European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Exmoor and Quantock Oakwoods Special Area of Conservation (SAC) UK0030148

Horner Wood - oak pollard in wood pasture in the Eastwater Valley.
North Exmoor SSSI/Dunkery & Horner Woods National Nature Reserve, Somerset.
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About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Exmoor and Quantock Oakwoods SAC.

This advice should therefore be read together with the SAC Conservation Objectives available here.

This site is contiguous along long boundaries with the Exmoor Heaths SAC so that you should also refer to the separate European Site Conservation Objectives and Supplementary Advice provided for those sites, which are available here.

This advice replaces a draft version dated January 2019 following the receipt of comments from the site's stakeholders.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Exmoor and Quantock Oakwoods Special Area of Conservation (SAC)
Location	Devon, Somerset
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1 April 2005
Qualifying features	See below
Designation Area	1894.05 ha
Designation Changes	None
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	West Exmoor Coast and Woods SSSI, Watersmeet SSSI, North Exmoor SSSI, Barle Valley SSSI, The Quantocks SSSI.
Relationship with other European or International Site designations	On Exmoor, the boundary of the SAC is contiguous with parts of the Exmoor Heaths SAC which can be seen here on the MAGIC website

Site background and geography

This site supports particularly large expanses of this habitat including some of the largest oak woods in southern England including Horner Wood and Watersmeet, which extend to nearly whole valley systems. The SAC has seven distinct blocks separated by semi-natural habitats or farmland and, in the case of the Quantocks, by the Taunton Vale. Most are located within Exmoor National Park, part of the Exmoor National Character Area (NCA). They include the Heddon Valley woods and Woody Bay in the far west of the National Park, the Watersmeet woodland complex above Lynton, Hawkcombe Woods and the extensive Horner Wood complex south of Porlock, and the Barle Valley woods below Withypool down to Dulverton. The Quantock outlier, within the Quantock Hills Area of Outstanding Natural Beauty, is represented by woodland extending up Holford and Hodder's Combes, together with Alfoxton and Shervage Woods.

The underlying Devonian sandstones and slates of the area underpin plateaux incised by fast flowing streams and rivers such as the Exe and Lyn, to form steep-sided valleys, 'combes'. They are rich in bryophytes, ferns and epiphytic lichens. The woodland is mainly ancient, semi-natural sessile oak woodland with rich lichen and bryophyte communities. The most widespread communities occurring are sessile oak - downy birch - *Dicranum majus* woodland on poorer, more lithomorphic soils on steeper slopes and sessile oak - downy birch - wood sorrel woodland on deeper soils developed on more moderate slopes towards the upper edge of the woods. Very small areas of deeper, wetter soils in the narrow floodplain may support richer stands of ash and alder. Large areas, especially on steep slopes, escaped Bronze Age clearances and later the replanting and coniferisation of the post 1600 modern era. In some places, there are long transitions to other semi-natural habitats, particularly heathland. Small areas of heaths, gorse and hawthorn scrub, acid grassland often with bracken, conifer or mixed woodland are included in the SAC. A small area at Woody Bay occurs on and above sea cliffs.

Much of the woodland will have been managed at some point in the last thousand years, but moving from a mainly pastoral landscape of medieval times into more intensive management within the last 200 years. Upland oak ‘plantations’ were common, woods that were clear-felled in the late 18th to early 19th century, and extensively planted up with oak for the purpose of producing oak coppice products (tan bark, charcoal and pit props). Many of these woods were coppiced on rotation, which resulted in a landscape covered in a patchwork of coppice coupes of different aged stands. As the coppicing industry declined in the 20th century, many of these coppice stools grew on to maturity. Today, many woodlands are characteristic of this sudden change in management, with a very even aged structure. Other areas represent remnants of the pastoral management and may be wood pasture in structure or open grown trees surrounded by younger stands. These areas have high ecological continuity and are critical to the survival of specialised lichens and other species.

The priority issue on the site is invasive species especially rhododendron and invasive knotweeds. Newer threats include Montbretia *Crocosmia crocosmifolia*, Himalayan balsam *Impatiens glandulifera* and fringecups *Tellima grandiflora which* are becoming recognised as problems locally and more widely. The wider catchment may be a source of new infestations for the SAC and so needs to be considered. Secondly, parts of the woodland lack a well-developed and open structure due to limited understorey development and/or an over-dominant canopy (lack of light and younger age classes) and locally an excessive abundance of beech. This is particularly a problem for areas rich in lichens of international importance. Thirdly, adaptation to climate change will be necessary, including to pests and diseases. Ash dieback (Chalara) is present locally on Exmoor and on the Quantocks. Ash trees are particularly valuable lichen hosts at younger ages than other species such as oak. Oak woodland on slightly richer soils with areas of mature ash, particularly along river valleys or derived from wood pasture, support the most important lichen communities of international importance. Dieback threatens this interest in the medium to long term and the future potential of the wood if whole generations of younger trees are affected. Additionally, nitrogen deposition exceeds site relevant critical loads and it is uncertain whether this is a major problem. Currently a sensitive feature, the lichen assemblage, appears to be in favourable condition for this particular factor. Currently grazing levels in woodlands are at generally acceptable levels because this this type of woodland benefits from light to moderate grazing levels, providing more open conditions for woodland birds, lichens and dead wood invertebrates). Locally, studies suggest deer have greater impact than agricultural stock. In places heavy deer browsing can have a significant impact, preventing natural regeneration.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- **H91A0. Old sessile oak woods with *Ilex* and *Blechnum in* the British Isles.**

This site supports large expanses of this habitat including some of the largest oakwoods in southern England including Horner Wood and Watersmeet, forming whole valley systems. They are rich in bryophytes, ferns and epiphytic lichens. The most widespread communities occurring are W17 sessile oak - downy birch - *Dicranum majus* woodland (Rodwell, 1991) on poorer, more lithomorphic soils on steeper slopes and W11 sessile oak - downy birch - wood sorrel woodland on deeper soils developed on more moderate slopes towards the upper edge of the woods. W16b *Quercus* ssp - *Betula* spp - *Deschampsia flexuosa* woodland (*Vaccinium myrtillus - Dryopteris dilatata* sub-community) also occurs, particularly to the east.

It tends to be less bryophyte-rich than some of the western oakwood types, reflecting the fact that the Quantocks is towards the eastern edge of the range for this type. There are also areas of W10 *Quercus robur – Rubus fruticosus – Pteridium aquilinum*. The woods generally have rich Atlantic bryophyte/fern communities (Ratcliffe 1968), including species that are scarce on Exmoor such as the liverwort *Bazzania trilobata*, hay-scented buckler-fern *Dryopteris aemula* and Tunbridge filmy-fern *Hymenophyllum tunbrigense*. The rocky ravine areas of Watersmeet and the Barle woods have the most well developed bryophytes. Lichens are especially important, especially epiphytes including on old trees, often associated with old pollards or open-grown maiden trees, since parts are former wood-pasture rather than the oak coppice that is more common with this type. The combination of high humidity, and air quality, an open canopy which allows good illumination of epiphytes and the presence of relatively mature ash and oak standards favours the development of very diverse communities. Parts of the Exmoor series of woods are of international importance, including the Horner complex and the Barle.

The two major lichen associations well represented here are the Lobarion and *Lecanactidetum premneae*. These are communities of ancient woodland and many species which are particularly indicative of a long continuity of woodland cover are present for example: *Nephroma laevigatum*, *Peltigera collina, P. horizontalis, Sticta limbata, S. sylvatica, Thelotrema lepadinum, Cresponea premnea, Biatorina atropurpurea* and all four species of *Lobaria* which are to be found in Britain. The Lobarion association is best represented here on larger trees in the combe bottom and on old pollards where conditions are moist and not too shaded. The *Lecanactidetum premneae* is to be found on drier well-lit parts of trees often on the higher parts of the slopes. The Quantock woodlands are less surveyed but are probably important on a national scale for a range of old woodland and parkland species, principally on oak but also holly and ash. The coastal woodland at Woody Bay represents a transition to, and example of, Vegetated sea cliffs of the Atlantic and Baltic coasts under the Habitats Directive. The more coastal woods such as Woody Bay and Watersmeet hold important populations of rare and endemic whitebeam *Sorbus* species.

- **H91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)***

This habitat comprises woods dominated by alder *Alnus glutinosa* and willow *Salix* spp. along many streams in narrow flood plains in a range of situations from islands in river channels to low-lying wetlands alongside the channels. The habitat typically occurs on moderately base-rich, eutrophic soils subject to periodic inundation. Many such woods are dynamic, being part of a successional series of habitats. Their structure and function are best maintained within a larger unit that includes the open communities, mainly fen and swamp, of earlier successional stages. The main NVC equivalent W7 *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland. On the drier or more neutral margins of these areas other tree species, notably ash *Fraxinus excelsior* and elm *Ulmus* spp., may become abundant in the canopy.

Understorey species include Hazel *Corylus avellana*, Field Maple *Acer campestre* and Blackthorn *Prunus spinosa*. The ground flora is dominated in many of the drier areas by Dog's Mercury *Mercurialis perennis* or by Pendulous Sedge *Carex pendula* on wetter soils. Ramsons *Allium ursinum* is present on flushed slopes.

The main NVC equivalent is W8 *Fraxinus excelsior Acer campestre Mercurialis perennis* woodland. These have some affinities with the *Tilio-Acerion* Ravine woodland under the Habitats Directive. In other situations the alder woods occur as a stable component within transitions to surrounding dry-ground forest, sometimes including other Annex I woodland types. These transitions from wet to drier woodland and from open to more closed communities provide an important facet of ecological variation. The ground flora is correspondingly varied. Some stands are dominated by tall herbs and sedges, for example common nettle *Urtica dioica*, greater tussock-sedge *Carex paniculata*, and meadowsweet *Filipendula ulmaria*, while others have lower-growing communities with creeping buttercup *Ranunculus repens*, common marsh bedstraw *Galium palustre*, opposite -leaved golden-saxifrage *Chrysosplenium oppositifolium* and marsh-marigold *Caltha palustris*.

Qualifying Species:

- ***S1308.* Barbastelle *Barbastella barbastellus;***

The barbastelle *Barbastella barbastellus* is a medium-sized species of bat by British standards, weighing between 6-13 grams. Its fur is almost black, usually with very pale or golden brown tips to the hairs giving it a frosted appearance. The under-fur is grey-brown, again often with pale tips to the hairs. The ears are black, short, broad and joined across the forehead and together with the rather squat face give this bat a very distinctive 'pug-like' appearance.

Barbastelle ecology is relatively poorly-known although more information has become available since this SAC was designated. It is a northern temperate species, occurring in upland sites in southern Europe. In the UK it is found in a variety of habitats where suitable roosting and foraging is found. The species forages in mixed habitats, including over water. Barbastelles appear to select cracks and crevices in wood for breeding, mostly in old or damaged trees, but cracks and crevices in the timbers of old buildings may also be used. Maternity colonies may move between suitable crevices within a small area, such as a piece of woodland or a complex of buildings. Caves and underground structures may be used for hibernation. The species is very sensitive to disturbance, together with the loss of roost-sites and food resources.

The barbastelle is one of the UK's rarest mammals. In recent years this species has been found to be more widespread across southern England and south Wales than previously recognised. The Exmoor and Quantock Oakwoods SAC is one of the few sites to be protected by SAC designation for barbastelle bats. A colony of barbastelle is associated with the cracks and crevices of trees within Horner Wood, the lower Barle Valley and the woods on the Quantocks including Alfoxton woods, Hodders Combe and Holford Combe. These trees are used as a summer maternity roost where the female bats gather to give birth and rear their young. Baby bats are usually born in July, sometimes even in early August; females usually produce a single baby, but occasionally twins. Juvenile bats can fly at about 3 weeks, and by 6 weeks can forage for themselves. Research indicates that juveniles follow the adults into their established foraging areas.

All species of bat present in the UK, including the barbastelle, are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation of Habitats and Species Regulations 2017, making it a 'European Protected Species'. A licence may therefore be required for any activities likely to harm or disturb individual bats.

- ***S1323.* Bechstein`s bat *Myotis bechsteinii;***

Bechstein's bat *Myotis bechsteinii* is a medium-sized species, with very long ears and a long, pointed, bare, pink face. It has shaggy light-to reddish-brown fur on its back and contrasting greyish white-tipped fur on its underside. The species is closely associated with mature deciduous woodland and appears to select old woodpecker holes or rot holes in trees for breeding. It also occurs in coniferous woodland in some areas. Maternity colonies may move between suitable crevices within a small area, such as a piece of woodland. It is believed to hibernate in hollow trees and sometimes in underground localities.

Bechstein's bat *Myotis bechsteinii* is one of the UK's rarest mammals, recorded from only a small number of sites in southern England and Wales. Recent surveys indicate hotspots in the distribution of breeding colonies in Dorset/Somerset, southwest Hampshire/IOW and Sussex. Bechstein's have been recorded on the Quantocks - two breeding females being captured in Holford Combe and Alfoxton Woods, and then traced back to roosts in Alfoxton Park (adjoining the SAC boundary). Very few maternity roosts are currently known, but surveys of lactating females or females in breeding season are being found more regularly and in tree roosts. The great majority of other records come from caves or abandoned mines, which are important hibernation sites for a range of bat species.

All species of bat present in the UK, including the Barbastelle, are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation of Habitats and Species Regulations 2017, making it a ‘European Protected Species’. A licence may therefore be required for any activities likely to harm or disturb individual bats.

- ***S1355.* Otter *Lutra lutra;***

Otters are semi aquatic, living mainly along rivers. They mainly eat fish, though crustaceans, frogs, voles and aquatic birds may also be taken. Being at the top of the food chain, an otter needs to eat up to 15% of its body weight in fish daily.

Otters are solitary shy animals, usually active at dusk and during the night. Otters can travel widely over large areas. Some are known to use 20 km or more of river habitat. Otters tend to live alone as they are very territorial. Otters deposit faeces in prominent places along a watercourse (known as spraints) which have a characteristic sweet musky odour. These mark their range which may help neighbouring animals keep in social contact with one another. Otters are found on most Exmoor and other rivers in Somerset and records show use of all the rivers within the SAC.

The otter is also a ‘European Protected Species’ in the UK, and it is an offence to disturb, capture, injure or kill an otter (either on purpose or by not taking enough care), or to damage, destroy or obstruct access to its breeding or resting places, without first getting a licence.

General References

Ratcliffe, D. A. 1968. An ecological account of the Atlantic bryophytes of the British Isles. New Phytologist, 67, 365-439.

Rodwell, J.S. (ed.) 1991. British Plant Communities. Volume 1 - Woodlands and scrub. Cambridge University Press

Site-specific seasonality of SAC features

The table below highlights in grey those months in which significant numbers of each qualifying feature are most likely to be present at the SAC during a typical calendar year. This table is provided as a general guide only. The presence of the features may vary depending on weather conditions.

Unless otherwise indicated, the months shown below are primarily based on information relating to the general months of occurrence of the feature in the UK. Where site-based evidence is available and has been used to indicate below that significant numbers of the feature are typically present at this SAC outside of the general period, the site-specific references have been added to indicate this.

Applicants considering projects and plans scheduled in the periods highlighted in grey would benefit from early consultation with Natural England given the greater scope for there to be likely significant effects that require consideration of mitigation to minimise impacts to qualifying features during the principal periods of site usage by those features. The months which are *not* highlighted in grey are not ones in which the features are necessarily absent, rather that features may be present in less significant numbers in typical years. Furthermore, in any given year, features may occur in significant numbers in months in which typically they do not. Thus, applicants should not conclude that projects or plans scheduled in months not highlighted in grey cannot have a significant effect on the features. There may be a lower likelihood of significant effects in those months which nonetheless will also require prior consideration.

Any assessment of potential impacts on the features must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional site-based surveys may be required.

Feature	Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Site-specific references where available
Barbastelle and Bechstein's bats	Breeding													

Table 1: Supplementary Advice for Qualifying Features: H91AO. Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles and H91EO. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-padion, Alnion incanai, Salicion albae*)

<table>
<tr><th colspan="2">Attributes</th><th>Targets</th><th>Supporting and Explanatory Notes</th><th>Sources of site-based evidence (where available)</th></tr>
<tr>
<td>Extent and distribution of the feature</td>
<td>Extent of the feature within the site</td>
<td>Maintain the total extent of the feature to not less than 1545 ha as measured for each individual SSSI a follows:

<table>
<tr><th>SSSI</th><th>Oak-woods</th><th>Alluvial forest</th></tr>
<tr><td>The Quantocks</td><td>307 ha</td><td>1 ha</td></tr>
<tr><td>North Exmoor</td><td>386 ha</td><td>26 ha</td></tr>
<tr><td>Barle Valley</td><td>357 ha</td><td>7 ha</td></tr>
<tr><td>Watersmeet</td><td>250 ha</td><td>1 ha</td></tr>
<tr><td>West Exmoor Coast & Woods</td><td>210 ha</td><td>0 ha</td></tr>
</table>
</td>
<td>There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored.

The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information.

The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis.

For this feature tree roots (particularly of veteran trees) can extend a considerable distance beyond the boundary of the site - they can be impacted by soil compaction (such as caused by vehicles or construction works); agricultural operations or other soil disturbance (like trenches); and agro chemicals or other chemicals which get into the soil.

Any loss of woodland area - whether at the edge or in the middle of a site will reduce the core woodland area where woodland conditions are found - these support significant assemblages of species dependent on woodland conditions (e.g. lichens and bryophytes - being one example). Loss of any woodland area which fragments a site into different parts will clearly disturb the movement of species between the remaining parts of the woodland.</td>
<td>Boyce, 2009.

Boyce, 2012.

English Nature, 2000.

Goldberg and Kirby, 2013.

National Trust, 1990.

National Trust, 2007.

National Trust, 2011.

National Trust, 2015.

Teverson, 1995.

This attribute will be periodically monitored as part of Natural England's SSSI condition assessments</td>
</tr>
</table>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			The area of Old sessile oakwoods includes mainly W11 and W17 woodland, plus W16 to the drier east, but with transitions to W8, W9 & W10 stands within the natural variation in communities within western oakwood type. The area of Alluvial forests on richer soils is mainly W7, with some W8 stands as transitional to drier ground. In some places W9 occurs, as well as closer to the coast above sea cliffs.	
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature.	Boyce, 2009. Boyce, 2012. English Nature, 2000. Goldberg and Kirby, 2013. National Trust, 1990. National Trust, 2007. National Trust, 2011. National Trust, 2015. Teverson, 1995. This attribute will be periodically monitored as part of Natural England's SSSI condition assessments
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type(s): W11, W16, W17 forming a mosaic, together with W8, W9 and W10, and to W7 on wetter ground.	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be	Boyce, 2009. Boyce, 2012. English Nature, 2000. Goldberg and Kirby, 2013. National Trust, 1990.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	National Trust, 2007. National Trust, 2011. National Trust, 2015. Teverson, 1995. This attribute will be periodically monitored as part of Natural England's SSSI condition assessments
Structure and function (including its typical species)	**Vegetation structure - canopy cover**	Maintain an appropriate tree canopy cover across the feature, which will typically be between 30-90% except in wood pasture stands or in lichen rich stands where the minimum cover is 20%.	Canopy cover is the overall proportion of vegetative cover consisting of any woody layer ranging from established regeneration to mature and veteran stages. Woodland canopy density and structure is important because it affects ecosystem function and in particular microclimate, litter fall, soil moisture, nutrient turnover and shading; this in turn influences the composition of plants and animals in lower vegetation layers and soil. Open canopies with just scattered trees will have less of a woodland character and reduced diversity of woodland-dependent species (although they may be still be important as a form of woodland-pasture). Completely closed canopies across the whole woodland are not ideal either however, as they cast heavier shade and support fewer species associated with edges, glades and open grown trees, and have little space where tree regeneration could occur. In general, the woodland canopy of this feature should provide a core of woodland interior conditions with some open and edge habitat as well.	Boyce, 2009. Boyce, 2012. This attribute will be periodically monitored as part of Natural England's SSSI condition assessments
Structure and function (including its typical species)	**Vegetation structure - open space**	Maintain areas of permanent/ temporary open space within the woodland feature, typically to cover approximately 10% of area.	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a	Boyce, 2009. Boyce, 2012. This attribute will be periodically monitored as part of Natural

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			particular site, taking account of its known interest, history, past management and the landscape context. Having some open, sunlit and largely tree-less areas as part of the woodland community is often important to facilitate natural tree and shrub regeneration and also to provide supporting habitat for specialist woodland invertebrates, birds, vascular and lower plants. Such open space can be permanent or temporary and may consist of managed grazed areas, linear rides and glades, or naturally-produced gaps caused by disturbance events such as windthrow/fire/tree falling over/snow damage.	England's SSSI condition assessments
Structure and function (including its typical species)	**Vegetation structure - old growth**	Maintain the extent and continuity of undisturbed, mature/old growth stands (typically at least 10% of the feature at any one time) or the assemblages of veteran and ancient trees at 5-10 trees per hectare.	Good woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. . For this habitat type, old or over-mature elements of the woodland are particularly characteristic and important features, and their continuity should be a priority.	Boyce, 2009. Boyce, 2012. Mosaic Mapping, 2010. Mosaic Mapping, 2011.
Structure and function (including its typical species)	**Vegetation structure - dead wood**	Maintain the continuity and abundance of standing or fallen dead and decaying wood, typically between 30 - 50 m3 per hectare of standing or fallen timber or 3-5 fallen trees >20cm diameter per hectare, and minimum 4-10 standing dead trees per hectare	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. Dead and actively decaying wood, either as part of a standing tree or as a fallen tree on the woodland floor, is an important component of woodland ecosystems, and supports a range of specialist invertebrates, fungi, lichens and bryophytes, and associated hole-nesting birds and roosting bats, all of which may be very typical of the feature.	This attribute will be periodically monitored as part of Natural England's SSSI condition assessments
Structure and function (including its typical species)	**Vegetation structure - age class distribution**	Maintain at least 3 age classes (pole stage/ medium/ mature) spread across the average life expectancy of the commonest trees.	A distribution of size and age classes of the major site-native tree and shrub species that indicate the woodland will continue in perpetuity, and will provide a variety of the woodland habitats and niches expected for this type of woodland at the site in question.	Boyce, 2009. Boyce, 2012. This attribute will be periodically monitored as part of Natural England's SSSI condition assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation structure - shrub layer**	Maintain an understorey covering at least 1-30% of total stand area, except (a) in wood pasture stands where there is no effective minimum and (b) in lichen-rich areas where dense shrub or climber growth particularly of evergreens e.g. rhododendron, ivy and holly around tree trunks no more than 10% and (c) on Exmoor where typically 10% is more appropriate.	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context. A higher target for W7 and W8 may be appropriate.	Boyce, 2009. Boyce, 2012. Sanderson, 2009. Sanderson, 2011. This attribute will be periodically monitored as part of Natural England's SSSI condition assessments
Structure and function (including its typical species)	**Vegetation structure - woodland edge**	Maintain a graduated woodland edge into adjacent semi-natural open habitats, other woodland/ wood-pasture types or scrub.	Woodland edge is defined as being the transitional zone between the forest feature and adjacent but different habitat types - the best woodland edges will have a varied structure in terms of height and cover. Many typical forest species make regular use of the edge habitats for feeding due to higher herb layer productivity and larger invertebrate populations. Grasslands / arable fields managed with high doses of agro-chemicals could potentially not allow this gradation of woodland edge and could have other impacts on the integrity of the site (pollution/ nutrient enrichment etc.).	
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the resilience of the feature by ensuring a diversity (at least 3 species) of site-native trees (e.g. sessile oak, birch, holly, rowan, willow) across the site.	The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be vulnerable overall but are a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. This recognises the increasing likelihood of natural habitat features needing to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an	Natural England, 2015.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability.	
Structure and function (including its typical species)	**Browsing and grazing by herbivores**	Maintain browsing at a low to moderate level that allows a well-developed understorey with no obvious browse line, & lush ground vegetation with some grazing sensitive species evident (bramble, ivy etc.), and tree seedlings and sapling common in larger gaps.	Herbivores, especially deer, are an integral part of woodland ecosystems. They are important in influencing woodland regeneration, composition and structure and therefore in shaping woodland wildlife communities. In general, both light grazing and browsing is desirable to promote both a diverse woodland structure and continuous seedling establishment. Short periods with no grazing at all can allow fresh natural regeneration of trees, but a long-term absence of herbivores can result in excessively dense thickets of young trees which shade out ground flora and lower plant species. However, heavy grazing by deer or sheep prevents woodland regeneration, and can cause excessive trampling and/or poaching damage, canopy fragmentation, heavy browsing, bark stripping and a heavily grazed sward. Higher levels of browsing are tolerated on this site as wood pasture origin and structure are present in many areas, large woodland blocks are grazed by red deer and grazing is critical for the maintenance of the oak woodland lichen interest feature. Without grazing the lower plants would be shaded out by growth of ground flora, undergrowth shading trunks and epiphytes such as ivy.	Boyce, 2009. Boyce, 2012.
Structure and function (including its	**Regeneration potential**	Maintain and restore the potential for sufficient natural regeneration of desirable trees and shrubs; typically tree seedlings of	The regeneration potential of the woodland feature must be maintained if the wood is to be sustained and survive, both in terms of quantity of regeneration and in terms of appropriate species. This will Include regeneration of the trees and shrubs	Boyce, 2009. Boyce, 2012.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)		desirable species (measured by seedlings and <1.3m saplings - above grazing and browsing height) should be visible in sufficient numbers in large (> 1ha) canopy gaps, at the wood edge and/or as regrowth as appropriate to maintain canopy density over a 10 year (Quantocks) or 50 year (Exmoor) period	from saplings or suckers, regrowth from coppice stools or pollards, and where appropriate planting. Browsing and grazing levels must permit regeneration at least in intervals of 5 years every 20. The density of regeneration considered sufficient is less in parkland sites than in high forest. Regeneration from pollarding of veteran trees should be included where this is happening. Less regeneration (50 year period) is accepted on this site as wood pasture origins are present in many areas, large woodland blocks are grazed by red deer and grazing is critical for the maintenance of the oak woodland lichen interest feature. Without grazing the lower plants would be shaded out by growth of ground flora, undergrowth shading trunks and epiphytes such as ivy.	This attribute will be periodically monitored as part of Natural England's SSSI condition assessments
Structure and function (including its typical species)	**Tree and shrub species composition**	Maintain or restore a canopy and under-storey of which 95% is composed of site native acceptable naturalised species trees and shrubs: sessile oak *Quercus petraea* and pedunculate oak *Q. robur*, ash *Fraxinus excelsior*, birch *Betula* spp., holly *Ilex aquifolium*, alder Alnus glutinosa, hazel *Corylus avellana*, rowan *Sorbus aucuparia* and native whitebeams *Sorbus* spp. sallows *Salix* spp., hawthorn *Crataegus monogyna*, field maple *Acer campestre* and yew *Taxus baccata*. On the Quantocks holly >10% cover is not acceptable Sessile oak to be present in areas away from W7 areas and providing at least 30% cover in	Native trees and shrubs in general support a greater diversity of associated species than non-native species, especially amongst groups of invertebrates which depend directly on trees for food and shelter. There are many plants and animals which use or co-exist with non-native trees, but many rare and threatened woodland species are specialists adapted to one or a few native trees or shrub species (birches, willows and oaks, are examples of trees that host many specialist insect species). Beech, sweet chestnut and sycamore are not site native but can be important in some areas. Sycamore can be important for lichens - along river valleys tolerate up to 10-20% in larger age categories. Beech or sweet chestnut is acceptable as mature/veterans or locally where mapped as dominant stands with little prospects of restoration to Annex I habitat type. Recent guidance (Natural England, 2009) on dealing with the changing distribution of tree species suggests decisions should be taken at a site level with reasons for either (a) a presumption towards acceptance of a species in a particular site or (b) towards management of a species in a particular site. The oak woodland (in the widest sense with sessile oak, ash, field maple, holly, alder, hazel, birch, hawthorn and sallow all	Boyce, 2009. Boyce, 2012. Natural England, 2009. This attribute will be periodically monitored as part of Natural England's SSSI condition assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		the canopy of mature stands over feature as a whole.	significant) and its exceptional lichen interest here is considered sufficiently important to generally aim to maintain the past native tree and shrub composition as closely as possible, whilst accepting change is inevitable (cf Chalara). In some areas where composition is more mixed up to 20% Beech, sycamore and other naturalised species (except rhododendron) should be accepted.	
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain or restore the abundance of the species listed below to enable each of them to be a viable component of the Annex 1 habitat: Epiphytic lichen assemblage Rich Atlantic bryophyte communities including oceanic species such as *Hyocomium armoricum, Plagiochila spinulosa, Scapania gracilis, Saccogyna viticulosa, the* **r**are fern *Hymenophyllum wilsonii,* and gametophyte of Schedule 8 plant *Trichomanes speciosum.* Endemic and rare *Sorbus* species including: Slender whitebeam *Sorbus subcuneata*, Bloody whitebeam *S. vexans*, Margaret's whitebeam S. margaretae and No Parking whitebeam *S. admonitor*. Breeding woodland birds including particularly strong populations of pied flycatcher *Ficedula hypoleuca*, wood warbler *Phylloscopus sibilatrix* and redstart *Phoenicurus*	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	For bryophytes: Holyoak, 2007. Callaghan, 2010. For fungi, including lichens: Green, 1993. National Trust, 2015. Sanderson, NA, 2009. Sanderson, NA, 2009. Sanderson, NA, 2009. Sanderson, NA, 2009. Sanderson, 2009. Sanderson, NA, 2011. British Lichen Society, 2013. For Sorbus: Rich, *et al*. 2010. For birds: Boyce, and Freshney, 2014. National Trust, 2015.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		phoenicurus together with the rarer Lesser Spotted woodpecker *Dryobates minor* Red wood ant *Formica rufa* Wood-decay invertebrate fauna (saproxylics) Deadwood fungi		For invertebrates: National Trust, 2015. National Trust, 2017 Boyce, 2002. Alexander, 1996. Duff, A, 1994. Hodge, 1994.
Structure and function (including its typical species)	**Invasive, non-native and/or introduced species**	Ensure invasive and introduced non-native species are either rare or absent, but if present are causing minimal damage to the feature Maximum acceptable cover of rhododendron or Himalayan/ Japanese knotweed = 0%	Invasive or introduced non-native species are a serious potential threat to the biodiversity of native and ancient woods, because they are able to exclude, damage or suppress the growth of native tree, shrub and ground species (and their associated typical species), reduce structural diversity and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (e.g. use of broad spectrum pesticides). Such species can include Rhododendrons, Montbretia, snowberry, Japanese knotweed, giant hogweed and Himalayan balsam, for example. Similarly, this would include pheasants, rabbits and non-native invertebrate 'pest' species.	Boyce, 2009. Information on the distribution of knotweed is available from the Exmoor Knotweed Control Project
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			ecological structure, function and processes associated with this Annex I feature.	
Structure and function (including its typical species)	**Root zones of ancient trees**	Maintain the soil structure within and around the root zones of the mature and ancient tree cohort in an un-compacted condition	The management of land within and around forest habitats which are characterised by ancient trees can be crucial to their individual welfare and long-term continuity, and the landscape they are part of can be just as or even more important. The condition of the soil surrounding such trees will affect their roots, associated mycorrhizal fungi and growth. Plants have difficulty in compacted soil because the mineral grains are pressed together, leaving little space for air and water which are essential for root growth. Unless carefully managed, activities such as construction, forestry management and trampling by grazing livestock and human feet during recreational activity may all contribute to excessive soil compaction around ancient trees.	
Supporting processes (on which the feature relies)	**Air quality**	Restore the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			measures to tackle diffuse air pollution, within realistic timescales. A 'restore' target has been included here as the maximum Critical Loads and Levels are being exceeded and present a risk to this vegetation.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and catchment level, maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. This is included as disruption/ damage to hydrological processes could be caused by activities at some distance from the site boundary, e.g. through extraction of ground or surface waters; diverting or damming river channels; pollution of water source; channel alignment that disrupts natural geomorphological processes; tunnelling etc.	Environment Agency SW Region. 2005. See River Basin Management Plans at https://www.gov.uk/government/collections/river-basin-management-plans-2015 and Catchment Flood Management Plans for North Devon or West Somerset at https://www.gov.uk/government/collections/catchment-flood-management-plans#south-west-river-basin-district
Supporting processes (on which the feature relies)	**Illumination**	Ensure artificial light is maintained below a level which is unlikely to affect natural phenological cycles and processes to the detriment of the feature and its typical species at this site.	Woodland biodiversity has naturally evolved with natural patterns of light and darkness, so disturbance or modification of those patterns can influence numerous aspects of plant and animal behaviour. For example, light pollution (from direct glare, chronically increased illumination and/or temporary, unexpected fluctuations in lighting) can affect animal navigation, competitive interactions, predator-prey relations, and animal physiology. Flowering and development of trees and plants can also be modified by un-natural illumination which can disrupt natural seasonal responses.	See for example Sky Quality data in the Exmoor National Park IDSA Dark Sky Places Annual Report October 2014 -2015
Version Control Advice last updated: **13 March 2019**: Added additional survey information in **Extent of feature within site** attribute.				
Variations from national feature-framework of integrity-guidance:				

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
The targets for some attributes listed above include both ‘maintain’ or ‘restore’ objectives. This is because this SAC is an extensive complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SAC but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request. **Browsing and grazing by herbivores** and **Regeneration potential have** adapted to follow the relevant component SSSI Favourable Condition Tables where browsing is acceptable at slightly higher levels and regeneration at lower levels to reflect wood pasture conditions or the importance of epiphytic lichens. **Vegetation structure - canopy cover** and **Vegetation structure - shrub layer** adapted to follow the relevant component SSSI Favourable Condition Tables where tree canopy cover is acceptable at slightly lower levels to reflect wood pasture conditions or the importance of epiphytic lichens. **Vegetation structure - old growth and Vegetation structure - deadwood** adapted to follow Common Standards Monitoring guidance which is less demanding at minimum 10% (cf. 20%) over-maturity, 5-10 trees/ha (cf. 10 trees/ha) or 3 fallen lying trees >20cm (3-5 trees >30cm).			

Table 2: Supplementary Advice for Qualifying Features: S1323. Bechstein's bat *Myotis Bechsteinii* and S1308. Barbastelle bat *Barbastella barbastellus*

Attributes		**Targets**	**Supporting and Explanatory Notes**	**Sources of site-based evidence (where available)**
Population (of the feature)	**Population abundance - maternity colony**	Maintain the abundance of the breeding population at a level which is above the baseline at or soon after the time of SAC designation, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. **Bechstein's baseline** This baseline was the presence of a maternity colony but no estimate of abundance was known. **Barbastelle baseline** Population above 51-100 bats	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as	Greena Ecological Consultancy, 2000. Bat Conservation Trust. 2011. Amec, 2012. Billington, 2000. Kazcanow, 2000. Bat Conservation Trust, 2016 & 2017. Scott & Altringham, 2014.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			possible, local Natural England staff can advise that the figures stated are the best available. **Bechstein's Bat:** At Horner Wood, a male Bechstein's was discovered in 1999 c. 300m+ outside the SSSI/SAC but no records of females have since been found. Lures were deployed by G. Billington subsequently but with no positive results. Further survey in 2007-2011 also found no Bechstein's. Despite the 2007-2011 surveys, two nursery tree roosts were found near Holford in the Quantocks by G. Billington in 2012. H. Andrews also recorded Bechstein's droppings, confirmed by DNA, in a tree roost in 2012-13 in Holford Combe. **Barbastelle:** The data available on the size of the breeding population is imprecise because it is very difficult to count Barbastelle bats. At this site (as most others in Britain) they roost in trees, which means that they are more difficult to discover than bats roosting in buildings. Scott and Altringham (2014) comment on this topic: Barbastelles are particularly difficult to count out of their roosts, because within the favoured zone of woodland, different trees will be used as roosts on different nights depending on the atmospheric conditions and roosting positions under loose bark cannot be sighted from the ground. Billington (2012) concluded that there was a maternity roost in Alfoxton Park adjoining the SAC in the Quantocks, and in addition it is known that there is at least one maternity roost east of the Quantock maternity roosts again outside the SAC to the east of Kilve. The Bat Conservation Trust carries out annual monitoring of the SAC through the National Bat Monitoring Programme using bat detectors from late July to early September. Three transects are done on the Quantocks at Hodder's Combe & Somerton Combe, Holford Combe and Alfoxton; two on Exmoor at Horner woods, one in Stoke Woods and one at Eastwater. The main purpose of this monitoring is to confirm presence or absence of barbastelles and no attempt is made to estimate the size of the population. The presence of barbastelles was recorded from 2009 in all years to date in	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Quantock transects and from 2011 (but none in 2012) to date in Horner Wood transects. Reports are produced annually, but each includes a summary of the results from previous years. The most recent report held locally is for 2016. In 2017 Barbastelle were found in all Quantocks transects, and in both Horner Wood transects. The population count used as the baseline at the time of SAC designation was based on best estimation from the radio tracking studies from one general bat survey and two Barbastelle targeted surveys over 3 years at Horner Woods. Subsequently the species has been found in the two other independent colonies: in the southern Barle Valley and in the Quantock woods. These were no doubt present before being discovered. The effective baseline must therefore be higher than the current one, perhaps at least double the numbers, but without further survey or specialist involvement, it is currently impossible to estimate.	
Supporting habitat: structure /function	**Supporting off-site habitat (flight-lines)**	Maintain the presence, structure and quality of any linear landscape features which function as flightlines between the SAC and surrounding foraging areas used by barbastelle and Bechstein's bats. Flightlines should remain unlit, functioning as dark corridors.	**Bechstein's bats** don't tend to range far from their roosts, generally up to a maximum distance of 1-2.5km, usually closer to 1km (Dietz *et al* 2010). Though, a few breeding females may choose to roost in hedgerow trees, which have connections to the main woodland habitat. Generally forages within deciduous woodland which contain water bodies, occasionally feeding along woodland edge, treelines and hedgerows. Bechstein's bat generally commutes along linear landscape features such as woodland edge, hedgerows, however, they will cross open fields to reach roost sites and foraging areas. Flightlines will extend beyond the designated site boundary into the wider local landscape **Barbastelle** bats may forage up to 5km from their maternity roosts, though some individuals in less favourable habitat may forage further to reach suitable feeding grounds (Greenaway, 2001). Generally forages within woodland canopy and margins, though will feed in more open areas i.e. orchards, suburban parks. Commutes along linear landscape features such as woodland edge, hedgerows etc., though will cross extensive open areas (i.e. arable fields) to reach foraging grounds and may feed to a certain extent within these more open areas.	Dietz, *et al*. 2009 Burrows, 2018

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Typical flightlines used by these species include linear hedgerows, waterways, blocks of scrub, wooded rides and tracks. Flightlines will extend beyond the designated site boundary into the wider local landscape. Two local councils (West Somerset and Sedgmoor) and Exmoor National Park published a guidance document prepared by Somerset County Council (Burrows 2018) for developers who are planning to build near to the SAC. This identifies zones around the SAC and bands within the zone reflect the likely importance of the habitat for bats and proximity to the maternity and other roost sites. Any development activity taking place within these zones has the potential to impact on the SAC.	
Supporting habitat: structure/ function	**Supporting off-site habitat (foraging areas)**	Maintain any core areas of feeding habitat outside of the SAC boundary that are critical to Barbastelles and Bechstein's Bat during their breeding period	Roost choice, and the presence of bats within the SAC, is likely to be influenced by the site's ability to provide bats with food and shelter. Key feeding areas around a roost, and the commuting routes (or flight-lines) between them, will be an important element of sustaining the SAC population. The current understanding of key roosts and supporting habitat associated with the SAC have also been used to identify a 15.5 km sustenance zone where Barbastelle bats are likely to be present centred around the maternity roosts. Bands within the zone reflect the likely importance of the habitat for bats and proximity to the maternity and other roost sites. Any development activity taking place within this Zone has the potential to impact on the SAC. A guidance document for developers who are planning to build near to the bat SAC has been produced (Burrows, 2018) which reviews current information and identifies these zones around the SAC. Special consideration is also to be given to habitat within 1 km of roost sites, within Juvenile Sustenance Zones (Burrows 2018). Most barbastelle colonies seem to have one large productive foraging zone very close to the roost woodlands to fulfil the juvenile requirement. Although patches closest to the roost area are usually shared by the colony members these may seasonally be left clear by adults as exclusive juvenile foraging zones.	Burrows, 2018

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**Woodland site - maternity colony**	Maintain the extent and structural diversity of supporting woodland habitat suitable for roosting, feeding and foraging by Barbastelles and Bechstein's bats	The structural diversity of supporting habitat will be important to provide roosting spaces and maintain optimal feeding and foraging conditions in close proximity to maternity roosts; key aspects of woodland structure will include good canopy cover (typically 50-90%), an abundance of standing and fallen dead wood, areas of permanent and open space and the retention of open water and/or wetland features. **Barbastelle:** In woodland they forage in the most open places such as Horner Side and along rides or track routes, these can include conifer plantations. Despite barbastelle bats using open habitats within the woodland and hedgerows in the fields, they rarely forage along the outer woodland edges, which can often be the favoured feeding places of several other bat species, which was found in the Horner Woods Bat Survey (Billington 2000) The wood pasture/high forest of Ten Acre Cleave/Eastwater and Horner Wood has a good canopy cover from 75-85% with an abundance of standing and fallen dead wood (Boyce, 2009) and also open water for at least some of the year. Burridge wood near Dulverton has less old trees and standing dead wood but similar canopy. The Quantock woodland areas represent some more mature stands of standard oak (sometimes with some beech and sycamore), amongst a wider matrix of neglected coppice, both with a generally closed canopy.	Boyce, 2009. Boyce, 2012.
Supporting processes (on which the feature and/or its supporting habitat relies)	**Disturbance from human activity**	Control and minimise human access to roost sites	Currently no buildings are known to be used. Any use of buildings should trigger securing these against unauthorised access, which can result in disturbance to bats at critical times of year and which can affect their population viability and use of the site. Grilles on site access points should be maintained where present. There is no evidence that daytime public access to woodland used by barbastelles for summer or winter roosts causes disturbance to these bats. It seems very likely that light pollution during hours of darkness would be disturbing. Tree management that damages actual or potential roosts, carried out for H&S reasons in areas used by the public, or indeed any	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			other reason, would certainly cause serious disturbance to the bats.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. **Barbastelle:** The survey work carried out by Billington at Horner Wood showed a concentration of activity of barbastelles, suggesting that the woodland in the Eastwater valley of Horner and below Cloutsham Ball is where most roosts within the SAC were situated. The canopy here has many standard oaks and also ash common. In the Barle Valley records are centred on Burridge Wood (SSSI unit 2) where breeding is suspected (reasonable numbers and typical nursery roost types -catastrophic fractures - found) but foraging in the other woods above Tarr steps (SSSI unit 35). On the Quantocks roosts within the SAC are in Alfoxton Wood (Unit 38) and Alfoxton Park (outside SAC in Unit 37) and in Hodder's Combe (Unit 49 and Unit 3) and east of Dowsborough Castle (Unit 3). These parts of the woodland and also other areas of old trees with splits and cracks in the remaining woodland within the SAC should be maintained by a regime of minimum management with little disturbance. Tree roosts should be retained intact and allowed to develop naturally. Sufficient suitable trees should be left throughout the surrounding woodland to provide additional roosting sites. Management Plans for this woodland needs to be very long term, and could include intentionally damaging younger trees to make them suitable roosts at an earlier age. The limited radio-tracking studies that have been carried out here showed that bats travelled as far as 9km away in summer	Boyce, 2009 Boyce, 2012 Burrows 2018 Natural England, 2014

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			nights to forage, and less (4km) in autumn. Thus conservation measures outside the boundary of the SAC are also important e.g. planting new woodlands to provide additional roosts for the future, managing hedges appropriately,	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the habitats which support the feature at: **Bechstein's Bat:** the extent of broadleaved woodland within Quantock part of SAC. Maintain the total extent of the habitat(s) which support the feature (at: broadleaved woodland within Quantock part of SAC **Barbastelle:** approximately 1067ha (the total extent of broadleaved woodland in SSSIs within the SAC currently supporting breeding roosts)	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. **Bechstein's Bat:** The extent given here is the sum of broadleaved woodland of the two Annex I habitats for the SSSI that is currently known to have breeding barbastelle (The Quantocks). The extent of habitats used for foraging (or roosting but this in unknown) may be greater than this as the species may use other woodland outside the SAC**.** **Barbastelle:** The extent given here is the sum of broadleaved woodland of the two Annex I habitats for the three SSSIs that are known to have breeding barbastelle (North Exmoor; Barle Valley; The Quantocks). The total area of habitats used for foraging and non-breeding roosts is likely to be considerably greater than this as the species will use other woodland and habitats outside the SAC (including in the adjacent Exmoor Heaths SAC), ranging widely for foraging in a variety of habitats. The most important habitats used for foraging were: (a) rough/ unimproved grassland (94.5% of the habitat in the colonies range was used for foraging); (b) scattered (gorse) scrub and broadleaved woodland (both >57% use); and (c) Bracken, running water and dense (gorse) scrub (all >25% use).	Billington, 2000 Billington, 2001
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		transitional vegetation types, across the site	and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of the species’ supporting habitats. This means that this site is considered to be vulnerable overall but are a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. This recognises the increasing likelihood of natural habitat features needing to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability.	Natural England, 2015
Supporting habitat:	**Soils, substrate and**	Maintain the properties of the underlying soil types, including structure, bulk density, total	Soil supports basic ecosystem function and is a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
structure/ function	**nutrient cycling**	carbon, pH, soil nutrient status and fungal: bacterial ratio, within typical values for the supporting habitat	which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with the supporting habitat of this Annex II feature.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain or, where necessary, concentrations and deposition of air pollutants at or below the site-relevant Critical Load or Level values given for the feature's supporting habitat on the Air Pollution Information System (www.apis.ac.uk).	The supporting habitat of this feature is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of the habitat's substrate, accelerating or damaging plant growth, altering its vegetation structure and composition (including food-plants) and reducing supporting habitat quality and population viability of this feature. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Currently (September 2018) the Air Pollution Information System (APIS) shows that deposition of nitrogen is above the critical load indicating that this pollutant will be affecting the woodland habitat of the barbastelle bats in this SAC. No data are available on the significance of this effect at this site, or if there is any direct effect on the bats themselves.	

