will encourage groundflora and shrub development. The suitability of coppicing and pollarding should be assessed as part of the first management plan review in Year 5, using the results of monitoring surveys to inform

the plans. If coppicing is implemented following the first review, this should be undertaken in winter/early spring.

3.14 Any tree removal will focus on non-native species of mature trees, scrub and ground flora e.g. sycamore, rhododendron, larch and turkey oak (**W2** and **W4**). This will encourage native flora to recover. Typical species which might be encouraged would be bluebell, honeysuckle and Dryopterid ferns.

3.15 Wildlife habitats will be created and maintained to include; bat boxes, bird boxes, log piles, standing dead wood (in remote areas of the site for health and safety reasons).

4. Heathland Habitats

4.1 Land parcels subject to these requirements are shown on plan at Appendix 1. The key principles which should be employed for future detailed management are:

- To ensure the valuable areas of heathland are maintained, expanded and enhanced.
- To ensure a variety of heather growth stages are maintained
- To control invasive species which could become established and compromise the biodiversity value of heathland areas.

4.2 The parcels of heathland in Quarry 2 (H1, H2 and H3) are in poor condition, encroached by gorse scrub, pine and birch and supporting heather of poor structure.

4.3 Generally it would be expected that lowland heathland in Staffordshire would be closely aligned with H9 *Calluna vulgaris-Deschampsia flexuosa* heathland. Typically this vegetation is dominated by *Calluna*. *Vaccinium myrtillus* is often an important component of this plant community. However, *Vaccinium* does not readily establish over previous mineral workings and the resultant vegetation often has affinities H1 *Calluna vulgaris-Festuca ovina* heath. It is suggested that the target habitat, is '**lowland heath based on H9 and local BAP objectives'**.

4.4 More specifically the target will be to establish and maintain a habitat that is dominated by *Calluna vulgaris* (50-70% cover when established). The long term objective will be to maintain lowland heath dominated by *Calluna* with characteristic associated species and negligible presence of negative indicators (e.g. rhododendron, other colonising scrub species – pine, birch, willow).

4.5 The main objectives of management will be to control undesirable species and to manage any potential affects from grazing and trampling.

4.6 The impacts of grazing and trampling are likely to be insignificant due to the inaccessible locations of the restoration areas, however monitoring will take account of these aspects and management will be introduced to control these if they become problematic (e.g. suitable fencing to allow the heather canopy to close).

4.7 Non-heathland weed species will be controlled whilst heather plants are growing. Once the heather canopy closes heathland is less susceptible to weed invasion, before this occurs weeds will be managed by spot treatment with a non-selective herbicide. Herbicide will be carefully applied using a knapsack sprayer to avoid causing damage to heathland plants. Given the low fertility of substrates at the site it is unlikely that significant weed growth will occur, however this situation will be monitored and appropriate management as outlined implemented if required.

4.8 Preventing the invasion of woody shrubs such as gorse, Scot's pine, silver birch and rhododendron is the key objective for long term management of heathland areas. Measures to control seedlings and saplings will involve:

- Hand pulling of seedlings.
- Cutting of saplings – with hand saws, brush cutter or chainsaw. Any cut stumps will be treated with a systemic herbicide to prevent re-growth.

4.9 Measures will be implemented to control bracken should this species become established within the restoration areas. Newly colonised bracken will be treated as soon as it is discovered. Control of bracken will be undertaken by a combination of herbicide (a fern specific herbicide) and cutting. Should bracken establish, two treatments will be carried out each year in June and August for four consecutive years. This will reduce the vigour of bracken so that subsequent treatments, if still present, can be limited to a cut every three years or a cut and herbicide application every six years.

4.10 To maintain heathland in a suitable condition, heather will be cut to 150mm height for the first 2-4 years and then at 200mm height in subsequent years. Cuttings will be removed. Cutting will be carried out in late summer. Where possible, arisings will be used to assist heathland establishment elsewhere within the former quarry areas. Cutting will aim to create a mosaic of heathland structure within the restoration areas with only 25% of each restoration area cut on a rotational basis during each year.

4.11 H3 is part of solar farm mitigation and as a consequence there is less area available for heathland. Opportunities for heather and heathland established should be explored within the hydra seeded areas that run in an approximate east-west band beneath the H3 location on the plan at Appendix 1. Substrate pH will need to be between 3-5 (it is considered highly likely that substrate is sufficient as this area is remnant quarry workings which supports heather in adjacent areas), if suitable then heathland can be created using heather brashings/litter (either sourced form site or a suitable local source). Open areas will need to be established within the hydra seeded areas due to the extent of scrub development. Scrub removal should follow the approach outlined in 4.8 above. Areas of scrub (50% in clusters) should be retained to provide shelter for establishing heathland. Ideally the method of creating heathland will use brashings and litter which would be taken in September and spread on to the open areas of hydra-seeded slope. Litter will be spread at about a depth of 1 cm and tease apart where clods form. Once established heather areas are to be maintained as set out in 4.8 – 4.10 above. Further details of suitability and method should be provided in the detailed management plan for the site.

5. Aquatic Habitats

5.1 The habitats covered within this section include the open water features shown on the plan at Appendix 1. The key principles to inform management of standing water habitats are:

- To protect and enhance wildlife interests of the existing ponds and watercourses.
- To maintain habitat connectivity for amphibians.
- To maximise the biodiversity potential of ponds and wetland habitats.
- To retain the amphibian species assemblage at the site.

5.2 Aquatic habitats at the site are summarised in the following table:

Feature	Description	Issues
A1	Former quarry 3 – steep sided quarry void that has filled with water. Limited or no aquatic/emergent vegetation development to date.	Deep water, steep sided, lack of vegetation.
A2 & A3	Former lagoon 7 within Quarry 2. Currently comprises tailings and small pools of water. Further earthworks (mounding) may be required to ensure that standing waterbodies are sustained in this area.	Hydrology.
A4	Dense scrub is colonising the northerly and western margins of the pond. Stands of common reed are present around the margins of pond along with reed mace, water mint and brooklime. A large area of open water is present within the centre of the pond. GCN present.	Scrub encroachment within terrestrial habitats.
A5	Former tailings lagoon – heavily silted with recent development of open water. Little aquatic/emergent vegetation. Willow scrub colonising.	Silted/tailings, limited aquatic vegetation.
A6	The pond is roughly circular and situated within a clearing of woodland. The pond is steep sided on one side with a cluster of reed. The pond is split into two adjoining sections and fed by an adjacent watercourse. Cessation of quarry working appears to be benefiting this pond. GCN recorded in 2014.	Siltation.
A7	Marginal vegetation is sparse apart from a small patch of emergent reed mace. The pond was part of the former siltation process for the quarry. The pond is heavily shaded by surrounding scrub making the banks inaccessible.	Dense shading.
A8	The pond is heavily shaded by the surround scrub/woodland habitat with the majority of the bankside impenetrable due to the dense vegetation. No aquatic vegetation was noted to be present with a deep leaf litter.	Dense shading/ leaf litter
A9	The pond is heavily shaded with a deep leaf litter and no aquatic vegetation. A layer of willow sp catkins is present upon the surface of the pond.	Dense shading/ leaf litter
A10	The pond is situated with dense woodland habitat and has no aquatic vegetation, deep leaf litter and mud margins.	Dense shading/ leaf litter
A11 & A12	Two artificial butyl lined ponds supporting great crested newts within Sibelco owned land,	Maintain habitat connectivity.

5.3 The following section identifies the broad management principles for aquatic habitats at the site. These principles apply to all aquatic habitats unless otherwise indicated by reference to a specific area.

5.4 All standing aquatic habitats will be managed for biodiversity by maintaining a variety of habitats though active management, including open water, marginal vegetation and surrounding rough grassland.