Version Control
Advice last updated:
4 March 2019: Following stakeholder comments. Additional information added about the bat guidance for planning provided by Somerset County Council.

Variations from national feature-framework of integrity-guidance:
The attributes concerned with the external and internal condition of buildings used by maternity colonies/for hibernation and access to the buildings have been deleted as there are no such buildings within the boundaries of the SAC, the maternity roosts being in trees.

Table 3: Supplementary Advice for Qualifying Features: S1355. Otter *Lutra lutra*;

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Anthropogenic mortality**	Reduce levels of mortality as a result of anthropogenic (man-made) factors so that they are not adversely affecting the overall abundance and viability of the population.	High numbers of otter casualties within or adjacent to SAC catchments will adversely affect the condition and viability of the population and mitigation measures should be initiated as quickly as possible. Causes of mortality may include roads, accidents with fishing equipment (nets, lobster creels), poisoning, pollutants, hunting and acidification/contamination of water courses (which reduces fish populations). It should be noted that otters are also a European protected species, and that it is an offence to deliberately disturb, capture, injure or kill an otter. Records of otter casualties from Somerset and Exmoor are held by Somerset Otter Group and the majority are usually recovered for autopsy and forwarded to Cardiff University.	Somerset Otter Group two-day surveys (2017) The Cardiff University Otter Project carries out autopsies on otters from England, Wales and Scotland.
Population (of the feature)	**Population abundance**	Maintain the continued presence of an actively-breeding otter population within the SAC, whilst avoiding deterioration from current levels as indicated by the latest mean peak count, estimate or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is	Somerset Otter Group two-day surveys (2017)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. For otters, it is difficult to estimate population size. It could be assumed that where there is a high frequency of positive signs in an area, such as a large number of spraints (of several ages), that otters are likely to be occupying the site. Breeding will be indicated by the presence of natal dens, cub sightings and intensive otter activity (e.g. feeding, sprainting, pathways through vegetation). DNA analysis of spraints is now being used as a technique for identifying otters. Otter spraints and occasional sightings confirm otters are present on all the Exmoor and Quantock rivers within the SAC. The Somerset Otter Group, based on many years of surveys of fresh spraint laid over two days, estimated that 20-24 individual otters live on Exmoor. This is broadly equivalent to the numbers expected for Exmoor's proportionate area when compared to the whole of Somerset, adjusted for the area in Devon.	
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability.	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the habitats which support the feature at: 106km of watercourses	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate	Explanation of Detailed River Network . Length mapped from NE Webmap within SAC boundary 17/9/18.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. The SAC contains 106km of river as mapped on the EA Detailed River Network including Primary, Secondary and Tertiary watercourses	
Supporting habitat: structure/ function	**Abundance of breeding and resting places**	Maintain an abundance of natural breeding and resting sites within the site	It should be noted that otters are highly mobile and are likely to spend their time within wider territories, where designated sites only form a proportion of their range and make a contribution to their wider requirements. Otters are a European protected species, and it is an offence to disturb their resting places. Otters will often use many holts at any one time. They may give birth in one, but raise their young in another. Important features of a successful breeding site are the availability of food, limited disturbance and safety from the risk of flooding. It is important to consider the whole site and not just the known holts as appropriate management will influence all of these factors. Some natal den structures have a limited lifespan (e.g. hollow tree trunks, piles of timber etc.) and if alternative opportunities for natal dens are limited, suitable replacements can be created or constructed. Maintaining dense bank vegetation, areas of reed etc. will ensure that there are suitable areas for resting couches.	
Supporting habitat: structure/ function	**Availability of refugia**	Maintain an abundance of dense bankside vegetation to limit significant disturbance to animals	The integrity of the interest feature may be dependent upon the quality of the adjacent habitat outside the boundary of the site, for instance tributaries. This is likely to be the case where bankside vegetation may be an important barrier to disturbing activity but may lie adjacent to and outside the boundary. Nevertheless it will be important to maintain, or in some cases, to restore dense bankside cover.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**Food availability**	Maintain fish biomass within expected natural levels for the supporting habitat (subject to natural fluctuations).	In freshwater, key fish prey sources for otters include eels, salmonids and bullhead. Frogs can also form an important part of the diet, depending on the habitat and time of year. Crayfish and water beetles may also form part of the diet, as well as an occasional waterbird (young coots, moorhens, ducks) or mammal (rabbits, water voles - although this is uncommon). The diet of otters varies depending on the availability of prey, which in turn varies with the time of year. There should be a diverse range of food sources available throughout the year, within the normal expectations of each particular water course. It should be noted however, that otters may take prey from adjacent fisheries which are stocked to an artificially high level, especially where there are numerous stocked ponds on a floodplain. This can lead to artificially high prey densities adjacent to European sites, which might be expected to, in turn, result in artificially high densities of otter on the designated sites. This highlights the importance of biosecurity around stocked fisheries, and if implemented at all artificial still water fisheries on a floodplain might result in a legitimate reduction in otter density.	
Supporting habitat: structure/ function	**Habitat quality - river habitat**	Maintain the quality of supporting river habitat features, using advice for H3260 habitat, based on natural river function, which provides a characteristic biotope mosaic that caters for otters.	Dense bank vegetation, mires and tall vegetation are important for otters, but they will use a long stretch of river and this won't necessarily fall within a protected site. Dense bank vegetation is favoured as resting areas, but otters will often travel some distance to a preferred 'couch' and this will not necessarily be along the edge of the river. The structure and quality of bankside vegetation and other nearby habitats should be maintained, particularly where there is evidence of use by otters. However, it is thought that the most significant determinant of otter usage of a habitat is the abundance of prey (Kruuk et al, 1998)	Kruuk, *et al*, 1998
Supporting habitat: structure/ function	**Habitat quality - waterway habitat**	Maintain the quality of supporting waterways and habitat features	Smaller tributaries of larger river systems (streams, waters etc) are extremely important for otters and have been shown to have been used more frequently by otters than larger rivers. This is thought to be in part due to differences in fish density and preference for hunting in shallow water with areas of riffles and boulders. Many of these tributaries will be outside the SAC	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			boundary, but some lie in the adjacent Exmoor Heaths SAC or other parts of the SSSIs not included in the SACs.	
Supporting habitat: structure/ function	**Water flow**	Maintain the natural flow regime of the river to that close to what would be expected in the absence of abstractions and discharges (the 'naturalised' flow).	Permanent or long-lasting reductions in flow may affect the availability and diversity of prey. This could lead to otters moving into new areas, increasing the likelihood of conflict with other otters. This may also alter they prey targeted by otters as they may hunt for low-preference food such as birds, rabbits, fish carrion or for frogs, depending on the time of year.	See River Basin Management Plans and Catchment Flood Management Plans for North Devon or West Somerset
Supporting habitat: structure/ function	**Water quality/quantity**	Maintain water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing and feeding habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SAC Conservation Objectives but in some cases more stringent standards may be needed to support the SAC feature. Further site-specific investigations may be required to establish appropriate standards for the SAC. The main impact of water chemistry on this feature is its effect on the food supply. For example, moderate levels of levels of eutrophication may increase certain fish populations, but excessive eutrophication can be detrimental. Excessive acidity in watercourses may also affect fish populations. Impacts from toxic pollutants can be devastating and were the major cause of otter population declines in the 50s, 60s and 70s.	See River Basin Management Plans and Catchment Flood Management Plans for North Devon or West Somerset Environment Agency. Pollution Incidents data, see http://apps.environment-agency.gov.uk/wiyby/37821.aspx
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of the species' supporting habitats. This means that this site is considered to be vulnerable overall but are a lower priority for further assessment and action. Individual species may be more or less vulnerable than their	Natural England, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. This recognises the increasing likelihood of natural habitat features needing to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Connectivity within and to the site**	Ensure there are no significant artificial barriers to the safe passage and movement of otters into, within and away from the site	Barriers such as roads, weirs etc. can generally increase the risk of harm to animals as they traverse or avoid them. If these barriers are considered a problem then mitigating measures could be taken. Otter populations within the SAC are dependent on the integrity of sections of river channel, riparian areas, freshwater still-waters, floodplains and transitional and marine waters that lie outside of the site boundary. Headwater areas and tributaries may not fall within the site boundary, yet otters may use these areas for feeding and these will be critical for sustaining populations within the site. Boundaries to river features on SACs often follow the first break of slope on the bank, with the result that much of the riparian habitat will lie outside the SAC, particularly if the river channel is operating under natural processes and moves laterally over time within the floodplain. It is possible that holts of otters that form part of the population for a SAC may lie on the adjacent floodplain out with the boundary of the SAC.	
Supporting processes	**Conservation measures**	Maintain the management measures (either within and/or	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further	Natural England, 2014

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(on which the feature and/or its supporting habitat relies)		outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quality : Toxic chemicals**	Avoid the presence of pollutants affecting the site, which are potentially toxic to otters.	The major cause of the decline in otter populations in the 60s and 70s was toxic chemicals such as dieldrin and related pesticides. Contaminants that might have an effect on otters may have an indirect effect (e.g. on food supply - organic pollution, eutrophication, acidification from mine waste and acid rain), a mainly direct effect (e.g. oil spillage, radioactivity) or effects of bioaccumulation (e.g. metals, especially mercury, cadmium and lead; pesticides and PCBs). PCBs, organochlorine pesticides and heavy metals all being seen as detrimental to otters, although the use of many of these is now banned.	Environment Agency. Pollution Incidents data, see http://apps.environment-agency.gov.uk/wiyby/37821.aspx .
Version Control: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

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European Site Conservation Objectives for Hestercombe House Special Area of Conservation
Site code: UK0030168

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- **The extent and distribution of the habitats of qualifying species**
- **The structure and function of the habitats of qualifying species**
- **The supporting processes on which the habitats of qualifying species rely**
- **The populations of qualifying species, and,**
- **The distribution of qualifying species within the site.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

S1303*. Rhinolophus hipposideros*; Lesser horseshoe bat

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment', including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term 'favourable conservation status' is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Hestercombe House Special Area of Conservation (SAC)
Site Code: UK0030168

Hestercombe House © yerffoeg2, Flickr

Date of Publication: 11 February 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Hestercombe House SAC.

This advice should therefore be read together with the SAC Conservation Objectives.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Hestercombe House Special Area of Conservation (SAC)
Location	Somerset
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1st April 2005
Qualifying Features	See section below
Designation Area	0.08 ha
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Hestercombe House SSSI. The SAC and SSSI boundary are the same.
Relationship with other European or International Site designations	N/A

Site background and geography

Hestercombe House SAC is a Grade II* listed former country house situated within an estate registered as a Grade I Registered Park and Garden. One mile south of the conurbation of Taunton in Somerset it lies between 35m and 120m AD on the south facing slopes of the foothills of the Quantock Hills Area of Outstanding Natural Beauty (AONB). Skirting the edge of the vale of Taunton Deane, within the *Vale of Taunton and Quantock fringes* National character Area (NCA 146), it commands extensive views across the vale and beyond to the Blackdowns AONB, c. 8km south. A landscape garden and woodlands occupy south facing combes with pasture occurring on the gentler slopes. Hestercombe's character is greatly influenced by its Geology and soils, with the majority of the site found lying over the Devonian Morte Slate Formation on free-draining, slightly acidic loam soils.

A colony of lesser horseshoe bats *Rhinolophus hipposideros* utilise two roof voids at Hestercombe. One can be found within a former stable block which has been purposefully converted to a roost for lesser horseshoe bats. The other is a domestic outbuilding connected to the main house. These roof voids are utilised as maternity (breeding) roosts during the summer months, with a small number of bats also using the space as hibernation sites during the winter. The maternity colony is the qualifying feature of the SAC. The boundary encompasses the maternity roosts, however supporting habitat, links to the wider countryside and a food source are also essential to sustain the population.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying Species:

- **S1303 Lesser horseshoe bat, *Rhinolophus hipposideros***

The lesser horseshoe bat is one of the UK's smallest bats and is so named because of its characteristic horseshoe shaped flap of skin around its nose, a noseleaf which they use in echolocation. Its fur is grey-brown on its back and white on its underside and they have a wing span of 19-25cm, half that of a greater horseshoe. It is one of the UK's rarest bats with a total population of approximately 50,000 individuals in the UK. Historic population declines means it is now restricted in its distribution to Wales, the West Midlands and South West England.

Hestercombe House is a large lesser horseshoe bat maternity site in the vale of Taunton. Although this maternity roost represents only a small proportion of the UK's population, it has been selected as it is representative of the species in South West England. Mating typically occurs from September to November and females will form the maternity colony in late spring. Usually a single pup is born in June or July and is weaned and fully independent by the end of August.

Some lesser horseshoe bats also hibernate in the roof void of the building, along with utilising the many buildings and structures found across the wider estate, but the hibernating population is not a designated feature of the SAC. Lesser horseshoe bats are particularly sensitive to disturbance, especially in their maternity and winter roosts, which is why such sites need specific protection. They also rely on the surrounding woodlands and grazed pasture for foraging, commuting between areas using linear features such as hedgerows within the landscape. Lesser horseshoe bats feeding will rarely fly more than five metres above the ground and will forage close to summer roosts (up to 4.2km away). The bats will also spend around half of their peak activity time within a radius of 600m feeding on a variety of insects including dung and crane flies, small moths, caddis flies, lacewings, small beetles, parasitic wasps and spiders.

The Lesser Horseshoe bat is also fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation of Habitats and Species Regulations 2010 (as amended), making it a 'European Protected Species'. A licence may therefore be required for any activities likely to harm or disturb lesser horseshoe bats.

Site-specific seasonality of SAC features

The table below highlights in grey those months in which significant numbers of the qualifying feature are most likely to be present at the SAC during a typical calendar year. This table is provided as a general guide only. The presence of the feature may vary depending on weather conditions.

Unless otherwise indicated, the months shown below are primarily based on information relating to the general months of occurrence of the feature in the UK. Where site-based evidence is available and has been used to indicate below that significant numbers of the feature are typically present at this SAC outside of the general period, the site-specific references have been added to indicate this.

Applicants considering projects and plans scheduled in the periods highlighted in grey would benefit from early consultation with Natural England given the greater scope for there to be likely significant effects that require consideration of mitigation to minimise impacts to qualifying features during the principal periods of site usage by the feature. The months which are *not* highlighted in grey are not ones in which the feature is necessarily absent, rather that the feature may be present in less significant numbers in typical years. Furthermore, in any given year, the feature may occur in significant numbers in months in which typically it does not. Thus, applicants should not conclude that projects or plans scheduled in months not highlighted in grey cannot have a significant effect on the feature. There may be a lower likelihood of significant effects in those months which nonetheless will also require prior consideration.

Any assessment of potential impacts on the feature must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional site-based surveys may be required.

Feature	Season	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Site-specific references where available
Lesser horseshoe bat *Rhinolophus hipposideros*	Breeding													

Table 1: Supplementary Advice for Qualifying Features: S1303. *Rhinolophus hipposideros*; Lesser horseshoe bat

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance- maternity colony**	Restore the abundance of the breeding population of lesser horseshoe bats to a level which is above the baseline population-size of 200 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as	Hestercombe House SSSI Favourable Condition Table (FCT), available from Natural England on request. DUVERGE, L. 2009. *A Report on Bat Surveys carried out at Hestercombe Site of Special Scientific Interest, Taunton, Somerset in 2007 and 2008.* Kestrel Wildlife Consultants Ltd. COOKSON & TICKNER, 2018. *Hestercombe Parkland Management Plan Feasibility Study.* Available from the national archive of parkland management plans. NATURAL ENGLAND, 2015. *Hestercombe House SAC Site Improvement Plan (SIP).* Available from: http://publications.naturalengland.org.uk/publication/5973745436983296 Monitoring data is held by the Natural England Somerset Team and Taunton Deane Borough Council. Available on request.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			possible, local Natural England staff can advise whether the figures stated are the best available. One of the largest reported maternity colonies in Somerset with 200 bats using the site at the time of notification in 2005. Volunteers from the Somerset Bat Group have made annual summer counts of Lesser horseshoe bats from the two roost sites since 1987. Counts are made from the same locations each year but are not likely to record all of the bats existing the roosts, as radio tracking studies have shown that some bats leave from the main house in directions that are not counted. Total Lesser horseshoe bat counts for May/June recorded between 1987 and 2018 show a range of between 90 bats in June 2010 and 264 bats in June 1995. Lesser horseshoe bat numbers increased significantly after 1991, with 200+ bats counted annually between 1993 and 2002. The bat population has appeared to be declining since notification in 2005, with a significant drop to a low of 90 bats in 2010 thought to be a response to large scale habitat clearance which took place close to the roost in this year. Numbers have been gradually increasing year on year since 2010 and have reached an average count of 132 in 2018 still below that at notification. The definitive causes of the general decline in population abundance are unknown but likely to involve habitat change (to forage areas & flightlines), and may include human disturbance and the physical condition of the roost sites. A maternity roost site has also been identified at West Monkton which is less than 2km away. The possibility of re-location to this roost site at West Monkton also needs investigating.	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the lesser horseshoe bat colony and the habitats which support the lesser horseshoe bats during the breeding period.	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection,	DUVERGE, L. 2009. *A Report on Bat Surveys carried out at Hestercombe Site of Special Scientific Interest, Taunton, Somerset in 2007 and 2008.* Kestrel Wildlife Consultants Ltd.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and may be subject to periodic review in light of improvements in data. The two roosts at Hestercombe play a major role as both a breeding roost, and an important night roost for this colony, accounting for 62% of all logged night time roosting of radio-tagged bats in August 2007, and 56% in May 2008. Outside of the boundary of the SAC, but also potentially of some importance to the colony, due to its proximity to the roof of the main maternity roost (outbuilding connected to the main house) is a connected building with a large interconnected roof space linked to the roost. A building inspection in 2018 identified two large and discrete piles of lesser horseshoe bat droppings, though no bats were present at the time of survey. The roof space is relatively light-filled in places which could be contributing to its more limited use. Evidence of lesser horseshoe night roosting has also been identified across the wider estate, with droppings found in four buildings and structures that include Combe House Stables, Combe house dogs kennels, the restored rustic seat and Charcoal burners hut. 12 additional temporary night roosts, which were used extensively, were located during 2007 and 2008 surveys (Duverge, 2009). There does not appear to be any other significant day roosts used by the colony within the vicinity of the SAC. A subsidiary maternity roost also occurs at West Monkton, less than 2km from Hestercombe.	COOKSON & TICKNER, 2018. *Hestercombe Parkland Management Plan Feasibility Study*. Available from the national archive of parkland management plans. BURROWS, L. 2018. *Hestercombe House Special Area of Conservation (SAC) Guidance on Development*. Somerset Ecology Services, Planning Control, Somerset County Council.
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of the lesser horseshoe bat colony and its supporting habitat.	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability. See 'Supporting and Explanatory Notes' for the 'Extent of supporting habitat' attribute, above.	
Supporting habitat: structure/function	**External condition of building - maternity colony**	Maintain the structural integrity and weatherproofing of the roof, walls and rainwater goods, with no significant shading of the main roost area by trees/vegetation or manmade structures.	Damp, draught and increases in light levels are likely to have a negative effect on the temperature and humidity of the roost. There are plans to re-roof the main house in the future.	NATURAL ENGLAND, 2015. *Hestercombe House SAC Site Improvement Plan (SIP).* Available from: http://publications.naturalengland.org.uk/publication/5973745436983296
Supporting habitat: structure/function	**Supporting off-site habitat (flightlines)**	Restore the presence, structure and quality of any linear landscape features which function as flightlines. Flightlines should remain unlit, functioning as dark corridors.	Lesser horseshoes tend to forage within 2.5km of their roost, though they can travel up to 4km from their roosts to suitable foraging grounds (Schofield, 2008). Lesser horseshoes commute and forage along linear features over wet grassland and woodland. Permanent pasture and ancient woodland linked with an abundance of tall bushy hedgerows is ideal supporting habitat for this species. Flightlines will extend beyond the designated site boundary into the wider local landscape. A number of flightlines have been recorded for the Hestercombe bat colony, linking distant regions of the colony's range and providing good foraging opportunities for commuting bats. The data shows that they fly along well-developed vegetated boundaries when commuting. These have been mapped for reference in the Hestercombe 2007-8 Lesser horseshoe bat survey report (Duverge, 2009). Earlier surveys suggest that individuals at the main house roost exit the roost and disperse to the formal landscape garden to access woodland to the east such as Gotten Wood. More recent observations suggest that the bats cross a driveway into	DUVERGE, L. 2009 *A Report on Bat Surveys carried out at Hestercombe Site of Special Scientific Interest, Taunton, Somerset in 2007 and 2008.* Kestrel Wildlife Consultants Ltd. MOTTE, G & LIBOIS, R 2002. *Conservation of the Lesser Horseshoe Bat (Rhinolophus hipposideros Bechstein, 1800) (Mammalia Chiroptera) in Belgium. A case study in feeding requirements.* Belgium Journey of Zoology **132**: 47-52 SCHOFIELD, H. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Vincent Wildlife Trust. SMITH, 2014. *Hestercombe*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			shrubbery and commute along a series of ponds and cascades to the north of the site. This involves crossing an open area along the lower edge and weir of the 'Pear Pond'. This area has been opened up to restore a 'treasured viewpoint', from the gateway of the Dutch garden up across the Pear Pond to the Temple Arbour, which is part of the historic Lutyen garden design. Linking features are highly important to the survival of Lesser Horseshoe bats in a landscape of fragmented woodlands (Motte & Libois, 2002). Lesser Horseshoe bats wherever possible will avoid crossing open areas and are vulnerable to the loss of these corridors. A study in Belgium showed that bats were not recorded further than 1m from a feature (Motte & Libois, 2002). Lesser horseshoe bat numbers may be negatively affected by changes in emergence and flight patterns as a result of the loss of linking features. Hestercombe Gardens is a public access site and artificial lighting is in use but usually before bats emerge, with the occasional occurrence of special evening events. Lesser horseshoe bat numbers may be negatively affected by this disturbance.	*Gardens Environmental Review, Appendix VI, Ecology & biodiversity – III, Conserving Hestercombe's Lesser horseshoe bats: an update.* Unpublished report for Hestercombe Gardens Trust by Farm & Countryside Liaison Services.
Supporting habitat: structure/function	**Supporting off-site habitat (foraging areas)**	Maintain any core areas of feeding habitat outside of the SAC boundary that are critical to lesser horseshoe bats during their breeding period Consideration to be given to foraging habitat such as woodland, ponds, watercourses, hedgerows, woodland edges, tree lines, rough grass and pasture within a 6km Zone around the SAC.	Roost choice, and the presence of bats within the SAC, is likely to be influenced by the site's ability to provide bats with food and shelter. Key feeding areas around a roost, and the commuting routes (or flightlines) between them, will be an important element of sustaining the SAC population. Lesser horseshoes tend to forage within 2.5km of their summer roost, though they can travel up to 4km from these roosts to suitable foraging grounds (Schofield, 2008). Within the winter, their foraging range is reduced, with a mean foraging radius of 1.2 km around hibernation sites reported. Lesser horseshoes commute and forage along linear features over wet grassland and woodland. Permanent pasture and ancient woodland linked with an abundance of tall bushy hedgerows is ideal supporting habitat for this species (Billington, 2005). Flightlines should remain as unlit, dark corridors. Flightlines will extend beyond the designated site boundary into	BURROWS, L. 2018 *Hestercombe House Special Area of Conservation (SAC) Guidance on Development*. Somerset Ecology Services, Planning Control, Somerset County Council. BILLINGTON, G. 2005 *Radio Tracking Study of Lesser horseshoe bats at Hestercombe House Site of Special Scientific Interest.* Report to English Nature DUVERGE, L. 2009 *A Report on Bat Surveys carried out at Hestercombe Site of Special Scientific Interest, Taunton,*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			the wider local landscape. The SAC designation encompasses maternity roosts and entrances, however to sustain the population, the provision of links to the wider countryside with supporting foraging habitat has to be sufficient. The lesser horseshoe bats at Hestercombe exhibit a broad diet and largely forage unselectively. They feed on a variety of insects including dung and crane flies, small moths, caddis flies, lacewings, small beetles, parasitic wasps and spiders. Early radio tracking studies of the lesser horseshoe bat population at Hestercombe have shown that the bats range up to 6km from the roost and utilise a variety of habitats for foraging, with bats recorded in open pasture, woodland, over arable fields, along woodland tracks, field edges, road verges, allotments, amenity grassland, marshy fields, ditches and lakes. Further studies in 2007 and 2008 found the majority of bats foraged within 1-4km of the roost, with the majority remaining within 2km. The current understanding of key roosts and supporting habitat associated with the SAC have been used to identify a 6km sustenance zone where Lesser horseshoe bats are likely to be present centred around the maternity roost at Hestercombe House. Bands within the zone reflect the likely importance of the habitat for bats and proximity to the maternity and other roost sites. Any development activity taking place within this Zone has the potential to impact on the Hestercombe House SAC. Special consideration is also to be given to habitat within 600m of the roost site, within the juvenile sustenance Zone. Feeding areas within this 600m zone are vitally important during spring and summer months for pregnant and lactating females, as well as their young, with bats spending about half their peak activity time within this zone.	*Somerset in 2007 and 2008.* Kestrel Wildlife Consultants Ltd. SCHOFIELD, H. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Vincent Wildlife Trust. SOMERSET COUNTY COUNCIL, 2008. *Lesser Horseshoe Bat Diet Analysis, Hestercombe House, Taunton, Somerset.* Knight Ecology Ltd.
Supporting habitat: structure/fun	**Internal condition of building -**	Restore humidity, temperature and ventilation. Maintain appropriate light levels.	The preferred internal temperature within a maternity roost for lesser horseshoe bats is approximately 34ºC (Schofield, 2008).	COOKSON & TICKNER, 2018. *Hestercombe Parkland Management Plan Feasibility*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
ction	**maternity**		Data logger temperature recordings taken from the two maternity roost sites over the May-August 2017 maternity period showed an average temperature in the stable roost of 24.5ºC (range 14.5-50.5ºC), with an average of 21.1ºC in the main roost (range 13.0ºC-27.5ºC). It is likely that the main house roost is more susceptible to draughts due to its open rectangular internal shape and open loft hatch. It also does not benefit from passive building heat unlike the stable roost which is within an occupied heated building.	*Study*. Available from the national archive of parkland management plans. SCHOFIELD, H. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Vincent Wildlife Trust.
Supporting habitat: structure/function	**Roost access**	Maintain the number of access points to the roost at an optimal size and in an unlit and unobstructed state. Restore surrounding vegetation to provide sheltered flyways without obstructing accesses.	This will prevent any negative internal climatic changes within the roost and maintain the ability of bats to freely enter and leave the roost as necessary. Normal minimum dimensions for lesser horseshoe access points: 300 x 200mm. Lesser horseshoe bat access to and from the roost in the domestic outbuilding appears to be via an open loft hatch. From the stable roost, bats access to and from the roost, via a purpose built louvered air vent on the north facing roof pitch which is the sole exit/entry point. Trees and shrubs close to roost exit points, have been removed over recent years. This includes extensive bush clearance immediately across the driveway from the emergence point at the main house. Lesser horseshoe bat numbers may be negatively affected by these changes and/or emergence and flight patterns may have changed as a result. Courtyard lighting is in place which has potential to inhibit the roost exit from the domestic outbuilding connected to the Main House. Security lighting is in place near the Stable block, this is a passive infrared sensor-triggered LED system which was approved through the planning process.	COOKSON & TICKNER, 2018. *Hestercombe Parkland Management Plan Feasibility Study*. Available from the national archive of parkland management plans. SMITH, 2014. *Hestercombe Gardens Environmental Review, Appendix VI, Ecology & biodiversity – III, Conserving Hestercombe's Lesser horseshoe bats: an update.* Unpublished report for Hestercombe Gardens Trust by Farm & Countryside Liaison Services.
Supporting processes (on which the	**Adaptation and resilience**	Maintain the lesser horseshoe bat's ability, and that of its supporting habitat, to adapt or	This recognises the increasing likelihood of supporting habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological	NATURAL ENGLAND. 2015. *Climate Change Theme Plan and supporting National Biodiversity*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
feature and/or its supporting habitat relies)		evolve to wider environmental change, either within or external to the site	system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of its supporting habitats. This means that this site is considered to be vulnerable overall but is a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. With reference to actual or expected climate change any increase in winter temperatures potentially could result in less time spent in torpor/hibernation e.g. more frequent awakening or earlier spring emergence. This would dictate the need for an earlier food source combined with frequent winter feeding. An increase in wet weather may also see a decrease in hunting ability, as bats avoid hunting in heavy rain due to increased energy costs. Changing vegetation around roost sites could potentially affect the humidity of sites and food availability during winter emergence. Wider landscape changes in vegetation may also affect food availability and flightlines between foraging areas. Climate change resilience will be aided by the protection, maintenance and restoration of quality foraging habitat close to the roost site to enable sufficient feeding to be undertaken in	*Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England*. Available at: http://publications.naturalengland.org.uk/publication/4954594591375360 SHERWIN, H.A., MONTGOMERY, W.I. & LUNDY, M.G. 2013. *The Impact and Implications of Climate Change for Bats*. Mammal Review **43:** 171-182. VOIGT, C.C., SCHNEEBERGER, K., VOIGT-HEUCKE, S. & LEWANZIK, D. 2011. *Rain Increases the Energy Cost of Bat Flight*. Biology Letters **7:** 793-795.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			sub-optimal weather conditions.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	The supporting habitat of this feature is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition (including food-plants) and reducing supporting habitat quality and population viability of this feature. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Mixed woodland occupies West Combe, Middle Combe and Hestercombe, with also a number of outlier woodlands providing key foraging habitat close to the maternity roosts. Target set to Restore because the current levels of nitrogen deposition (APIS accessed on 10 January 2019) exceed the critical loads for this supporting foraging habitat of broadleaved, mixed and yew woodland. Exceedance impacts can include changes in soil processes, nutrient imbalance, altered composition of mycorrhiza and ground vegetation. Deposition of other measured pollutants such as Ammonia, Nitrogen Oxides, Sulphur Dioxide and Acid deposition are within the limits given for this habitat type.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site	BURROWS, L. 2018 *Hestercombe House Special Area of Conservation (SAC)*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
feature and/or its supporting habitat relies)		appropriate) which are necessary to Maintain the structure, functions and supporting processes associated with lesser horseshoe bats and/or its supporting habitats.	can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. To maintain appropriate conditions for this maternity roost site consideration needs to be given to temperature and humidity regimes, access points, lighting and vegetation links where bats emerge. Lesser horseshoe bats also utilise different foraging areas at different times of year, the security of the colony at Hestercombe depends on the continued maintenance of supporting habitat and interconnecting links. Surrounding the SAC maternity roost, the series of wooded coombes and a wildflower meadow which has been created are being managed through a Countryside Stewardship agreement with appropriate management in place to maintain this important foraging habitat. A decoy pond is also to be restored which will support a good population of aquatic insects, a favoured food source of lesser horseshoe bats. Hestercombe Gardens Trust in October 2018 purchased an additional 129ha of parkland surrounding the SAC. Adopting sensitive management of the land with the assistance of Agri-Environment funding will help promote the sustainability of the lesser horseshoe bat population at Hestercombe. The current land use is primarily improved pasture supporting dairy cattle. There is scope to increase connectivity in the landscape whilst managing the existing network of hedgerow and trees for lesser horseshoe bats. The introduction of a sympathetic grazing regime with minimal use of insecticides should also be considered. There are also plans to create further areas of species-rich grassland which will attract higher densities of insects.	*Guidance on Development*. Somerset Ecology Services, Planning Control, Somerset County Council. ENGLISH NATURE, 2004 *A statement of English Nature's views about the management of Hestercombe House Site of Special Scientific Interest (SSSI).* Available from: https://designatedsites.naturalengland.org.uk/PDFsForWeb/VAM/2000424.pdf NATURAL ENGLAND, 2015. *Hestercombe House SAC Site Improvement Plan (SIP).* Available from: http://publications.naturalengland.org.uk/publication/5973745436983296
Supporting processes (on which the	**Disturbance from human activity**	Control and minimise human access to roost sites	Site should be secured against unauthorised access, which can result in disturbance to bats at critical times of year and which can affect their population viability and use of the site.	Bats: Protection and Licences, available from https://www.gov.uk/guidance/bats

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
feature and/or its supporting habitat relies)			The roosts occupy roof spaces within the Main House and Stable Block, the only risk of disturbance is when either routine maintenance or the need for more substantial building works arises. This type of work would need to be completed under a Natural England Licence and Consented. An infra-red camera has been installed in the Stable Block roof void to provide visitors to Hestercombe with a view of the maternity colony. The camera requires ongoing maintenance repairs.	-protection-surveys-and-licences
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Maintain water quality and quantity of supporting habitats to a standard which provides the necessary conditions to support lesser horseshoe bat.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Bontadina *et al*. (2002) found that woodland associated with water was the most preferred habitat by lesser Horseshoe bats. A food supply is provided by mosquitoes, caddis fly larvae, gnat larvae and gnats and midges. There are a number of streams and ponds on the Hestercombe Estate which are associated with wooded combes close to the SAC roost. An assessment of tree cover along water courses and standing water bodies has been recommended by Knight Ecology Ltd (2008), to determine whether opportunities for foraging and planting exist.	BONTADINA, F. SCHOFIELD, H & NAEF-DAENZER, B. 2002. *Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland*. Journal of Ecology **252**: 281-290. KNIGHT ECOLOGY LTD., 2008. *Lesser Horseshoe Bat Diet Analysis, Hestercombe House, Taunton, Somerset.* Report to Somerset County Council.
Version Control Advice last updated: N/A				

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)

Variations from national feature-framework of integrity-guidance:

- Removed the attribute '**External condition of underground site - maternity and hibernation'.** The lesser horseshoe bats occupy roof void spaces and whilst they utilise underground sites for hibernation across the wider estate this is not part of the SAC designation.
- The attribute '**Disturbance from human activity**': removed 'Grilles on site access points should be maintained where present' from 'Supporting and Explanatory notes' column as not applicable in this instance as bats occupy roof voids.
- Deleted **'Soils**' attribute as a tenuous link to SAC feature through supporting habitat types and no specific evidence available.

European Site Conservation Objectives for Mendip Limestone Grasslands Special Area of Conservation Site code: UK0030203

NATURAL ENGLAND

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- **The extent and distribution of qualifying natural habitats and habitats of qualifying species**
- **The structure and function (including typical species) of qualifying natural habitats**
- **The structure and function of the habitats of qualifying species**
- **The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely**
- **The populations of qualifying species, and,**
- **The distribution of qualifying species within the site.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H4030. European dry heaths

H6210. Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*); Dry grasslands and scrublands on chalk or limestone

H8310. Caves not open to the public

H9180. *Tilio-Acerion* forests of slopes, screes and ravines; Mixed woodland on base-rich soils associated with rocky slopes*

S1304*. Rhinolophus ferrumequinum*; Greater horseshoe bat

* denotes a priority natural habitat or species (supporting explanatory text on following page)

*** Priority natural habitats or species**

Some of the natural habitats and species for which UK SACs have been selected are considered to be particular priorities for conservation at a European scale and are subject to special provisions in the Habitats Regulations. These priority natural habitats and species are denoted by an asterisk (*) in Annex I and II of the Habitats Directive. The term 'priority' is also used in other contexts, for example with reference to particular habitats or species that are prioritised in UK Biodiversity Action Plans. It is important to note however that these are not necessarily the priority natural habitats or species within the meaning of the Habitats Regulations.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment', including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term 'favourable conservation status' is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives for Mendip Woodlands Special Area of Conservation
Site Code: UK0030048

NATURAL ENGLAND

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- **The extent and distribution of qualifying natural habitats**
- **The structure and function (including typical species) of qualifying natural habitats, and**
- **The supporting processes on which qualifying natural habitats rely**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H9180. *Tilio-Acerion* forests of slopes, screes and ravines; Mixed woodland on base-rich soils associated with rocky slopes*

* denotes a priority natural habitat or species (supporting explanatory text on following page)

*** Priority natural habitats or species**

Some of the natural habitats and species for which UK SACs have been selected are considered to be particular priorities for conservation at a European scale and are subject to special provisions in the Habitats Regulations. These priority natural habitats and species are denoted by an asterisk (*) in Annex I and II of the Habitats Directive. The term 'priority' is also used in other contexts, for example with reference to particular habitats or species that are prioritised in UK Biodiversity Action Plans. It is important to note however that these are not necessarily the priority natural habitats or species within the meaning of the Habitats Regulations.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment', including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term 'favourable conservation status' is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives for North Somerset and Mendip Bats Special Area of Conservation Site Code: UK0030052

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- **The extent and distribution of qualifying natural habitats and habitats of qualifying species**
- **The structure and function (including typical species) of qualifying natural habitats**
- **The structure and function of the habitats of qualifying species**
- **The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely**
- **The populations of qualifying species, and,**
- **The distribution of qualifying species within the site.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H6210. Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*); Dry grasslands and scrublands on chalk or limestone

H8310. Caves not open to the public

H9180. *Tilio-Acerion* forests of slopes, screes and ravines; Mixed woodland on base-rich soils associated with rocky slopes*

S1303*. Rhinolophus hipposideros*; Lesser horseshoe bat

S1304*. Rhinolophus ferrumequinum*; Greater horseshoe bat

* denotes a priority natural habitat or species (supporting explanatory text on following page)

*** Priority natural habitats or species**

Some of the natural habitats and species for which UK SACs have been selected are considered to be particular priorities for conservation at a European scale and are subject to special provisions in the Habitats Regulations. These priority natural habitats and species are denoted by an asterisk (*) in Annex I and II of the Habitats Directive. The term 'priority' is also used in other contexts, for example with reference to particular habitats or species that are prioritised in UK Biodiversity Action Plans. It is important to note however that these are not necessarily the priority natural habitats or species within the meaning of the Habitats Regulations.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment', including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term 'favourable conservation status' is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

North Somerset and Mendip Bats Special Area of Conservation (SAC)
Site Code: UK0030052

Greater horseshoe bats in limestone cave © Natural England/Michael Hammett

Date of Publication: 14 March 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to North Somerset and Mendip Bats SAC.