5.5 Areas of marginal vegetation and rough grassland adjacent to the existing pond will be retained and managed. Connectivity will be maintained to terrestrial habitats adjacent to ponds, including purpose built hibernacula and refugia. Particular attention will be paid to ensuring that habitat connectivity is maintained between **A4**

and terrestrial habitats to the east (woodland and grassland) – this will require careful design at the detailed planning stage to ensure that there will be no barriers to amphibian movement or features such as gully pots which could pose a hazard to amphibians. However, it is considered that development around **A4** and the creation of new standing water habitat (**A5**) will be designed to provide amphibians with more diverse refuge habitat and improved breeding habitat. Securing management of aquatic habitats at the site will ensure that breeding populations are sustained and dispersal opportunities for amphibians are improved. Furthermore, over time as pH levels improve within Q2, areas of standing water (**A2** and **A3**) will provide additional opportunities for amphibian breeding, again increasing the diversity and quality of habitats for amphibians in the area.

5.6 Aquatic vegetation management in ponds will be undertaken by hand using a grapple hook/weed rake. De-silting and clearance of leaf-fall from ponds will be carried out in autumn/early winter (**A8, A9** and **A10**). Any silt or accumulated leaf litter removed from ponds will be left in place for 24 hours so that any invertebrates and amphibians can move back into the water. The spoil will then be removed off site. Clearance and/or thinning of excessive shading tree or scrub cover around pond margins (**A4, A7, A8, A9** and **A10**) will be undertaken using hand tools.

5.7 Natural colonisation of new ponds (**A2, A3** and **A5**) will be allowed, to ensure species of local provenance become established. Where marginal planting is required (**A1, A2, A3** and **A5**), species appropriate to the locality will be used, using locally grown stock wherever possible.

5.8 Areas of scrub/wetland habitat to be created (by natural colonisation with seeding/planting as required following monitoring) in succession from open water areas in Quarry 2 (**A2** and **A3**) as shown on Appendix 1. This area should be monitored to ensure that a diverse assemblage of native species colonises. Excessive scrub establishment should be managed to ensure that a suitable matrix of habitats is maintained, no more than 30% of the wetland habitat around **A2** and **A3** should be colonised by scrub.

5.9 All ponds to have a minimum of 30% open water to ensure suitable conditions are sustained for amphibian breeding. Limit the development of shade (no more than 50% of surface shaded at midday) for all none-woodland ponds (**A1-A8**).

5.10 High quality terrestrial habitat for amphibians present in close proximity to ponds will be retained and managed.

5.11 Ponds will be monitored and corrective management implemented if issues such as invasive species presence are highlighted. Mechanical removal will be favoured over chemical treatment. There will be no chemical control of aquatic vegetation, or chemical input to the ponds of any kind.

5.12 Given the presence of great crested newts at the site ecological input and supervision will be required to ensure delivery of management objectives for aquatic habitats. Further detail of ecological supervision should be provided in the detailed management plan for the site.

6. Boundary Features

6.1 Land parcels subject to these requirements are within area A and B on the plan at Appendix 1. A network of boundary features will be created in this location to provide habitat diversity and enhance wildlife connectivity.

6.2 In this particular location it is suggested that linear habitats reflect surrounding habitat and as such should comprise native species such as gorse, broom and holly (specification/mix to be agreed with the LPA ecologist/ecological advisors).

6.3 Hedgerows will be cut every other year once established, or preferably every third year with slow growing hedges. No more than a third of the hedgerows will be cut in any one year.

6.4 Cutting of hedgerows will be completed outside of the breeding bird season. Hedgerows will not be cut between April and the end of August. Ideally cut in January and February, after most of the berries have been eaten.

6.5 Trimming should aim to maintain a topped A-shape. It is considered that low growing woody features should be maintained (maximum height of 1.5m) along these boundaries

6.6 If grazing commences livestock will be fenced away from hedgerows by at least one metre.

6.7 A minimum 1m buffer of un-mown grassland will be maintained when mowing grassland alongside hedgerows and other boundary features.

7. Other Habitats; mosaics, bare ground

7.1 Whilst this document focuses upon grassland, woodland, aquatic habitats and boundary features the long term management of the site will also include features previously identified within the Approved Restoration Proposals including:

- Mosaics of heath, open ground and acid grassland (Quarry 2 and Quarry 3), and
- Natural colonisation (Quarry 2).

7.2 Mosaic habitats will be provided within all three areas of previously worked quarry (Q1, 2 and 3). Steep cliffs and exposures will be present in the northern part of all three areas of previous quarrying. Areas of heath and acid grassland will be retained and maintained within Q2.