This advice should therefore be read together with the SAC Conservation Objectives available here

This advice replaces a draft version dated 21 January 2019 following the receipt of comments from the site's stakeholders.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	North Somerset and Mendip Bats Special Area of Conservation (SAC)
Location	Somerset (England) and the Unitary Authorities of North Somerset and Bath & North East Somerset (England)
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1 April 2005
Qualifying Features	See section below
Designation Area	561.19 hectares
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Banwell Caves SSSI, Banwell Ochre Caves SSSI, Brockley Hall Stables SSSI, Compton Martin Ochre Mine SSSI, King's Wood and Urchin Wood SSSI, The Cheddar Complex SSSI, Wookey Hole SSSI. All of these SSSIs except for The Cheddar Complex are fully within the SAC. Approximately 85% of the Cheddar complex is SAC.
Relationship with other European or International Site designations	This SAC is functionally linked with the Mendip Limestone Grassland SAC, Mendip Woodlands SAC, Mells Valley SAC, Bath and Bradford on Avon Bats SAC with the bats moving between these sites.

Site background and geography

An archipelago site incorporating individual components located mainly in the Mendip Hills National Character Area but also beyond this into the Bristol, Avon Valleys and Ridges National Character Area in North Somerset. The component sites are highly variable including one of the largest areas of ancient woodland in the former county of Avon; Cheddar Gorge and surrounding sites; as well as caves, mines and buildings in the surrounding areas. The SAC as a whole supports 3% of the UK population of Greater horseshoe bats and internationally significant populations of lesser horseshoe bats. The site also contains internationally important ravine woodland and calcareous grassland interest as supporting features of the bats and also in their own right.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated

Qualifying habitats:

- **H6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia)**

The Cheddar complex and Wookey Hole areas support a wide range of semi-natural habitats including semi-natural dry grasslands. The principal community present is CG2 *Festuca ovina – Avenula pratensis* grassland which occurs on rock ledges and on steep slopes with shallow limestone soil, especially in the dry valleys and gorges and on the south-facing scarp of the Mendips. The site is also important for the large number of rare plants which are associated with Carboniferous limestone habitats. These include dwarf mouse-ear *Cerastium pumilum*, Cheddar pink *Dianthus gratianopolitanus* and rock stonecrop *Sedum forsterianum*, which occur on rocks, screes, cliffs and in open grassland. Transitions to and mosaics with limestone heath, calcareous screes, scrub and 9180 Tilio-Acerion forests are a particular feature of the Cheddar complex part of the site.

- **H9180 Tilio-Acerion forests of slopes, screes and ravines**

The main block of Tilio-Acerion forest at Kings and Urchin's Wood has developed over limestone which outcrops in parts of the site and forms a steep scarp to the south-east. Ash *Fraxinus excelsior* predominates in the canopy with small-leaved lime *Tilia cordata*, yew *Taxus baccata* and elm *Ulmus spp*., mostly formerly coppiced, but including some pollard limes. There is a rich ground flora including lily-of-the-valley *Convallaria majalis*, columbine *Aquilegia vulgaris*, angular Solomon's-seal *Polygonatum odoratum* and purple gromwell *Lithospermum purpureocaeruleum*. There is also a small amount of Tilio-Acerion forest within The Cheddar Complex and as well as lime there are also rare whitebeams (*Sorbus* spp.).

- **H8310 Caves not open to the public**

Caves are formed by the erosion of soluble rocks, such as limestones. They typically form the subterranean components of a distinctive 'karst' landscape, and are associated with various topographic features, including gorges, dry valleys, 8240 Limestone pavements, and dolines (surface depressions and hollows). Caves not open to the public is interpreted as referring to natural caves which are not routinely exploited for tourism, and which host specialist or endemic cave species or support important populations of Annex II species.

Caves lack natural illumination, and therefore support species which are adapted to living in the dark. Microclimatic conditions vary widely within and between caves, and this determines the composition of the fauna and flora. This site includes caves selected because they are important hibernation sites for bat species.

Only natural caves have been selected. Sites that are entirely artificial in origin, e.g. mines and tunnels, are excluded from the Annex I definition, even though in some cases the species present may be similar to those of more natural sites.

Caves within the Cheddar Complex and Wookey Hole SSSIs form some of the finest examples of deep phreatic (sub-water table) limestone caves in Britain. Badger Hole and Rhinoceros Hole are two dry caves on the slopes above the Wookey ravine near the Wookey Hole resurgence and contain *in situ* cave sediments laid down during the Ice Age. The sediments contain remains of fossil mammals and occasional human artefacts. This is the only site in the Mendips and one of the few in Britain at which a continuous sequence of sediments of this age can be examined.

Some caves within the site are included because they support S1303 lesser horseshoe and S1304 Greater horseshoe bat features, but not the H8310 Caves not open to the public feature. Some caves in wider the area are famously exploited for tourism and are excluded from selection.

Qualifying Species:

- **S1303 Lesser horseshoe bat *Rhinolophus hipposideros***

The lesser horseshoe bat is one of the smallest bats in the UK. During the summer they form maternity colonies in old buildings and emerge to hunt in nearby woodland. The species prefers sheltered valleys with extensive deciduous woods or dense scrub, close to roost sites. Where habitat is fragmented, linear features such as hedgerows are important corridors between roosts and foraging areas. Ideally, roost sites offer a range of temperature conditions in different parts of a single site, allowing the bats to change location; otherwise breeding females are likely to change site during the summer. In winter they hibernate in caves, mines and other cave-like places. Summer and winter roosts are usually less than 5-10 km apart. The bats are vulnerable to the loss or disturbance of both summer and winter roost sites and the removal of linear habitat corridors.

The lesser horseshoe bat is also fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation of Habitats and Species Regulations 2017, making it a 'European Protected Species'. A Licence may therefore be required for any activities likely to harm or disturb lesser horseshoe bat.

- **S1304 Greater horseshoe bat *Rhinolophus ferrumequinum***

The greater horseshoe bat is one of the largest bats in the UK. During the summer, they form maternity colonies, generally in large old buildings, and forage in pasture, edges of mixed deciduous woodland and hedgerows. Such mixed land-use, especially on south-facing slopes, favours the beetles, moths and other insects on which the bats feed. In winter they depend on caves, abandoned mines and other underground sites for undisturbed hibernation. A system or series of sites is required, offering a range of temperatures and air-flow patterns. Summer and winter roosts are usually less than 20-30 km apart. The bats are vulnerable to the loss of insect food supplies due to insecticide use, changing farming practices and the loss of broad-leaved tree-cover, and to the loss or disturbance of underground roost sites.

This site in south-west England is selected on the basis of the size of population represented (3% of the UK greater horseshoe bat *Rhinolophus ferrumequinum* population) and its good conservation of structure and function, having both maternity and hibernation sites. This site contains an exceptionally good range of the sites used by the population, comprising two maternity sites in lowland north Somerset and a variety of cave and mine hibernation sites in the Mendip Hills.

The greater horseshoe bat is also fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation of Habitats and Species Regulations 2017, making it a 'European Protected Species'. A Licence may therefore be required for any activities likely to harm or disturb greater horseshoe bat.

Site-specific seasonality of SAC features

The table below highlights in grey those months in which significant numbers of each qualifying feature are most likely to be present at the SAC during a typical calendar year. This table is provided as a general guide only. The presence of the features may vary depending on weather conditions.

Unless otherwise indicated, the months shown below are primarily based on information relating to the general months of occurrence of the feature in the UK. Where site-based evidence is available and has been used to indicate below that significant numbers of the feature are typically present at this SAC outside of the general period, the site-specific references have been added to indicate this.

Applicants considering projects and plans scheduled in the periods highlighted in grey would benefit from early consultation with Natural England given the greater scope for there to be likely significant effects that require consideration of mitigation to minimise impacts to qualifying features during the principal periods of site usage by those features. The months which are *not* highlighted in grey are not ones in which the features are necessarily absent, rather that features may be present in less significant numbers in typical years. Furthermore, in any given year, features may occur in significant numbers in months in which typically they do not. Thus, applicants should not conclude that projects or plans scheduled in months not highlighted in grey cannot have a significant effect on the features. There may be a lower likelihood of significant effects in those months which nonetheless will also require prior consideration.

Any assessment of potential impacts on the features must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional site-based surveys may be required.

Feature	**Season**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Site-specific references where available**
Greater horseshoe bat	Breeding													
Lesser horseshoe bat	Breeding													
Greater horseshoe bat	Hibernation													
Lesser horseshoe bat	Hibernation													

Table A: Presence of qualifying SAC features within component SSSIs

SSSI	SAC feature				
	H6210 Dry grasslands and scrublands on chalk or limestone	H8310 Caves not open to the public	H9180 Mixed woodland on base-rich soils associated with rocky slopes	S1303 *Rhinolophus hipposideros*; Lesser horseshoe bat	S1304 *Rhinolophus ferrumequinum*; Greater horseshoe bat
Banwell Caves		X		X	X
Banwell Ochre Caves		X		X	X
Brockley Hall Stables					X
Compton Martin Ochre Mine					X
King's Wood and Urchin Wood		X	X		X
The Cheddar Complex	X	X		X	X
Wookey Hole		X			X

Table 1: Supplementary Advice for Qualifying Features: H6210. Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia); Dry grasslands and scrublands on chalk or limestone

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain and restore the total extent of the feature to approximately 151ha	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. Within the SAC, this feature is only found within The Cheddar Complex SSSI (137.57ha) and Wookey Hole SSSIs (14.2ha).	This attribute will be periodically monitored as part of Natural England's site condition assessments. BURTON *et al*. 1983 NATURAL ENGLAND. 2015b NATURE CONSERVANCY COUNCIL. 1988 NATIONAL TRUST. 1995
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and	This attribute will be periodically monitored as part of Natural England's site condition assessments. Reference material as above.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. The area above Cheddar Gorge is a mosaic of habitats with some calcareous grassland and other patches of mesotrophic and acid grassland Acid grassland is found mainly at Blackrock, with small patches above the Gorge and the rest is mainly towards the eastern end of the Cheddar Complex. Lowland heath (c25ha) is found new Ulbey, Warren & Charterhouse. Calaminarian grassland (c2ha) is focused on spoil heaps at Blackmoor reserve, Chaterhouse.	
Structure and function (including its typical species)	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats. This means	NATURAL ENGLAND. 2015a Additional reference material as above.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			that this site is considered to be vulnerable overall but is a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable.	
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. Structural connectivity refers to physical connections between habitat patches, often referred to as corridors, and functional connectivity is a measure of how easily species can move through the landscape and often relates to vegetation structure or management intensity. These connections can take the form of landscape features such as patches of habitat, hedges, watercourses and verges and will extend beyond the boundary of the designated sites. These features are critical for the migration, dispersal and genetic exchange of the species typically associated with the Annex 1 habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	SOMERSET WILDLIFE TRUST. 2016. Additional reference material as above.
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature • The constant and preferential plants of the CG2 grassland NVC community which form a key	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition').	This attribute will be periodically monitored as part of Natural England's site condition assessments. Monitoring reports available from Natural England including surveys by:

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		component of a H6210 SAC habitat present on this site. • Vascular plant assemblage (see explanatory notes for further information) • Variety of whitebeam trees *Sorbus* sp, including species which are endemic to the Gorge. These include but may not be limited to: *Sorbus aria*; *Sorbus anglica*; Sorbus *eminens, Sorbus porrigentiformis*; *Sorbus cheddarensis*; *Sorbus eminentoides*; *Sorbus rupicoloides*.	• **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. **Vascular plant assemblage** includes: Cheddar Pink (*Dianthus gratianopolitanus*); Slender Bedstraw (*Galium pumilum*); Little Robin (*Geranium purpureum*); Spring Cinquefoil (*Potentilla neumanniana*). Dwarf mouse-ear (*Cerastium pumilum*); Soft-leaved sedge (*Carex montata*); Rock stonecrop (*Sedum forsteranium*);Limestone Fern (*Gymnocarpium robertianum*); Spring sandwort (*Minuartia verna*); Slender Tare (*Vicia parviflora*); Bitter Wood-vetch (*Vicia orobus*); Narrow-lipped Helleborine (*Epipactis muelleri* ssp. *leptochila*);	ALDER ECOLOGY Ltd. 2010 HOUSTON. 2006 HOUSTON. 2012 McDONNELL. 1997 WESSEX ECOLOGICAL CONSULTANTS. 2004 CROUCH. 2016
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes	Additional reference material as above.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			associated with this Annex I feature.	
Structure and function (including its typical species)	**Supporting off-site habitat**	Maintain or where necessary restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the feature.	This recognises that sites do not exist in isolation. The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which are outside the designated site boundary and changes in surrounding land-use may adversely (directly or indirectly) affect the functioning of the feature and its component species. This supporting habitat may be critical to the typical species of the feature to support their feeding, breeding, roosting, population dynamics ('metapopulations'), pollination or to prevent/reduce/absorb damaging impacts from adjacent land uses e.g. pesticide drift, nutrient enrichment. Recent ecological network mapping provides a useful picture of the potential high-quality habitats in and around The Cheddar Complex and Wookey Hole some of which support high quality calcareous grassland habitats. Many of the sites covered by The Mendip Limestone Grassland SAC along with various other key SSSIs including King and Middle Down SSSI (Somerset Wildlife Trust), Bubwith Acres / Bradley Cross (Somerset Wildlife Trust), Draycott Sleigh SSSI, The Perch SSSI, Axbridge and Frys Hill. The CORE toolbox developed by Forest Research and Somerset Wildlife Trust allows ecological network maps to be assessed for coherence and resilience. This method highlights where ecological networks are fragmented and where creation or restoration work could link up habitats such as species rich grassland and woodland.	SOMERSET WILDLIFE TRUST. 2016.
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type CG2 - *Festuca ovina-Avenula*	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT), available from Natural

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		pratensis grassland	vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	England on request.
Structure and function (including its typical species)	**Vegetation community transitions**	Maintain the pattern of natural vegetation zonations/transitions	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna.	Additional reference material as above.
Structure and function (including its typical species)	**Vegetation: proportion of herbs (including Carex spp)**	Maintain the proportion of herbaceous species within the range 40%-90%	A high cover of characteristic herbs, including sedges (*Carex* species) is typical of the structure of this habitat type.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Structure and function (including its typical species)	**Vegetation: undesirable species**	Restore the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread; No species/taxa more than occasional throughout the sward or singly or together more than 5% cover No more than 10% cover of Tor –grass (*Brachypodium pinnatum)* and Upright brome (*Bromopsis erecta)*, in period	There will be a range of undesirable or uncharacteristic species which, if allowed to colonise and spread, are likely to have an adverse effect on the feature's structure and function, including its more desirable typical species. These may include invasive non-natives such as Cotoneaster spp, or coarse and aggressive native species which may uncharacteristically dominate the composition of the feature. Target set to Restore because invasive non-natives are widespread on the site. They include Cotoneaster spp. (*Cotoneaster*); Common lilac (*Syringa vulgaris*); Rose-of-Sharon (*Hypericum calycinum*); Turkey oak (*Quercus cerris*). Control measures have been put in place but further works are required to eradicate them from the SAC	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT), available from Natural England on request

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		May-July No more than 5% cover of tree and scrub cover Invasive non-native species should be absent.		
Supporting processes (on which the feature relies)	**Air quality**	Restore the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Target set to Restore because current levels of nitrogen deposition (APIS accessed on 10 December 2018) are exceeding the critical load for H6210 grassland.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the ‘search by site’ tool on the Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	Additional reference material as above. ENGLISH NATURE, 2005a. ENGLISH NATURE, 2005b.
Version Control Advice last updated: **19 February 2019** following stakeholder comments. '**Functional connectivity with wider landscape**' attribute reference added and more detail added to clarify attribute in supporting and explanatory notes. More detail added to "**Supporting off site habitat**" to clarify attribute in supporting and explanatory notes including explanation of CORE toolbox designed by Somerset Wildlife Trust and Forest Research.				
Variations from national feature-framework of integrity-guidance: The targets for some attributes listed above include both 'maintain' or 'restore' objectives. This is because this SPA is an extensive complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SPA but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request."				

Table 2: Supplementary Advice for Qualifying Features: H8310. Caves not open to the public

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature	See explanatory notes for this attribute in Table 1. 2200m passages mentioned in the Geological Conservation Review for The Cheddar Complex SSSI, but this is known to not include significant areas of the interest. Plans showing the passages and their connectivity are available within the Geological Conservation Review which constitutes the best easily available indication of extent.	WALTHAM *et al*. 1997. JNCC SAC standard data form Anecdotal evidence, B Corns, T Lane 2018
Structure and function (including its typical species)	**Naturalness**	Maintain the natural structure of the cave feature and ensure it can continue to evolve naturally.	This should be interpreted as referring to natural caves which are not routinely exploited for tourism, and which host specialist or endemic cave species. Several notable caves outside of the SAC are already exploited for tourism, these areas should not be extended into areas with cave decoration (such as stalactites and stalagmites) or bats unless adequate measures are in place to protect them, and this would have to be agreed in advance with Natural England.	
Structure and function (including its typical species)	**Sedimentatio n**	Old cave sediments are undisturbed and maintained in an unmodified form, and increased sediment loadings from alterations of inflowing watercourses are avoided.	The Cheddar Complex represents a nationally important example of dated sediments in limestone caves. Elsewhere, sediment loading from ingress to the cave systems can damage interest features either directly or through the process of necessary removal/cleaning and should be reduced.	WALTHAM *et al*. 1997.
Supporting processes (on which the feature relies)	**Cave water quality**	Avoid or reduce any metal-ion contamination into interstitial and cave waters	Though little data exists, there is some evidence which points to major impacts on the characteristic subterranean fauna from metal contamination. Impacts on the biofilms may be significant.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, Maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the feature.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		site	This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Important to maintain natural geomorphological processes and to provide supporting habitat for cave flora and fauna; use of groundwater monitoring may be used as a partial proxy for cave water quality. There is potential for hydraulic fracturing in this area**.**	
Supporting processes (on which the feature relies)	**Illumination**	Maintain naturally-occurring light levels within the cave body, whilst minimising any artificial light.	Caves lack natural illumination, and therefore support species which have evolved or are adapted to living in the dark. Microclimatic conditions vary widely within and between caves, and this determines the composition of the fauna and flora at each site. Disturbance or modification of those patterns can influence numerous aspects of plant and animal behaviour. For example, light pollution (from direct glare, chronically increased illumination and/or temporary, unexpected fluctuations in lighting) can affect animal navigation, competitive interactions, predator-prey relations, and animal physiology.	
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, Maintain water quality and quantity to a standard which provides the necessary conditions to support the feature. Where the feature is not dependent on surface water and/or groundwater, water quality and quantity should still be maintained to a level at which existing natural features should not be damaged and features that would be expected to develop naturally are not unreasonably inhibited	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Although nutrients are critical to the fauna associated with this feature as effectively the only significant Nitrogen source, high initial inputs deplete the fauna, and whilst it subsequently recovers (and thrives) it raises the possibility of seriously damaging rare genotype	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			populations in the first nutrient wave. See notes regarding sedimentation.	

Version Control
Advice last updated:
19 February 2019 Additional text added within '**Hydrology**' attribute to identify potential of hydraulic fracturing within the geology following stakeholder feedback.

Variations from national feature-framework of integrity-guidance: The site is not known to support any significant cave fauna or flora (anecdotal evidence, B Corns 2018) therefore the relevant typical species attribute has been removed. Similarly there is no known interest relating to woody debris, indeed there is a greater likelihood that woody debris would have caused a negative impact in increasing sedimentation, impeding monitoring/restoration, and increasing CO_2 levels from decomposition so the woody debris attribute has similarly been removed.

Table 3: Supplementary Advice for Qualifying Features: H9180. Tilio-Acerion forests of slopes, screes and ravines; Mixed woodland on base-rich soils associated with rocky slopes *

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the features to approximately 158ha hectares King's Woods & Urchin Wood SSSI 128ha (combined W8 & W10) The Cheddar Complex SSSI 30ha	See explanatory notes for this attribute in Table 1 For this feature tree roots (particularly of veteran trees) can extend a considerable distance beyond the boundary of the site - they can be impacted by soil compaction (such as caused by vehicles or construction works); agricultural operations or other soil disturbance (like trenches); and agro chemicals or other chemicals which get into the soil. Any loss of woodland area - whether at the edge or in the middle of a site will reduce the core woodland area where woodland conditions are found - these support significant assemblages of species dependent on woodland conditions (e.g. lichens and bryophytes - being one example). Loss of any woodland area which fragments a site into different parts will clearly disturb the movement of species between the remaining parts of the woodland. In the absence of specific site surveys tailored to identifying extents of Tilio-Acerion habitat, NVC community W8 has been used as a proxy to the Annex I habitat. This, in part, explains the discrepancy between the JNCC standard data form and the individual FCT figures (given the figure for King's Wood and Urchin Wood SSSI combining W8 & W10). Further survey effort is needed to determine the proper extent of the Annex 1 habitat (and/or its proxy community W8 as no NVC maps are known to exist) since there are specific areas known to exhibit features such as slopes, screes and ravines, but these are as yet unmapped and undefined	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT), available from Natural England on request.
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restore the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. See also notes for 'Extent' attribute. Restore the woodland by reducing the number of Sycamore.	Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England. NATURAL ENGLAND. 2015b
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the resilience of the feature by ensuring a diversity of site-native trees (at least 4 site native tree species) e.g. ash/ small-leaved lime/ aspen/ alder/ sycamore/ rowan/ bird cherry/ birch) is present across the site.	See explanatory notes for this attribute in Table 1 Chalara Ash die back (*Hymenoscyphus fraxineus*) is a concern for this site and may in the future result in changes to the vegetation composition.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available from Natural England on request.
Structure and function (including its typical species)	**Browsing and grazing by herbivores**	Maintain browsing at a (low) level that allows well developed understorey with no obvious browse line, & lush ground vegetation with some grazing sensitive species evident (bramble, ivy, *etc*), and tree seedlings and sapling common in gaps.	Herbivores, especially deer, are an integral part of woodland ecosystems. They are important in influencing woodland regeneration, composition and structure and therefore in shaping woodland wildlife communities. In general, both light grazing and browsing is desirable to promote both a diverse woodland structure and continuous seedling establishment. Short periods with no grazing at all can allow fresh natural regeneration of trees, but a long-term absence of herbivores can result in excessively dense thickets of young trees which	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT), Available on request from Natural England.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			shade out ground flora and lower plant species. However, heavy grazing by deer or sheep prevents woodland regeneration, and can cause excessive trampling and/or poaching damage, canopy fragmentation, heavy browsing, barkstripping and a heavily grazed sward. Feral goats are present in the Cheddar Complex SSSI which are highly beneficial in controlling scrub growth on grassland but could damage other interest features such as the woodland.	
Structure and function (including its typical species)	**Invasive, non-native and/or introduced species**	Ensure invasive and introduced non-native species are either rare or absent, but if present are causing minimal damage to the feature At least 95% of canopy cover in any one layer of site-native or acceptable naturalised species. Death, destruction or replacement of native woodland species through effects of introduced fauna or other external unnatural factors not more than 10% by number or area in a five year period.	Invasive or introduced non-native species are a serious potential threat to the biodiversity of native and ancient woods, because they are able to exclude, damage or suppress the growth of native tree, shrub and ground species (and their associated typical species), reduce structural diversity and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (e.g. use of broad spectrum pesticides). Such species can include Holm Oak, Turkey Oak, Laurel, Rhododendrons, snowberry, Japanese knotweed, giant hogweed and Himalayan balsam, for example. Similarly, this would include pheasants, rabbits and non-native invertebrate 'pest' species. The consideration of what is 'introduced non-native' has become more complex in the light of the likely impacts of Chalara ash dieback. It is likely that species such as Sycamore and Beech, whilst not usually considered a native component of ancient woodland in this area, may have to move to an accepted naturalised status to retain a broad enough mix of acceptable species and spread the risk of possible future diseases. A continuing watching brief should be the default on the status of Chalara and the possible impacts of these substitute species on individual sites. Other non-native spp. like Holm oak, Turkey oak, Rhododendron and Laurel are or could become an issue within the woodlands and work should be	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England. SAC Site Improvement Plan (SIP), available from https://designatedsites.naturalengland.org.uk/

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			completed to control and where possible eradicate them.	
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature: Ash (*Fraxinus excelsior*) predominates in the canopy with small-leaved lime (*Tilia cordata*), yew (*Taxus baccata*) and elm (*Ulmus* spp.), mostly formerly coppiced, but including some pollard limes. Variety of whitebeam trees *Sorbus* sp, including species which are endemic to the Gorge. These include but may not be limited to: *Sorbus aria*; *Sorbus anglica*; Sorbus *eminens, Sorbus porrigentiformis*; *Sorbus cheddarensis*; *Sorbus eminentoides*; *Sorbus rupicoloides*. Greater Horseshoe bats *Rhinolophus ferrumequinum* Common Dormouse *Muscardinus avellanarius*	See explanatory notes for this attribute in Table 1. Both the Cheddar Complex and to a lesser extent King's Wood & Urchin Wood are known to support various species of whitebeam trees some of which are endemic to Cheddar Gorge. Chalara Ash die back (*Hymenoscyphus fraxineus*) is a concern for this site and may in the future result in changes to the species composition.	Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England CROUCH, H. 2016 WESSEX ECOLOGICAL CONSULTANTS. 2004.
Structure and function (including its typical species)	**Regeneration potential**	Maintain the potential for sufficient natural regeneration of desirable trees and shrubs; typically tree seedlings of desirable species (measured by seedlings and <1.3m saplings -	The regeneration potential of the woodland feature must be maintained if the wood is to be sustained and survive, both in terms of quantity of regeneration and in terms of appropriate species. This will Include regeneration of the trees and shrubs from saplings or suckers, regrowth from coppice stools or pollards, and where appropriate planting. Browsing and grazing	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		above grazing and browsing height) should be visible in sufficient numbers in gaps, at the wood edge and/or as regrowth as appropriate	levels must permit regeneration at least in intervals of 5 years every 20. The density of regeneration considered sufficient is less in parkland sites than in high forest. Regeneration from pollarding of veteran trees should be included where this is happening.	Favourable Condition Tables (FCT). Available on request from Natural England.
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: W8 – *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodland	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. Chalara Ash die back (*Hymenoscyphus fraxineus*) is a concern for this site and may in the future result in changes to the vegetation composition.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England
Structure and function (including its typical species)	**Vegetation structure - age class distribution**	Maintain at least 3 age classes (pole stage/ medium/ mature) spread across the average life expectancy of the commonest trees.	A distribution of size and age classes of the major site-native tree and shrub species that indicate the woodland will continue in perpetuity, and will provide a variety of the woodland habitats and niches expected for this type of woodland at the site in question.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation structure - canopy cover**	Maintain an appropriate tree canopy cover across the feature, between 30-90% of the stand.	Canopy cover is the overall proportion of vegetative cover consisting of any woody layer ranging from established regeneration to mature and veteran stages. Woodland canopy density and structure is important because it affects ecosystem function and in particular microclimate, litterfall, soil moisture, nutrient turnover and shading; this in turn influences the composition of plants and animals in lower vegetation layers and soil. Open canopies with just scattered trees will have less of a woodland character and reduced diversity of woodland-dependent species (although they may be still be important as a form of woodland-pasture). Completely closed canopies across the whole woodland are not ideal either however, as they cast heavier shade and support fewer species associated with edges, glades and open grown trees, and have little space where tree regeneration could occur. In general, the woodland canopy of this feature should provide a core of woodland interior conditions with some open and edge habitat as well.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England
Structure and function (including its typical species)	**Vegetation structure - dead wood**	Maintain the continuity and abundance of standing or fallen dead and decaying wood, typically between 30 - 50 m^3 per hectare of standing or fallen timber or ≥3 fallen trees >20cm per hectare, and ≥4 standing dead trees per hectare	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England
Structure and function (including its typical species)	**Vegetation structure - old growth**	Maintain the extent and continuity of undisturbed, mature/old growth stands (typically comprising at least 10% of the feature at any one time) and the assemblages of veteran and ancient trees (typically 5-10 trees per hectare).	Good woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context. For this habitat type, old or over-mature elements of the woodland are particularly characteristic and important features, and their continuity	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			should be a priority.	
Structure and function (including its typical species)	**Vegetation structure - open space**	Maintain areas of permanent/temporary open space within the woodland feature at ≥ 10% of area	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context. Having some open, sunlit and largely tree-less areas as part of the woodland community is often important to facilitate natural tree and shrub regeneration and also to provide supporting habitat for specialist woodland invertebrates, birds, vascular and lower plants. Such open space can be permanent or temporary and may consist of managed grazed areas, linear rides and glades, or naturally-produced gaps caused by disturbance events such as windthrow/fire/tree falling over/snow damage.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT). Available on request from Natural England
Structure and function (including its typical species)	**Vegetation structure - shrub layer**	Maintain an understorey of shrubs (2-5m) cover ≥20% of the stand area (this will vary with light levels and site objectives)	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component SSSI Favourable Condition Tables (FCT), available from https://designatedsites.naturalengland.org.uk/
Structure and function (including its typical species)	**Vegetation structure - woodland edge**	Maintain a graduated woodland edge into adjacent semi-natural open habitats, other woodland/wood-pasture types or scrub.	Woodland edge is defined as being the transitional zone between the forest feature and adjacent but different habitat types - the best woodland edges will have a varied structure in terms of height and cover. Many typical forest species make regular use of the edge habitats for feeding due to higher herb layer productivity and larger invertebrate populations. Grasslands / arable fields managed with high doses of agro-	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			chemicals could potentially not allow this gradation of woodland edge and could have other impacts on the integrity of the site (pollution/ nutrient enrichment *etc*).	
Supporting processes (on which the feature relies)	**Air quality**	Restore the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1 Target set to Restore because current levels of nitrogen and acid deposition (APIS accessed on 11/12/2018) are exceeding the critical load for H9180 woodland.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). NATURAL ENGLAND. 2015. North Somerset and Mendip Bats SAC Site Improvement Plan (SIP)
Supporting processes (on which the feature relies)	**Functional connectivity with wider landscape**	Maintain the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. Structural connectivity refers to physical connections between habitat patches, often referred to as corridors, and functional connectivity is a measure of how easily species can move through the landscape and often relates to vegetation structure or management intensity. These connections can take the form of landscape features such as patches of habitat, hedges, watercourses and verges and will extend beyond the boundary of the designated sites. These features are critical for the migration, dispersal and genetic exchange of the species typically associated with the Annex 1 habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	WEST OF ENGLAND PARTNERSHIP (WENP). 2013 SOMERSET WILDLIFE TRUST. 2016.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Numerous exercises have been undertaken recently to map existing and prospective ecological networks. Land surrounding the sites, if managed sensitively, will buffer the site from damaging impacts and can provide other benefits such as providing species with places to feed, roost and spread into over time.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, Maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. This is included as disruption/ damage to hydrological processes could be caused by activities at some distance from the site boundary. E.g. through extraction of ground or surface waters; diverting or damming river channels; pollution of water source; channel alignment that disrupts natural geomorphological processes; tunnelling *etc*.	
Supporting processes (on which the feature relies)	**Illumination**	Ensure artificial light is Maintained at a level which is unlikely to affect natural phenological cycles and processes to the detriment of the feature and its typical species at this site.	Woodland biodiversity has naturally evolved with natural patterns of light and darkness, so disturbance or modification of those patterns can influence numerous aspects of plant and animal behaviour. For example, light pollution (from direct glare, chronically increased illumination and/or temporary, unexpected fluctuations in lighting) can affect animal navigation, competitive interactions, predator-prey relations, and animal physiology. Flowering and development of trees and plants can also be modified by un-natural illumination which can disrupt natural seasonal responses. Potential for significant impact on bat populations supported by the woodland and its environs.	
Version Control Advice last updated:				

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
19 February 2019 following stakeholder comments. '**Functional connectivity with wider landscape**' attribute reference added and more detail added to clarify attribute in supporting and explanatory notes including how the sensitive management of surrounding sites can offer some buffer to future impacts. Chalara Ash die back (*Hymenoscyphus fraxineus*) mentioned throughout in the supporting and explanatory notes as currently impacting vegetation composition within the site.			
Variations from national feature-framework of integrity-guidance: N/A			

Table 4: Supplementary Advice for Qualifying Features: S1303. *Rhinolophus hipposideros*; Lesser horseshoe bat

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance - hibernation site**	Maintain the abundance of the population at a level of above 75 bats, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of	This attribute will be periodically monitored as part of Natural England's site condition assessments. Monitoring information is held by the Natural England local area team. This information is sensitive and requests for it should be discussed with Natural England

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are the best available. There are no counts for the SAC as a whole at a certain point in time. However, the following data has been collated: The hibernating population has been assessed over the years 2017 and 2018 at Cheddar Complex SSSI and are as follows: January 2017 – 133 March 2017 – 88 January 2018 – 53 March 2018 – 122 The following SSSIs are part of the North Somerset and Mendip Bats SAC but do not have Lesser Horseshoe bats as a SSSI notified feature. They are however part of the North Somerset Bat assemblage: Banwell Caves SSSI – 20 (peak count) Banwell Ochre Mines SSSI – 88 (peak count)	
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site.	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction can also fragment habitats within a site and disrupt the ability of the feature to move around the site and to occupy and use habitat patches. Fragmentation of habitats typically results in smaller and more isolated populations which are more vulnerable to extinction. This could undermine the ability of the feature to adapt to future environmental changes Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for this feature and this	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			may affect its viability.	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the habitats which support the feature at/to: 446ha (Cheddar Caves Complex SSSI)	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England component Cheddar Caves Complex SSSI Favourable Condition Tables (FCT). Available on request from Natural England
Supporting habitat: structure/ function	**Condition of underground site hibernation**	Maintain the structural integrity of the roost space, with no recent collapses/falls or signs of geological instability.	Damp, draught and increases in light levels are likely to have a negative effect on the temperature and humidity of the roost.	
Supporting habitat: structure/ function	**Flightlines from roost into surrounding habitat and foraging areas**	Maintain the presence, structure and quality of any linear landscape features which function as flightlines. Flightlines should remain unlit, functioning as dark corridors.	Roost choice, and the presence of bats within the SAC, is likely to be influenced by the site's ability to provide bats with food and shelter. The provision of rich feeding areas around a roost, and the commuting routes (or flight-lines) to them, will be an important element in sustaining the SAC population. Lesser horseshoes tend to forage 2-3km of their roost, though they can travel up to 4km from their roosts to suitable foraging grounds. Lesser horseshoes commute and forage along linear features over grassland and woodland. They feed on flies (mainly midges), small moths, caddis flies, lacewings, beetles, small wasps and spiders. Permanent pasture and ancient woodland linked with an abundance of tall bushy hedgerows is ideal supporting habitat for this species (English Nature, 2003). Flightlines will extend beyond the designated site boundary into the wider local landscape. Flightlines should remain unlit, functioning as dark corridors.	WILLIAMS *et al*. 2011
Supporting	**Supporting**	Maintain any core areas of	This recognises that sites do not exist in isolation. The structure	BAT CONSERVATION TRUST.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
habitat: structure/ function	**off-site habitat (foraging areas)**	feeding habitat outside of the SAC boundary that are critical to Lesser Horseshoe bats during their [breeding OR hibernation] period	and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which are outside the designated site boundary and changes in surrounding land-use may adversely (directly or indirectly) affect the functioning of the feature and its component species. This supporting habitat may be critical to the feature to support, for example, their ability to feed, breed, roost and their population dynamics ('metapopulations'). Surrounding areas can also prevent, reduce or absorb damaging impacts from adjacent land uses such as pesticide drift. Roost choice, and the presence of bats within the SAC, is likely to be influenced by the site's ability to provide bats with food and shelter. Key feeding areas around a roost, and the commuting routes (or flight-lines) between them, will be an important element of sustaining the SAC population. Lesser horseshoes tend to forage within 2.5km of their summer roost, though they can travel up to 4km from these roosts to suitable foraging grounds (Schofield, 2008). Within the winter, their foraging range is reduced, with a mean foraging radius of 1.2 km around hibernation sites reported. Lesser horseshoes commute and forage along linear features over wet grassland and woodland. Permanent pasture and ancient woodland linked with an abundance of tall bushy hedgerows is ideal supporting habitat for this species. Flight-lines should remain as unlit, dark corridors. Flightlines will extend beyond the designated site boundary into the wider local landscape. During the winter, lesser horseshoes emerge from hibernacula about once every two weeks for water / food, therefore condition of habitat in the immediate vicinity of hibernacula is very important. Winter prey (e.g. crane-flies, winter gnats, midges, dung flies) is often associated with damp woodland with decaying wood, and grazed pasture with abundant dung. Feeding areas used by SAC bats may be outside of the SAC	2016 NORTH SOMERSET COUNCIL *et al*. 2017 SCHOFIELD. 2008 SOMERSET WILDLIFE TRUST. 2016. WILLIAMS *et al*. 2011

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			boundary but be critical to successful hibernation (these undesignated areas are sometimes referred to as ‘sustenance zones’ or ‘functionally-linked land’). Hibernating bats need a water source close to the hibernation site. Freshwater is largely supplied by ponds and small streams. Measures to improve water retention, e.g. ponds, re-wetting bogs and slowing the flow of water from the land to the main rivers will help to maintain a fresh water supply for the bats. North Somerset Council *et al.* (2017) have published a guidance document for developers who are planning to build near to the SAC. This identifies zones around the SAC and bands within the zone reflect the likely importance of the habitat for bats and proximity to the maternity and other roost sites. Any development activity taking place within these zones may have the potential to impact on the SAC. Special consideration is also given to habitat within 600m of the roost site, within the juvenile Sustenance Zone. Feeding areas within this 600m zone are vitally important during spring and summer months for pregnant and lactating females, as well as their young, with bats spending about half their peak activity time within this zone.	
Supporting habitat: structure/ function	**Internal condition of underground site - maternity and hibernation**	Maintain or as necessary restore appropriate light levels, humidity, temperature and ventilation.	Greater and lesser horseshoe bats roost mainly in underground sites during winter, often communally. The preferred temperature of lesser horseshoe bat hibernation sites is a stable 6-7ºC, with humidity approaching 100%. Damp, draught and increases in light levels are likely to have a negative effect on the temperature and humidity of the roost. There should be no recent collapses/falls or signs of geological instability.	
Supporting habitat: structure/ function	**Roost access**	Maintain the number of access points to the roost at an optimal size and in an unlit and unobstructed state, with surrounding vegetation providing sheltered flyways without	This will prevent any negative internal climatic changes within the roost and maintain the ability of bats to freely enter and leave the roost as necessary. Normal minima dimensions for horseshoe access points; lesser horseshoes 300 x 200mm.	Surveys are carried out by licenced persons and organisations for Natural England – This information is sensitive and requests for it should be discussed with Natural England

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		obstructing access points.	Vegetation is required close to the entrance to enable bats to feel secure enough to leave at dusk rather than delaying until fully dark. Any lights shining on the entrance are likely to deter the bats from leaving (Downs *et al*. 2003). No artificial lights should be shining on the entrance to the hibernation site.	DOWNS *et al*. 2003 JNCC. 2004 STONE *et al*. 2009
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site.	See explanatory notes for this attribute in Table 1 The Lesser Horseshoe bat in England is at the northern edge of its European range. With climate change it is expected that their range may move further north. In terms of lesser horseshoe bat response to climate change, increasing winter temperatures may result in less time in torpor/hibernation e.g. more frequent awakening or earlier spring emergence. This would require more frequent winter feeding and food to be available earlier in the year. The availability of both food and water may change. Water availability is particularly important for lactating females. Temperature regulation within roost/hibernation sites or the availability of roosts with a variety of temperature and humidity regimes is important to ensure the continued availability of suitable roosts. There may be a decrease in hunting ability with an increase in wet weather as bats avoid hunting in heavy rain due to increased energy costs. Changing vegetation around caves/mines may affect humidity of the hibernation site and the availability of food during winter emergence. Wider landscape changes in vegetation my also affect food availability and flightlines between foraging areas. Climate change resilience will be aided by the protection and maintenance/restoration of quality feeding habitat close to the roosts and the identification and protection of satellite roosts and their surrounding habitat to enable sufficient feeding to occur during sub-optimal weather conditions.	SHERWIN *et al*. 2013 VOIGT *et al*. 2011.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1 Target set to Restore because current levels of nitrogen and acid deposition (APIS accessed on 12/12/2018) are exceeding the critical loads for woodland supporting habitat.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Management for this site includes maintaining grills to hibernation entrances, maintaining appropriate wooded cover around entrances, maintaining and restoring flight-lines and feeding grounds and protecting swarming sites associated with the SAC bat population.	Component SSSI Favourable Condition Tables (FCT). Available from Natural England on request. NATURAL ENGLAND. 2015. North Somerset and Mendip Bats SAC Site Improvement Plan (SIP), DAVIDSON & THOMAS. 2017
Supporting processes (on which the feature and/or its supporting habitat relies)	**Disturbance from human activity**	Control and minimise unauthorised public access to roost sites.	Site should be secured against unauthorised access, which can result in disturbance to bats at critical times of year and which can affect their population viability and use of the site. Grilles on site access points should be maintained where present.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. The SSSIs within the North Somerset Levels have water quality standards which are more stringent than the WFD standards. Bats in North Somerset are known to use the rhynes or ditches to navigate by and also as a place to forage. Good water quality ensures there is a good mix of plants with different structures, in turn providing a rich habitat for invertebrates as prey for the bats. Water availability is particularly important for lactating females. Hibernating bats also need a water source close to the hibernation site.	
Version Control Advice last updated: **28 February 2019** following stakeholder comments. '**Population abundance – hibernation**' attribute, Banwell Caves SSSI peak count updated with more recent survey data within supporting and explanatory notes. '**Distribution of supporting habitats**' and '**Supporting off-site habitats (foraging areas)**' attribute reference added and more detail added to clarify attribute in supporting and explanatory notes. Additional information added about the bat guidance for planning in North Somerset.				
Variations from national feature-framework of integrity-guidance: The following attributes have been removed as they are considered not to be relevant the Lesser Horseshoe bat hibernation site at Cheddar: **Soils, substrate and nutrient recycling; External condition of the building – maternity colony; external condition of the building – hibernation site; Population abundance – maternity colony.**				