7.3 Areas of scrub and trees will be removed to encourage the expansion of heathland habitat, most notably in mosaic habitats in Quarry 2 (H2 and Natural Colonisation Areas shown on the plan at Appendix 1). The detailed management plan for the site should include detailed mapping of areas of heathland restoration and management.

7.3 The plan at Appendix 1 indicates the approximate extent of natural colonisation habitat within Q2. In the long term this area should be managed to maintain a diversity of habitats, this is likely to include management of scrub to retain structural diversity.

7.4 Areas of bare quarry face should be retained to provide invertebrate and and martin habitat within Q3. Details of location should be provided in the detailed management plan.

7.5 Long term management should ensure that these features are maintained to deliver a diverse range of habitats at the site. Any future detailed management plan should provide details of the location, extent and management of these habitats at the site.

8. Recreational Management and Interpretation

8.1 The proposed development will seek to positively promote wildlife awareness and the particular wildlife interests at the site.

8.2 Access will be managed in a manner which minimises damage to sensitive habitats including areas of ancient woodland, re-planted ancient woodland, aquatic habitats, grassland and heathland.

8.3 Targeted management will be undertaken as an aid to guiding access to ensure limited levels of disturbance in areas with high value woodland groundflora.

8.4 Detailed design should ensure that footpaths are of a sensitive nature to minimise impacts upon wildlife.

8.5 Substrates for the creation and maintenance of pathways will be selected so as not to have a detrimental impact on species composition e.g. surfacing materials should be inert and there should be no use of calcareous/acid substrate.

8.6 As a further guide, features can be used as 'targets' along the path to guide footpath use particularly in woodland areas. Targets can include examples of typical woodland plants (e.g. bluebells), woodland sculptures, historical/cultural points of interest which may relate to historical use of the site and information boards/signs.

8.7 Recreational use will be guided to minimise disturbance to ponds known to support great crested newt or other protected species. Utilise fencing, timber knee rails and/or footpaths where appropriate to prevent un-authorised access and increase safety.

8.8 Recreational use will be guided to minimise disturbance to areas of vulnerable habitat either due to species presence or condition (e.g. recently restored habitats such as heathland/grassland). Utilise fencing where appropriate to prevent un-authorised access.

8.9 Wildlife features in accessible areas and areas which are not considered to be vulnerable to disturbance will be signposted. Sign-posting of features will be concentrated upon path side locations to act as targets to guide access through the woodland and reduce disturbance.

8.10 Interpretation boards for habitats including woodland, grassland and ponds will be installed and maintained. These will detail important habitats but will also promote other less ecologically sensitive spaces around the site, including formal routes to get to these places.

9. Implementation, Monitoring and Review

9.1 This current plan is in outline and should be used as a basis for the production of a detailed site wide management plan at the appropriate stage, should the scheme receive planning consent. The detailed plan should identify the mechanism, various roles and responsibility for implementation of the plan. The detailed plan should also include a detailed Work Programme identifying when works are programmed to take place.

9.2 Any future management plan should be adopted for the lifetime of the development and should be subject to a review every 5 years. This quinquennial review should include an appraisal of the habitats present at the site (in conjunction with monitoring), assessment of the success of the management plan to date and any required revisions to the plan.

9.3 Monitoring will be more intensive in the early years of the management plan, and will take the form of an ecological survey each year for five years. Following this an ecological monitoring survey will be undertaken once every five years. The monitoring surveys will be timed appropriately to feed into the management plan review.

9.4 The outline monitoring requirements for each habitat type are provided below:

Grassland habitats (See Appendix 3 for floristic indicator scoring)

9.5 The following measures should be used in conjunction with the scoring system at Appendix 3 to assess the success of grassland management and should also be used to inform revision to management planning and implementation at the site.