Table 5: Supplementary Advice for Qualifying Features: S1304. *Rhinolophus ferrumequinum*; Greater horseshoe bat

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance - hibernation site**	Maintain the abundance of the hibernating population at a level which is above 200 which is the known population at present. Avoid deterioration from its current level as indicated by the latest mean peak count or equivalent.	See explanatory notes for the Population Abundance attribute in Table 4. Numbers recorded at the March 2018 hibernation count at Cheddar Complex SSSI were 621. Wookey Hole 2010 – 60 Banwell Caves SSSI peak counts were 32 in 2017 Banwell Ochre Mines SSSI peak counts were 244 in 2017 with numbers increasing steadily from 58 in 2005	This attribute will be periodically monitored as part of Natural England's site condition assessments. Monitoring data held by Natural England's Local Area Team This information is sensitive and requests for it should be discussed with Natural England
Population (of the feature)	**Population abundance - maternity colony**	Maintain the abundance of the breeding population at a level which is above 350 Avoid deterioration from its current level as indicated by the latest mean peak count or equivalent.	See explanatory notes for the Population Abundance attribute in Table 4. Cheddar Complex SSSI: A maternity roost is recorded in Gough's Caves. Numbers unknown The peak emergence count at King's Wood and Urchinwood SSSI in 2006 was 52. Monitoring ceased due to health and safety reasons but re-started in 2017 when a peak emergence count was 135. Brockley Hall Stables peak count in 2018 was approximately 500 adults and 250 young.	This attribute will be periodically monitored as part of Natural England's site condition assessments. English Nature, 1999. Radio Tracking study of Greater Horseshoe bats at Cheddar, North Somerset. Unpublished report
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site.	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to	NATURAL ENGLAND. 2015b WEST OF ENGLAND PARTNERSHIP (WENP). 2013

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			its interior. These conditions may not be suitable for this feature and this may affect its viability. A summary of the sites is given below: Banwell Caves – cave – hibernation Banwell Ochre Caves – cave – hibernation, possible maternity? Brockley Hall Stables – building – maternity Compton Martin Ochre mines – cave – hibernation King's Wood and Urchinwood – mines – hibernation and maternity Cheddar – cave – hibernation and maternity Wookey Hole – cave – hibernation and maternity See notes for 'Extent of supporting habitat' attribute which are also valid for the distribution of supporting habitat, with particular importance placed on the location of suitable foraging habitat directly around and close to maternity sites.	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the habitats which support the feature at 561 hectares	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. The woodland surrounding the underground mines is important for the maintenance of optimal humidity conditions inside the mine system and also as foraging areas. The woodland structure should be maintained. For the maternity site at Cheddar Caves, much of their supporting habitat is included in the species rich SAC grassland and woodland surrounding the caves. It is not however, known whether the bats use the whole area of the SSSI.	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**External condition of building - maternity colony**	Maintain the structural integrity and weatherproofing of roof, walls etc, with no significant shading of the main roost area by trees/vegetation or manmade structures.	Damp, draught and increases in light levels are likely to have a negative effect on the temperature and humidity of the roost.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Supporting habitat: structure/ function	**External condition of underground site - maternity and hibernation**	Maintain the structural integrity of the roost space, with no recent collapses/falls or signs of geological instability.	Damp, draught and increases in light levels are likely to have a negative effect on the temperature and humidity of the roost.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Supporting habitat: structure/ function	**Internal condition of underground site – maternity and hibernation**	Maintain the structural integrity of the roost space to provide consistently cool (8-12ºC) and dark conditions suitable for hibernation with a relative humidity of over 90%	Damp, draught and increases in light levels are likely to have a negative effect on the temperature and humidity of the roost. There should be no recent collapses/falls or signs of geological instability. The variation between hibernation sites and the strong adherence of the bats to their traditional sites makes it important to refer to file notes on the condition of the site. Greater and lesser horseshoe bats roost mainly in underground sites during winter, often communally, however, they are also known to use some caves in this SAC as a maternity roost. They are usually found in hibernation sites with a relative humidity over 90%	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Supporting habitat: structure/ function	**Internal condition of building - maternity**	Maintain appropriate light levels, humidity, temperature and ventilation	Changes to light levels, through-draught, ventilation, noise levels, vibration and water penetration may adversely alter the necessary roost conditions. Damp, draught and increases in light levels are likely to have a negative effect on the temperature and humidity of the roost.	
Supporting habitat: structure/	**Roost access**	Maintain the number of access points to the roost at an optimal size and in an unlit and	This will prevent any negative internal climatic changes within the roost and maintain the ability of bats to freely enter and leave the roost as necessary.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
function		unobstructed state, with surrounding vegetation providing sheltered flyways without obstructing access points Maintain vegetation close to the entrances but not obstructing it.	Normal minima dimensions for horseshoe access points: Greater horseshoe bats: 400 x 300mm Vegetation is required close to the entrances to enable bats to feel secure enough to leave at dusk rather than delaying until fully dark. Any lights shining on the entrances are likely to deter the bats from leaving (Downs *et al*. 2003; Stone, Jones & Harris 2009).	
Supporting habitat: structure/ function	**Supporting off-site habitat flightlines from the roost into surrounding habitat and foraging areas**	Maintain the presence, structure and quality of any linear landscape features which function as flightlines between the SAC and the surrounding foraging areas used by Greater Horseshoe bats. Flightlines should remain unlit, functioning as dark corridors.	This recognises that sites do not exist in isolation. The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which are outside the designated site boundary and changes in surrounding land-use may adversely (directly or indirectly) affect the functioning of the feature and its component species. This supporting habitat may be critical to the feature to support, for example, their ability to feed, breed, roost and their population dynamics ('metapopulations'). Surrounding areas can also prevent, reduce or absorb damaging impacts from adjacent land uses such as pesticide drift. Roost choice, and the presence of bats within the SAC, is likely to be influenced by the site's ability to provide bats with food and shelter. The provision of rich feeding areas around a roost, and the commuting routes (or flight-lines) to them, will be an important element in sustaining the SAC population. The concept of Core Sustenance Zones (North Somerset Council *et al.*, 2017) can be used to take account of the supporting habitat within the area of highest bat activity surrounding the roost. North Somerset Council *et al*. (2017), have published guidance which identifies zones around the SAC which reflect the likely importance of the habitat for bats and proximity to maternity and other roost sites. Special consideration is also to be given to habitat within 8km of the roost site, within the juvenile Sustenance Zone. Feeding areas within this 2.2km zone are vitally important during spring and	BAT CONSERVATION TRUST. 2016 CLARKE WEBB. 2003 ENGLISH NATURE. 2001 ENGLISH NATURE. 1999 FROIDEVAUX *et al*. 2017 NATURAL ENGLAND. 2015b NORTH SOMERSET COUNCIL *et al*. 2017 SOMERSET WILDLIFE TRUST. 2016. WEST OF ENGLAND PARTNERSHIP (WENP). 2013

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			summer months for pregnant and lactating females, as well as their young, with bats spending about half their peak activity time within this zone. Greater horseshoe bats commute and forage along linear features, over grazed pasture and in woodland. Permanent pasture and ancient woodland linked with an abundance of tall bushy hedgerows is ideal supporting habitat for this species. Flightlines should remain unlit, functioning as dark corridors. They will extend beyond the designated site boundary into the wider local landscape and are especially important as a link between summer and winter roost sites e.g. Brockley Hall Stables SSSI maternity roost and King's Wood and Urchin Wood which does have a maternity roost but also supports a hibernating population of bats. It has been concluded that the conservation of photophobic bat species such as the Greater Horseshoe bat should concentrate on both the improvement of foraging/commuting habitats as well as the creation of dark areas. (Froidevaux *et al*. 2017) Connectivity between sites is important as the bats navigate using linear features particularly such as hedgelines, walls and ditches. They use many caves within Somerset and migrate quite large distances including flying to and from Gloucestershire and Devon. It was found that the Greater Horseshoe Bats used 76 different sites on Mendip in one year, (Clarke Webb 2003) Mapping has been undertaken to find where the distribution of ecological networks are fragmented to enable bodies to find funding to work on linking up habitats such as species rich grassland and woodland, Somerset Wildlife Trust 2016 In North Somerset, the radio tracking study of Greater Horseshoe bats from Brockley Hall Stables were found to have flown over 210 square km, using a total of 20 main foraging areas. They regularly commuted between the stables and the	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			caves at King's Wood an Urchinwood SSSI. Studies have also shown that Greater Horseshoe Bats use hedges, walls and ditches to navigate around the area of North Somerset, foraging over grassland which is grazed by animals, providing insects such as dung beetles	
Supporting habitat: structure/ function	**Supporting off-site habitat (foraging areas)**	Maintain any core areas of feeding habitat outside of the SAC boundary that are critical to Greater Horseshoe bats during their breeding and hibernation period	Roost choice, and the presence of bats within the SAC, is likely to be influenced by the site's ability to provide bats with food and shelter. Key feeding areas around a roost, and the commuting routes (or flight-lines) between them, will be an important element of sustaining the SAC population. Greater horseshoes tend to forage within 2.5km of their summer roost, though they can travel up to 4km from these roosts to suitable foraging grounds (Schofield, 2008). Within the winter, their foraging range is reduced, with a mean foraging radius of 1.2 km around hibernation sites reported. Greater horseshoes commute and forage along linear features over wet grassland and woodland. Permanent pasture and ancient woodland linked with an abundance of tall bushy hedgerows is ideal supporting habitat for this species (English Nature, 2003). Flight-lines should remain as unlit, dark corridors. Flightlines will extend beyond the designated site boundary into the wider local landscape. During the winter, greater horseshoes emerge from hibernacula about once every two weeks for water / food, therefore condition of habitat in the immediate vicinity of hibernacula is very important. Winter prey (e.g. crane-flies, winter gnats, midges, dung flies) is often associated with damp woodland with decaying wood, and grazed pasture with abundant dung. Feeding areas used by SAC bats may be outside of the SAC boundary but be critical to successful hibernation (these undesignated areas are sometimes referred to as 'sustenance zones' or 'functionally-linked land').	CLARKE WEBB. 2003 ENGLSIH NATURE. 2001 SOMERSET WILDLIFE TRUST. 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Although the SAC includes the SSSIs noted here, their supporting habitat includes a large range of sites surrounding their maternity and hibernation roosts. It is generally agreed that the juvenile sustenance zones are in the 1-2 km surrounding maternity roosts and are especially important in providing foraging habitats close to the roost for the adults. It is especially important that grazing of this area particularly with cattle continues to provide invertebrates for the bats to eat. Adult bats are known to forage over a larger area, for example, over the Somerset Levels from the roosts at Cheddar and Wookey Hole. Greater Horseshoe bats are known to shift their foraging sites over several nights so that any radio tracking survey at one point in time is not necessarily representative of the bats' foraging range. A circular radius is therefore too simplistic to be very accurate but gives an indication of their potential habitat.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	See explanatory notes for this attribute in Table 1. The Greater Horseshoe bat in England is at the northern edge of its European range. With climate change it is expected that its range boundary may move further north. It has been shown that the population expansion of the Greater Horseshoe bat in the UK has been driven by climate change rather than any conservation or habitat management. (Froidevaux *et al*. 2017). Temperature regulation within roost/hibernation sites or the availability of roosts with a variety of temperature and humidity regimes is important to ensure the continued availability of suitable roosts. There may be a decrease in hunting ability with an increase in wet weather as bats avoid hunting in heavy rain due to increased energy costs. Changing vegetation around caves/mines may affect humidity	FROIDEVAUX *et. al*. 2017 SHERWIN *et al*. 2013. VOIGT *et al*. 2011.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			of the hibernation site and the availability of food during winter emergence. Wider landscape changes in vegetation my also affect food availability and flightlines between foraging areas. Climate change resilience will be aided by the protection and maintenance/restoration of quality feeding habitat close to the roosts and the identification and protection of satellite roosts and their surrounding habitat to enable sufficient feeding to occur during sub-optimal weather conditions.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1. Target set to Restore because current levels of nitrogen and acid deposition (APIS accessed on 14/12/2018) are exceeding the critical loads for woodland supporting habitat.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Maintain the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Management for this SAC includes maintaining grills to hibernation entrances, maintaining appropriate wooded cover around entrances, maintaining and restoring flightlines and feeding grounds and protecting swarming sites associated with the SAC bat population and flightlines to swarming sites. Management of the wider landscape is also integral to the condition of the SAC, such as keeping farmland in appropriate management to support the food supplies for the bat population (maintain grazing, particularly cattle) A heater was installed in the Cheddar Complex caves in 1998 to provide optimum conditions for the maternity colony and this	Natural England component SSSI Views About Management (VAM), available from https://designatedsites.naturalengland.org.uk/

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			needs to be maintained. A number of Greater horseshoe bat nocturnal roosts have been identified on site and the importance of these roosts is being increasingly recognised and understood through a number of projects (Batscapes, Devon Greater Horseshoe Bat Project and Beacons for Bats).	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Disturbance from human activity**	Control and minimise unauthorised public access to roost sites	Site should be secured against unauthorised access, which can result in disturbance to bats at critical times of year and which can affect their population viability and use of the site. Grilles on site access points should be maintained where present. Wooden safety fences are to be installed around the cave entrances at Banwell Ochre Caves SSSI by the landowner who was carrying out forestry works. These are to be placed to avoid any people falling into the cave entrances and also to provide a buffer around the cave entrances. Most of the mine entrances at King's Wood and Urchin Wood SSSI have also been fenced off for safety reasons.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, maintain water quality and quantity within the associated bat foraging areas including those areas outside of the SAC designation to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. The SSSIs within the North Somerset Levels have water quality standards which are more stringent than the WFD standards.	See FCT for Tickenham, Nailsea and Kenn SSSI. Natural England component SSSI Favourable Condition Tables (FCT). Available from Natural England on request.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Bats in North Somerset are known to use the rhynes or ditches to navigate by and also as a place to forage. Good water quality ensures there is a good mix of plants with different structures, in turn providing a rich habitat for invertebrates as prey for the bats. Water availability is particularly important for lactating females. Hibernating bats also need a water source close to the hibernation site.	

Version Control
Advice last updated:
28 February 2019 following stakeholder comments. '**Population abundance – hibernation**' attribute, peak count updated with more recent survey data within supporting and explanatory notes. '**Supporting off-site habitat flightlines from the roost into surrounding habitat and foraging areas**' attribute reference added and more detail added to clarify attribute in supporting and explanatory notes. '**Conservation measures**' attribute the importance of bat night roosts mentioned in supporting and explanatory notes. Further information added regarding North Somerset Council Bat Guidance and core sustenance zones.

Variations from national feature-framework of integrity-guidance: The following attributes were removed as they are not considered relevant to the Greater Horseshoe bats within this SAC: **Soils substrate and nutrient recycling; External condition of the building – hibernation site.**

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European Site Conservation Objectives for Severn Estuary Special Protection Area Site Code: UK9015022

NATURAL ENGLAND

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- **The extent and distribution of the habitats of the qualifying features**
- **The structure and function of the habitats of the qualifying features**
- **The supporting processes on which the habitats of the qualifying features rely**
- **The population of each of the qualifying features, and,**
- **The distribution of the qualifying features within the site.**

This document should be read in conjunction with the accompanying Conservation Advice document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

A037 *Cygnus columbianus bewickii*; Bewick's swan (Non-breeding)
A048 *Tadorna tadorna*; Common shelduck (Non-breeding)
A051 *Anas strepera*; Gadwall (Non-breeding)
A149 *Calidris alpina alpina*; Dunlin (Non-breeding)
A162 *Tringa totanus*; Common redshank (Non-breeding)
A394 *Anser albifrons albifrons*; Greater white-fronted goose (Non-breeding)
Waterbird assemblage

This is a cross border site

This site crosses the border between England and Wales Some features may only occur in one Country. The advice of Natural Resources Wales should therefore be sought separately.

This is a European Marine Site

This SPA is a part of the Severn Estuary European Marine Site (EMS). These Conservation Objectives should be used in conjunction with the Conservation Advice document for the EMS.

Natural England's formal Conservation Advice for European Marine Sites can be found via GOV.UK.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations'). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment' including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives, and the accompanying Supplementary Advice (where this is available), will also provide a framework to inform the management of the European Site and the prevention of deterioration of habitats and significant disturbance of its qualifying features

These Conservation Objectives are set for each bird feature for a Special Protection Area (SPA).

Where these objectives are being met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving the aims of the Wild Birds Directive.

Publication date: 21 February 2019 (version 4). This document updates and replaces an earlier version dated 5 February 2016 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives for Somerset Levels and Moors Special Protection Area Site Code: UK9010031

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- **The extent and distribution of the habitats of the qualifying features**
- **The structure and function of the habitats of the qualifying features**
- **The supporting processes on which the habitats of the qualifying features rely**
- **The population of each of the qualifying features, and,**
- **The distribution of the qualifying features within the site.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

A037 *Cygnus columbianus bewickii*; Bewick's swan (Non-breeding)
A052 *Anas crecca*; Eurasian teal (Non-breeding)
A140 *Pluvialis apricaria*; European golden plover (Non-breeding)
A142 *Vanellus vanellus*; Northern lapwing (Non-breeding)
Waterbird assemblage

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 (as amended) (‘the Habitats Regulations’). They must be considered when a competent authority is required to make a ‘Habitats Regulations Assessment’ including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives, and the accompanying Supplementary Advice (where this is available), will also provide a framework to inform the management of the European Site and the prevention of deterioration of habitats and significant disturbance of its qualifying features

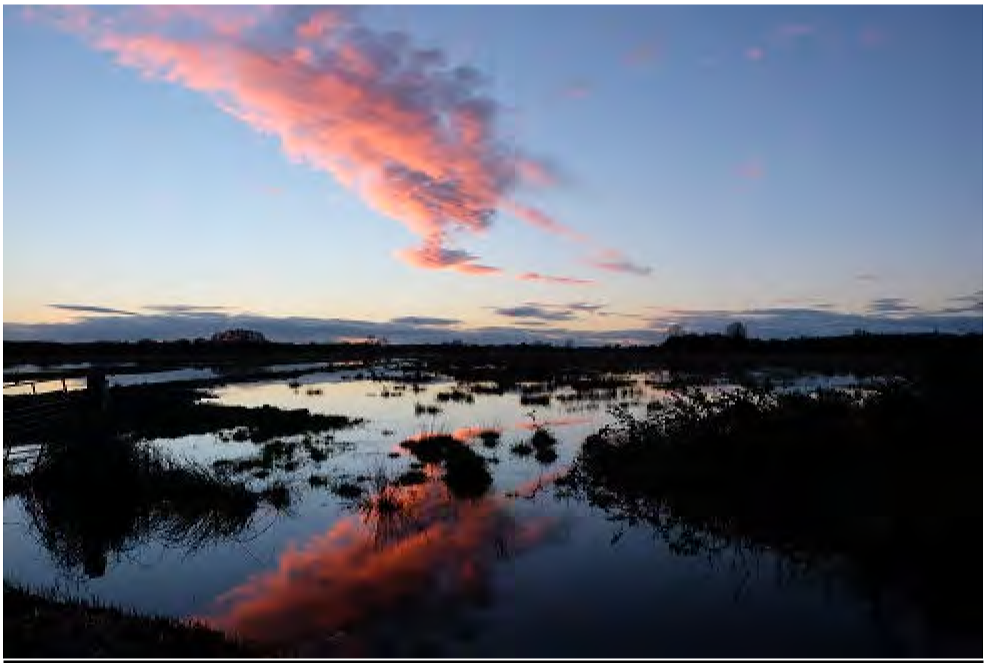
These Conservation Objectives are set for each bird feature for a Special Protection Area (SPA).

Where these objectives are being met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving the aims of the Wild Birds Directive.

Publication date: 21 February 2019 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Somerset Levels and Moors Special Protection Area (SPA) Site Code: UK9010031



Westhay Moor SSSI in winter. (Photo: Barry Phillips)

Date of Publication: 4 February 2019

About this document

This document provides Natural England's supplementary advice for the European Site Conservation Objectives relating to Somerset Levels and Moors SPA. This advice should therefore be read together with the SPA Conservation Objectives available here.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Somerset Levels and Moors Special Protection Area (SPA)
Location	Somerset
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	26 June1997
Qualifying Features	Non-breeding (overwintering): • Bewick's Swan *Cygnus columbianus bewickii* A037 • Eurasian Teal *Anas crecca* A052 • European Golden Plover *Pluvialis apricaria* A140 • Northern Lapwing *Vanellus vanellus* A142 • Waterbird assemblage
Designation Area	6394.18 ha
Designation Changes	None
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Catcott Edington and Chilton Moors SSSI Curry and Hay Moors SSSI King's Sedgemoor SSSI Moorlinch SSSI Shapwick Heath SSSI Southlake Moor SSSI Tealham and Tadham Moors SSSI West Moor SSSI West Sedgemoor SSSI Westhay Heath SSSI Westhay Moor SSSI Wet Moor SSSI
Relationship with other European or International Site designations	The boundary of this SPA coincides with the Somerset Levels and Moors Ramsar Site (Site Code: UK11064) This SPA is ecologically linked to the Severn Estuary SPA with bird species notified as mobile qualifying features using either the inland or coastal European Sites as alternative winter feeding grounds according to weather conditions.

Site background and geography

The SPA is comprised of 12 SSSIs located across the Somerset Levels and Moors floodplain. Five are in the Brue Valley to the north of the low ridge of the Polden Hills, while the remainder are on the floodplains of the Rivers Parrett and Tone to the south.

The Somerset Levels and Moors is a unique landscape in the British Isles and has achieved widespread recognition in the public mind for its extensive flatness and frequent floods. The open expanse of grasslands broken up by isolated hills and ridges is some of the lowest land in the UK, with large areas lying below the level of the highest tides. Water dominates the landscape and a complex network of watercourses is evidence of a long history of drainage to reclaim productive farmland from marshland. It remains largely pastoral and was once renowned for its dairy herds. Today, beef production is the most common enterprise but its future is uncertain in some areas as structural reform in the agricultural industry, market pressures and social changes render marginal areas less viable even for extensive farming. The peat-cutting industry of the Brue Valley in the north of the floodplain has declined dramatically in recent years, and worked-out areas are now reverting to biodiversity-rich wetland habitats. A detailed description of the area's natural and cultural features can be read in the Somerset Levels & Moors National Character Area profile (NCA Profile 142)

Its nature as a floodplain means that the Levels and Moors will always be a landscape in transition. The rivers drain to the Bristol Channel, which has the second highest tidal range in the world. Ground levels on inland moors can be up to 6 metres below peak tide levels. Over the centuries, a complex system of sea walls, elevated river banks and pumping stations developed in a piecemeal way to protect settlements and farmland. More intensive farming was made possible by pump-drainage, which inevitably compromised the survival of wetland biodiversity.

Today, the Somerset Levels and Moors contain the largest area of lowland wet grassland in England: 21% of the resource. Huge flocks of migratory waterfowl arrive in winter; more than at any other inland site in the UK. Its importance is year-round as it is one of the UK's most important breeding areas for Lapwing, Curlew, Redshank and Snipe: wading birds that depend on extensively grazed wet grassland. Meadows with more than 60 species in a single field and ditches supporting a unique assemblage of rare invertebrates add to its diversity.

The floodplain's surviving biodiversity is recognised by a series of statutory designations. There are 17 Sites of Special Scientific Interest reflecting the national importance of 7,300 ha for lowland wet grassland, breeding wader populations and aquatic invertebrates. Twelve of the SSSIs, covering almost 6,400 ha, have been classified as important for wintering wildfowl and designated a Special Protection Area under the EC Birds Directive. The tiers of conservation designations are completed by recognition under the Ramsar Convention that the best habitats on the floodplain are notable for rare aquatic invertebrates and wintering waterbirds, making it one of the world's premier wetlands.

The accumulation of designations makes it easy to lose sight of the fact that together they cover only 12% of the area of the floodplain. While they have helped attract limited investment to protect their biodiversity, little attention and few resources are given to the remainder, optimistically known as the "wider wetland". Much of the area outside the designated sites is a farmed grassland monoculture: too dry at critical times of the year to support wetland wildlife. This does not mean that it will always be of substantially lower value for wildlife. Promoting sustainable flood management and farming practices tailored to a wetland environment would rapidly reverse past losses and provide greater protection for the SPA.

About the qualifying features of the SPA

The following section gives you additional, site-specific information about this SPA's qualifying features.

These are the individual species of wild birds listed on Annex I of the European Wild Birds Directive, and/or the individual regularly-occurring migratory species, and/or the assemblages (groups of different species occurring together) of wild birds for which the SPA was classified for.

Qualifying individual species listed in Annex I of the Wild Birds Directive (Article 4.1)

During the non-breeding season the SPA regularly supports:

- **Bewick's Swan *Cygnus columbianus bewickii* (non-breeding) A037**

When the SPA was notified it supported a peak mean of 310 individuals in the five-year period from 1989/90 to 1993/94. This number represented at least 4.4% of the British and 1.8% of the North-west European overwintering population.

Since notification there has been a dramatic decline in numbers visiting the SPA with a 5-year peak mean of 5 individuals in the period 2012/13 to 2016/17. This reflects national and international trends since the mid-1990s. WeBS (Wetland Birds Survey) High Alerts have been issued for the medium (-80%) and long (-89%) terms.

The reasons behind the decline remain unclear. Unfavourable conditions on breeding grounds, staging areas and overwintering sites are all possible reasons. Fewer birds now cross the North Sea in mild winters, and this phenomenon partly explains the recent decline in numbers visiting Great Britain. Populations can also fluctuate from year to year in relation to the severity of winters. Numbers visiting the Somerset Levels and Moors had already declined in the years before the SPA was notified at a time when the national population had increased. The reason was not identified, but it was speculated that it may have been due to a reduction in winter floods.

In winter Bewick's Swan are found on flooded grassland, large waterbodies and estuaries, where they roost on water and feed on grasses and submerged vegetation. It also forages on waste root crops, grain stubbles and winter cereals. This species is very sensitive to disturbance.

- **European Golden Plover *Pluvialis apricaria* (non-breeding) A140**

When the SPA was notified it supported a peak mean of 3,110 individuals in the five-year period from 1989/90 to 1993/94. This number represented at least 1.2% of the British population.

Since notification there has been a substantial increase in numbers with a 5-year peak mean of 14,024 individuals in the period 2012/13 to 2016/17.

Golden Plover is an Annex 1 species and recent numbers of overwintering birds on the Somerset Levels and Moors exceed the threshold required for international importance. There is widespread variation in numbers at site, regional and national scales making analysis of trends difficult.

In winter Golden Plover have similar habitat requirements to Lapwing and these species are frequently found associating on inland and coastal sites. Flocks are highly mobile responding to prevailing weather conditions, available food resources and levels of disturbance. It is less dependent than most waders on shallow flood events to provide favourable feeding conditions.

Qualifying individual species not listed in Annex I of the Wild Birds Directive (Article 4.2)

During the non-breeding season the SPA regularly supports:

- **Eurasian Teal *Anas crecca* (non-breeding) A052**

When the SPA was notified it supported a peak mean of 7,476 individuals in the five-year period from 1989/90 to 1993/94. This number represented at least 5.3% of the British and 1.9% of the North-west European overwintering population.

Since notification there has been a substantial increase in numbers with a peak mean of 21,918 individuals in the period 2012/13 to 2016/17. The Somerset Levels and Moors is now the most important overwintering site for Teal in Great Britain.

The rate of increase in the Somerset Levels and Moors SPA has been higher than regional and national trends, emphasising its exceptional importance as a refuge for this species. Numbers usually peak in January or February with the majority of birds (70%) concentrated on West Sedgemoor SSSI, part of which is an RSPB reserve.

The disproportionately high numbers recorded on RSPB reserves on the Somerset Levels and Moors applies to other species, and demonstrates what can be achieved when the primary objective is to provide undisturbed feeding and roosting conditions for wetland birds. It must be noted that counts are made during the daytime when birds are mainly roosting. At night, they may disperse to other parts of the SPA and land of functional importance outside it to feed (Chown, 2001). The scale of movements over the course of the day is not known.

Parts of some component SSSIs, such as King's Sedgemoor (West) and Aller Moor are sub-optimal for Teal because of interrupted sightlines and disturbance. It is not known why numbers remain very low on King's Sedgemoor East when a Raised Water Level Area is maintained over 159 ha.

The neighbouring Severn Estuary SPA also supports an internationally significant number of Teal: a peak mean of 6,210 in the period 2012/13 to 2016/17.

In winter Teal prefer shallow water conditions in a wide range of wetland habitats including flooded grassland, bays of large waterbodies and estuaries. It is extremely sensitive to disturbance, and particularly vulnerable to severe cold weather. Maintenance of extensive areas of shallow water across the SPA is essential to support the population at its current level.

- **Northern Lapwing *Vanellus vanellus* (non-breeding) A142**

When the SPA was notified it supported a peak mean of 36,565 individuals in the five-year period from 1989/90 to 1993/94.

Since notification there has been a decline in numbers with a peak mean of 32,896 individuals in the period 2012/13 to 2016/17. A WeBS (Wetland Birds Survey) Medium Alert has been issued for the medium term (-31%). The overwintering population in Great Britain has also declined significantly since the 1990s.

In winter Lapwing frequent a wide variety of habitats, both coastal and inland. Flocks can be highly mobile responding to prevailing weather conditions, available food resources and levels of disturbance. Although mainly associated with wet grassland throughout the year they are often found on ploughed land and frequently roost at coastal sites.

The majority of the overwintering population (59%) on the Somerset Levels and Moors are supported on two RSPB reserves: West Sedgemoor SSSI within the SPA, and Greylake Reserve, which is outside but links two SPA component SSSIs (Moorlinch and King's Sedgemoor). Like Teal and other overwintering waterbirds, Lapwing will fly from these refuges at night to feed on land inside and outside the SPA boundaries (Chown, 2001). The scale of movements over the course of the day is not known.

Qualifying assemblage of species (Article 4.2)

In winter the SPA regularly supports an assemblage of waterfowl of more than 20,000 birds. When the SPA was notified the 5-year peak mean for the five-year period from 1989/90 to 1993/94 was 58,093, comprising 41,442 waders and 16,651 wildfowl.

In addition to the Annex 1 and 2 species featured above (Bewick's Swan *Cygnus columbianus bewickii*, Golden Plover *Pluvialis apricaria*, Teal *Anas crecca* and Lapwing *Vanellus vanellus*), the assemblage included Gadwall *Anas strepera*, Wigeon *Anas penelope*, Shoveler *Anas clypeata*, Pintail *Anas acuta*, Snipe *Gallinago gallinago* and Whimbrel *Numenius phaeopus*.

Since notification there has been a substantial increase in numbers with a 5-year peak mean of 90,205 individuals in the period 2012/13 to 2016/17. The representation of species exceeding national and international population thresholds in the assemblage has changed with eight species exceeding the international threshold (Golden Plover *Pluvialis apricaria*, Teal *Anas crecca,* Lapwing *Vanellus vanellus,* Gadwall *Anas strepera*, Wigeon *Anas penelope*, Shoveler *Anas clypeata*, Pintail *Anas acuta* and Mute Swan *Cygnus olor*), and five exceeding the national threshold (Bittern *Botaurus stellaris*, Little Egret *Egretta garzetta*, Ruff *Philomachus pugnax* and Green Sandpiper *Tringa ochropus*).

Gadwall *Anas strepera*

When the SPA was notified it supported a peak mean of 94 individuals in the five-year period from 1989/90 to 1993/94, which represented 1.2% of the British population.

Since notification numbers have increased with a 5-year peak mean of 618 individuals in the period 2012/13 to 2016/17. However, there are indications of a decline in overwintering numbers on the SPA with WeBS Medium Alerts issued for the short (-42%) and medium (-40%) terms.

In winter Gadwall prefer large waterbodies, including permanently flooded voids on former peat excavation sites in the Brue Valley and are less likely to be found on shallow flooded grassland.

Pintail *Anas acuta*

When the SPA was notified it supported a peak mean of 148 individuals in the five-year period from 1989/90 to 1993/94.

Since notification there has been a substantial increase in numbers with a 5-year peak mean of 922 individuals in the period 2012/13 to 2016/17.

This highly mobile species occurs in small numbers across the floodplain. It is mainly found dabbling in open water, but it also grazes on pastures and marsh and forages for spilt grain on cereal fields.

Wigeon *Anas Penelope*

When the SPA was notified it supported a peak mean of 5,927 individuals in the five-year period from 1989/90 to 1993/94, which represented 2.1% of the British population.

Since notification there has been a substantial increase in numbers with a 5-year peak mean of 23,543 individuals in the period 2012/13 to 2016/17, which exceeds the international threshold. The Somerset Levels and Moors is the third most important overwintering site in Great Britain after the Ribble Estuary and Ouse Washes.

In winter Wigeon are found predominantly on estuarine mudflats, saltmarshes and coastal pastures. About 20% of the national population overwinter on inland sites where they feed on short swards and sometimes crops. Large areas of un-flooded but wet grassland need to be maintained to sustain this species.

Numbers of Wigeon on the Somerset Levels and Moors usually peak in January or February. The highest concentration of birds is on West Sedgemoor with 11, 375 individuals: 42% of the total. Daytime counts confirm the value of West Sedgemoor and other safe roosts, but it is known that at night birds disperse from them to feed elsewhere in the SPA and land of functional importance outside it (Cheung, 2001). Extensive and prolonged deep water floods are detrimental to its presence on the Somerset Levels and Moors.

Shoveler *Anas clypeata*

When the SPA was notified it supported a peak mean of 217 individuals in the five-year period from 1989/90 to 1993/94, which represented 2.1% of the British population.

Since notification there has been an increase in numbers with a 5-year peak mean of 1380 individuals in the period 2012/13 to 2016/17, which exceeds the international threshold. Numbers within the SPA have increased at a faster rate than at the regional and national scales. In winter, Shoveler depend on shallow areas of open water and flooded grassland. When flooded, West Sedgemoor is particularly important within the SPA with a 5-year peak mean of 372 individuals.

It is a dabbling duck which prefers larger bodies of permanent water, although it will also feed on flooded grassland.

Snipe *Gallinago gallinago*

The five-year peak mean for the period 1991/92 to 1995/96 (selected to include the earliest reported year for this species on the SPA) was 1768 individuals.

A peak mean of 1,254 individuals was recorded in the period 2012/13 to 2016/17. The Somerset Levels and Moors remains the most important overwintering site for Snipe in Great Britain. A combination of perfect camouflage and secretive behaviour makes this species notoriously difficult to count accurately, and the overwintering population will be higher.

Snipe depend on soft, wet ground to feed, and will move to the coast to escape freezing conditions inland.

Notable non-qualifying species of birds on the Somerset Levels and Moors

The SSSIs within the SPA and NNRs and reserves outside it also support an important assemblage of breeding and wintering birds. In addition to the species mentioned above, the Annex 1 species Bittern *Botaurus stellaris,* Little Egret *Egretta garzetta,* Great White Egret *Ardea alba* and Marsh Harrier *Circus aeruginosus* breed and overwinter. Other regular Annex 1 winter visitors are Merlin *Falco columbarius,* Peregrine *Falco peregrinus,* Hen Harrier *Circus cyaneus* and Short-eared Owl *Asio flammeus*. The Somerset Levels and Moors remains nationally important for its breeding wader assemblage (principally Lapwing *Vanellus vanellus*, Snipe *Gallinago gallinago*, Redshank *Tringa totanus* and Curlew *Numenius arquata)*, but numbers have declined significantly and its future has become increasingly dependent on raised water level areas in SSSIs acting as refugia.

References:

Nagy, S., Petkov, N., Rees, E., Solokha, A., Hilton, G., Beekman, J. and Nolet, B. 2012. International Single Species Action Plan for the Conservation of the Northwest European Population of Bewick's Swan (Cygnus columbianus bewickii). AEWA Technical Series No. 44. Bonn, Germany.

Chown, D. 2001. Nocturnal use of the Somerset Levels and Moors floodplain by overwintering waterfowl: 2000/2001, A report to the English Nature Somerset Team.

Site-specific seasonality of SPA features

The table below highlights in grey those months in which significant numbers of each mobile qualifying feature are most likely to be present at the SPA during a typical calendar year. This table is provided as a general guide only.

Unless otherwise indicated, the months shown below are primarily based on information relating to the general months of occurrence of the feature in the UK. Where site-based evidence is available and has been used to indicate below that significant numbers of the feature are typically present at this SPA outside of the general period, the site-specific references have been added to indicate this.

Applicants considering projects and plans scheduled in the periods highlighted in grey would benefit from early consultation with Natural England given the greater scope for there to be likely significant effects that require consideration of mitigation to minimise impacts to qualifying bird features during the principal periods of site usage by those features. The months which are *not* highlighted in grey are not ones in which the features are necessarily absent, rather that features may be present in less significant numbers in typical years. Furthermore, in any given year, features may occur in significant numbers in months in which typically they do not. Thus, applicants should not conclude that projects or plans scheduled in months not highlighted in grey cannot have a significant effect on the features. There may be a lower likelihood of significant effects in those months which nonetheless will also require prior consideration.

Any assessment of potential impacts on the features must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional site-based surveys may be required. Non-breeding water bird monthly maxima data gathered for this site through the Wetland Bird Survey ('WeBS') may be available upon request from the British Trust for Ornithology.

Feature	**Season**	**Period**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Site-specific references where available**
Bewick's Swan	Non-breeding	Winter													
Golden Plover	Non-breeding	Winter													
Teal	Non-breeding	Winter													
Lapwing	Non-breeding	Winter													
Waterbird Assemblage	Non-breeding	Winter													

Guide to terms:
Breeding – present on a site during the normal breeding period for that species
Non-breeding - present on a site outside of the normal breeding period for that species (includes passage and winter periods).
Summer – the period generally from April to July inclusive
Passage - the periods during the autumn and spring when migratory birds are moving between breeding areas and wintering areas. These periods are not strictly defined but generally include the months of July – October inclusive (autumn passage) and March – April inclusive (spring passage).
Winter - the period generally from November to February inclusive.

Table 1: Supplementary Advice for Non-breeding Qualifying Features: Bewick's Swan *Cygnus columbianus bewickii* (A037), European Golden Plover *Pluvialis apricaria* (A140), Eurasian Teal *Anas crecca* (A052), Northern Lapwing *Vanellus vanellus* (A142) and Waterbird Assemblage

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Non-breeding population	**Population abundance**	**Bewick's Swan** Restore the size of the non-breeding population to a level which is at or above 310 individuals (calculated at a 5-year peak mean at time of notification), while avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. **Golden Plover** Maintain the size of the non-breeding population at a level which is at or above 3,110 individuals (calculated at a 5-year peak mean at time of notification), while avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. **Teal** Maintain the size of the non-breeding population at a level which is at or above 7,476 individuals (calculated at a 5-year peak mean at time of notification), while avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the abundance of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's abundance has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current abundance of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and/or	The latest data can be requested via the BTO (British Trust for Ornithology) website.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Lapwing Restore the size of the non-breeding population at a level which is at or above 36,565 individuals (calculated at a 5-year peak mean at time of notification), while avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	migration movements) and breeding productivity. Adverse anthropogenic impacts on either of these rates may precede changes in population abundance (e.g. by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured/estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise on whether the figures stated are the best available.	
Assemblage of species	**Assemblage abundance**	**Assemblage of Waterfowl** Maintain the overall abundance of the non-breeding assemblage at a level which is above 20,000 individual wintering wetland birds, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent. The non-breeding assemblage of waterfowl was 58,093 individuals (calculated at a 5-year peak mean) at time of notification.	This will sustain the assemblage population and contribute to viable local, national and bio-geographic populations of its component species. Assemblage abundance is the annual sum of peak counts of each assemblage component species (at any time of year, though peaks tend to occur in the non-breeding season), unless otherwise stated. Five year peak means are the average of these annual peak sums for the relevant period. An assemblage component is any waterbird using the site. Due to the dynamic nature of assemblage component populations, this target may be subject to periodic review. However, the target assemblage abundance is considered to be the minimum standard for conservation or restoration measures and therefore where at any time the assemblage abundance is greater than the target value given, any measure or impact assessment should take account of the greater abundance. This meets with the obligation to avoid deterioration of a European site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects giving rise to the risk of such deterioration or disturbance.	JNCC SPA description Somerset Levels and Moors SPA citation document (March 1995). Available here: http://publications.naturalengland.org.uk/publication/4598158654963712 The latest data can be requested via the BTO (British Trust for Ornithology) website.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Whether to maintain or restore depends on the overall assemblage abundance (i.e. the peak mean derived from the summed peak counts of components), and should only change in response to this value, excepting natural change. Fluctuations of individual assemblage component species alone should not necessarily change the target. Assemblage abundance is linked to the demographic rates of assemblage components, including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and/or migration movements) and breeding productivity. Adverse anthropogenic impacts on either of these rates may precede changes in population abundance (e.g. by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured/estimated (particularly for the main or named components) to inform judgements of likely changes to the assemblage and associated impacts on abundance targets. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise on whether the figures stated are the best available.	
Assemblage of species	**Diversity of species**	**Assemblage of Waterfowl** Maintain the species diversity of the bird assemblage.	This will ensure the bird assemblage reflects the diversity of species the SPA supports. Assemblage diversity is a product of species richness (the number of different species present), abundance (population size of each assemblage component species) and relative 'importance' (an assessment of the conservation status of each assemblage component, described below). Each component makes a different contribution to the diversity of the assemblage, and changes to some components may be	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			considered to affect diversity more than others. Negative changes to small numbers of relatively important assemblage components may have a similar overall effect to negative changes in larger numbers of less important components. To meet the target, the populations of each of the 'main component' assemblage species to be maintained or restored are i) those present in nationally important numbers (≥1% GB population); ii) migratory species present in internationally important numbers (≥1% biogeographic population); iii) those species comprising ≥2,000 individuals (≥10% of the minimum qualifying threshold for an internationally-important assemblage); and iv) 'named components' otherwise listed on the SPA citation. In addition to the main components, other components should be considered as these contribute collectively to the assemblage diversity, in particular proportionally abundant populations of species of conservation importance. Examples are those 'red-listed' as Birds of Conservation Concern and/or those listed on Sections 41/42 of the Natural Environment and Rural Communities Act 2006. The species composition of an assemblage may change over time. However, to meet this target, the total number of all native waterbird species contributing to the assemblage species richness should not decline significantly.	
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting non-breeding habitat**	Maintain the extent and distribution of suitable habitat within and outside the SPA boundary) which supports the qualifying features for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding)	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target also applies to supporting habitat (habitats of functional importance for qualifying features) which lies outside the SPA boundary.	More detailed information for each component part of the SPA may be available from Natural England. Somerset Levels and Moors Natural Area. A nature conservation profile. English Nature (1997). Natural England 2014

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Land and open water: 6394.18 ha. Within the SPA boundary: grazing marsh, fen, reedbeds, species-rich and species poor neutral grassland, open water, rivers, artificial drainage channels and ditches. Outside the SPA boundary: an unquantified area of land of functional importance for qualifying features.	The grassland community types within each component SSSI are a complex mosaic of species-rich and species-poor neutral grassland, fen, mire and swamp communities. Land of functional importance on the floodplain outside the SPA boundary includes arable land, species-poor grassland, species-rich grassland and a variety of wetland habitats in nature conservation reserves, such as the RSPB reserves at Ham Wall and Greylake. The SPA's capacity to support and sustain an assemblage comprising a very large number of birds (in excess of 20,000) made up of a diverse mix of species will be reliant on the overall quality and diversity of the habitats that support them. The feeding and roosting habitats which support the assemblage occur within and outside the site boundary. This target is applicable to both circumstances. Due to the large number of species and natural fluctuations in the overall composition of an assemblage, it is not practical to provide specific targets relating to each supporting habitat relevant to the assemblage. Generally speaking, the specific attributes of each supporting habitat may include vegetation characteristics and structure, water depth, food availability, connectivity between nesting, roosting and feeding areas both within and outside the SPA. Further advice will be provided by Natural England on a case by case basis.	Site Improvement Plan: Somerset Levels and Moors
Supporting habitat (both within and outside the SPA): **function/ supporting process**	**Water quantity**	Maintain the supply of water to a standard which provides the necessary conditions to support the qualifying features of the SPA. In winter the flood regime must provide a mixture of splash, shallow and deep flooded areas.	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. The presence of overwintering SPA birds on the floodplain depends on a complex integrated approach to water level and flood risk management. Raised Water Level Areas (RWLAs) provide a safety net to ensure the presence of qualifying features, but the continuation	"Conservation Requirements for the Somerset Levels and Moors SPA/Ramsar/SSSI and Wider Wetland." English Nature (1999). Water level management on component SSSIs is implemented in line with 10 Water Level Management Plans (WLMPs) approved by Natural England, the Environment Agency and the

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Continue to facilitate a pattern of natural low level flood events across the floodplain each winter. Favourable water levels must be maintained from 1 December to the end of February. **Target conditions across the SPA:** **Splash** conditions (field level to 10 cm deep) should occur over at least 30% of the SPA and the majority of component SSSIs. **Shallow** conditions (10 to 30 cm deep) should occur over 10 to 25% of the SPA and the majority of component SSSIs. Ideally, shallow flooding should occur over at least 20 ha when combined with at least 20 ha of deep flooding. **Deepe**r conditions (25 to 75 cm deep) should occur over at least 5 to 10% of the SPA, but not necessarily every component SSSI. Ideally, deep flooding should occur over at least 20 ha when combined with at least 20 ha of shallow flooding. **Target conditions at field scale:**	of natural low-level flood events across the floodplain each winter is essential to for the survival of qualifying features within and outside the SPA boundary. During the winter months, the number of waterfowl present is influenced by the extent of controlled and uncontrolled flooding. This becomes critical when freezing conditions elsewhere displace more birds to the Somerset Levels and Moors. Maintenance of favourable water levels is essential to attract wintering waterfowl. The extent of shallow flooding should be achieved by the first week in December and reduced gradually from the end of February until it is gone by mid-March. Areas managed for deep flooding should be ready by mid-December and water removed gradually from mid-February until it is gone by early March. Achievement of the target in November and March will be influenced by prevailing weather conditions, particularly droughts and flood events. Splash flooding provides conditions for Wigeon and Teal to feed, and after receding leaves damp ground that attracts Snipe, Lapwing and Golden Plover. Shallow flooding is necessary to provide undisturbed feeding areas and roosting sites for ducks and roosting sites for waders. Areas of shallow or deep flooding covering at least 20 ha need to be close to areas of at least 20 ha of splash, shallow or deep flooding to act as a minimum refuge size for waterfowl. At the time of writing, the extent of shallow flooding is a little less than required. Deep flooding is necessary to provide feeding areas and roosting sites for Bewick's Swan and ducks. Water levels in excess of the defined range can be evacuated, when and where possible. Sometimes, more water may need to be	Parrett Internal Drainage Board inn July 2011: Bridgwater & Pawlett WLMP (2009) Othery, Middlezoy, Westonzoyland & Chedzoy WLMP (2009) West Sedgemoor WLMP (2009) North Drain WLMP (2010) South Drain WLMP (2010) Wet Moor WLMP (2010) West Moor WLMP (2010) King's Sedgemoor & Aller Moor (2010) North Moor & Salt Moor (2010) Curry Moor (2011)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Early winter (from mid-November): water levels should rise gradually to create extensive pools covering 20 to 50% of most fields with the lowest lying fields being close to 50% inundated. **Mid-winter** (1 December to the end of February): extensive areas of splash flooding and shallow pools up to 25 cm deep covering at least 50% of most fields with deep water roost sites covering at least 60 ha with water 25 to 75 cm deep. **Late winter to early spring** (31 March): water levels should be lowered gradually to leave splash conditions with shallow pools in the lowest lying fields.	removed to prevent anoxic conditions from developing during mild weather or when shallow or deeper water has been present continuously between December and February. Prolonged deep water flooding can reduce the extent and quality of feeding habitat because probing waders are unable to reach food sources. At the time of writing, the area of deep water exceeds the target. Sufficient deep water for safe roosts exists in the Brue Valley in the form of flooded peat excavations at Shapwick and Westhay SSSIs, and on the Parrett floodplain at West Sedgemoor and Southlake. In severe cold weather, the wider water courses, and in particular the King's Sedgemoor Drain, are used as ice-free roost sites.	
Supporting habitat (both within and outside the SPA): **Function /supporting process**	**Water quality**	**Water quality target** The SPA qualifying features are relatively insensitive to organic and nutrient pollution. The current water quality of the Somerset Levels and Moors is likely to be adequate to support the SPA qualifying features.	Poor water quality can adversely affect the availability and suitability of feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. The main source of lowered water quality through the Somerset Levels and Moors is diffuse water pollution, caused primarily by high phosphate levels from nutrient enrichment (inorganic and organic agricultural fertilisers, soil loss from arable land and overflows from private septic tanks). Point sources of pollution mainly occur at sewage treatment works.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Although water quality is unlikely to pose a risk to the SPA qualifying features, it is relevant that the ditch aquatic plant and invertebrate communities of the coincident Ramsar Site are suffering from the effects of hyper-eutrophication. Measures to reverse this are in place through PR19 (Ofwat), CSF (Catchment Sensitive Farming Programme) and the Somerset Levels and Moors Ramsar Diffuse Water Pollution from Agriculture Plan. These measures are forecast to improve water quality. The Environment Agency has also undertaken nutrient modelling to identify the relative importance of diffuse and point sources to nutrient enrichment in the catchment and is working with the water companies to reduce nutrient discharges from sewage treatment works. Acute problems associated with catastrophic pollution events need to be dealt with on a case-by-case basis.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to maintain the structure, function and/or the supporting processes associated with the feature and its supporting habitats. Grassland used by SPA birds should be managed by grazing, or mowing and removing field-dried hay followed by aftermath grazing. By November, the sward should be a mixture of grass tussocks and areas of	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. The suite of conservation management measures necessary to support overwintering SPA birds encompasses mowing and grazing low input meadows, maintaining the extensive ditch system to supply and remove water, sympathetically managing ditches to maintain the plant and invertebrate assemblages, controlling water levels across component SSSIs, maintaining artificial Raised Water Level Areas (RWLAs) designed to	“Conservation Requirements for the Somerset Levels and Moors SPA/Ramsar/SSSI and Wider Wetland.” English Nature (1999). Water level management on component SSSIs is implemented in line with 10 Water Level Management Plans (WLMPs) approved by Natural England, the Environment Agency and the Parrett Internal Drainage Board inn July 2011: Bridgwater & Pawlett WLMP (2009) Othery, Middlezoy, Westonzoyland & Chedzoy WLMP (2009) West Sedgemoor WLMP (2009)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		shorter grass from 5 to 15 cm in height. Livestock should be removed by the end of November. Fields should support a mixture of grasses and herbs with some patches of rushes and sedges to provide vegetation and seeds for ducks and swans to eat in winter. Habitats within the SPA should support abundant populations of aquatic and soil invertebrates for ducks and waders to eat in winter. The landscape should remain relatively free of tall trees and scrub to provide sightlines for birds of over 200 m to reduce excessive predation in feeding areas and roost sites. In winter (1 December to 31 March), water in ditches (locally called “rhynes”) must be at least 30 cm deep.	provide appropriate water levels for SPA birds, maintaining flooded voids in the peat production zone, controlling invasive plant species and minimising the level of disturbance caused by human activities. Land management measures in most of the SPA are currently delivered through voluntary agri-environment scheme agreements. A succession of schemes have secured the short-term future for qualifying features, but changes in requirements as schemes evolve and uptake varies makes it difficult to guarantee the long-term integrity of privately-owned Raised Water Level Areas (RWLAs). Outside the SPA, uptake of new agreements is low and there is an increasing risk that agricultural intensification will affect land of functional importance for qualifying features. Landowners always have the option of ending agreements at the 5-year break point, which contributes to uncertainty over the future. Water level management measures are delivered through Water Level Management Plans (WLMPs).	North Drain WLMP (2010) South Drain WLMP (2010) Wet Moor WLMP (2010) West Moor WLMP (2010) King’s Sedgemoor & Aller Moor (2010) North Moor & Salt Moor (2010) Curry Moor (2011)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Air quality**	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System. Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical	The structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a	More information about site-relevant Critical Loads and Levels for this SPA is available by using the ‘search by site’ tool on the Air Pollution Information System.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.	
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Reduce the frequency, duration and/or intensity of disturbance within close proximity of affecting roosting, foraging, feeding, moulting and/or loafing birds so that the qualifying features are not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, and presence of people, animals and structures. Daytime use of feeding areas and roost sites by SPA birds will be minimal if the level of disturbance is an issue. Management of public access, through pedestrian and vehicle access strategies, visitor management plans and promoting	Natural England 2014 Site Improvement Plan: Somerset Levels and Moors

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			awareness of the sensitivity of particular areas, can reduce disturbance to over wintering bird populations Development of settlements and a corresponding increase in the human population on and around the floodplain may lead to an increase in levels of disturbance to qualifying features on some parts of the SPA and associated functional land. Measures to reduce the impact of recreational disturbance might include provision of greenspace within settlements and educational information on the sensitivity of birds to disturbance	
Supporting habitat (both within and outside the SPA): structure	**Landscape**	Maintain open and unobstructed terrain within and around roosting and feeding areas with no overall decrease in field sizes	The qualifying features favour large areas of open terrain, largely free of obstructions in and around roosting and feeding areas to detect approaching predators. Bewick's Swan requires an unimpeded sightline of 500 m at feeding, roosting and refuge sites.* The other qualifying features require an unimpeded sightline of 200 m at feeding, roosting and refuge sites.*	*Natural England & the Countryside Council for Wales' advice for the Seven Estuary European Marine Site given under Regulation 33(2) (a) of the Conservation (Natural Habitats, &c.) Regulations 1994, as amended (June 2009).
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the safe passage of birds moving between roosting and feeding areas within and outside the component SSSIs and between the Somerset Levels and Moors and Severn Estuary SPAs.	The ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Structures and wind-turbines located between component SSSIs, functionally-linked land on the floodplain and in the flyway between the Somerset Levels and Moors and Severn Estuary SPAs may lead to increased mortality of SPA birds through collisions and displacement from feeding habitats and roost sites. Research into the role of the flyway between the estuary and inland moors and the extent and importance of functionally-linked land outside the SPA boundary is required.	Natural England 2014 Site Improvement Plan: Somerset Levels and Moors

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	**Bewick's Swan** Maintain the availability of cereal grains, rape, potatoes and sugar beet, where these sources are locally important to feeding flocks. **Golden Plover and Lapwing** Maintain the availability of key invertebrate prey species (e.g. earthworms and beetles) of preferred prey sizes. **Teal** Maintain the cover/abundance of preferred food plants (e.g. *Polygonum, Eleocharis, Rumex, Ranunculus, and Juncus*). **Assemblage** Maintain the cover/abundance of preferred food plants and availability of key invertebrate prey species.	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population. In winter, Bewick's Swans forage mainly by day feeding on grasses, aquatic plants, leftover grains and other crops, such as potatoes and beets. The serious decline in the overwintering population on the Somerset Levels and Moors makes it difficult to recommend the extent of feeding habitat necessary restore it to the level when the SPA was notified. Research is needed on the extent and suitability of arable land outside the SPA boundary that has the potential to support this species. An increase in the extent of arable land on the floodplain is not seen as necessary to reverse the population decline. Golden Plover and Lapwing feed primarily on earthworms and insects and their larvae. In winter, these species feed across the floodplain mainly by day, but sometimes at night. Teal prefer to feed at night in winter to avoid disturbance, but can be in active in the day in quiet locations. It mainly forages for seeds on grassland in winter but can feed on stubble. Research is needed to establish the scale of nocturnal use of land outside the SPA by foraging qualifying species.	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

ANNEX 7

Letter from Natural England regarding the impact of Phosphate on the Somerset Levels and Moors SPA / Ramsar Site

Date: 17 August 2020

Customer Services
Hornbeam House
Crewe Business Park
Electra Way
Crewe
Cheshire
CW1 6GJ

T 0300 060 3900

Dear Sir/Madam

Matters regarding development in relation to the Somerset Levels and Moors Ramsar Site

Background

Natural England is writing to your Authority regarding the implications of the CJEU case known as the "Dutch N" (Joined Cases C-293/17 and C-294/17 Coöperatie Mobilisation for the Environment UA and Others v College van gedeputeerde staten van Limburg and Others) in relation to planning applications than may affect the Somerset Levels and Moors Ramsar protected site.

Dutch-N concerns agricultural N-pollution affecting protected heathland sites. However, the general principles involved are applicable to other pollutants or other receptors – the essential point being that where the conservation status of a protected natural habitat is unfavourable, the possibility of authorising activities which may subsequently compromise the ability to restore the site to favourable condition and achieve the conservation objectives is "necessarily limited".

The ruling has resulted in greater scrutiny of plans or projects that will result in increased nutrient loads that may have an effect on:

- Special Protection Areas (SPA) designated under the Habitat Regulations 2017
- Special Areas of Conservation (SAC) designated under the Habitat Regulations 2017
- Sites designated under the Ramsar Convention, which as a matter of national policy[1] are afforded the same protection as if they were designated under the Habitat Regulations 2017

By informing the way in which Reg. 63 of the Habitats Regulations 2017 should apply to pollution-related matters Dutch-N has resulted in the need for greater scrutiny of the effects of plans or projects that are likely to, either directly or indirectly, increase nutrient loads to internationally important sites (i.e. SACs, SPAs and Ramsar Sites) where a reason for unfavourable condition is an

[1] NPPF para. 176.

excess of a specific pollutant. Following the Dutch N ruling, the legal difficulty in authorising plans or projects that lead to further inputs of that pollutant is clear.

Somerset Levels and Moors Protected Site(s)

The Somerset Levels and Moors are designated as an SPA under the Habitat Regulations 2017 and listed as a Ramsar Site under the Ramsar Convention. The Ramsar Site broadly covers the same area as the Somerset Levels and Moors SPA. While the SPA is designated for its international waterbird communities, the Ramsar Site is designated for its internationally important wetland features including the floristic and invertebrate diversity and species of its ditches, which is shared as a designated feature of the underpinning Sites of Special Scientific Interest (SSSIs). Further information relating to the unfavourable condition of the Ramsar Site and the underpinning SSSIs designated under the Wildlife & Countryside Act 1981 (as amended) is provided at Annex 1.

In relation to the Somerset Levels and Moors SPA, based on our current understanding, Natural England is satisfied that additional nutrients from typical new developments described in this letter are unlikely, either alone or in combination, to have a likely significant effect on the internationally important bird communities for which the site is designated. On this basis, Natural England is satisfied that the effects of additional nutrients from development on the SPA can normally be screened out of further assessment.

However, the interest features of the Somerset Levels and Moors Ramsar Site are considered unfavourable, or at risk, from the effects of eutrophication caused by excessive phosphates. Further, although improvements to the Sewage Treatment Works, along with more minor measures to tackle agricultural pollution have been secured, these will not reduce phosphate levels sufficiently to restore the condition of the Ramsar Site features. The scope for permitting further development that would add additional phosphate either directly or indirectly to the site, and thus erode the improvements secured, is necessarily limited.

Listed Wetlands of International Importance under the Ramsar Convention (Ramsar) are protected as a matter of Government policy (National Planning Policy Framework paragraph 176). Therefore in line with national policy, Natural England advises that your Authority, as the competent authority under the Habitats Regulations 2017, considers the implications of these matters on the Ramsar Site through an appropriate assessment of the implications of the plan or project in view of that site’s conservation objectives. Having carried out that assessment, permission for the plan or project may only be given if the assessment allows you to ascertain that it will not have an adverse effect on the integrity of the site.

Conservation Objectives for Ramsar Sites

Site specific conservation objectives for Ramsar Sites have not been published. However, the following generic Conservation Objectives for all Ramsar Sites have previously been signed off by Natural England:

“With regard to the Ramsar Site and the wetland habitats, individual species and/or groups of species for which the site has been listed (its ‘Qualifying Features’), and subject to natural change;

Ensure that the integrity of the [Ramsar] site is maintained or restored as appropriate, and ensure that the site contributes to achieving the wise use of wetlands across the UK, by maintaining or restoring;

- The extent and distribution of qualifying habitats and habitats of qualifying species
- The structure and function of qualifying habitats and habitats of qualifying species
- The supporting processes on which qualifying habitats and habitats of qualifying species rely
- The populations of each qualifying species, and,
- The distribution of each qualifying species within the site.”

The conservation objectives for the Ramsar Site should also ensure consistency with the published conservation objectives for the Somerset Levels and Moors SPA.

Implications for development within the hydrological catchment of the Somerset Levels and Moors Ramsar Site

Natural England advises that, in light of the unfavourable condition of the Somerset Levels and Moors Ramsar Site, before determining a planning application that may give rise to additional phosphates within the catchment, competent authorities should undertake a Habitats Regulations Assessment proceeding to an appropriate assessment where a likely significant effect cannot be ruled out, even where the development contains pollution mitigation provisions. Note the need for an appropriate assessment of proposals that include mitigation measures designed to avoid an adverse impact is established in domestic case law[2] and European case law[3]. The appropriate assessment must rule out any reasonable doubt as to the likelihood of an adverse impact on the integrity of the site, having regard to its conservation objectives.

It has been established that a 'nutrient neutrality' approach to development is likely to be a lawfully robust solution to enable the grant of permissions that give rise to an appreciable effect. Examples of multi authority catchment solutions include the nutrient neutrality methodology in the Solent, the River Avon Local Authorities phosphorous interim delivery plan to deliver phosphate neutrality, the River Axe (Devon) Nutrient Management Plan (currently in draft) and Nitrogen Reduction in Poole Harbour Supplementary Planning Document. Your authority may wish to consider this approach to enable developments to proceed in the catchment that will result in additional phosphates. It is however emphasised that for such an approach to be lawful, it is likely that the measures used to offset such impacts should not compromise the ability to restore the designated site to favourable condition and achieve the conservation objectives.

Development types affected

1. Additional residential units and commercial development

Additional residential units within the catchment are likely add phosphate to the designated site via the waste water treatment effluent, thus contributing to the existing unfavourable condition and further preventing the site in achieving its conservation objectives. Natural England therefore advises that your authority carry out an appropriate assessment of planning applications that will result in a net increase in population served by a wastewater system, including new homes, student and tourist accommodation.

Provided the competent authority is satisfied that new commercial development will not significantly increase loadings at the catchment's waste water treatment works then they may be screened out from further assessment on the basis that people living in the catchment are also likely to work and use facilities in the catchment, and therefore wastewater generated by that person can be calculated using the population increase from new homes and other accommodation.

Tourism attractions (e.g. theme parks) are normally considered exceptions as these land uses attract people into the catchment and generate additional wastewater within the Somerset Levels and Moors catchment. There may also be cases where planning applications for new commercial or industrial development could result in the release of additional phosphates into the system, for

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[2] *Gladman Developments Limited v S of S for Housing, Communities and Local Government and another* [2019] EWHC 2001 (Admin)

[3] *Sweetman vs Coillte Teoranta CJEU C-323/17* ("People over Wind")

example through processes that add phosphates, or significant volumes of additional waste water to the sewage treatment works.

Where applicable, the appropriate assessment should consider the improvements to Wessex Water's sewage treatment works secured under PR19. Once up and running these improvements will significantly reduce (although not remove) the offsetting requirements for new residential development in perpetuity. However, additional more temporary measures may be required to take account of the increased nutrient loads in the interim period.

2. Infrastructure that supports agricultural intensification

Increased agricultural intensification within the catchment of the Somerset Levels and Moors Ramsar Site will also lead to increased nutrient loading. For example, planning applications for new or expanded livestock housing (e.g. cattle sheds, chicken, or pig farm facilities, etc.) are all forms of agricultural intensification that if located within the catchment are likely to increase nutrient loads to the designated site and should be subject to an appropriate assessment.

Additional considerations relating to slurry storage

The Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010, abbreviated to the SSAFO regulations, require agricultural holdings to provide storage infrastructure for silage, slurry and agricultural fuel oil to a given standards, sizes and lifespan to prevent water pollution. The size of a slurry store needed by a holding is determined by factors including the number of livestock, area of uncovered yard, presence of a separator, volumes of parlour washings etc. The installation of a new slurry store, or in some cases the enlargement of an existing slurry store, requires planning permission.

Natural England advises that when your Authority is seeking to determine applications for new or enlarged slurry stores on agricultural holdings within the catchment of the Somerset Levels and Moors Ramsar Site it should, in accordance with Reg. 63 of the Habitats Regulations 2017, consider the plan or project that underlies the application for planning permission. The need for a new slurry store will in many cases be part of a broader plan or project, namely an increase in livestock numbers on the holding in question, with the slurry store being a legally necessary means of enabling that plan or project. The grant of planning permission for a new slurry store is likely to unlock the ability to intensify the use of the holding in question.

When carrying out an appropriate assessment of this sort, Natural England advises that a competent authority should proceed on the basis of an analysis of the added livestock capacity that a new slurry store would unlock. This principle has been established in decision making (see Torridge Council Appropriate Assessment under the Habitats Regulations of Planning Application 1/1041/2015/FULM: Land at Beckland Farm, Hartland).

3. Anaerobic digesters

Natural England has particular concerns relating to the potential impacts of additional anaerobic digester (AD) plants within the Somerset Levels and Moors catchment. AD plants require the input of organic matter, often in the form of farmyard manure and arable plant matter. Livestock and arable crops within the catchment are significant contributors to the elevated phosphate and unfavourable condition of the designated sites, in particular at locations where there are runoff pathways. New (or increased capacity) of AD is therefore likely to be driving local land use changes such as the production of maize, which is known to be a significant contributor to diffuse water pollution.

It follows that permitting new, or increasing the capacity of existing, AD plants through the grant of planning permission is likely to unlock land use change which is known to contribute phosphorous and sediment to the catchment watercourses. Natural England advises that the competent authorities should consider new or enlarged AD facilities as simply one aspect of a plan or project of land use change. In this regard, when an application for a new or extension to an existing AD plant is within (or within close proximity) to the catchment of the Somerset Levels and Moors Ramsar

Site, your authority should consider the risk that the development will indirectly increase the amount of phosphates entering the designated site. If an increase in the catchment's phosphate loads is considered likely then the implications of the proposals, along with any measures that may be implemented to alleviate that risk, should also be considered through an appropriate assessment.

4. **Other development types**

We have focused here on the main types of development that result in additional phosphates in the Somerset Levels and Moors catchment. There may be other types of development that fall into that bracket and we would welcome further discussion in that respect.

Mitigation options

Nutrient offsetting mitigation should be in place so as to avoid either permanent, or temporary increases in phosphate loads to the designated site and must be effective for the duration of the effect. In the case of new housing the duration of the effect is typically taken as in perpetuity, with the costs of maintaining, monitoring and enforcing mitigation calculated for a minimum of 80 – 125 years. It does not, however, follow that mitigation is not needed after that period, rather the expectation is the mitigation will continue indefinitely (e.g. through securing appropriate permanent land use change). In contrast, phosphate offsetting measures for agricultural intensification or AD plants need only be effective for the duration of the operation facilitated by the permission and therefore less permanent mitigation measures may be appropriate. Natural England would be happy to discuss potential phosphate mitigation options for different types of development in due course.

Note

This is the opinion of Natural England as statutory consultee to local planning authorities in relation to nature conservation and impacts of plans or projects on designated sites. It is up to individual planning authorities to take their own legal advice when exercising their statutory functions.

Natural England is keen to help your authority to understand the scope of the issues discussed above and to establish solutions which do not undermine the delivery of your plan policies. There are a number of mitigation measures which may be available to enable developments to proceed, whether on-site or off-site. We are also happy to engage directly with applicants on bespoke solutions through our Discretionary Advice Service.

If you have any queries relating to the advice in this letter please contact me on 07900 608072.

Yours sincerely

Simon Stonehouse, Natural England Wessex Team

Annex 1
Further information on the Somerset Levels and Moors Ramsar Site and SSSIs

The favourable condition of the ditches of the designated sites is in part dependent on the water quality within them. In freshwater habitats it is often the case that the abundance of nutrients, especially phosphorus (P), is a key limiting factor of excessive primary productivity, particularly algae. Excessive nutrients leading to such adverse biological effects is known as “hyper-eutrophication”. In lowland ditch systems such as the Somerset Levels and Moors, these effects are typified by the excessive growth of filamentous algal, particularly in the form of large mats on the water surface, and a massive proliferation of certain species of *Lemna*. This can adversely affect the ditch invertebrate and plant communities through a variety of mechanisms including shading, smothering and anoxia, leading to a dominance of plant species better able to deal with these conditions, with negative competitive effects on others. This can lead to a significant negative shift in habitat quality and structure which in turn affects invertebrate communities.

The vast majority of the ditches within the Ramsar Site and the underpinning SSSI’s are classified as being in unfavourable condition due to excessive P and the resultant ecological response, or at risk from this process.

The sources of P, commonly assessed in the form of phosphates, derive from diffuse water pollution (such as agricultural leaching) and point discharges (such as from Waste Water Treatment Works) within the catchment. Phosphorus levels are frequently 2-3 times higher than the target for total phosphorus set out within the Conservation Objectives underpinning the Ramsar Site. There is widespread evidence of biological harm linked to eutrophication in the form of increasing blooms of *Lemna* and filamentous algae that are threatening the integrity of the biological communities that should be specially protected under the Ramsar designation. This view is reinforced by the Environment Agency’s Water Framework Directive (WFD) assessment of water bodies across the Somerset Moors, which is that many are at significantly less than ‘Good’ status for phosphate. Specifically, Water Framework Directive (WFD) phosphate limits of 100µg/l are exceeded across the Somerset Levels and Moors Catchment. River catchments which lie within the wider Somerset Levels are currently classified as *Poor Ecological Status* under the WFD.

Somerset Levels and Moors Sites of Special Scientific Interest

Catcott Edington and Chilton Moors SSSI Curry and Hay Moors SSSI King's Sedgemoor SSSI Moorlinch SSSI Shapwick Heath SSSI Southlake Moor SSSI Tealham and Tadham Moors SSSI West Moor SSSI West Sedgemoor SSSI Westhay Heath SSSI Westhay Moor SSSI Wet Moor SSSI

ANNEX 8

Guidance published by Somerset County Council in relation to Bat SAC Consultation Zones

Barbastelle Bats

Exmoor and Quantocks Oak Woodlands

Special Area of Conservation (SAC)

Guidance on Development

Version 1.2 – April 2018

This guidance was prepared by Larry Burrows, Ecologist, Somerset Ecology Services, Planning Control, Somerset County Council working in partnership with Natural England

Acknowledgements

I wish to thank the following for their input into the development of the guidelines for the North Somerset and Mendip Bats SAC. The methodology developed for the guidance on the North Somerset and Mendip Bats SAC. Which was endorsed by Natural England, is used for Barbastelle bats and modified to take account of their spatial ecology in this guidance.

Henry Andrews, Andrews Ecology
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Jan Collins, Bat Conservation Trust
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Alison Howell, Natural England
John Mellor, FPCR Environment and Design Ltd
Susan Stangroom, North Somerset Council
Simon Stonehouse, Natural England
Carol Williams, Bat Conservation Trust
Roger Willmot, North Somerset Council
Gareth Withers, North Somerset Council

For data: Natural England; Bat Conservation Trust; Somerset Environmental Records Centre; Radio tracking reports by Greena Ecological Consultants; various reports from Council websites

Cover Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust (http://www.vwt.org.uk/)

EXMOOR AND QUANTOCKS OAK WOODLANDS
SPECIAL AREA OF CONSERVATION (SAC): GUIDANCE ON DEVELOPMENT

Contents

Exmoor and Quantocks Oak Woodlands Special Area of Conservation (SAC)

PART A

Non-technical guidance

1. Who is the guidance aimed at and why?

1.1 This advice is aimed at developers, consultants, and planners involved in planning and assessing development proposals in the landscapes surrounding in Sedgemoor used by Barbastelle bats from the North Exmoor and Quantocks component sites of the Exmoor and Quantocks Oak Woodlands SAC.

1.2 The overall aim is for a clearer approach to considering impacts of development on the SAC. The guidance provides a consistent basis for understanding how rare Barbastelle bats use the landscape and where there is likely to be greater risk or opportunity for development. This will help inform strategic planning for the area's future housing needs.

1.3 The guidance will comprise a component of the development management process, to be considered in line with relevant policies, such as policy DM8 (Nature Conservation) of the Sedgemoor District Council Local Plan; NH3 of the West Somerset District Council Local Plan; Policy CE-S3 of the Exmoor National Park Authority Local Plan; and Policy DM2: Biodiversity and Geodiversity of the Somerset County Council Minerals Plan; and Policy DM3: Impacts on the environment and local communities in the Somerset County Council Waste Core Strategy

1.4 At project level the guidance will help identify key issues at pre-application stage that can inform the location and sensitive design of development proposals and minimise delays and uncertainty. Within the areas identified, there will be clear requirements for survey information and a strong emphasis on retaining and enhancing key habitat for bats and effective mitigation where required. This will demonstrate that development proposals avoid harm to the designated bat populations and support them where possible.

1.5 The guidance explains how development activities can impact the SAC and the steps required to avoid or mitigate any impacts. It applies to development proposals that could affect the SAC and trigger the requirements of the Habitats Regulations (see Annex 8).The local planning authority will consider, on the basis of evidence available, whether proposals (planning applications) are likely to impact on Barbastelle bats and hence require screening for Habitats Regulations Assessment (HRA). Those are the proposals to which the guidance will be applied. This will reduce the likelihood that it would be applied to minor developments which would not have an impact on the SAC

1.6 The guidance brings together best practice and learning from areas with similar approaches, such as Somerset County Council and South Hams, and the best scientific information available at the time of writing. It will be kept under review by Sedgemoor District Council and Somerset County Council and their partners and is fully endorsed by Natural England. The planning guidance is part of a wider approach that is being pursued by partner organisations to safeguard and improve habitat for rare bats that includes farm management. The guidance is also consistent with Natural England's Site Improvement Plan for the SACs.

2. What is the Bats SAC?

2.1 Special Areas of Conservation (SAC) are European sites of international importance for wildlife. The Exmoor and Quantocks Oak Woodlands SAC is important for two bat species, Barbastelle and Bechstein's bats present in the both the North Exmoor and the Quantocks SSSI components of the SAC. Bechstein's bats are a woodland species that are likely to be restricted to the SAC designated woodlands.

2.2 However, the landscapes around the SAC itself are also important in providing foraging habitat needed to maintain in particular the favourable conservation status of Barbastelle bats. Therefore the guidance makes strong requirements for consultation, survey information and appropriate mitigation, to demonstrate that development proposals will not adversely impact on the designated bat populations.

3. Juvenile Sustenance Zones

3.1 The guidance identifies the Juvenile Sustenance Zones of 1 kilometre (km) around the maternity roosts. New build development on green field sites should be avoided in the Juvenile Sustenance Zones (JSZs) in view of their sensitivity and importance as suitable habitat as foraging areas for young bats.

4. Bat Consultation Zone

4.1 The guidance also identifies the "Bat Consultation Zone" where Barbastelle bats may be found, divided into bands A, B and C, reflecting the likely importance of the habitat for the bats and proximity to maternity and other roosts.

4.2 Within the Consultation Zone development may be permitted but is likely to be subject to particular requirements, depending on the sensitivity of the site.

5. Need for early consultation

5.1 Section 3 of Part B of the guidance stresses the need for pre-application consultation for development proposals.

5.2 Within bands A or B of the Consultation Zone, proposals with the potential to affect features important to bats (identified in Section B paragraph 3.2 below) should be discussed with the local authority and/or Natural England as necessary.

5.3 Within band C developers should take advice from their consultant ecologist.

6. Survey requirements

6.1 Section 3 and Annex 4 of the guidance sets out the survey requirements normally applying to development proposals within the Bat Consultation Zone. Outside the Bat Consultation Zone development proposals may still have impacts on bats, and developers should have regard to best practice guidelines, such as Bat Conservation Trust survey guidelines and Natural England's Standing Advice for Bats.

6.2 For proposals within the Consultation Zone (all Bands) developers must employ a consultant ecologist at an early stage to identify and assess any impacts.

6.3 For proposals within bands A and B of the Bat Consultation Zone, full season surveys will be needed (unless minor impacts can be demonstrated), and must include automated bat detector surveys. Survey results are crucial for understanding how bats use the site, and therefore how impacts on Barbastelle bats can be avoided, minimised or mitigated. Where mitigation is needed the survey results will inform the metric for calculating the amount of habitat needed (see Annex 6).

6.4 Within band C survey effort required will depend on the suitability habitat to support prey species hunted by Barbastelle bats.

7. Proposed developments with minor impacts

7.1 In some circumstances a developer may be able to clearly demonstrate (from their qualified ecologist's site visit and report) that the impacts of a proposed development are proven to be minor and can be mitigated (or do not require mitigation) without an impact on SAC bat habitat, so a full season's survey is not needed. This should be substantiated in a suitably robust statement submitted as part of the development proposals.

8. Need for mitigation, possibly including provision of replacement habitat

8.1 Within the Bat Consultation Zone (all Bands), where SAC bats could be adversely affected by development appropriate mitigation will be required.

8.2 Development proposals should seek to retain and enhance existing habitats and / or features of value to bats such as those listed in paragraph 3.2 of Part B in this guidance. Where this is not, or is only partially possible appropriate mitigation such as the provision of replacement habitat will be required. The council's ecologist will have regard to relevant considerations in determining the mitigation requirements, including survey results and calculations relating to quantity of replacement habitat. Annex 6 sets out the methodology and metric for calculating how much replacement habitat should be provided[1].

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[1] In the Somerset County area developers may ask the Local Planning Authority to carry out the calculation for the amount of habitat required to replace the value of that lost to Barbastelle bats prior to the application being submitted, to check that the proposed master plan for the site has adequate land dedicated to the purpose. A charge may be levied for this service.

8.3 Any replacement habitat must be accessible to the Barbastelle bat population affected.

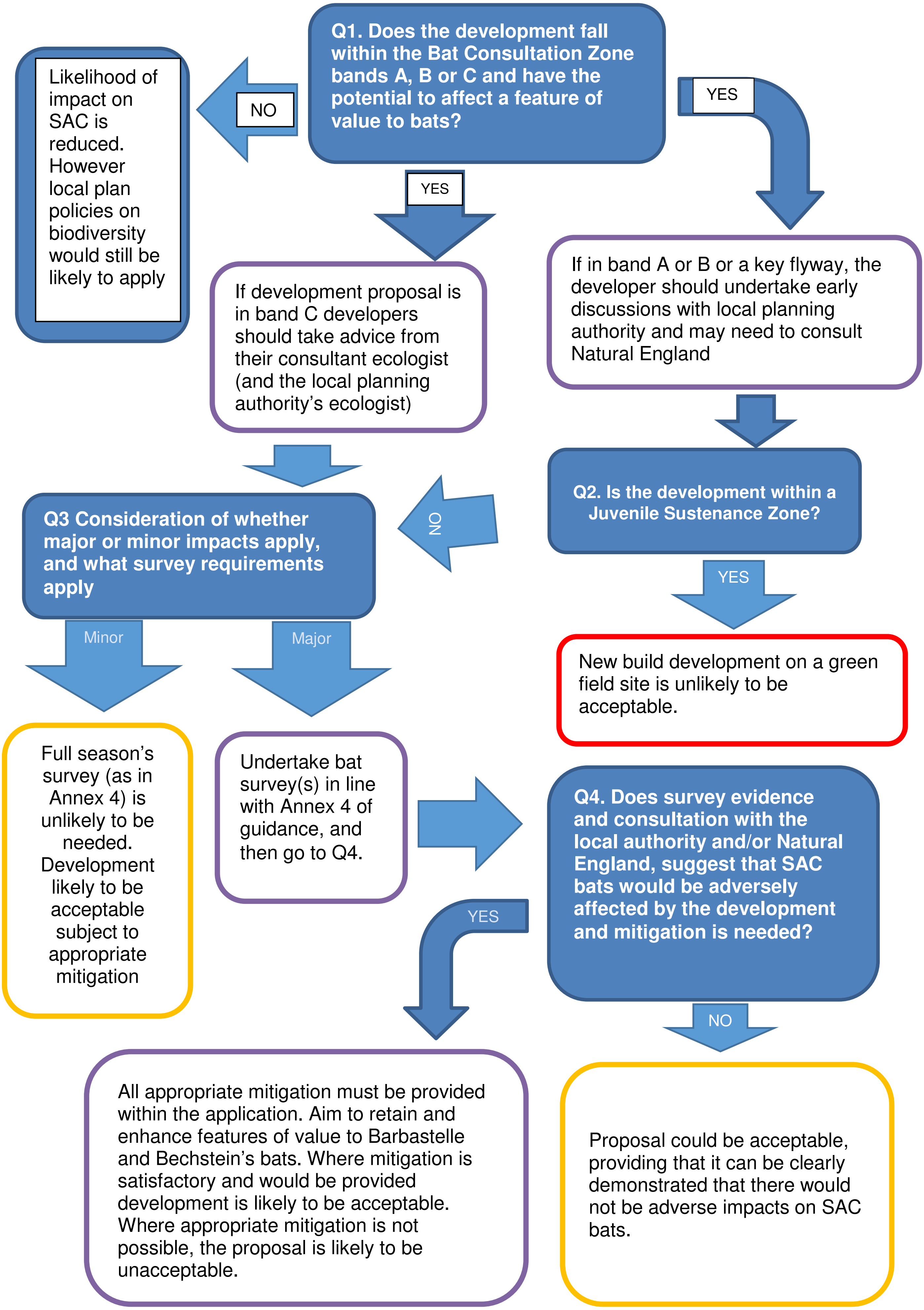
8.4 Where the replacement provision is to be made on land off-site (outside the red line development boundary for the planning application) any existing value of that land as bat habitat will also have to be factored in to the calculation.

8.5 Where the replacement provision is to be off site, and land in a different ownership is involved, legal agreements are likely to be needed to ensure that the mitigation is secured in perpetuity.

8.6 An Ecological Management Plan for the site must be provided setting out how the site will be managed for SAC bats in perpetuity.