- The extent of the habitats of interest (Areas A-G on Appendix 1) should be maintained or increased.
- The Soil Phosphate Index should be no higher than 1 and ideally 0.
- There should be no increase in cover of more vigorous grasses such as false oat, perennial rye grass and cocksfoot. Over time the cover of these species should decrease.
- By year 5:
    - Cover of wildflowers in the sward (excluding undesirable species but including rushes and sedges), should be between 40% and 70%.
    - At least 70% of the wildflowers should be flowering during May-July.
    - At least 3 high value indicator species for the BAP Habitat – lowland neutral grassland should be frequent-occasional in the sward: common bird's foot trefoil, meadow vetchling and common knapweed.
    - The sward should meet a score of at least 14 according to the method at Appendix 3.
- By year 10:
    - Cover of wildflowers in the sward (excluding undesirable species but including rushes and sedges) should be between 50% and 70%.
    - At least 70% of the wildflowers should be flowering during May-July.
    - The sward should meet a score of at least 20 according to the method at Appendix 3.
    - At least 2 extra high value indicator species for the S41 Habitat (see Appendix 3 for indicator list) – lowland neutral grassland should be occasional in the sward: autumn hawkbit and selfheal.

Woodland Habitats

9.6 Monitoring surveys of the woodlands will record the presence/absence of ancient woodland indicator species, presence of non-native/ornamental species, coverage of shrub layer, natural regeneration and the presence of standing and fallen dead wood.

Any evidence of faunal use (including deer damage) will be recorded. For newly planted/restored areas of woodland the monitoring surveys will assess woodland establishment and the presence of any woodland ground flora species.

Heathland Habitats

9.7 Heathland areas will be monitored annually to ensure:

- That the heather canopy becomes well established and ultimately the heather canopy is fully formed by year 5 following restoration;
- That further management is implemented (e.g. introduction of heather litter, brash, seedlings from other sites in Staffordshire) to achieve the restoration objective, and
- That weed species, scrub and bracken do not establish within these areas.

Aquatic habitats

9.8 The monitoring surveys will record:

- The presence of any notable species
- Invasive/non-native species, or any undesirable species such as reedmace *Typha latifolia*
- Extent of shaded and open water
- Presence or likely absence of fish
- Indicators of good or poor water quality
- Evidence of pollution or eutrophication, along with any excessive siltation/leaf litter accumulation or erosion
- Establishment and mapping of wetland/scrub in Quarry 2 including species list, % cover of scrub, presence of undesirable species (e.g. reedmace)

Field Boundary Features

9.9 The monitoring survey to assess the establishment of linear features should follow the following guidelines[4]:

- Percentage of whole hedgerows/30m samples with no more than 10% cover of recently introduced, non-native species.
- Cross-sectional area at least $3m^2$
- Height of at least 1m (maximum 1.5m)
- Width of at least 1.5m.
- Gaps less than 10% of the hedgerow length
- No gap greater than 5m
- Base of leafy growth less than 0.5m from the ground for a shrubby hedgerow

[4] Adapted from: Defra (2007) Hedgerow Survey Handbook. A standard procedure for local surveys in the UK. Defra, London.