8.7 Where appropriate a Monitoring Strategy must also be provided to ensure continued use of the site by SAC bats, and include measures to rectify the situation if negative results occur.

Barbastelle Bat. Photo: Henry Schofield. Courtesy Vincent Wildlife Trust


Q1. Does the development fall within the Bat Consultation Zone bands A, B or C and have the potential to affect a feature of value to bats?
NO
Likelihood of impact on SAC is reduced. However local plan policies on biodiversity would still be likely to apply
YES
If development proposal is in band C developers should take advice from their consultant ecologist (and the local planning authority's ecologist)
YES
If in band A or B or a key flyway, the developer should undertake early discussions with local planning authority and may need to consult Natural England
Q2. Is the development within a Juvenile Sustenance Zone?
NO
Q3 Consideration of whether major or minor impacts apply, and what survey requirements apply
YES
New build development on a green field site is unlikely to be acceptable.
Minor
Major
Full season's survey (as in Annex 4) is unlikely to be needed. Development likely to be acceptable subject to appropriate mitigation
Undertake bat survey(s) in line with Annex 4 of guidance, and then go to Q4.
Q4. Does survey evidence and consultation with the local authority and/or Natural England, suggest that SAC bats would be adversely affected by the development and mitigation is needed?
YES
NO
All appropriate mitigation must be provided within the application. Aim to retain and enhance features of value to Barbastelle and Bechstein's bats. Where mitigation is satisfactory and would be provided development is likely to be acceptable. Where appropriate mitigation is not possible, the proposal is likely to be unacceptable.
Proposal could be acceptable, providing that it can be clearly demonstrated that there would not be adverse impacts on SAC bats.

Technical Guidance

1. Introduction

1.1. The Exmoor and Quantocks Oak Woodlands SAC is designated under the Habitats Directive 92/43/EEC, which is transposed into UK law under the Conservation of Habitats and Species Regulations 2010 (as amended) ('Habitat Regulations). This means that the populations of bats supported by this site are of international importance and therefore afforded high levels of protection, placing significant legal duties on decision-makers to prevent damage to bat roosts, feeding areas and the routes used by bats to travel between these locations. ;

1.2. Amongst the qualifying features for the SAC are two Annex II species:

- the Barbastelle bat *Barbastella barbastellus;* and
- the Bechstein's bat *Myotis bechsteinii*

1.3. Bechstein's bats are present in the Exmoor component site at Horner Wood only. However, longer range dispersal of Bechstein's bats is likely to benefit from habitat structure used by the Barbastelle bat and therefore the conservation and provision of such structure is given emphasis in the guidance. The 'Precautionary Principle' dictates that if their requirements are met, then the other SAC bat species is also likely to be protected. For more detail on the SAC see Annex 1.

1.4. The Conservation Objectives for the SAC[2] are: With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' which include the bat species listed above), and subject to natural change, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and,
- The distribution of qualifying species within the site.

1.5. Therefore, planners and prospective developers need to be aware that the habitats and features which support the populations of SAC bats outside the designated site are a material consideration in ensuring the integrity of the designated site.

1.6. The purpose of this advice is not to duplicate or override existing legal requirements for protected bat species or their roosts. These aspects are well governed by the Natural

[2] http://publications.naturalengland.org.uk/publication/5696090506526720?category=5374002071601152

England licensing procedures (Wildlife Management and Licensing Unit) for protected species.

1.7. This document should serve as an evidence base and provide guidance on the planning implications for development control in the relevant local planning authority (LPA). There are opportunities beyond the scope of this document to use this evidence base to inform the preparation of land use plans through the local plans.

1.8. This advice is aimed at applicants, agents, consultants and planners involved in producing and assessing development proposals in the landscapes surrounding the SAC. Within these areas there will be a strong requirement for survey information, mitigation and compensation for bats and their habitat in order to demonstrate that development proposals will not impact on the designated bat populations.

1.9. The guidance explains how development activities can impact the SAC and the steps required to avoid or mitigate any impacts. It applies to development proposals that could affect the SAC and trigger the requirements of the Habitats Regulations[3] (see Annex 8). The local planning authority will consider, on the basis of evidence available, whether proposals (planning applications) are likely to impact on SAC bats and hence require screening for Habitats Regulations Assessment (HRA). Those are the proposals to which the guidance will be applied. This will reduce the likelihood that it would be applied to minor developments which would not have an impact on the SAC.

1.10. An important objective of the advice is to identify areas in which development proposals might impact on the designated populations at an early stage of the planning process, in order to inform sensitive siting and design, and to avoid unnecessary delays to project plans by raising potential issues at the outset.

1.11. This technical guidance is based on the advice from experts and ecological consultants[4], current best practice and the best scientific information available at the time of writing. It will be kept under review by Somerset County Council, Exmoor National Park Authority and Natural England.

2. Sensitive Zones for Barbastelle Bats

Introduction

2.1 To facilitate decision making and in order to provide key information for potential developers at an early stage, using the best available data a Bat Consultation Zone affecting West Somerset and Sedgemoor districts and Exmoor National Park, and Juvenile Sustenance Zones affecting West Somerset and the National Park (See Plans 1 to 4 below) have been identified. This is an accumulation of known data, beginning with the 2000 radio tracking study of the Horner Wood colony and the 2012 Quantocks radio tracking studies of Barbastelle bat roosts.[5] The data is constantly being added to and updated. Therefore the Plans reflect the current understanding of key roosts and habitat associated with the SAC.

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[3] Conservation of Habitats and Species Regulations 2010, SI 2716, Regulation 61

[4] See acknowledgements

[5] Rush, T. & Billington, G. 2012. *Report on a radio tracking study of Barbastelle bats at Hinkley Point C.* Witham Friary: Greena Ecological Consultants.

Bat Consultation Zone (orange, yellow and pale yellow shading on Plans 1 and 2 below)

2.2 Barbastelle bats are spread very thinly in the landscape. At the Ebernoe roost in Sussex the density of bats in late summer was rather less than one female or juvenile to six square kilometres. This area would include very large areas of land that are not or seldom used consisting of arable fields, The hunting territories themselves form a select and vulnerable set of more stable and productive habitats; a small percentage of the total area, but rich in diversity.[6]

2.3 The Bat Consultation Zone illustrates the area where Barbastelle bats may be found. It is divided into three bands, A, B and C reflecting the density at which Barbastelle bats may be found at a distance from a roost site. The basis for these distances is set out in Annex 2 and is based on the distances recorded through radio tracking studies at Horner Wood on Exmoor, in the Quantocks, Dartmoor and at Mottisfont in Wiltshire; field survey records; and research into the spatial use of the home range by the species. Note that the radio tracking studies only recorded the movements of a small number of bats from each of the maternity roosts and therefore it is likely that any area within the Bat Consultation Zone could be exploited by Barbastelle bats. The zone's band widths are set out in Table 1 below and in Annex 2.

Table 1: Band Widths for Barbastelle Bat (from Maternity Woodlands)

Band	Distance (metres)
A	7000
B	10100
C	15500

2.4 The Bat Consultation Zone radius circle is centred on the maternity roosts around Alfoxton and Waltham's Wood in the Quantocks and around Horner Wood on Exmoor. The Consultation Zone is further defined by the coastline east of the Quantocks and at Porlock and by forming a buffered Minimum Convex Polygon on the extents of recorded occurrences of the species to produce the broad directional dispersal of Barbastelle bats through a colony's home range. (See Annex 2)

2.5 Band A is shown in orange shading, Band B in yellow and Band C in pale yellow reflecting the decreasing density at which Barbastelle bats are likely to occur away from the home roost. However, if foraging activity or a key flyway is recorded in Band B or C then they should be treated as for Band A (see Annexes 3 and 6).

Juvenile Sustenance Zones (for information only and shown by red shading on Plans 3 and 4 below)

2.6 Juvenile Sustenance Zones are formed around woodland containing maternity roosts to a distance of 1 kilometre (km) for Barbastelle bats. Although patches closest to the roost area are usually shared by the colony members these may seasonally be left clear by adults as exclusive juvenile foraging zones. Most colonies seem to have one large productive foraging zone very close to the roost woodlands to fulfil the juvenile

[6] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

and shared requirement. The availability of productive habitat producing abundant prey close to the roost in this period is a major key to the success of any bat colony. Examples of such foraging areas are small woodland floodplains and ponds or small river systems with a plentiful shrubby growth of species like willows. These foraging areas also need to be on the adult female bats' flyway.[7]

3. Consultation and Surveys

3.1 Where a proposal within the Consultation Zone has the potential to affect the features identified below early discussions with the local planning authority (who will consult Natural England as necessary) are also essential.

- Known bat roost
- On or adjacent to a Site of Special Scientific Interest (SSSI)
- Linear features: watercourses, hedgerows, tree lines
- Riparian, broadleaved woodland, unimproved grassland, improved grassland, mixed woodland, coniferous woodland, scrub, and gorse habitats
- Wetland habitat: ponds, rivers, streams, rhynes
- New wind turbine proposals (in respect of displacement)[8]
- Development which introduces new lighting

3.2 Early discussion refers to pre application stage prior to submission of a planning application; and, essentially, *before* any Master Plan proposals are submitted or finalised. This will ensure that adequate survey data is obtained. Please note that early discussions will also help inform likely mitigation requirements, and ensure, for example, that proposals seek to retain and enhance key features and habitats, and that sufficient land can be allocated for such avoidance and/or mitigation measures as may be required. This should result in appropriate bespoke mitigation measures that are designed in at an appropriately early stage. A site lighting plan with existing (pre-development) night time lux levels should also be provided.

3.3 In Band C developers should take advice from their consultant ecologist and planners from their ecologist colleagues.

3.4 Failure to provide the necessary information in support of an application is likely to lead to delays in registration and determination, and the application may need to be withdrawn. If insufficient information is submitted to allow the local planning authority to assess the application in accordance with the Habitats Regulations, the application is likely to be considered unacceptable.

3.5 For proposals within the Bat Consultation Zone (all Bands) an ecological consultant[9] should be commissioned at an early stage to identify and assess any impacts the proposals may have.

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[7] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature ; Greenway, F. & Hill, D. 2005. *Woodland management advice for Bechstein's bat and barbastelle bat*. Peterborough, English Nature.

[8] Barbastelle bat casualties are very rare with only four casualties being recorded in Europe over the ten year period 2003 to 2013. (Eurobats. 2014. *Report of the Intercessional Working Group on Wind Turbines and Bat Populations*. EUROBATS.StC9-AC19.12)

[9] Consultants should be members of CIEEM www.cieem.net or taken from the Environmental Consultants Directory www.endsdirectory.com

3.6 Surveys should determine the use of the site by Barbastelle bats, whether the site is being used as a commuting route or contains hunting territories or both. Survey results inform the metric for calculating the amount of replacement habitat required in the methodology set out in Annex 6. Consideration should be given to the site within the wider landscape.

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3.7 Surveys should be carried out in accordance with the Survey Specification at Annex 4. Exact survey requirements will reflect the sensitivity of the site, and the nature and scale of the proposals. The ecological consultant will advise on detailed requirements following a preliminary site assessment and desk study.

3.8 It is essential to note that bat surveys are seasonally constrained. For proposals which have the potential to impact on the SAC, a full season (April to August inclusive plus October) will be required, but this may not be necessary in certain circumstances, where this is demonstrable to the council's ecologist. (See Section B paragraphs 4.14 to 4.15 on minor impacts.) This will need to be included in the plan for project delivery at an early stage to avoid a potential 12-month delay to allow appropriate surveys to be undertaken.

3.9 Outside the Bat Consultation Zone, development proposals may still have impacts on bats. All species of bat and their roosts are protected by the Wildlife and Countryside Act (1981, as amended) and the Habitats Regulations. Further advice on potential impacts to bats is contained in Natural England's Standing Advice for Development Impacts on Bats, English Nature's Bat Mitigation Guidelines (2004) and the Bat Conservation Trust Bat Survey Guidelines for Professionals. [10]

4. Mitigation within the Consultation Zone

4.1 Within the Bat Consultation Zone, where SAC bats would be affected or potentially affected by development appropriate mitigation will be required. The aim should be to retain and enhance habitat and features of value to Barbastelle bats, such as those listed in paragraph 3.2 of Part B of this guidance. Where this is not possible replacement habitat may be needed. The council's ecologist will have regard to relevant considerations in determining the mitigation requirements, including survey results and calculations relating to replacement habitat. (See the methodology and metric in Annex 6) The developer's ecologist should carry out the calculations when requested by the council's ecologist. Replacement habitat should always aim to be the optimal for the species affected

4.2 The following are examples of habitats to which the above principles will apply:

- Hunting habitat such as grassland; hedgerows; woodland; scrub; riparian vegetation; tree lines; arable margins; and ponds. They also need water to drink from.

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[10] http://www.naturalengland.org.uk/ourwork/planningdevelopment/spatialplanning/standingadvice/default.aspx ; Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition). London: Bat Conservation Trust; Mitchell-Jones, A. J. 2004. *Bat Mitigation Guidelines*. Peterborough: English Nature.

- Connecting habitat, which is important to ensure continued functionality of commuting habitats including both sides of a track where it occurs. (Proposals must seek to retain existing linear commuting features as replacement of hedgerows is likely to require a significant period to establish). Note that strategic or key flyways are important to barbastelle bats and are sued by several members of a colony whilst dispersing to individual feeding areas (See Annex 3).

4.3 The following are also important principles:

- Seek to maintain the quality of all semi-natural habitats and design the development around enhancing existing habitats to replace the value of that lost making sure that they remain accessible to the affected bats

4.4 Loss of habitat refers not only to physical removal but also from the effects of lighting. A development proposal will be expected to demonstrate that bats will not be prevented from using features by the introduction of new lighting or a change in lighting levels. Reference to specific lux levels will be expected. Lighting refers to both external and internal light sources. Applicants will be expected to demonstrate that considerations of site design, including building orientation; and the latest techniques in lighting design have been employed in order to, ideally, avoid light spill to retained bat habitats. Applicants will similarly be expected to demonstrate use of the latest techniques to avoid or reduce light spill from within buildings.

4.5 Where replacement habitat provision is necessary, the type(s) of habitat to be provided shall be agreed with the local authority's ecologist and/or Natural England as appropriate.

4.6 Where replacement habitat is required off site in mitigation the land should not be a designated Site of Special Scientific Interest, be contributing already to supporting conservation features or in countryside stewardship to enhance for bats.

4.7 Replacement habitat should aim to be the optimal for the species affected (See Annex 7). The following are examples of habitats of value to Barbastelle bats and which are likely to be required in the replacement provision.

- Hedgerows with trees – tall, bushy hedgerows at least 3 metres wide and 3 metres tall
- Unimproved grassland / wildflower meadow - managed for moths, e.g. Long swards[11].
- Scrub including gorse
- Riparian vegetation
- Wide field margins at least 6 metres wide
- Ponds - for drinking

4.8 The method for checking the adequacy of replacement habitat provided with an application or then in Master Planning of a proposed development, is given in Annex 6.

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[11] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature. Noctuid moths form a large element of Barbastelle bat diet

4.9 It is important that provision of the replacement habitat is carried out to timescales to be agreed by the local authority and/or Natural England as appropriate.

4.10 In the case of quarries, waste sites or other large scale sites where restoration is proposed this should not be considered as mitigation for habitat lost to Barbastelle bats. The timescale to when these restorations are likely to be implemented, i.e. 40 years after the quarry has been worked, is too long to provide any replacement to maintain the existing population at the time of impact.

4.11 **It is vital that any replacement habitat is accessible to the Barbastelle bat population affected.**

4.12 An Ecological Management Plan for the site must be provided setting out how the site will be managed for SAC bats for the duration of the development. Where appropriate a Monitoring Strategy also needs to be included in order to ensure continued use of the site by SAC bats and includes measures to rectify the situation if negative results occur.

Lighting

4.13 Lighting is considered to have a high impact on Barbastelle bat roosts and a lesser impact on foraging and commuting habitats. This does not mean that there are no effects at all - Barbastelle bats do not feed through street lights as some more tolerant bat species even though their prey is attracted to them - and lighting on features used by these bats should be minimised. Other bat species, including Bechstein's bats, present at a proposed development site could be light sensitive and it is recommended that prospective developers provide evidence with their application of introduced light levels so as not to disturb the behaviour of the more sensitive species.[12]

4.14 A variety of techniques will be supported to facilitate development that will minimise and/or compensate for light spill:

- Use of warm white LED lights with directional baffles as required (LED light lacks a UV element and minimises insect migration from areas accessed by SAC bats
- use of building structure, design, location and orientation to maintain and/or provide a functional
- use of landscaping to protect and/or create dark corridors on site. Planting will be expected to consist of native species, with provision for invertebrates, and planting will be expected to be managed for ecology rather than practicality
- use of SMART glass
- use of internal lighting design solutions to minimise light spill
- use of smart lighting solutions

4.15 Prospective developers will be expected to provide evidence, ideally in the form of a lux contour plan and sensitive lighting strategy, with their application to demonstrate that introduced light levels will not affect existing and proposed features used by SAC bats to above 0.5 lux; or not exceeding baseline light levels where this is not feasible.

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[12] Stone, E. L. 2013. *Bats and Lighting Overview of current evidence and mitigation*. Bristol: University of Bristol. Light levels for lesser horseshoe bats are used lacking evidence for Bechstein's bats

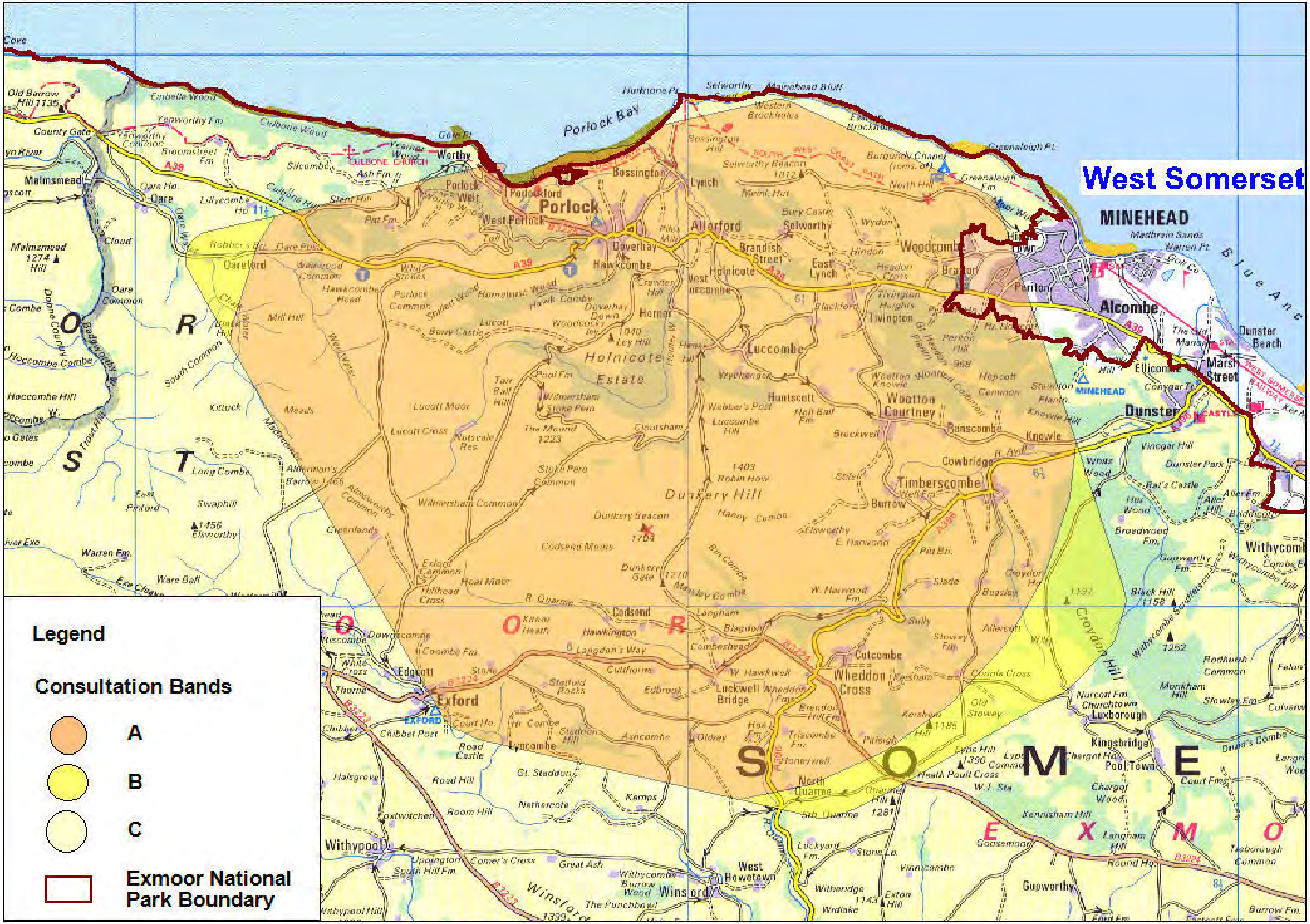
Proposed developments with minor impacts

4.16 In circumstances where this is likely to be overall less potential impact, especially in Band C, mitigation may be put forward without the need for a full season's survey. (See Annex 4) This approach will only be suitable where it can be clearly demonstrated that the impacts of a proposed development are proven to be minor and can be fully mitigated without an impact upon the existing (& likely) SAC bat habitat. In order to adopt this approach, it will be necessary for a suitably qualified ecologist to visit the site and prepare a report with an assessment of existing (& likely) SAC bat habitat. The information from this report should provide the basis to determine appropriate mitigation measures associated with the proposed development. The proposed mitigation should clearly demonstrate that there will be no interruption of suitable SAC bat commuting habitat and replacement of foraging habitat as appropriate.

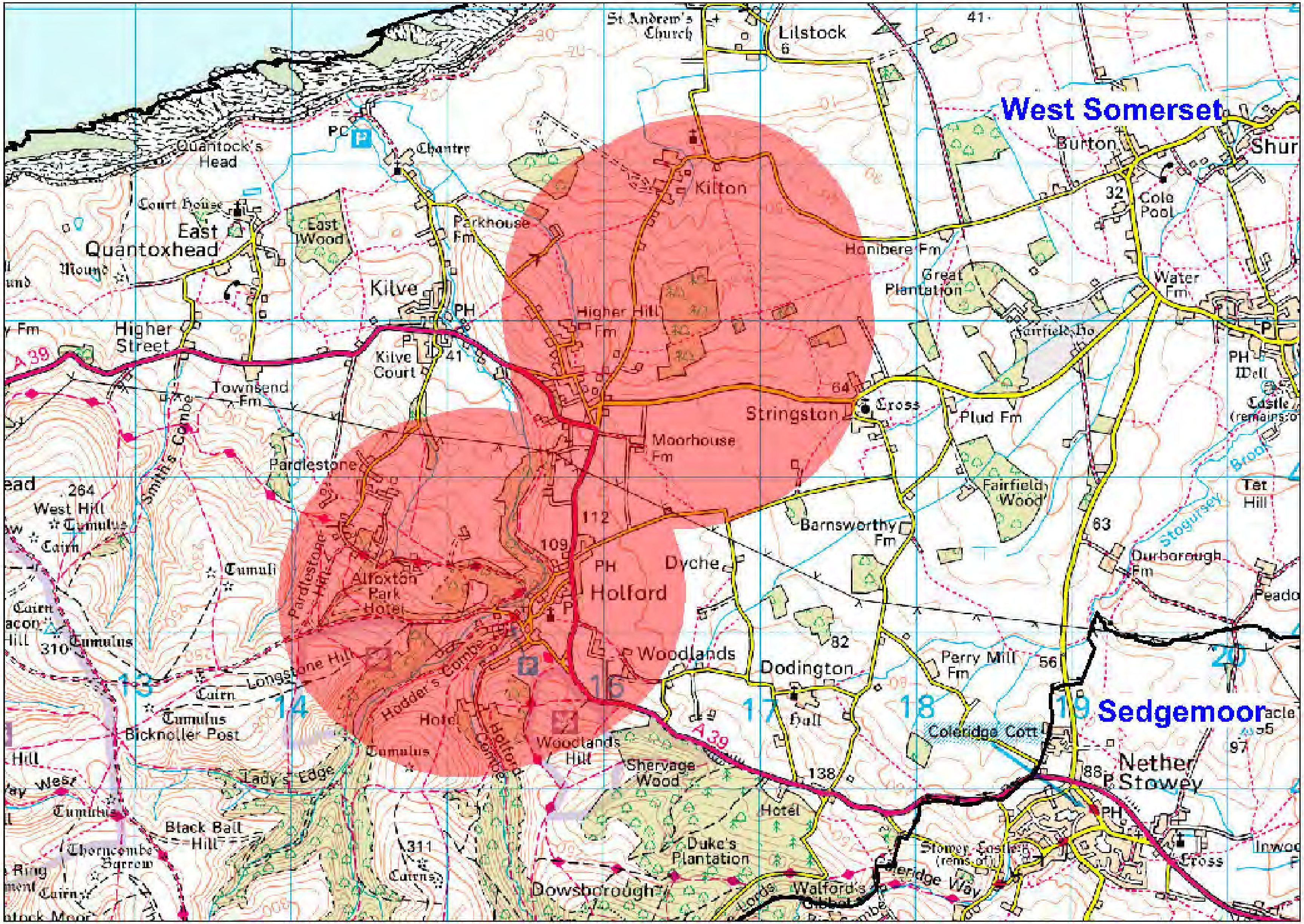
4.17 There may also be situations where mitigation will not be required because the proposed development does not have an impact upon existing (& likely) SAC bat habitat. In adopting this approach it will be necessary to substantiate this with a suitably robust statement as part of the submission of the development proposals. In terms of impacts on SAC bats and habitat, it is important to bear in mind that minor proposed developments do not necessarily equate with small developments.

Plan 1: Bat Consultation Zone (Quantocks Roosts)

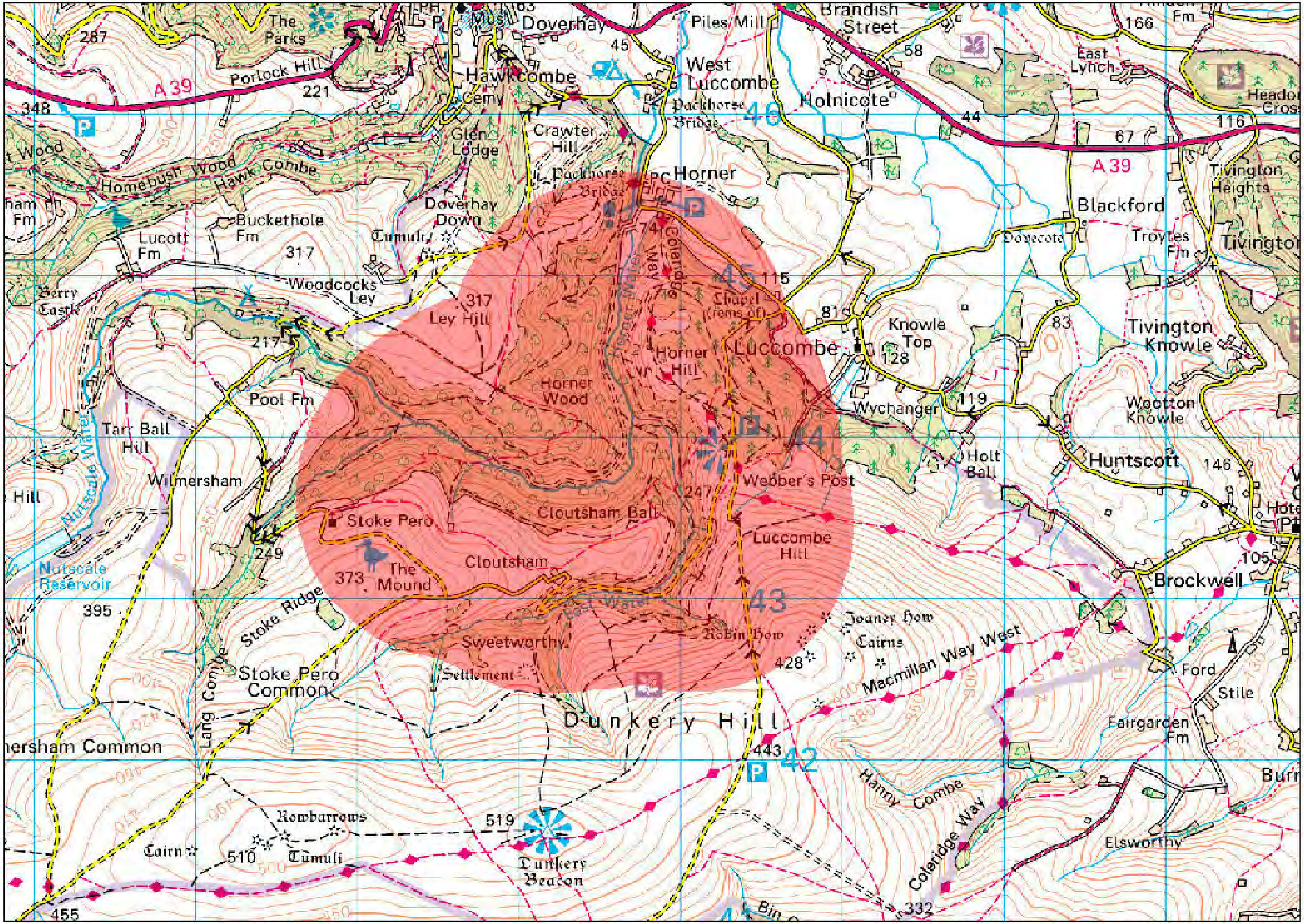
Plan 2: Bat Consultation Zone (Exmoor Roosts)



Plan 3: Juvenile Sustenance Zone (Quantocks)



Plan 4: Juvenile Sustenance Zone (Exmoor)



Annex 1: Details of the Exmoor and Quantocks Oak Woodlands Special Area of Conservation

A1.1 The SAC is made up of 7 component Sites of Special Scientific Interest (SSSI):

- **North Exmoor SSSI**
- Barle Valley SSSI
- Watersmeet SSSI
- West Exmoor Coast & Woods SSSI
- **The Quantocks SSSI**

A1.2 The SAC is primarily designated, aside from its habitats, for a maternity colony of Barbastelle bats *Barbastella barbastellus* that utilises a number of tree roosts in an area of predominantly of oak (*Quercus* spp) woodland. The designation of Barbastelle bats for the SAC was originally due to the Horner Wood maternity sites in the North Exmoor SSSI component site. However, since the date of designation Barbastelle bats have been found roosting in The Quantocks SSSI component site of the SAC with one of the associated maternity roosting areas located in a nearby woodland outside the designated site. Even so this latter roosting area would support the integrity of the roosts located within the SAC. Barbastelle bats frequently switch roosts from one to another on average within 300 metres but up to 1 kilometre apart[13].

A1.3 Bechstein's bats are not the primary reason for designation of the SAC but, nonetheless, needs to be considered in carrying out a 'Test of Likely Significant Effect'. Like the Barbastelle bat they are present in Horner Woods on Exmoor and have since the SACs designation also been found in the Quantocks component site as well.

A1.4 In terms of physical area, the SAC designation applies to a tiny element of the habitat required by the bat population (some of the woodland supporting maternity roosts and their hibernation sites). It is clear that the wider countryside supports the bat populations because of the following combination of key elements of bat habitat:

A1.5 The area has to be large enough to provide a range of food sources capable of supporting the whole bat population; the bats feed at a number of locations through the night and will select different feeding areas through the year linked to the seasonal availability of their insect prey;

1. Barbastelle bats regularly travel through the administrative areas of West Somerset and Sedgemoor District Councils, and Exmoor National Park between their roosts and feeding sites via a network of established flyways. Barbastelle bats leave the home woodland as a group and 'peel off' into foraging territories. It is likely that female Barbastelle bats seek out male roosts in September, accompanied by their young, and return to their home woodland for the winter.[14] It may be that bats from the colony of breeding females move considerable distances in late summer to find a mate. Bats need a range of habitats during the year in response to the annual cycle of mating, hibernating, giving birth and raising young;

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13 Russo, D., Cistrone, L. & Jnes, G. 2005. Spatial and temporal patterns of roost use by tree-dwelling barbastelle bats *Barbastellus barbastella*. *Ecography* 28: 769 – 776. 2005

14 Billington, G. 2012. *Further research on the Barbastelle Bat, Holnicote National Trust Estate, Exmoor, North Somerset.* Report for Natural England. Witham Friary: Greena Ecological Consultants.

2. It follows that Barbastelle bats need to be able to move through the landscape between their roosts and their foraging areas in order to maintain 'Favourable Conservation Status'. They require linear features in the landscape to provide landscape permeability. Barbastelle bats have three types of echolocation call. Compared to most other bat species, the amplitude of echolocation call of the Barbastelle bat is between ten and a hundred times lower than other bats and then at short range when hunting.[15] The Barbastelle bat will tend to fly at tree top height, amongst the woodland canopy and margins and mostly alongside hedgerow cover in a continual forward progression. Over open ground and water they fly at low level.[16] Radio tracking studies[17] and observations in the field confirm that Barbastelle bats will use regular flyways associated with lines of hedgerows and woodland. Further studies[18] have shown that landscapes with broadleaved woodland, large bushy hedgerows and watercourses are important as they provide habitat continuity up to 7km from the roost, after which it is considered dark enough to enable more open spaces to be crossed. Habitat is therefore very important to SAC bats in terms of *quality* (generation of insect prey) and *structure* (allowing them to commute and forage);

3. SAC bats are sensitive to light and will avoid lit areas[19]. Although Barbastelle bats will use areas of low intensity illumination[20] the interruption of a flyway by light disturbance, as with physical removal/ obstruction, would force the bat to find an alternative route which is likely to incur an additional energetic burden and will therefore be a threat to the viability of the bat colony. In some circumstances, an alternative route is not available and can lead to isolation and fragmentation of the bat population from key foraging areas and/or roosts. The exterior of roost exits must be shielded from any artificial lighting and suitable cover should be present to provide darkened flyways to assist safe departure into the wider landscape[21].

4. The feeding and foraging requirements of the Barbastelle bats have been reasonably well studied in the southern England and Europe[22]. From this work we know that most feeding activity is concentrated in an area within 7km of the roost (even juvenile bats will forage up to 7km at a stage in their life when they

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[15] Goerlitz, H. R., ter Hofstede, H. M., Zeale, M. R. K, Jones, G. & Holderleed, M. W. 2010. An Aerial-Hawking Bat Uses Stealth Echolocation to Counter Moth Hearing. *Current Biology, 20, 1568 – 1572*.

[16] Greenaway, F. 2008. Barbastelle *Barbastella barbastellus*: in Harris, S. & Yalden, D. W. (eds.) 2008. *Mammals of the British Isles: Handbook, 4th Edition*. Southampton: The Mammal Society.

[17] Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust

[18] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

[19] http://www.batsandlighting.co.uk/

[20] Billington, G. 2000. *Holnicote Estate, Somerset - Horner Woods Barbastelle Bat: radio tracking study*. Holnicote: The National Trust.

[21] Stone, E. L. 2013. *Bats and Lighting Overview of current evidence and mitigation*. Bristol: University of Bristol.

[22] Dietz, C., von Helversen, O. & Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. London: A. & C. Black Publishers Ltd; Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust; Hillen, J., Kiefer, A. & Veith, M. 2009. Foraging site fidelity shapes the spatial organisation of a population of female western barbastelle bats. *Biological Conservation, 142 (2009) 817 – 823*; Zeale, M. R. K. 2011. *Conservation biology of the barbastelle (*Barbastella barbastellus*): applications of spatial modelling, ecology and molecular analysis of diet*. PhD Thesis. University of Bristol, Bristol, UK; Eriksson, A. 2004. *Habitat selection in a colony of* Barbastella barbastellus *in south Sweden*. Uppsala: Institutionen för naturvårdsbiologi; etc.

are most susceptible to mortality). The most important types of habitat for feeding have been shown to be grassland, hedgerows, riverine vegetation, wetlands and woodland that support an abundance of moths with ears. Depending upon the availability of suitable flyways and feeding opportunities, most urban areas will provide limited habitat of any value to Barbastelle bats.

Barbastelle Bat: Henry Schofield. Courtesy Vincent Wildlife Trust

Annex 2: Bat Consultation Zones

A2.1 The Bat Consultation Zone density band widths will vary from species to species depending on its characteristic use of its home range. The summer foraging range of Barbastelle bats was recorded as being up to 9 kilometres (km) in the Horner Wood area on Exmoor (English Nature, Conservation Objectives for North Exmoor SSSI). Other studies have shown that Barbastelle bats can fly up to 20km from roost sites although the average was about 8km. On Dartmoor the individual mean maximum foraging range of radio tracked Barbastelle bats varied from 3.16 to 20.38km. In Brandenburg hunting grounds are within 4.5km of a nursery colony and young bats and males forage on average closer to their roost sites.[23]

A2.2 Foraging grounds have been recorded in excess of 25km from the roost area in the woodland. Even 6 week old juveniles have been recorded travelling 7km from the roost site. Barbastelle bats fly very fast and often fly more or less directly to their foraging areas, and have been recorded covering 20km in approximately 45 minutes.[24]

A2.3 Individual home ranges varied considerably, with bats traveling between 1 and 20 km to reach foraging areas [$\bar{X}$ = 6.8 km ± 4.8 SD][25].

A2.4 The Barbastelle bats radio tracked in the study by Hillen et al (2009) spent the first 1-2 hours in their roost woodland but would often forage 6-7km from their roost throughout the night with some individuals travelling as far as 12-17km.[26]

A2.5 Foraging takes place within the home range in individual core areas of between 2 and 70 hectares (ha). Dietz et al (2009) report foraging areas of 8.8ha with single bats hunting each night in up to 10 separate areas. There is minimal overlap of individual core foraging areas although the home wood is shared. In the Hillen et al study (2009) the core area sizes ranged from 5 to 285ha (median: 67ha). On Dartmoor the mean core foraging area was 82.49ha ± 21.93ha. In Germany seven radio tracked Barbastelle bats had a total of 24 distinct foraging sites, sizes between 2ha and 48ha, with each individual bat visiting between 1 and 7 sites. A home range and core area overlap analysis showed that site fidelity across years seems to be more important for home range distribution than competition among colony members. Although the home wood is shared, as afore stated, there is minimal overlap of individual core foraging areas, females being highly faithful to more or less "private" foraging areas which constituted a small fraction ($\bar{X}$ = 10.1% +/- 8.8 SD) of home ranges. [27]

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[23] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park.* Report for Dartmoor National Park/ SITA Trust; Dietz, C., von Helversen, O. & Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa.* London: A. & C. Black Publishers Ltd.

[24] Warren, J. n/d. Barbastelle Bats. www.ewebmagazine.co.uk

[25] Zeale, M. R. K., Davidson-Watts, I, & Jones, G. 2012. Home range use and habitat selection by barbastelle bats (*Barbastella barbastellus): implications for conservation. Journal of Mammalogy* 93(4):1110-1118. 2012.

[26] Hillen, J., Kiefer, A. & Veith, M. 2009. Foraging site fidelity shapes the spatial organisation of a population of female western barbastelle bats. *Biological Conservation, 142 (2009) 817 – 823.*

[27] Boye, Dr. P. & Dietz, M. 2005. *English Nature Research Reports Number 661: Development of good practice guidelines for woodland management for bats.* Peterborough: English Nature; Dietz, C., von Helversen, O. & Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa.* London: A. & C. Black Publishers Ltd; Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park.* Report for Dartmoor National Park/ SITA Trust; Hillen, J., Kiefer, A. & Veith, M. 2009. Foraging site fidelity shapes the spatial organisation of a population of female western barbastelle bats. *Biological Conservation, 142 (2009) 817 – 823*; Zeale, M. R. K.

A2.6 Barbastelle bats go out in groups from the roosting area then disperse to individual hunting grounds. Barbastelle bats are reliant on darkened connecting habitat features between roost sites and feeding areas. Typically these are along vegetated rivers and streams or lines of trees and large hedgerows and paths. Barbastelle bats' foraging paths are generally within 200 metres of water features. Commutes were typically rapid and direct and bats moved freely across large open areas. When Barbastelle bats cross open ground they will fly at low level. At the maternity roost at Longforth Farm, Wellington located in a single tree in the middle of a field Barbastelle bats cross an open space of 100 metres on emergence (pers.comm. Liz Biron, Somerset Environmental Records Centre, 2011).[28]

A2.7 The entire home range of the colony is used by individuals having hunting territories both close to and far from the roosting area and of equal importance considering the size of Barbastelle maternity colonies. They commute at high speed making for the most productive foraging area of the night and ignore foraging opportunities along the way[29].

A2.8 Barbastelle bats are spread very thinly in the landscape. At the Ebernoe roost in Sussex the density of bats in late summer was rather less than one female or juvenile to six square kilometres. This area would include very large areas of land that are not or seldom used consisting of arable fields, The hunting territories themselves form a select and vulnerable set of more stable and productive habitats; a small percentage of the total area, but rich in diversity.[30]

A2.9 Radio tracking of Barbastelle bats from Horner Wood in autumn/ early winter showed that they ranged up to 4km from their roosts compared to at least 9km in summer, with one exception in November when a radio tagged male bat was briefly recorded moving around 16km west of Horner Wood in a wooded valley at Hillsford Bridge, near Lynmouth, Devon. However, this was probably associated with a seasonable movement/ dispersal.[31]

A2.10 Zeale (2009) identified that the majority of foraging areas occurred within 6km of the home wood although 5km had been previously given particular importance. Subsequently Zeale et al (2012) suggested that land managers must consider areas of up to 7km radius around maternity roosts, based on their data, when designing and implementing management plans for Barbastelle bats and that feeding sites outside of this range, when identified through radio tracking or by other means, should also be

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2011. *Conservation biology of the barbastelle (*Barbastella barbastellus*): applications of spatial modelling, ecology and molecular analysis of diet.* PhD Dissertation. University of Bristol, Bristol, UK; Simon, M., Hüttenbügel, S. & Smit-Viergutz, J. 2004. *Ecology and Conservation of Bats in Villages and Towns*. Bonn: Bundesamt für Naturschutz.

[28] Dietz, C., von Helversen, O. & Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. London: A. & C. Black Publishers Ltd; Greenway, F. 2001. The Barbastelle in Britain. *British Wildlife 12, 5, 327-334*; Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; Greenaway, F. 2008. *Barbastelle Bats in the Sussex West Weald 1997- 2008.* Sussex Wildlife Trust/ West Weald Landscape Partnership; Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust; Zeale, M. R. K., Davidson-Watts, I, & Jones, G. 2012. Home range use and habitat selection by barbastelle bats (*Barbastella barbastellus*): implications for conservation. *Journal of Mammalogy 93(4):1110-1118. 2012*

[29] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

[30] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

[31] Billington, G. 2012. *Further research on the Barbastelle Bat, Holnicote National Trust Estate, Exmoor, North Somerset*. Report for Natural England. Witham Friary: Greena Ecological Consultants.

protected. Based on this a 7km buffer around the maternity woodland is used as the basis for Band A.[32] The woodland is chosen as Barbastelle bats are likely to roost switch within a few days within the woodland[33].

A2.11 Band B has been determined by the average recorded maximum summer range recorded for the Quantock roosts, which are 10.2km (See Appendix 1 - the mean for all studies, excluding one in Germany where only short distances were recorded, is 10.1km). Band C is 15.5km based on the recorded Barbastelle bat fixes from field surveys carried out east of the Quantocks roosts. Zones are further defined by the by a Minimum Convex Polygon is formed of all records associated or potentially associated with the maternity roosts. This is buffered by 500 metres to allow for possible unrecorded occurrences outside this area, based on the range of the species' principal prey species, noctuid moths. The Bat Consideration Zone is then confined by this parameter given the directional nature of home range use by Barbastelle bats. [34]

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[32] Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust; Zeale, M. R. K., Davidson-Watts, I, & Jones, G. 2012. Home range use and habitat selection by barbastelle bats (*Barbastella barbastellus*): implications for conservation. *Journal of Mammalogy 93(4):1110-1118. 2012*

[33] Russo, D., Cistrone, L. & Jnes, G. 2005. Spatial and temporal patterns of roost use by tree-dwelling barbastelle bats *Barbastellus barbastella*. *Ecography* 28: 769 – 776. 2005

[34] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; the 500 metres buffer is based on the dispersal distance of noctuid moths that are the prey of Barbastelle bats (e.g. see Dulieu, R., Merckx, T., Paling, N. & Holloway, G. 2007. Using mark-release-recapture to investigate habitat use in a range of common macro-moth species. *Centre for Wildlife Assessment & Conservation E-Journal, 1: 1-19*)

Annex 3: Key Flyways

A3.1 Maternity colonies are located within mature woodland, which is used year after year. Females disperse from the woodland to feed along established flyways to hunting areas which may be several kilometres away. Flyways consist of tracks and paths through woodland, overgrown hedgerows, and paths with hedgerows on both sides. In open country flyways follow watercourses lined with vegetation. To some extent the ability of the female to feed herself and dependent young depends on the condition of these flyways. A female will repeatedly use the same flyway to visit her hunting territories located along it. [35]

A3.2 Close to the roost females will share common flyways but the longest flyway at its end is likely to only be used by one bat. The initial sections of flyway may be used by up to 20 individual bats. However, Billington observed that female Barbastelle bats would split up individually to small connected foraging zones, and then meet up again to forage together, or to move off to another foraging area where they repeated the same behavior.[36]

A3.3 The flyways of Barbastelle bats are usually within 200 metres of water.[37]

A3.4 Key flyways are not mapped but where flyways are identified in field surveys they should be treated as for Band A and will need to be maintained and secured from any impacts arising from development.

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[35] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

[36] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; Billington, G. 2002. The Bats of Horner Woods. *Somerset Wildlife News* – January 2002, 10 -11.

[37] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

Annex 4: Survey Specification for Surveys for Planning Applications Affecting Consultation Zones.

A4.1 Three types of survey are required to inform the impact of proposed development. These are:

- Bat Surveys
- Habitats / Land use Surveys
- Light Surveys

Bat Surveys

A4.2 The following table sets out the survey requirements for development sites within the Bat Consultation Zone based on the guidance given by the Bat Conservation Trust (2016) but adapted to Barbastelle bat ecology.[38] Note that the objective is to detect commuting routes and foraging areas rather than roosts. Barbastelle bats emerge in early dusk and often in the light and are active sporadically throughout the night. Typically they emerge from their roosts about 17 to 27 minutes after sunset but then spend another 11 to 45 minutes foraging within the home woodland before setting out to commute to their individual hunting territories[39].

A4.3 The following specification is recommended in relation to development proposals within a Barbastelle bat key flyways and zones A and B of the Bat Consultation Zone. It is also worth mentioning the difficulty associated with detecting the Barbastelle bat's echolocation call when hunting. This fact emphasises the requirement for greater surveying effort and the value of broadband surveying techniques. It is recommended that the most sensitive equipment for detecting lower frequencies should be used. It is also recommended that the local planning authority ecologist be contacted with regard to survey effort.

(i) Surveys should pay particular attention to linear landscape features such as hedgerows, paths and tracks between hedgerows, tree lines, watercourses, ditches and rhynes that may provide flyways and areas of grassland, arable margins, scrub and meadow. Ensuring all wider habitat links to woodland are surveyed.

(ii) Automatic bat detector systems should be deployed at an appropriate location (i.e. on a likely flyway; the precise location can also be adjusted from the manual survey findings). The total period of deployment should be at least 50 days from April to October and must include at least one working week in each of the months of April, May, June, August and October (50 nights out of 153; ≈33%).

(iii) The number of automated detectors will vary in response to the number of linear landscape elements and foraging habitat types, the habitat structure, habitat quality, the suite of bat species likely to be present, their foraging strategy and flight-altitude. Every site is different, but the objective would be to sample each habitat component equally[40]. Generally:

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[38] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition). London: Bat Conservation Trust

[39] Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust

[40] Pers. Comm. Henry Andrews, AEcol, 23/09/2016

- Riparian corridors, both banks and vegetated edges
- With hedges it depends on the height and width, and also whether they have trees, as to how many detectors might be needed to ensure the coverage is comprehensive no matter what the wind decides to do.
- With grassland and arable margins, the number depends on whether the site is of long sward height or not
- In a woodland situation a sample with three detectors: one on the woodland edge, two in the interior.
- Areas of scrub particularly gorse and buddleia
- Ponds

(iv) Results from automated detectors recording should be analysed to determine whether the site supports foraging or increased levels activity as this affects the Band used in calculating the amount of replacement habitat required to mitigate losses to Barbastelle bats.

(v) Manual transect surveys[41] should be carried out on ten separate evenings; at least one survey should be undertaken in each month from April to August plus October[42], as the bats' movements vary through the year. Transects should cover the area of and all habitats likely to be affected by the proposed development, including a proportion away from commuting features in field. Moreover, manual surveys only give a snap shot of activity (10 nights out of 183; ≈5.5%), are less effective at detecting Barbastelle bat behaviour and unreliable[43], therefore automated bat detector systems should also be deployed see section (vi).

(vi) Surveys should be carried out on warm (>10 °C but >15°C in late summer), still evenings that provide optimal conditions for foraging (insect activity is significantly reduced at low temperatures; see commentary below). Details of temperature and weather conditions during surveys should be included in the final report.

(vii) Surveys should cover the period of peak activity for bats from sunset for at least the next 2.5 hours.[44]

(viii) Transect surveys should preferably be with most sensitive equipment available. Digital echolocation records of the survey should be made available with the final report; along with details of the type and serial number of the detector.

(ix) Surveys should be carried out by suitably qualified and experienced persons. Numbers of personnel involved should be agreed beforehand with the appropriate Somerset authority or Natural England, be indicated in any report and be sufficient to thoroughly and comprehensively survey the size of site in question.

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41 Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines.* (3rd Edition). London: Bat Conservation Trust

42 Female Barbastelle bats are absent from the home woodland during September when they disperse to find male roosts.

43 Warren, J. n/d. Barbastelle Bats. www.ewebmagazine.co.uk

44 Barbastelle bats can cover 20km in 45 minutes (Warren, J. n/d. www.ewebmagazine.co.uk). Note that some individual Barbastelle bats may not leave the home woodland for an hour after emergence.

(x) Surveys should also include a desktop exercise collating any records and past data relating to the site via the Somerset Environmental Records Centre (SERC), local Bat Groups etc.

(xi) All bat activity should be clearly marked on maps and included within the report.

(xii) Basic details of records for the site should be passed to SERC after determination of the application.

A4.4 Survey effort in Band C is to some extent dependent on whether commuting structure is present but not entirely so. More regard should be given to the suitability of the habitat to support prey species hunted by Barbastelle bats. Nonetheless this should be in accordance with Bat Conservation Trust guidelines (Collins, 2016[45])

Habitat Surveys

A4.5 Phase 1 surveys should be carried out for all land use developments within the Bat Consultation Zone and be extended to include the management and use of each field, e.g. whether the field is grazed or used as grass ley, and the height, width and management of hedgerows in the period of bat activity. Information can be sought from the landowner on typical management. If grazed, the type of stock and management regimes should be detailed if possible. Habitat mapping should include approximate hectarage of habitats to inform the methodology for calculating replacement habitat required.

Lighting Survey

A4.6 Surveys of existing light levels on proposed development sites should be undertaken and submitted with the planning application. This should cover the full moon and dark of the moon periods so that an assessment of comparative Barbastelle bat activity on a proposed site can be ascertained. Light levels should be measured at 1 metre above ground level. This survey data can then be used to inform the masterplan of a project.

A4.7 A lux contour plan of light levels down to 0.5 Lux, modelled at 1 metre above ground level, should be submitted with the application.

[45] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition). London: Bat Conservation Trust

Annex 5: Habitat Requirements of Barbastelle Bats

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Prey

A5.1 Barbastelle bat specialize in preying upon small tympanate moths. Over 90% of their diet comes from the families Pyralidae; Geometridae; Arctiidae; Noctuidae: Tortricidae and Gelechiidae, particularly of the families Noctuidae and Geometridae. In one study 49 species of moth were identified. Most of the species taken amongst these have hearing organs as a defense against bats. The most frequent moth species taken were White Ermine; Buff Ermine; Riband Wave; White-pinion Spotted; Scalloped Hazel; Brown Silver-line; Heart and Dart; Shuttle-shaped Dart; Dark Arches; The Dun-bar; Vine's Rustic; Large Yellow Underwing; and Angle Shades.[46]

A5.2 Barbastelle bats also eat micro moths, a few Diptera, including Tipulids (craneflies), small beetles and other flying insects. They are heavily reliant on small moths throughout the year but have a more diverse diet in winter eating flies, earwigs and spiders.[47]

General

A5.3 Greenaway (2002)[48] states that '*The ideal example of a Barbastelle colony of the distant past would be of a small catchment with dense woodland on its headwaters and wooded river valleys leading down to a wide zone of water meadows and finally reed beds and sand dunes before reaching the sea. Roosts would be in the headwater woodlands and the Barbastelle bats would have individual foraging areas spread up and down the catchment's tributaries and the main river. The colony's territory boundaries would be set by the extent of the catchment area.*' However, radio tracking at Horner Wood shows that no all Barbastelle bat colonies conform to this pattern and individuals cross over into different catchments.

A5.4 In the radio tracking study carried out by Zeale on Dartmoor in 2008 the most significant habitat preferences were shown to be the following in order:

- Riparian vegetation;
- Broad-leaved woodland;
- Unimproved grassland

A5.5 All three habitats support a high density of insects and often associated with the common species of moth hunted by Barbastelle bats. Other habitats used were improved grassland; mixed woodland; coniferous woodland; scrub; urban; open water; arable and upland moor, the latter four being avoided.

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[46] Zeale, M. 2009. Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park. *Presentation at the South West Bat Conservation Trust Conference, 25 April, 2009;* Zeale, M. R. H. 2011. *Conservation Biology of the Barbastelle* (Barbastella barbastellus): *Applications of Spatial Modelling, Ecology and Molecular Analysis of Diet.* PhD Dissertation, University of Bristol; Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature.

[47] Dietz, C., von Helversen, O. & Nill, D. 2009. *Bats of Britain, Europe and Northwest Africa*. London: A. & C. Black Publishers Ltd; Greenaway, F. 2008. Barbastelle bat *Barbastella barbastellus*: in Harris, S. & Yalden, D. W. (eds.) 2008. *Mammals of the British Isles: Handbook, 4th Edition*. Southampton: The Mammal Society.

[48] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

A5.6 For Barbastelle bats at Horner Wood on Exmoor foraging in summer occurred mostly out of woodlands and included areas of scrub, heath, unimproved grassland, along hedgerows and streams and salt marsh. By contrast in the autumn/ early winter bats almost exclusively foraged in woodlands with up to half of the time spent in conifer plantations. Habitats recorded as being used to the east of Porlock Weir during these surveys include patches of scrub (including bramble, gorse, nettles, blackthorn and dog rose); patches of bramble scrub on shingle; saltmarsh; trees lining dry shingle-lined channels; strips of tall vegetation; and short improved turf grazed by sheep. Billington (2012) stated for the Horner Wood maternity colony that, '*The most important single habitat was rough/ unimproved grassland 94.5% of the habitat in the colonies range was used for foraging. The next most important (>57% use) habitats were scattered (Gorse) scrub and broadleaved woodland and other important (>25% use) habitats were Bracken, running water and dense (Gorse) scrub*.'[49]

A5.7 In Sussex habitat use can be summarised as old meadows, hedgerows and woodlands often in rich valley bottoms during summer and dense old growth deciduous woodland habitats in the colder months. The final destination of most bats is larger floodplain meadows as can be found towards the River Parrett and its estuary. Many of the known British colonies, as is the Quantocks SAC colony, are also within commuting distance of the sea, and besides the SAC colony at least three other colonies are recorded as utilising dune, marsh and established coastal grasslands.[50]

<u>Grassland</u>

A5.8 During the summer there is a super abundance of moths, and particularly micro moths, over unimproved grasslands. This is a primary habitat for Barbastelle bats. Longer swards benefit the larvae of Noctuid moths.[51]

A5.9 Improved grassland is the fourth most used habitat in the Dartmoor study. Typically it is species poor and likely to be of little importance but they are smaller than arable fields and consequently have a higher density of boundary features. Zeale (2009) considered that caution should be taken when assessing this habitat's true value as it is likely that most foraging activity is focused along hedgerows. Moths are likely to be negatively affected by moderate and high levels of cattle grazing. However, the vast majority (over 90%) of insects found near hedges does not originate in the hedge but come from other habitats brought in on the wind. Nonetheless, field margins, including hedgerows, and woodland edge support comparatively high densities of moths and Barbastelle bats have been observed foraging in these areas.[52]

A5.10 The wider the field margin the higher the abundance of macro-moths compared to standard margins. The presence of trees has no significant effect on moth abundance.

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[49] Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust; Billington, G. 2012. *Further research on the Barbastelle Bat, Holnicote National Trust Estate, Exmoor, North Somerset*. Report for Natural England. Witham Friary: Greena Ecological Consultants.

[50] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

[51] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; Ransome, R. D. 1996. *The management of feeding areas for Greater Horeseshoe bats*. Peterborough: English Nature; Ransome, R. D. 1997.

[52] Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust; Ekroos, J., Heliola, J. & Kuussaari, M. 2010. Homogenization of lepidopteron communities in intensively cultivated agricultural landscapes. *Journal of Applied Ecology, 2010, 47, 459 – 467*; Bat Conservation Trust. 2003. *Agricultural practice and bats: A review of current research literature and management recommendations*. London: Defra project BD2005; Zeale, M., Davidson-Watts, I. & Jones, G., 2012. Home range use and habitat selection by barbastelle bats (*Barbastella barbastellus*): implications for conservation. *Journal of Mammalogy 93: 1110-1118*.

Sites with higher nectar availability also had higher abundances of moths. Plant species richness and vegetation height may provide higher larval food availability and shelter from potential predators.[53]

Woodland

A5.11 When Barbastelle bat flyways cut across woodland blocks these are usually utilised as secondary foraging areas. Unbroken strips of dense mature woodland connecting down to water with continued woodland features are an ideal pattern of vegetation. If track ways are available they are used as flyways. They will also hunt above the canopy. Trees producing a low spreading twiggy structure over a thick understorey will increase shade but the bats will require a clear central track way. They rarely forage along woodland edges.[54]

A5.12 Barbastelle bats foraging in summer occurred mostly out of woodlands. By contrast in the autumn/ early winter bats almost exclusively foraged in woodlands with up to half of the time spent in conifer plantations.[55]

A5.13 The occurrence of moth eating bats is higher in large and well-connected woodland patches with dense understorey cover. Understorey plants are the larval foods of many small moths, the Geometridae in particular. Macro and micro moths are most abundant where there is grass or litter but less so where there are ferns, moss, bare ground or herbs. They are also more abundant where there is native tree diversity and with larger basal areas. Species such as oak, willow and birch have large numbers of moths, whereas beech has little comparable to non-native species such as sycamore. Moth diversity is greatest on oak and willow species and oak woodlands support high moth diversity. Thermophilous bushes are the most attractive host plants for micro Lepidoptera: 60 species feed on hawthorn and 48 on blackthorn. Oak is the most attractive tree with 83 species.[56]

A5.14 Uniform stands of trees are poorer in invertebrates than more diversely structured woodland. It is also indicated that small woodlands of less than 1 hectare do not have characteristic woodland moth communities.[57]

A5.15 Where coppicing is necessary it should be carried out in small patches.[58]

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[53] Dulieu, R, Merckx, T., Paling, N. & Holloway, G. 2007. Using mark-release-recapture to investigate habitat use in a range of common macro-moth species. *Centre for Wildlife Assessment & Conservation E-Journal (2007), 1, 1 – 9;* Fuentes-Montemayor, E., Goulson, D & Park K. J. 2010. The effectiveness of agri-environmental schemes for the conservation of farmland moths: assessing the importance of landscape-scale management approach. *Journal of Applied Ecology, 2010*

[54] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; Billington, G. 2000. *Holnicote Estate: Horner Woods Barbastelle Bat: radio tracking study*. Cullompton: Greena Ecological Consultancy; Eriksson, A. 2004. *Habitat selection in a colony of* Barbastella barbastellus *in south Sweden*. Uppsala: Institutionen för naturvårdsbiologi

[55] Billington, G. 2012. *Further research on the Barbastelle Bat, Holnicote National Trust Estate, Exmoor, North Somerset*. Report for Natural England. Witham Friary: Greena Ecological Consultants

[56] Fuentes-Montemayor, E.,Goulson, D., Cavin, L., Wallace, J.M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation 153 (2012) 265–275*; Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; Sierro, A. 1999. Habitat selection by barbastelle bats (Barbastella barbastellus) in the Swiss Alps (Valais). *J. Zool. Lond. (1999) 248, 429 – 432;*

[57] Kirby, K. J. (ed). 1988. *A woodland survey handbook*. Peterborough: Nature Conservancy Council; Usher, M.B., Keiller, S.W.J., 1998. The macrolepidoptera of farm woodlands: determinants of diversity and community structure. Biodivers. Conserv. *7, 725–748*.

[58] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

A5.16 In Switzerland Barbastelle bats avoided open woodland on stony outcrops and rocky slopes[59]

Hedgerow

A5.17 Hedgerows under stewardship management do not offer any benefit over conventionally managed hedgerows for hunting micro and macro moths. However, for commuting Barbastelle bats the structure of hedgerows is more important than species composition. High wide hedgerows are preferred especially where they occur either side of a track or path way and where trees develop to form a tunnel. Hedgerows need to be at least 1.5m high. Trimmed hedges provide very poor cover to commuting bats.[60]

Others

A5.18 Riparian vegetation is the most used habitat by Barbastelle bats in a study on Dartmoor (Zeale, 2009)[61]. However, open water was the least selected habitat. The report also stated that it is the riparian vegetation rather than the water that is important to foraging Barbastelle bats, although the secondary importance of water in supporting riparian vegetation should be noted. In summer there is a super-abundance of moths, and particularly micro-moths, over wooded riversides and water meadows.[62]

A5.19 Greenway states that, '*The habitat types utilised by the Ebernoe nursery colony consist largely of the flood plains of rivers and streams together with woodlands in proximity to the watercourse. As bats move away from the roost area, woodlands form most of the intermediate foraging zones. Many of these are quite wet. The final destinations of most bats are larger floodplain meadows, particularly on the Arun and the Rother. Normally each bat has a territory of open meadows with an adjoining area of scrub or woodland. To the north and west of Ebernoe the foraging areas are much more enclosed by woodland and the streams are much smaller. In consequence the major foraging areas here are very tightly linear following streams and their floodplains. Several of the bats have a tributary stream each.*'[63]

A5.20 In other studies Barbastelle bats are highly associated with foraging habitats over water, such as the pond at Hinkley power station. In south western Germany Barbastelle bats have been observed to forage above water in a similar way to Daubenton's bats.[64]

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[59] Sierro, A. 1999. Habitat selection by barbastelle bats (Barbastella barbastellus) in the Swiss Alps (Valais). *J. Zool. Lond. (1999) 248, 429 – 432.*

[60] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature; Fuentes-Montemayor, E., Goulson, D & Park K. J. 2010. The effectiveness of agri-environmental schemes for the conservation of farmland moths: assessing the importance of landscape-scale management approach. *Journal of Applied Ecology, 2010*; Simon, M., Hüttenbügel, S. & Smit-Viergutz, J. 2004. *Ecology and Conservation of Bats in Villages and Towns*. Bonn: Bundesamt für Naturschutz

[61] Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust

[62] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

[63] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

[64] Boye, Dr. P. & Dietz, M. 2005. *English Nature Research Reports Number 661: Development of good practice guidelines for woodland management for bats*. Peterborough: English Nature.

A5.21 Billington (2000) found that a patchwork of scrub was an important foraging habitat for Barbastelle bats from Horner Woods. Gorse, which attracts an abundance of moths, was shown to be particularly important. [65]

A5.22 Large Yellow Underwing moths are attracted to Buddleia or Butterfly Bush. Butterfly Bush flowers from July to September. There is potential to deprive Barbastelle bats of a foraging ground by restoring large areas of butterfly bush scrub all in one hit and at the wrong time of year.[66]

A5.23 Coastal habitats, such as saltmarsh and dunes, were used for foraging both by Barbastelle bats from Horner Woods and the Quantocks roost sites.[67]

A5.24 Apart from its edge heathland / upland moor was avoided by Barbastelle bats despite the abundance of moths it supports on both Dartmoor and Exmoor, probably due to low temperatures and exposure to winds.[68]

<u>Habitat Associations of Moth Species</u>

A5.25 A number of moth species have been identified as being preyed upon by Barbastelle bats through DNA analysis of droppings. The following gives some of the characteristics of those species most often found within the droppings of Barbastelle bats on Dartmoor.[69]

- White Ermine is widely distributed and fairly common over much of Britain. It is found in a range of habitats including gardens, hedgerows, grassland, heathland, moorland and woodland. The larvae eat a range of herbaceous plants, including stinging nettle, common broom, viper's bugloss and dandelion. It generally flies from May to July and sometimes later in the south.

- Buff Ermine is a common to most of Britain and is found in woods, gardens and parks. The larva feeds on a wide variety of trees, shrubs and herbaceous plants, including oak, alder, birch, plantain, dock, sorrel, ragwort, nettle, bramble, elder and honeysuckle. The adult flies from May to July.

- Riband Wave is a common species throughout Britain and tends to fly between June and August, and sometimes has a second autumn brood in the south. It is found in a wide range of habitats, including gardens, hedgerows, woodland, heathland, calcareous grassland and fens. The larvae feed on a range of low plants such as dock and dandelion.

- White-pinion Spotted is thought to survive in low densities. It has been found amongst hedgerows, in parks and woodland and along riversides. The larvae feed on the foliage

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[65] Billington, G. 2000. *Holnicote Estate: Horner Woods Barbastelle Bat: radio tracking study*. Cullompton: Greena Ecological Consultancy; Billington, G. 2012. *Further research on the Barbastelle Bat, Holnicote National Trust Estate, Exmoor, North Somerset*. Report for Natural England. Witham Friary: Greena Ecological Consultants

[66] Pers. comm. Henry Andrews. AEcol, 22/09/2016

[67] Billington, G. 2012. *Further research on the Barbastelle Bat, Holnicote National Trust Estate, Exmoor, North Somerset*. Report for Natural England. Witham Friary: Greena Ecological Consultants; Rush, T. & Billington, G. 2012. *Report on a radio tracking study of Barbastelle bats at Hinkley Point C*. Witham Friary: Greena Ecological Consultants

[68] Zeale, M. R. K. 2011. *Conservation Biology of the Barbastelle* (Barbastella barbastellus): *Applications of Spatial Modelling, Ecology and Molecular Analysis of Diet*. Thesis: University of Bristol.

[69] Zeale, M. R. K. 2011. *Conservation Biology of the Barbastelle* (Barbastella barbastellus): *Applications of Spatial Modelling, Ecology and Molecular Analysis of Diet*. Thesis: University of Bristol.

of English elm and have also been reported to feed on wych elm. The adults fly at night from late July to September.

- Scalloped Hazel is moderately common and found in woodland, heaths and suburban habitats, and feeds on a number of deciduous as well as coniferous trees. It flies in May and June. The larvae feed on a wide range of plants including oak, ash, birch, hawthorn, ivy, Norway spruce, larch, willow, poplar, mugwort and burdock.

- Brown Silver-line is a fairly common moth over much of Britain, and can often be disturbed in the daytime by walking through bracken, its food plant. It is often found near bracken, occurring in woodland, heathland and moorland. It flies in a single generation during May and June, and occupies woodland and upland areas where its food plant grows in profusion.

- Heart and Dart are found in agricultural land, meadows, waste land, gardens and places where their food plants grow. Food plants include dock, plantain, chickweed, fat hen, turnip, sugar beet and many other herbaceous plants. The larvae feed on various wild and garden plants. The moth flies from May to July, when it is readily attracted to light.

- Shuttle-shaped Dart is fairly common in southern England and Wales it is found in a range of habitats including gardens, farmland, grassland, heathland and open woodland. There are possibly three generations during the year, with moths on the wing from May to October. The larvae feed on a number of low plants.

- Dark Arches are found in meadows and other grassy place and food plants include cocksfoot, couch grass and other grasses. The larvae feed on the bases and stems of various grasses. The moth is on the wing from July to August and is readily attracted to light.

- The Dun-bar is commonly distributed over much of Britain. It is found in woodland, gardens and hedgerows. It flies at night from July to September and is attracted to light and sugar and sometimes to nectar-rich flowers. The larvae feed on a variety of plants, mainly trees and shrubs, including maple, birch, hazel, hawthorn and oak, and also on the larvae of other Lepidoptera species, even occasionally its own species.

- Vine's Rustic is fairly frequent in the southern part of England up to south Wales and probably enjoying an increase in recent years. It is found in grassland, heathland, woodland rides and gardens. There are two generations with moths occurring between May and October, with the second brood somewhat more numerous.

- Large Yellow Underwing are found in a range of habitats, including agricultural land, gardens, waste ground, and has a range of food plants including dandelion, dock, grasses and a range of herbaceous plants both wild and cultivated, including dog violet and primrose. The larva is one of the 'cutworms' causing fatal damage at the base of virtually any herbaceous plant, including hawkweeds, grasses, plantains and dandelions and a range of cultivated vegetables and flowers. This moth flies at night from July to September and is freely attracted to light.

- Angle Shades occurs throughout Britain, commonly in places, and more so in the south. The adults generally fly between May and October, in at least two generations, but can be found in any month. It may be found almost anywhere. The larvae feed on a variety of herbaceous plants, including oak, birch, ivy, dead nettle, red valerian, bramble, dock and nettle.[70]

Barbastelle Bat. Photo: C. Robiller / Naturlichter.de

[70] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; http://ukmoths.org.uk/species/noctua-pronuba/; http://ukmoths.org.uk/species/panemeria-tenebrata/; http://ukmoths.org.uk/species/agrotis-exclamationis; http://ukmoths.org.uk/species/apamea-monoglypha/

Annex 6: Methodology for Calculating the Amount of Replacement Habitat Required

Introduction

A6.1 The method used to calculate the amount of habitat required to replace that lost to the SAC Barbastelle bat population due to development is based on the requirements for maintaining that needed to support viable populations. It uses an approach similar to the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service (1980) to provide '…*for mitigation and compensation that can allow fair use of the land and maintain healthy habitats for affected species*'.[71] HEP is structured around the calculation of Habitat Units (HU), which are the product of a Habitat Suitability Index (quality) and the total area of habitat (quantity) affected or required[72].

A6.2 A key assumption is that habitat type, amount and distribution influence the distribution of associated animal species. It is also important to recognise that Habitat Suitability Index (HSI) models predict habitat suitability, not actual occurrence or abundance of species populations.[73]

A6.3 The HEP uses the Integrated Habitat System (IHS) developed by Somerset Environmental Records Centre, described below. It requires a Habitat Suitability Index for the Barbastelle bat scored on IHS descriptions, which are given in Appendices 2 and 3.

A6.4 Such methods are necessary to obtain an objective quantitative assessment that provides improved confidence that the mitigation agreed is likely to be adequate; and that a development will not significantly reduce the quantity or quality of habitat available to the Barbastelle bat population; whereas current ecological impact assessments are often based on subjective interpretations. In Somerset they have been used since 2009 including for effects on Barbastelle, Greater and Lesser Horseshoe bats to inform the adequacy of replacement habitat provided by the developer. The method has gone through planning inquiries including for a Nationally Significant Infrastructure Project.

A6.5 The methodology has also been reviewed and further developed with the Bat Conservation Trust.

Integrated Habitat System Mapping

A6.6 The Integrated Habitat System coding is used as a basis for describing and calculating habitat values used as a base in applying scores in Habitat Suitability Indices. The Integrated Habitat System (IHS)[74] classification comprises over 400 habitat categories, the majority drawn from existing classifications, together with descriptions, authorities and correspondences arranged in a logical hierarchy that allow application for different purposes. The classification can be customised for a geographical area or special project use without losing data integrity.

A6.7 The IHS represents a coded integration of existing classifications in use in the UK with

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[71] http://www.fort.usgs.gov/Products/Software/HEP/

[72] U. S. Fish and Wildlife Service. 1980. *Habitat Evaluation Procedures ESM102*. Washington, D. C.: Department of the Interior.

[73] Dijak, W. D. & Rittenhouse, C. D. 2009. Development and Application of Habitat Suitability Models to Large Landscapes: in Millspaugh, J. J. & Thompson, F. R. 2009. *Models for Planning Wildlife Conservation in Large Landscapes*. London: Academic Press.

[74] http://www.somerc.com/integrated+habitat+system/

particular emphasis on Broad Habitat Types, Priority Habitat Types, Annex 1 of the Habitats Directive and Phase 1[75].

A6.8 Standard habitat definitions from these classifications are combined into a hierarchy starting at the level of Broad Habitat Types, through Priority Habitat types, Annex 1 to vegetation communities which are coded. These are the Habitat Codes.

A6.9 Within IHS Habitat Codes are hierarchical with the numbers in the code increasing as the habitat becomes more specific. Descriptions of habitats can be found in IHS Definitions (Somerset Environmental Records Centre)[76]. For example:

- WB0 Broadleaved, mixed and yew woodland (Broad Habitat Type)
- WB3 Broadleaved woodland
- WB32 Upland mixed ashwoods (Priority Habitat Type)
- WB321 Tilio-Acerion forests on slopes, screes and ravines (upland) (Annex 1 Habitat)

A6.10 As well as Habitat Codes IHS provides Matrix, Formation and Land Use/Management Codes which are added as a string to the main Habitat Code to provide further description.

A6.11 Ideally habitat information for the whole of the geographic area of the Somerset authorities should be mapped in a GIS programme, such as MapInfo or ArcGIS. However, when used in ecological impact assessment for calculating the value of impacts of habitat change on a species population then at minimum it is only necessary that IHS coding is applied to the habitat types present on the proposed development site to enable the use of Habitat Suitability Indices in the HEP metrics.

Habitat Suitability Indices

Introduction

A6.12 A form of Habitat Suitability Indices (HSI) has been used in the United States and Canada since the early 1980s as a way of assessing the impacts of development on species' populations and distributions. In addition, they have been used to predict what replacement habitat needs to be created to maintain species' populations. The process assumes that the suitableness of habitat for a species can be quantified - the HSI. The overall suitability of an area for a species can be represented as a product of the geographic extents of each habitat and the suitability of those habitats for the species[77].

Description

A6.13 In constructing the HSI the index scores are applied to each Habitat, and Matrix, Formation and Land Use / Management codes in the Integrated Habitat System (IHS) based on analysis of the ecological requirements, from existing literature and professional judgement, for each species assessed or mapped.

A6.14 Each IHS 'Habitat' category is scored on a scale of 0 to 6 (as defined below) using a

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[75] Phase 1 (JNCC, 1993) habitat mapping can be converted to IHS by using the software provided by Somerset Environmental Records Centre.

[76] http://www.somerc.com/integrated+habitat+system/

[77] http://www.fort.usgs.gov/Products/Software/HEP/

potential or precautionary approach as a starting point, e.g. Broadleaved, mixed and yew woodland is assumed to be the Annex 1 broadleaved woodland habitat unless otherwise proved not. The score will be the same across each of the hierarchical levels of the IHS Habitat coding (e.g. poor is scored as 1 whether this is at broadest habitat level or priority habitat level unless there is discernible differences in the type of habitat used, e.g. oak or beech woodland)[78]. This means that the full range of scoring is used before the modifiers (the IHS Formation and Management codes) are applied.

A6.15 The Habitat Code scoring is considered in combination with the IHS Matrix codes[79]. These are either added or subtracted from the Habitat code, e.g. grassland score 3 + scrub score 2 would equal 5. This is to account for species, for example that use grassland with a matrix of scattered scrub or single trees, which would otherwise avoid open grassland habitat.[80] Habitat Codes have a range of 0 to 6 but when considered in combination must not exceed a score of 6 or fall below a score of 0, Where there is no effect from a Matrix type then a default score of 0 is used.

A6.16 All other Codes are scored between 0 and 1 and are multipliers. Where there is no effect from Formation or Management of the habitat then a default score of 1 is used.

Table 3: Example of HSI Calculation

	Habitat Code	Matrix Code	Formation Code	Land Use / Management Code	HSI Score
Code	GI0	SC2	-	GM12	
Description	Improved Grassland	Scattered Scrub	-	Sheep Grazed	
HSI Score	2	1	1*	0.5	1.5

*default score

A6.17 Scores will be applied such that a precautionary approach or 'potential' approach is taken, e.g. if a species requires grassland which is most valuable when grazed then grassland scores the top score. This potential score will take into account a combination of the Habitat and Matrix codes. The management modifier would then maintain the habitat score at this high level by a multiplier of 1. If the management is not grazed a decimal multiplier is applied to reduce the value of the habitat. For example a grassland habitat is valued at 6 but by applying the relevant management code, i.e. either mown or other management type, the value of the habitat will be reduced. Only one management code is allowed. An example is set out in Table 3 above.

A6.18 The definition of poor, average, good and excellent habitat is adapted from the ‘Wildlife Habitat Handbook for the Southern Interior Ecoprovince’, British Columbia, Ministry of Environment[81] and expanded, in consultation with the Bat Conservation Trust, as follows:

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[78] The 1 to 6 scale matches Defra's habitat distinctiveness range used in its metric.

[79] IHS considers that patches of scrub and single trees are matrix habitat acting in combination with main habitats types rather than separate habitats in their own right. It is possible that further sub codes be added to the grassland habitat codes, e.g. calcareous grassland with scattered scrub, etc. but this would lead to a proliferation of coding and current IHS GIS mapping would need amending to take this into account. Therefore by providing a positive multiplier the needs of those species which require a mosaic of grassland and scrub is taken into account.

[80] IHS considers that patches of scrub and single trees are matrix habitat acting in combination with main habitats types rather than separate habitats in their own right.

[81] For example http://www.env.gov.bc.ca/wld/documents/techpub/r20.pdf

Excellent - provides for essential life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied >70% chance of occurrence, can support positive recruitment. Can be a critical life-cycle association.
Very good - provides for essential life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied 50 - 70% chance of occurrence, can support positive recruitment.
Good - provides for a life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied 40 -50% chance of occurrence, can support a stable population.
Average - provides for moderately required life needs, including feeding, reproduction or special needs and supports a relatively moderate population density, implied 25 - 40% chance of occurrence, can support a stable population.
Marginal - provides for marginally required life needs, including feeding, reproduction or special needs and supports a relatively modest population density, implied 15 - 25% chance of occurrence, can support a small population.
Poor - provides for a non-essential life needs, including feeding, reproduction or special needs and supports a relatively low population density, implied <15% chance of occurrence.

A6.19 It is recognised that not all habitat patches of the same type have equal value in terms of resource to a species, for example see Dennis, 2010[82]. However, in scoring the overall HSI, i.e. including all Habitat, Matrix, Formation codes, etc., it is considered that a higher value is given as a precaution. However, there is a factor in the HEP taking into account survey results which is partly aimed to account for variability in habitat quality.

A6.20 No allowance for seasonal variations, i.e. due to the availability of prey species at different times of year, has been made in developing the HSI. It is considered a habitat valued at 6 at a particular period but not at other times will remain at a value of 6 being necessary to support that species at that time of year when other prey or other resources may not be so readily available.

A6.21 The HSI score arising from the above calculation can be joined into a GIS base habitat map and displayed using thematic mapping to give a graphical representation of the value of a landscape to Barbastelle bats.

A6.22 The Habitat Suitability Index for Barbastelle Bats can be found in Appendix 2.

Validation

A6.23 A HSI model can be reviewed against occurrence data held by the biological records centre. The Gulf of Maine HSI work[83] established the principle of producing several HSI models for one species and retained the model, which had the best association with known occurrences. The mapping is produced and matched with species data at the biological records centre and the model refined to fit the records with a view to errors of omission and commission.

[82] Dennis, R.L.H. 2010. *A Resource-Based Habitat View for Conservation. Butterflies in the British Landscape.* Chichester: Wiley-Blackwell.
[83] http://www.fws.gov/r5gomp/gom/habitatstudy/Gulf_of_Maine_Watershed_Habitat_Analysis.htm

A6.24 Garshelis (2000)[84] concluded that the '...*utility of the models is to guide further study or help make predications and decisions regarding complicated systems; they warrant testing but the testing should be viewed as a never-ending process of refinement, properly called bench-marking or calibration*.' The validation should be seen as a continuous refinement process and HSI scoring should be reviewed from time to time and up dated[85].

A6.25 In this study HSI have initially been researched and scored by the author. However, the scores can be varied through review, further research findings or to reflect local conditions based on survey. Where varied by consultants the reason for the variation should be given and supported by evidence.

Density Band

A6.26 The HSI score is multiplied by the location of the proposed site in relation to that of the Barbastelle bat roost. The Consideration Zone (CZ) is divided into three Density Bands. The three Bands are, 'A' closest to the record, 'B' and 'C' furthest from the record valued at 3, 2 and 1 respectively. The values are given in Table 4 below.

Table 4: CZ Band

Band	Score
A	3
B	2
C	1

A6.27 When two Bands occur within one field take the higher value as the score. The Density Band widths can be found in Table 1 above.

A6.28 Following ecological surveys for Barbastelle bats carried out for the proposed development the Density Band score may be modified up depending on whether feeding activity or a key flyway was recorded or not or whether absence is recorded. This reflects uneven use of a home range and refines the value of the habitat for a species (e.g. see Zeale 2009, 2012[86]). Note that sufficient automated detectors should be deployed.

A6.29 The following criteria should be used to modify the Band following the results of site surveys and applied to the whole of the proposed development site:

- Not present – Where potential habitat is present reduce the Band score down by 0.5, e.g. at A from 3 to 2.5; at B from 2 to 1.5; except at C where it reduced to 0.
- Commuting only – as the Band the site falls within
- Commuting and Foraging or Key Flyway – increase the band score as for A.

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[84] Garshelis, D. L. 2000. Delusions in Habitat Evaluation: Measuring Use, Selection, and Importance: in Boitam, L. & Fuller, T. K. (eds.) 2000. *Research Techniques in Animal Ecology: Controversies and Consequences*. New York: Columbia University Press.

[85] http://www.fws.gov/r5gomp/gom/habitatstudy/Gulf_of_Maine_Watershed_Habitat_Analysis.htm

[86]. Zeale, M. 2009. *Barbastelles in the Landscape: Ecological Research and Conservation in Dartmoor National Park*. Report for Dartmoor National Park/ SITA Trust; Zeale, M. R. K., Davidson-Watts, I, & Jones, G. 2012. Home range use and habitat selection by barbastelle bats (*Barbastella barbastellus*): implications for conservation. *Journal of Mammalogy 93(4):1110-1118. 2012*

A6.30 The identification of 'foraging' (i.e. a higher level of activity) for Barbastelle bat species is defined as:

- The criteria for foraging for horseshoe bat species, which have low intensity calls, makes use of Miller's (2001) Activity Index.[87] '*Call sequences with a negative minute on either side (i.e. a minute in which the species was not recorded) are judged to be commuting contacts, whereas contacts in two consecutive minutes or more are judged to be foraging contacts*.' 'Foraging' is defined as 9 or more minutes in which foraging contacts were recorded over any three nights in the five nights of any one automated detector during a recording period.