Appendix 1 Integrated Outline Habitat Management Plan

BOW111 Moneystone Quarry

Drawing title: Integrated Wildlife Habitat Plan

Drawn by: LB
Checked by: JJ

Date: 01/06/16

bowland ecology

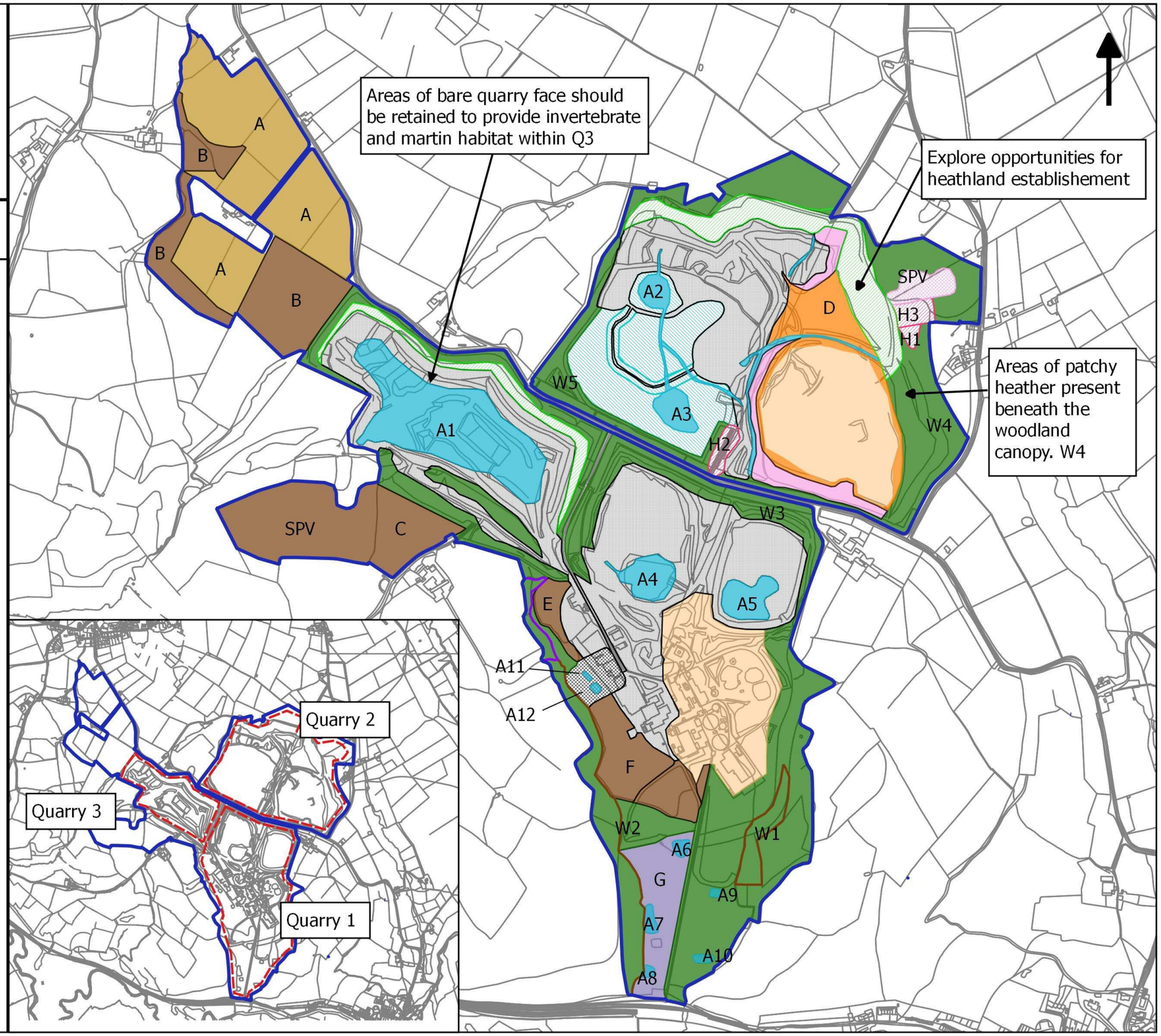
Legend

- Ownership boundary
- Leisure development area
- Solar PV area
- Sibelco Labs

Habitats

- Hydra seeded habitats (birch/willow scrub to be removed/thinned)
- Natural colonisation (mosaic habitat: bareground/heath/grassland)
- Moderate diversity grassland to enhance to MG5
- Species poor grassland to restore to MG5
- MG5 Grassland to be created
- Woodland habitats
- Aquatic habitats
- Scrub/wetland
- Grass scrub mosaic
- Conifer plantation restored to heathland
- Heathland management
- Re-planted ancient woodland
- Ancient woodland

A-G Grassland compartments
W1-6 Woodland compartments
A1-12 Aquatic features
SPV SPV enhancement area
H1-3 Heathland compartments



Appendix 2 Grassland Species Tables

Area B NVC Quadrat Data

Species	1	2
Ranunculus repens	4	4
Rumex acetosa	2	2
Plantago lanceolata	2	4
Cynosurus cristatus	6	7
Holcus lanatus	2	3
Festuca rubra	4	4
Trifolium pratensis	4	5
Trifolium repens	5	4
Anthoxanthum odoratum	2	2
Agrostis stolonifera	4	3
Carex hirta		3
Dactylis glomerata	2	3
Cirsium arvense	3	
Leontodon autumnalis	1	3
Lolium perenne	7	5

Area F MG6 (Lolium perenne – Cynosurus cristatus) grassland NVC Quadrat Data

	Quadrat Number					
Species	**1**	**2**	**3**	**4**	**5**	**6**
Centaurea nigra				1		
Deschampsia cespitosa	1		5			
Ranunculus repens	4		4	5		
Lathyrus pratensis		2	3			
Juncus effusus	1			3		
Rumex acetosa		3	2			
Plantago lanceolata	2		3	6		
Cynosurus cristatus	6	3	3		2	1
Carex caryophyllea						
Holcus lanatus	7	6	5	6	4	5
Juncus inflexus			1			
Carex flacca	1		2			
Cerastium fontanum						3
Festuca rubra	6	7	6	4	7	7
Trifolium pratense	4	2	4	4	4	
Trifolium repens	2	2	1	5		
Anthoxanthum odoratum	3	4	2	2	4	4
Lotus corniculatus	2					4
Agrostis stolonifera	6	6	7	4	4	3
Luzula campestris / multiflora	5					3
Senecio jacobea			1			
Dactylis glomerata	1	2				
Pseudoscleropodium purum					2	4
Agrostis capillaris					4	4
Taraxacum agg.	1		2			
Calliergonella cuspidata			2			
Cirsium arvense		4	2	1		

Area F continued…	**Quadrat Number**					
Species	**1**	**2**	**3**	**4**	**5**	**6**
Achillea millefolium					2	
Alopecurus pratensis				4		
Lolium perenne				4		
Rhytidiadelphus squarrosus					6	7
Vicia sp					2	
Centaurium erythraea					4	
Pilosela officinarum					6	
Rumex acetosella					1	3
Polytrichum sp					2	
Hypnum compressiforme					2	

Area G MG5 (Cynosurus cristatus – Centaurea nigra grassland) NVC Quadrat Data

	Quadrat Number		
Species	**7**	**8**	**9**
Centaurea nigra	6	2	2
Lathyrus pratensis	2	2	2
Rumex acetosa	3	3	3
Plantago lanceolata	4	4	3
Holcus lanatus	5	5	5
Cerastium fontanum		2	2
Festuca rubra	5	3	7
Trifolium pratensis	3	2	
Prunella vulgaris	2	4	
Agrostis stolonifera	5	5	6
Leucanthemum vulgare	5	6	4
Senecio jacobea	3	6	1
Dactylis glomerata			4
Pseudoscleropodium purum		3	
Calliergonella cuspidata	4	3	
Achillea millefolium	2	3	2
Leontodon autumnalis	2	2	
Rhytidiadelphus squarrosus			7
Vicia sp	2		1
Potentilla reptans	2		2
Valeriana officinalis		2	
Chamerion angustifolium		3	
Heracleum sphondylium		2	2
Rubus fruticosus		2	
Stellaria graminea			1
Campanula rotundifolia	1		
Arenaria sp.	2		2
Dactylorhiza fuchsii	1		
Centaurium erythraea	3		

Appendix 3 Botanical Checklist for Grassland Monitoring

4.10 Grassland guidelines

Sites of Biological Importance

Sites over 0.25ha referable to the following National Vegetation Classification (NVC) communities: **MG4, MG5, MG6, MG8, MG9, MG10, CG2, CG3, CG7, U1, U2, U3, U4, M22-26**.

OR

Sites over 0.25ha which score over 20 points on the following species checklist:

Biodiversity Alert Sites

Sites over 0.25ha which score between 14 and 19 on the following species checklist:

Table 8 Checklist of Grassland Species

Scientific Name	Common Name	present	O / LF	F or F+
Achillea millefolium	Yarrow		1	1
A ptarmica	Sneezewort		1	2
Ajuga reptans	Bugle		1	2
Alchemilla species	Ladies' Mantles	1	2	3
Angelica sylvestris	Wild Angelica		1	2
Anthoxanthum odoratum	Sweet Vernal-grass		2	2
Briza media	Quaking-grass	1	2	3
Calluna vulgaris	Heather		1	2
Caltha palustris	Marsh Marigold	1	2	3
Campanula rotundifolia	Harebell	1	2	3
Cardamine pratensis	Cuckoo-flower		1	2
C amara	Large Bitter-cress		1	2
Carex species	Sedges	1	2	2
Centaurea nigra	Common Knapweed		1	2
Cerastium fontanum	Common Mouse-ear		1	2
Cirsium palustre	Marsh Thistle		1	1
Conopodium majus	Pignut		1	2
Crepis capillaris	Smooth Hawk's-beard		1	2
Cynosurus cristatus	Crested Dogs-tail	1	1	2
Dactylorhiza fuchsii	Common Spotted-orchid	1	2	3
Deschampsia cespitosa	Tufted Hair-grass	1	1	
D. flexuosa	Wavy Hair-grass	1	2	2
Euphrasia species	Eyebrights	1	2	3
Filipendula ulmaria	Meadowsweet		1	1
Galium palustre	Common Marsh Bedstraw		1	2
Galium saxatile	Heath Bedstraw	1	2	3
Galium verum	Lady's Bedstraw	1	2	3
Geum rivale	Water Avens	1	2	3
Hieracium species	Hawkweeds		1	2
Hypochaeris radicata	Cat's-ear		1	2
Juncus species	Rushes		1	2
Knautia arvensis	Field Scabious	1	2	3
Lathyrus pratensis	Meadow Vetchling		1	2
Leontodon autumnalis	Autumnal Hawkbit		1	2

Leucanthemum vulgare	Ox-eye Daisy	1	2	2
Linum catharticum	Fairy Flax		1	2
Listera ovata	Common Twayblade	1	2	3
Lotus corniculatus	Common Bird's-foot-trefoil		1	2
Lotus pedunculatus	Large Bird's-foot-trefoil		1	3
Luzula campestris	Field Wood-rush	1	2	2
Luzula. multiflora	Heath Wood-rush	1	2	2
Lychnis flos-cuculi	Ragged Robin	1	2	3
Mentha aquatica	Water Mint		1	2
Myosotis scorpioides	Water Forget-me-not		1	2
Pilosella officinarum	Mouse-ear Hawkweed		1	2
Pimpinella major	Greater Burnet-saxifrage	1	2	3
Pimpinella saxifraga	Burnet-saxifrage	1	2	3
Plantago lanceolata	Ribwort Plantain		1	1
Polygala species	Milkwort species	1	2	3
Potentilla erecta	Tormentil		1	2
Primula veris	Cowslip	1	2	3
Primula vulgaris	Primrose	1	2	3
Prunella vulgaris	Selfheal		1	2
Pulicaria dysenterica	Fleabane		1	2
Ranunculus acris	Meadow Buttercup		1	2
Ranunculus bulbosus	Bulbous Buttercup	1	2	3
Ranunculus flammula	Lesser Spearwort		1	3
Rhinanthus minor	Yellow-rattle	1	2	3
Rumex acetosa spp. acetosa	Common Sorrel		1	1
Rumex acetosella	Sheep's sorrel		1	2
Sanguisorba minor	Salad Burnet	1	2	3
Sanguisorba officinalis	Great Burnet	1	2	3
Senecio aquaticus	Marsh Ragwort		1	1
Stachys officinalis	Betony	1	2	3
Stellaria uliginosa	Bog stitchwort		1	2
Succisa pratensis	Devil's-bit Scabious	1	2	3
Trifolium pratensis	Red Clover		1	1
Trisetum flavescens	Yellow Oat-grass	1	2	3
Vaccinium myrtillus	Bilberry		1	2
Valeriana dioica	Marsh Valerian	1	2	3
Valeriana officinalis	Common Valerian	1	2	3
Veronica officinalis	Heath Speedwell		1	2
Vicia cracca	Tufted Vetch		1	1
Viola palustris	Marsh Violet	1	2	3
Viola riviniana	Common Violet		1	2
All species listed in Hopkins (1985) as R or VR		2	3	4

Native species of scrub at between 2% and 10% cover score additional 2 points

Bare ground (bluffs or scrapes) at between 1% and 5% cover score additional 2 points

Marshes or flushes at between 2% and 10% cover score additional 2 points

Hopkins, I.J. (1985) *Staffordshire flowering plants and ferns*. City Museum and Art Gallery, Stoke-on-Trent.