Calculating the Habitat Unit Value

A6.31 For information the value of the proposed site to a Barbastelle bats in Habitat Suitability value is calculated by using the HSI Score and the Density Band (See Table 5). The outcome of the Habitat Suitability Units used in the HEP is on a scale of 0 to 18[88].

Table 5: Matrix Combining Habitat Suitability Score and Density Band

		Habitat Suitability Score					
		Poor 1	**Marginal** 2	**Average** 3	**Good** 4	**Very Good** 5	**Excellent** 6
Band	**A (3)**	3	6	9	12	15	18
	B (2)	2	4	6	8	10	12
	C (1)	1	2	3	4	5	6

A6.32 The habitat replacement value required is calculated by multiplying the score by the hectarage of the habitat affected (hectares x [HSI x Band]) giving figure in **Habitat Units**. For example a HSI x Band score of 12 for an area of 1.50 hectares would give a value of 18 Habitat Units.

A6.33 The resultant total of Habitat Units for the whole proposed development site could then be divided by 18 (6 [HS] x 3 [Band]) to arrive at the minimum area in hectares of accessible replacement habitat required to develop the proposed site

A6.34 Hedgerows and some watercourses are not mapped as separate polygons in OS Mastermap and if a width is not known a default width of 3 metres is used and multiplied by the length to give an area in hectares. These values are usually small and do not significantly affect the overall area of a site, and for simplicity's sake and considering their value to wildlife are not deducted from the area of bordering fields, compartments or OS Mastermap polygons. If preferred calculations can be carried out

[87] Miller, B. 2001. A method for determining relative activity of free flying bats using a new activity index for acoustic monitoring. *Acta Chiropterologica* 3 (1): 93 – 105.

[88] This range is in line with that used for the habitat metric used by Defra in its pilot projects 2012 -2014.

separately for these features using linear measurements but the end result is the same, especially if a direct replacement value of the hedgerow or watercourse is required.

A6.35 Nonetheless hedgerow and other commuting structure should be seen as having a functional role, and should normally be maintained or replaced to maintain Barbastelle bat commuting across a proposed development site.

A6.36 HEP calculations for development sites should be made on the basis that the total site area would be lost to a species and would therefore produce a maximum replacement requirement to develop the site. This saves a separate calculation for the value of the existing habitat on which enhanced habitat is created. Where habitat remains unchanged and is retained by the development it is not included in the calculation.

A6.37 To calculate the amount of replacement habitat provided as mitigation within a master plan for a proposed development site the same procedure as described above is used for each area of created or enhanced habitat. These habitats should in the first instance be aimed at providing optimal foraging habitat for Barbastelle bats (although it is unlikely that some habitats such as grazed pasture would be possible to re-create within a development site).

A6.38 Standard prescriptions that can be used for replacement habitats can be found in Annex 7. Habitats will need to be accessible and undisturbed by introduced lighting to count towards mitigation. As all habitats are considered optimal the HSI score would automatically be 6.

A6.39 In addition to the standard calculation described above Fraction Multipliers are also applied to the calculation to allow for temporal effects and the difficulty in restoring or creating a habitat (See below).

Fraction Multipliers

A6.40 In delivering the replacement habitat there may also be an issue or risk with delivering a functional offset and the timing of the impact. A loss in biodiversity would result and there could potentially be a risk to maintaining a species population during the intervening period even though it would recover in time. Therefore, it is important and desirable that where feasible replacement habitat is in place and functional just before development commences on site. However, functionality may not be achieved until several years after replacement habitat has been created and there is a risk that it may fail due to the difficulty in recreating or restoring. To account for these possibilities Fraction Multipliers are used. These are usually applied only once to the calculation for the value of the habitat lost to Barbastelle bats. However, in some circumstances the Fraction Multipliers may be applied to habitat created as replacement for that lost where this has been designed and there are multiple habitat types. In this case they are not applied to the habitat lost calculation.

A6.41 *The aim of a multiplier is to correct for a disparity or risk. In practice this is very difficult to achieve, not least because of uncertainty in the measurement of the parameters and the complexity of gathering the required data.'*[89] In order that any habitat creation or

[89] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.

enhancement would functionally replace habitat lost to development (and the need to take a precautionary approach in the case of Barbastelle bats, as features of European sites and European protected species) a 'fraction multiplier' is applied to the resultant Habitat Units needed to replace habitat lost to development in order to provide robust mitigation, e.g. to maintain 'favourable conservation status'.

A6.42 '*There is wide acknowledgement that ratios should be generally well above 1:1. Thus, compensation ratios of 1:1 or below should only be considered when it is demonstrated that with such an extent, the measures will be 100% effective in reinstating structure and functionality within a short period of time (e.g. without compromising the preservation of the habitats or the populations of key species likely to be affected by the plan or project.*[90] The Environment Bank recommend a two for one ratio where habitats are easily re-creatable contiguous to the development or on similar physical terrain as a minimum.[91]. In many other situations a significantly higher multiplier may be appropriate[92]. *The conclusion of the BBOP* [Business Biodiversity Offsets Programme] paper *(Ekstrom et al, 2008) is that where there are real risks around the methods and certainty of restoration or creation then the Moilanen framework is applicable; but for some other situations, (averted risk ...and where restoration techniques are tried and tested), lower ratios can be used.*[93]

A6.43 Appendices 4 and 5 give a guide to difficulty in creating and restoring habitats and the time frame required to reach maturity or functionality.

<u>Delivery Risk</u>

A6.44 As different habitats have different levels of difficulty in creation or restoration there will be different risks associated with each. '*Once there is an estimate of the failure risk, it is possible to work out the necessary multiplier to achieve a suitable level of confidence (Bill Butcher pers com; Moilanen, 2009; Treweek & Butcher, 2010). The work of Moilanen provides a basis for different multipliers of various levels of risk. We* [Defra] *have used this work to come up with categories of difficulty of restoration/expansion, and associated multipliers, as set out in* [Tables 6 and 7] *below*.'[94]

A6.45 In most cases a multiplier will be applied to the calculation of the habitat lost on the development site and the figure (≥1) shown in middle column of Table 6 below will be used. This assumes that the optimal habitat for Barbastelle bats will be created. The resultant figure can either be checked against that provided in the Master Plan to confirm that there is sufficient to mitigate the loss or then be used to design the area into a Master Plan.

A6.46 Where the replacement habitat has been designed, and includes several types, in an

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[90] European Communities. 2007. *Guidance document on Article 6(4) of the'Habitats Directive' 92/43/EEC: Clarification of the concepts of: alternative solutions*, *imperative reasons of overriding public interest*, *compensatory measures*, o*verall coherence, opinion of the commission.* Brussels: Office for Official Publications of the European Communities.

[91] Briggs, B., Hill, D. & Gillespie, R. 2008. Habitat banking – how it could work in the U.K. http://www.environmentbank.com/docs/Habitat-banking.pdf

[92] Moilanen, A., Van Teeffelen, A., Ben-Haim, Y. & Ferrier, S. 2009. How much compensation is enough? A framework for incorporating uncertainty and time discounting when calculating offset ratios for impacted habitat. *Restoration Ecology 17, 470-478*.

[93] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.

[94] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.

offsite location, for example, this needs to be checked to ensure that adequate mitigation habitat has been provided. In this case, due to the nature of the calculation the multiplier is inversed (≤1) as shown in the right hand column of Table 6 and applied to the replacement habitat not the lost habitat.

Table 6: Multipliers for different categories of delivery risk (Defra, 2011)

Difficulty of recreation/restoration	Multiplier	*Multiplier (Where the replacement site has been designed and consists of multiple habitat types)*
Very High	10	*0.1*
High	3	*0.33*
Medium	1.5	*0.67*
Low	1	*1*

A6.47 For information Appendix 3 gives an indicative guide to risk levels which have been assigned to habitats to these broad categories using expert opinion by Defra (2011). Factors such as substrate, nutrient levels, state of existing habitat, etc. will have an impact on the actual risk factor, which may need to be taken into account.

Temporal Risk

A6.48 In delivering replacement habitat there may be a difference in timing between the implementation of the development and the functionality and maturity of the replacement habitat in terms of providing a resource for the affected species

. This time lag would be minimised by calculation of existing habitat value in the pre application stage and implementation of the habitat creation and / or restoration in consultation with the local authority and other nature conservation organisations. In some cases the replacement habitat may be planted or managed concurrently with that of the site development.

A6.49 Where a time lag occurs a multiplier will be applied to take account of the risk involved to the ‘no net loss’ objective. These are set out in Table 7 below. Appendix 4 gives general guidance on how long different habitats would be expected to reach maturity. The actual multiplier used needs to be judged on a case by case basis. As with Delivery Risk the multiplier in the left hand column is likely to apply in most cases (see paragraphs A5.45 and A5.46 above).

A6.50 It is considered that some priority habitats cannot be recreated due to the length of time that they have evolved and the irreplaceability of some constituent organisms, at least in the short and medium terms. It is also considered that in the medium and longer terms the management of any replacement habitat may be uncertain. Therefore Table 7 has been constrained to a maximum period of 20 years. In some cases the time lag for the development of a habitat to support a population may be too long to be acceptable.

Table 7: Multipliers for different time periods using a 3.5% discount rate

Years to target condition	Multiplier	Multiplier *(Where the replacement site has been designed and multiple habitat types)*
5	1.2	*0.83*
10	1.4	*0.71*
15	1.7	*0.59*
20	2.0	*0.5*

A6.51 An Excel spread sheet in which figures used in the calculation for the HEP just as an example is shown in Appendix 5. It is likely that a full spread sheet will be made available by the Council.

Summary

A6.52 The total replacement habitat required therefore comprises the following metric for each habitat type within a proposed development site. The whole proposed development site should be included in the calculation.

The HSI = Habitat Code (Range 0 to 6) + or – Matrix Code (Range 0 to 6, Default 0) x Formation Code (Range 0 to 1, Default 1) x Management Code (Range 0 to 1, Default 1)

HSI x Band x hectares x Delivery Risk x Temporal Risk = Habitat Units required.

Habitat Units divided by 18 = hectares required

Off Site Replacement Habitat

A6.53 Where there are residual offsets, i.e. where the replacement habitat cannot be created within the proposed development sites red line boundary an allowance is calculated for the value of the existing habitat on the intended habitat creation site as this will be lost or included in the value of any enhancement. Where replacement habitat is located offsite then the value of that site needs to be taken into account. The formula applied to offset losses of existing habitat at the offset site is:

$$\frac{\text{Area Equivalent of Habitat Units Needed to Offset from Development}}{\text{(Habitat Value of Desired Habitat Type – Habitat Value of Offsite Habitat Creation Site)}}$$

A6.54 This figure is then added to the Habitat Units derived from the calculation from the proposed development site and the total divided by 18 to find the amount of offsite replacement habitat required. For example the proposed development requires 32HUs to replace that lost to Barbastelle bats. The habitat to be created is valued at a suitability score of 6 and the field intended for the creation of replacement habitat at 1. The calculation would be 32/ (6-1) + 32 = 38.4HU (or, divided by 18, 2.13 hectares).

A6.55 It is critical that the replacement site where habitat has been enhanced is accessible to the population of Barbastelle bats affected.

Annex 7: Habitat Creation Prescriptions

A7.1 The principal source of prey for Barbastelle bats is small moths. Most moths require food for their caterpillars (For some species this is a single type of plant, although most species are not so restricted – see Annex 5). Energy in the form of nectar from flowers is required for the adult. Many species have favoured nectar plants, but some moths do not feed at all in the adult stage; and somewhere to over-winter safely - usually in taller vegetation, scrub or ivy. One study found that night flying moth abundance and diversity correlated positively with the number of bramble (*Rubus fruticosus*) clumps along a hedgerow[95].

Grassland[96]

A7.2 The creation of species rich grassland is likely to be more feasible in response to providing replacement habitat to mitigate the impacts of a development. This will need to be managed to produce a long sward to support an abundance of Noctuid moths, one of the main prey items hunted by Barbastelle bats. Specified seed mixes should include food plants, as well as grasses, such as dandelion, dock, hawkweeds, plantains, ragwort, chickweed, fat hen, mouse-ear and red valerian and other herbaceous plants.

A7.3 Wetter areas of grassland and ponds, such as can be created through sustainable drainage systems, are also favourable to Barbastelle bats

A7.4 Buddleia and bramble in particular, and other scrub species may be planted within or on the edges of the grassland. The grassland should be divided into parcels and cut in rotation once a year in October and the cuttings removed.

A7.5 Where grassland is established as a field margin this should be at least 6 metres wide out from the face of the bounding hedgerow. Cuts should be made once a year in the autumn to avoid harming moth populations.

Hedgerow

A7.6 Hedgerows should be maintained as large as possible and a second row of trees and shrubs parallel to the existing or planted hedgerow leaving a pathway between will create effective flight line conditions. The larger the hedgerow the better the flight line for Barbastelle bats.[97]

A7.7 Uniformity of species or structure is undesirable and trees with a tall clean trunk, such as ash or beech avoided. Trimmed hedgerows provide poor cover for commuting Barbastelle bats. Where necessary only one side a double hedge line should be trimmed in any one year or then cut back in short sections in rotation on one side of the hedge only. This may not be able to be controlled if hedgerows form the boundaries of

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[95] Coulthard, E. 2015. The Visitation of Moths (Lepidoptera) to Hedgerow Flowering Plants in Intensive Northamptonshire Farmland: in Coulthard, E. 2015. *Habitat and landscape-scale effects on the abundance and diversity of macro-moths (Lepidoptera) in intensive farmland.* PhD. University of Northampton.

[96] Merckx, T. & Macdonald, D. W. 2015. Landscape-scale conservation of farmland moths: in Macdonald, D. W. & Feber, R. E. (eds) 2015. *Wildlife Conservation on Farmland. Managing for Nature on Lowland Farms.* Oxford: Oxford University Press; Fuentes-Montemayor, E., Goulsion, D.& Park, K. J. 2010, The effectiveness of agri-environment schemes for the conservation of farmland moths: assessing the importance of a landscape-scale management approach. *Journal of Applied Ecology* 48, 532-542

[97] Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

residential properties which should be taken into account when master planning a proposed development site.[98]

A.7.8 If not present bramble should be planted at regular intervals in hedgerows and should be included in the planting schedule for new hedgerows[99]. Cow parsley (*Anthriscus sylvestris*) should also be seeded in association with hedgerow enhancement and creation. Bramble is also closely related to other cultivated species such as raspberry (*Rubus idaeus*), Loganberry (*Rubus loganobaccus*); and cloudberry (*Rubus chamaemorus*).

Watercourses

A7.9 Watercourses and their margins form a major component of Barbastelle bat flyways and vary from larger hedgerow ditches up to medium sized rivers with their bankside vegetation, this latter forming the structure of the flyway. A stream with trees either side and canopies touching is ideal.[100] Watercourses forming part of proposed developments should be maintained and enhanced so that there is sufficient structure to support a flyway. Existing vegetation should not be removed.

Woodland and Trees

A7.10 Macro moth communities were influenced to some extent by the surrounding landscape. Fuentes-Montemayor et al (2012) found that moth abundance was influenced by the percentage cover of woodland in the surrounding landscape at relatively small spatial scales (<500 m), suggesting that local habitat management (or a landscape management at this spatial scale) would be suitable for moth conservation.

A7.11 Woodland supports high levels of moth abundances. Macro moths are densest where there is grass or litter, less so where there are ferns, moss, bare ground or herbs. Understorey plants often provide larval foods for small moths, the Geometridae in particular. Within development trees can be planted within grassland areas to form small copses. A diverse mix of tree species should be used using species such as oak, willow and birch which can support large numbers of moths. Species such as beech should be avoided as it has small numbers of moths even when compared to non-native species such as sycamore. Uniformity of stands of trees should also be avoided as they are poorer in invertebrates than more diversely structured woodland.[101]

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98 Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

99 Coulthard, E. 2015. The Visitation of Moths (Lepidoptera) to Hedgerow Flowering Plants in Intensive Northamptonshire Farmland: in Coulthard, E. 2015. *Habitat and landscape-scale effects on the abundance and diversity of macro-moths (Lepidoptera) in intensive farmland*. PhD. University of Northampton.

100 Greenaway, F. 2004. *Advice for the management of flightlines and foraging habitats of the barbastelle bat* Barbastella barbastellus. Peterborough: English Nature

101 Fuentes-Montemayor, E.,Goulson, D., Cavin, L., Wallace, J.M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation 153 (2012) 265–275*; Grenaway, F. 2005. *Advice for the management of flightlines and foraging habitats of the barbastelle bat Barbastella barbastellus*. Peterborough:English Nature; Kirby, K. J. (ed). 1988. *A woodland survey handbook*. Peterborough: Nature Conservancy Council.

Annex 8: Application of the Habitats Regulations

A8.1 The Habitats Regulations protect identified *sites* by designation as Special Areas of Conservation. However, the Habitats Regulations also protects *habitat* which is important for the Favourable Conservation Status of the species.

A8.2 Achieving Favourable Conservation Status of a site's features '… *will rely largely on maintaining, or indeed restoring where it is necessary, the critical components or elements which underpin the integrity of an individual site. These will comprise the extent and distribution of the qualifying features within the site and the underlying structure, functions and supporting physical, chemical or biological processes associated with that site and which help to support and sustain its qualifying features'*.

A8.3 Regulation 63 Habitats Regulations states that:

A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which:

- is likely to have a significant effect on a European Site (either alone or in combination with other plans or projects), and
- is not directly connected with or necessary to the management of that site must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.

A8.4 Regulation 63 therefore describes a two-stage procedure: a screening stage where the "competent authority" has grounds to conclude whether a plan or project is likely to have a significant effect on a European site, and the appropriate assessment stage if it concludes that a significant effect is likely.

A8.5 In accordance with Regulation 61 information submitted with a planning application will be used by Sedgemoor District Council or Somerset County Council (in the case of minerals or waste applications) to determine whether the proposal is likely to have a significant effect on the SAC. Sedgemoor District Council will apply a "Test of Likely Significant Effect" for proposals which involve or may involve:

- the destruction of a Barbastelle or Bechstein's bat roost (maternity, hibernation or subsidiary roost);
- loss of foraging habitat for SAC bats
- fragmentation of commuting habitat for SAC bats
- increase in luminance in close proximity to a roost and/or increase in luminance to foraging or commuting habitat
- impacts on foraging or commuting habitat which supports the SAC bat populations structurally or functionally

A8.6 When considering whether a project is likely to have a significant effect on a European site, the competent authority should take account of mitigation measures which are built into the project. Mitigation measures are measures which are designed to avoid or reduce adverse effects on a European site. It is important to distinguish these from compensatory measures which are designed to compensate for unavoidable adverse effects on a European site and follow the "3 tests"[102]. Compensatory measures will not be taken into account at the Test of Likely Significant Effect stage.

A8.7 The precautionary principle underpins the Habitats Directive[103] and hence the Habitats Regulations and must be applied by the local planning authority as Competent Authority as a matter of law.[104] It is clear that the decision whether or not an appropriate assessment is necessary must be made on a precautionary basis.[105] In addition, the Waddenzee judgement[106] requires a very high level of certainty when it comes to assessing whether a plan or project will adversely affect the integrity of a European site. The judgement states that the competent authority must be sure, certain, convinced that the scheme will not adversely affect the integrity of the site. It goes on to state that that there can be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site.

A8.8 For Sedgemoor District Council, West Somerset District Council, the Exmoor National Park Authority or Somerset County Council (in the case of schools, highways, minerals or waste applications) to be able to conclude with enough certainty that a proposed project or development will not have a significant effect on the SAC, the proposal or project must therefore be supported by adequate evidence and bespoke, reasoned mitigation. Where appropriate a long term monitoring plan will be expected to assess whether the bat populations have responded favourably to the mitigation. It is important that consistent monitoring methods are used pre- and post-development, to facilitate the interpretation of monitoring data.

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[102] See ODPM circular 06/2005
[103] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (known as the 'Habitats Directive')
[104] *Assessing Projects under the Habitats Directive: Guidance for Competent Authorities* 2011, CCW p.15
[105] ODPM Circular 06/2005 para13
[106] ECJ judgement: C-127/02 [2004] ECR-I

A8.9 Mitigation, an Ecological Management Plan and, (where required) monitoring during and / or post development, will be secured through either planning conditions or a S106 agreement or both. Data from monitoring will be used by the Sedgemoor District Council, West Somerset District Council, the Exmoor National Park Authority and / or Somerset County Council to determine how the bat populations have responded to mitigation and to increase the evidence base.

Appendix 1: Comparison of Home Ranges of Barbastelle Bats Derived from Radio-Tracking Studies

Home range distance	Minimum Distance	Average Distance	Maximum Distance	Home range area	Reference
On average, bats travelled 8.4 km +/- 4.9 *SD* (range 1.1–20.4 km) from roosts to foraging areas.	1.1	8.4	13.3	Females were highly faithful to more or less "private" foraging areas which constituted a small fraction ($\bar{X}$ = 10.1 % +/- 8.8 *SD*) of home ranges.	Zeale, M. R. K. 2011. *Conservation biology of the barbastelle (*Barbastella barbastellus*): applications of spatial modelling, ecology and molecular analysis of diet*. PhD Thesis. University of Bristol, Bristol, UK.
The foraging areas ranged from 0.75km up to 10.2km away from the roosting site.	0.75		10.2	The bats multi-lateral polygon range (MLP) was over a distance of 9.8km (east/ west and using an area of 31.6km^2. This is a more accurate method compared to the commonly used academic analysis method of multi convex polygon, which would exaggerate the area by 34.2% to 48km^2.	Rush, T. & Billington, G. 2013. *Report on a radio tracking study of Barbastelle bats at Hinkley Point C.* Witham Friary: Greena Ecological Consultancy.
Bats ranged 3.5km northwest,4.5km north, 6km northeast, 6km east, 9km southeast and 6 km south			9		Billington, G. 2000. *Horner Woods Barbastelle Bat: radio tracking study*. The National Trust.
In October and November 2001 Barbastelle bats ranged up to 3km from their roosts compared to at least 9km in summer, there was one in November a radio tagged male bat was briefly recorded moving around 16km west of Horner Wood at Hillsford Bridge, near Lynmouth, Devon			*3*		Billington, G. 2012. *Further research on the Barbastelle Bat Holnicote National Trust Estate, Exmoor, North Somerset*. Natural England Research Report. Witham Friary: Greena Ecological Consultancy
Ebemore roosts – 1.17km to 10.46km, mean 5.2km (lactating 5.09km)	1.17	5.2	10.46	Ebemore roosts – 50% kernel 20.88 – 368.25 ha, mean 178.15ha.	Greenaway, F. 2008. *Barbastelle Bats In The Sussex West Weald 1997 – 2008.* Sussex Wildlife Trust/ West Weald Landscape Partnership
The Mens roosts – 2.64km to 11.98km, mean 7.11km (lactating 7.67km)	2.64	7.11	11.98	The Mens roosts – 50% kernel 61.33 – 1152.24ha, mean 379.75	
				Individual 95% kernel, 125 - 2551ha, median 403ha. Individual 50% kernal 5-285 ha, median 67 ha.	Hillen, J., Kiefer, A., Veith, M., 2009. Foraging site fidelity shapes the spatial organisation of a population of female western barbastelle bats. *Biological Conservation* 142: 817-823.
				Individual MCP mean 222ha ± 88.5, individual 50% kernal 16ha ± 10.	Kerth, G., Melber, M., 2009. Species-specific barrier effects of a motorway on the habitat use of two threatened forest-living bat species. *Biological Conservation* 142: 270-279.

Home range distance	Minimum Distance	Average Distance	Maximum Distance	Home range area	Reference
Mean maximum distance from roost to furthest edge of core foraging area (80% cluster cores) 6.8km ± 4.8. Per colony the mean maximum distances were 8.5km (5.6-11.3km) and 5.2km (2.7-7.7km).	2	8.5	11.3	Colony MCPs 10,660ha and 14,804 ha.	Zeale, M., Davidson-Watts, I., Jones, G., 2012. Home range use and habitat selection by barbastelle bats (*Barbastella barbastellus*): implications for conservation. *Journal of Mammalogy 93: 1110-1118.*
		5.2	7.7		
				95% kernel 183 ha and 50% kernel 27 ha.	Hillen, J., Kiefer, A., Veith, M., 2010. Interannual fidelity to roosting habitat and flight paths by female western barbastelle bats*. Acta Chiropterologica 12: 187-195*
Maximum home range was 5km. The distance between roosts in the forest to foraging sites was less than 1km for males and between 3km and 4.5km for females.		(*3.75*)	(*5*)	Core regions (calculated using harmonic means) are 100-500m in diameter. Nine tracked animals used a total area of 35km²	Steinhauser, D., Burger, F., Hoffmeister, U., Matez, G., Teige, T., Steinhauser, P., Wolz, I., 2002. Untersuchungen zur Okologie der Mopsfledermaus, Barbastella barbastellus (Schreber, 1774), und der Bechsteinfledermaus, Myotis bechsteinii (Kuhl, 1817) im Suden des Landes Brandenburg. Schriftenr. *Landschaftspflege. Naturschutz 71: 81–98.*
				Mean individual home range 8.8 ha ±5.8 SD	Sierro, A., 1999. Habitat selection by barbastelle bats (*Barbastella barbastellus*) in the Swiss Alps (Valais). *Journal of Zoology 248: 429-432.*
				Home range approximately 1000 ha	Greenaway, F., 2001. The barbastelle in Britain. *British Wildlife* 12: 327-334.
Distance between roost and foraging sites was between 0.8km and 8.2 km (average 3.9km)	0.8	3.9	8.2	Seven Barbastelle radio tracked had a total of 24 distinct foraging sites, sizes between 2ha and 48ha. Each individual bat visiting between 1 and 7 sites.	Simon, M., Hüttenbügel, S. & Smit-Viergutz, J. 2004. *Ecology and Conservation of Bats in Villages and Towns.* Bonn: Bundesamt für Naturschutz
Mean Distances	**1.41**	**6.385**	**10.1**		

Appendix 2: Barbastelle Bat Habitat Suitability Index

<u>Text Colour</u>
Black = Habitat Codes
Blue = Matrix Codes
Green = Formation Codes
Red = Management Codes

NP = Not permissible. It is considered that the habitat is not replaceable

A complete list with full descriptions and parameters of the habitat labels can be obtained from Somerset Environmental Records Centre.[107]

The columns on the right refer to scores given by three Barbastelle bat specialists to broad habitat types on a decimal scale of 0 to 1 through a Delphi process and are given for information only. Figures in italics refer to scores given to a Habitat Type rather than a Matrix Code and should be compared with the modified HSI score not that shown which is a multiplier.

Code	Label	HSI	Notes	ZE	BI	GR
WB0	Broadleaved, mixed, and yew woodland	6	Barbastelle bats prefer riparian vegetation, broad leaved woodland, unimproved grassland, improved grassland, scrub, mixed woodland, coniferous woodland and avoid urban, upland moor, arable habitats and areas of open water (Zeale, 2009). Over 90% of barbastelle bats from Horner Wood in Somerset foraged along linear wooded scrub strips including along watercourses, overgrown hedgerows, uncut grassland, heather moorland edge (within Exmoor Heath SAC), gardens and areas of low level street lighting. Gorse was also important. (Billington, 2002). Barbastelle bats foraging in summer occurred mostly out of woodlands and included areas of scrub, heath, unimproved grassland, along hedgerows and streams and salt marsh. By contrast in the autumn/ early winter bats almost exclusively foraged in woodlands with up to half of the time spent in conifer plantations. Habitats recorded as being used to the east of Porlock Weir during these surveys include patches of scrub (including bramble, gorse, nettles, blackthorn and dog rose); patches of bramble scrub on shingle; saltmarsh; trees lining dry shingle-lined channels; strips of tall vegetation; and short improved turf			
WB1	Mixed woodland	4				
WB2	Scrub woodland	2				
WB3	Broadleaved woodland	6		1	1	1
WB31	Upland oakwood [=Old sessile oak woods with Ilex and Blechnum in the British Isles(AN1)]	NP				
WB32	Upland mixed ashwoods	5				
WB321	Tilio-Acerion forests of slopes, screes and ravines [upland]	NP				
WB32Z	Other upland mixed ashwoods	5				
WB33	Beech and yew woodlands	4				
WB331	Lowland beech and yew woodland	4				
WB3311	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion)	NP				
WB3312	Asperulo-Fagetum beech forests	NP				
WB3313	Taxus baccata woods of the British Isles	NP				
WB331Z	Other lowland beech and yew woodland	4				
WB33Z	Other beech and yew woodlands	4				
WB34	Wet woodland	4				
WB341	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	NP				
WB342	Bog woodland	NP				
WB34Z	Other wet woodland	4				
WB36	Upland birch woodland	NP				
WB361	Lowland mixed deciduous woodland	6				
WB362	Old acidophilous oak woods with Quercus robur on sandy plains	NP				

[107] SERC, 34 Wellington Road, Taunton TA1 5AW **Telephone**: 01823 664450 **Fax**: 01823 652411

Code	Label	HSI	Notes	ZE	BI	GR
WB363	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	NP	grazed by sheep. (Billington, 2012). Oak woodlands support high moth diversity (Zeale, 2009a) Moth diversity is greatest on oak and willow species Understorey plants are the larval foods of many small moths, the Geometridae in particular. (Greenaway, 2004) It is indicated that small woodlands of less than 1ha do not have characteristic woodland moth communities (Usher & Keiller, 1998) Scrub, mixed and coniferous woodland of relatively little importance (Zeale, 2009) However, Billngton (2000) found Barbastelle bats using coniferous plantations especially in early winter. In Switzerland Barbastelle bats avoided open woodland on stony outcrops and rocky slopes (Sierro, 1999).			
WB36Z	Tilio-Acerion forests of slopes, screes and ravines [lowland]	NP				
WB3Z	Other lowland mixed deciduous woodland	6				
WC0	Coniferous woodland	3				
WCZ	Other coniferous woodland	3				
IH0	Introduced shrub	0				
WF0	Unidentified woodland formation	1				
WF1	Semi-natural	1				
WF11	Native semi-natural	1				
WF111	Canopy Cover >90%	0.5				
WF112	Canopy Cover 75 - 90%	0.8				
WF113	Canopy Cover 50 - 75%	1				
WF114	Canopy Cover 20 - 50%	1				
WF12	Non-native semi-natural	0.7				
WF121	Canopy Cover >90%	0.3				
WF122	Canopy Cover 75 - 90%	0.5				
WF123	Canopy Cover 50 - 75%	0.7				
WF124	Canopy Cover 20 - 50%	0.7				
WF2	Plantation	0.75	Moth eating bats are higher in large and well-connected woodland patches with dense understorey cover. Accordingly a well-developed woodland understorey has been linked to the occurrence of moth eating bats (Fuentes-Montemayor et al, 2013) Uniform stands of trees are poorer in invertebrates than more diversely structured woodland (Kirby, 1988)	*1*	*0.8*	*0.9*
WF21	Native species plantation	0.75				
WF22	Non-native species plantation	0.5				
WF3	Mixed plantation and semi-natural	0.75				
WF31	Mixed native species semi-natural with native species plantation	0.75				
WF32	Mixed native species semi-natural with non-native species plantation	0.75				
WF33	Mixed non-native species semi-natural with native species plantation	0.5				
WF34	Mixed non-native species semi-natural with non-native species plantation	0.5				
WM0	Undetermined woodland management	1	Trees in unmanaged woodland are preferred over open woodland and parkland (Russo *et al*, 2004)			
WM1	High forest	1				
WM2	Coppice with standards	0.5	Where coppicing is necessary it should be carried out in small patches (Greenaway, 2004)			
WM3	Pure coppice	0.5				
WM4	Abandoned coppice	0.75				
WM5	Wood-pasture and parkland	0.75				
WM51	Currently managed wood pasture/parkland	0.75				
WM52	Relic wood pasture/parkland	0.75				
WM6	Pollarded woodland	0.5				
WM7	Unmanaged woodland	1				
WMZ	Other woodland management	1				
WG0	Unidentified woodland clearing	1				
WG1	Herbaceous woodland clearing	1				
WG2	Recently felled/coppiced woodland clearing	0.5				
WG3	Woodland ride	1				
WG4	Recently planted trees	0.25				
WGZ	Other woodland clearings/openings	1				
GA0	Acid grassland	4	The vast majority (over 90%) of insects found near hedges do not			
GAZ	Upland acid grassland	0				
GC0	Calcareous grassland	4		0.8	0.7	0.5
GC1	Lowland calcareous grassland	4				

Code	Label	HSI	Notes	ZE	BI	GR
GC2	Upland calcareous grassland	1	originate in the hedge but come from other habitats brought in on the wind (BCT, 2003)			
GN0	Neutral grassland	4				
GN1	Lowland meadows	4				
GI0	Improved grassland	2		0.5	0.2	0.3
GP0	Grassland, probably improved	2				
GU0	Grassland, possibly unimproved	3		0.7	0.4	0.5
SC0	Scrub	1				
SC1	Dense/continuous scrub	1		*0.8*	*0.7*	*0.5*
SC2	Open/scattered scrub	1				
SC21	Open/scattered scrub: native shrubs	1				
SC22	Open/scattered scrub: introduced shrubs	1				
TS0	Scattered trees	1				
TS1	Scattered trees some veteran	1				
TS11	Broadleaved	1				
TS12	Mixed	0.75				
TS13	Coniferous	0				
TS2	Scattered trees none veteran	0				
TS21	Broadleaved	0				
TS22	Mixed	0				
TS23	Coniferous	0				
PA0	Patchy bracken	0				
PA3	Scattered bracken	0				
OT0	Tall herb and fern (excluding bracken)	0				
OT2	Upland species-rich ledges	0				
OT3	Tall ruderal	0				
OT4	Non-ruderal	0				
OT41	Lemon-scented fern and Hard-fern vegetation (NVC U19)	0				
OT4Z	Other non-ruderal tall herb and fern	0				
OTZ	Other tall herb and fern	0				
HS0	Ephemeral/short perennial herb	0				
BG1	Bare ground	0				
GM0	Undetermined grassland etc. management	1				
GM1	Grazed	0.7	Butterflies and other arthropods are negatively affected by moderate and high levels of cattle grazing (Ekroos, J., Heliola, J. & Kuussaari, M. 2010. Homogenization of lepidopteron communities in intensively cultivated agricultural landscapes. *Journal of Applied Ecology,* 2010, 47, 459 - 467			
GM11	Cattle grazed	0.7				
GM12	Sheep grazed	0.5				
GM13	Horse grazed	0.6				
GM14	Mixed grazing	0.5				
GM1Z	Other grazing	0.6				
GM2	Mown	0.3				
GM21	Silage	0.2				
GM22	Hay	0.3	Hay cutting has great effect on biomass suddenly altering local insect availability at a very susceptible time of year for pregnant bats (Greenaway, 2004)			
GM23	Frequent mowing	0				
GM2Z	Other mowing regime	0.2				
GM3	Hay and aftermath grazing	0.2				
GM4	Unmanaged	1				
GM5	Burning/swaling	0				
GMZ	Other grassland etc. management	1				
GL1	Amenity grassland	0.2				
GL11	Golf course	0.5				
GL12	Urban parks, playing and sports fields	0.1				
GL1Z	Other amenity grassland	0.1				

Code	Label	HSI	Notes	ZE	BI	GR
GL2	Non-amenity grassland	1				
GL21	Permanent agricultural grassland	1				
GL211	Arable reversion grassland	1				
GL2111	Species-rich conservation grassland	1				
GL211Z	Other arable reversion grassland	1				
GL21Z	Other permanent agricultural grassland	1				
GL2Z	Other grassland use	1				
CL3	Unintensively managed orchards	1				
CL31	Traditional orchards	1				
CL32	Defunct orchards	1				
CL3Z	Other unintensively managed orchards	1				
CF1	Coastal and floodplain grazing marsh	1				
BR0	Bracken	3				
HE0	Dwarf shrub heath	1	Zeale (2009) found that Barbastelle bats avoided upland moors although they support unimproved habitat are highly exposed with colder temperatures and stronger winds likely to reduce insect abundance and the energetic costs of flight. However, Billington (2002) found Barbastelle using moorland edge			
HE1	European dry heaths	1				
HE2	Wet heaths	1				
HE21	Northern Atlantic wet heaths with Erica tetralix	NP				
HE22	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	NP				
HE2Z	Other wet heaths	1				
HE3	Lichen/Bryophyte heath	NP				
HEZ	Other dwarf shrub heath	1				
HL1	Lowland Heathland	1				
HU1	Upland Heathland	0				
EO0	Bog	2				
EO1	Blanket bog [=Blanket bogs (AN1)]	NP				
EO2	Lowland raised bog	NP				
EO21	Degraded raised bogs still capable of natural regeneration	NP				
EO22	Active raised bogs	NP				
EO2Z	Other lowland raised bogs	NP				
EOZ	Other bogs	NP				
EM0	Fen, marsh and swamp	2				
EM1	Swamp	2				
EM11	Reedbeds	3				
EM12	Calcareous fens with Cladium mariscus and species of the Carex davallianae	NP				
EM1Z	Other swamp vegetation	2				
EM2	Marginal and inundation vegetation	1				
EM21	Marginal vegetation	2				
EM22	Inundation vegetation	0				
EM3	Fens	2				
EM31	Fens [and flushes - lowland]	2				
EM311	Calcareous fens with Cladium mariscus and species of the Carex davallianae	NP				
EM312	Springs	2				
EM3121	Petrifying springs with tufa formation [Cratoneurion]	NP				
EM312Z	Other springs	2				
EM313	Alkaline fens [lowland]	2				
EM31Z	Other lowland fens	2				
EM32	Upland flushes and fens	1				
EM322	Alkaline fens [upland]	NP				

Code	Label	HSI	Notes	ZE	BI	GR
EM323	Transition mires and quaking bogs [upland]	NP				
EM32Z	Other upland flushes and fens	1				
EM3Z	Other fens, transition mires, springs and flushes	1				
EM4	Purple moor grass and rush pastures [Molinia-Juncus]	3				
EM41	Molinia meadows on calcareous, peaty or clayey-silt-laden soils [Molinia caeruleae]	3				
EM4Z	Other purple moor grass and rush pastures [Molinia-Juncus]	3				
AS0	Standing open water and canals	3	Riparian vegetation is the most used habitat by Barbastelle bats in a study on Dartmoor (Zeale, 2009). However, open water was the least selected habitat. The report also stated that it is the riparian vegetation rather than the water that is important to foraging Barbastelle bats, although the secondary importance of water in supporting riparian vegetation should be noted. In SW Germany have been observed to forage above water in a similar way to Daubenton's (Boye & Dietz, 2005) Surveys at Hinkley LWS recorded intensive activity above pond (EDP, 2010) Barbastelle bats' foraging paths are generally within 200 metres of water features (Greenaway, 2008) An ideal example of breeding colony of Barbastelle bats in the distant past would be of a small river catchment with dense woodland on its headwaters and wooded valleys leading to a wide zone of water meadows and finally reed beds and sand dunes before reaching the sea. The colony's territorial boundary would be the catchment area. In modified landscapes colony territories are difficult to define as now they often have unnatural access to new foraging possibilities in adjacent catchments - through plantations for example. (Greenaway, 2004)	0.2	0.6	0.8
AS1	Dystrophic standing water	2				
AS11	Natural dystrophic lakes and ponds	1				
AS1Z	Other dystrophic standing water	2				
AS2	Oligotrophic standing waters	1				
AS21	Oligotrophic lakes	1				
AS211	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	1				
AS212	Oligotrophic to mesotrophic standing waters with vegetation of the littorella uniflorae and/or the Isoeto-nanojuncetea	1				
AS21Z	Other oligotrophic lakes	1				
AS2Z	Other oligotrophic standing waters	2				
AS3	Mesotrophic standing waters	3				
AS31	Mesotrophic lakes	1				
AS311	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	1				
AS312	Oligotrophic to mesotrophic standing waters with vegetation of the littorella uniflorae and/or the Isoeto-nanojuncetea	1				
AS31Z	Other mesotrophic lakes	1				
AS3Z	Other mesotrophic standing waters	3				
AS4	Eutrophic standing waters	4				
AS41	Eutrophic standing waters	1				
AS411	Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation	1				
AS41Z	Other eutrophic standing waters	1				
AS4Z	Other eutrophic standing waters	4				
AS5	Marl standing water	3				
AS6	Brackish standing water with no sea connection	0				
AS7	Aquifer fed naturally fluctuating water bodies	1				
ASZ	Other standing open water and canals	4				
AC0	Channel of unknown origin	1				
AC1	Artificial channels	1				
AC11	Drains, rhynes and ditches	1				
AC111	Species-rich drains, rhynes and ditches	1				
AC11Z	Other drains, rhynes and ditches	1				
AC12	Artificially modified channels	1				
AC13	New artificial channels	0.1				
AC14	Canals	0.75				
AC1Z	Other artificial channels	0.5				
AC2	Natural/naturalistic channels	1				
AO0	Open water of unknown origin	1				
AO1	Artificial open water	1				
AO11	Reservoir	0.5				
AO12	Gravel pits, quarry pools, mine pools and marl pits	0.75				

Code	Label	HSI	Notes	ZE	BI	GR
AO13	Industrial lagoon	0				
AO14	Scrape	1				
AO15	Moat	1				
AO16	Ornamental	0.25				
AO1Z	Other artificial open water	0.25				
AO2	Natural open water	1				
AP1	Pond	1				
AP11	Ponds of high ecological quality	1				
AP1Z	Other pond	0.8				
AP2	Small lake	1				
AP3	Large lake	1				
LT1	Canal-side	1				
LT11	Canal-side with woodland	1				
LT12	Canal-side with scrub or hedgerow and standard trees	1				
LT13	Canal-side with scrub or hedgerow	1				
LT14	Canal-side with layered vegetation	1				
LT15	Canal-side with grassland	0.5				
LT16	Canal-side with damaged banks	0.2				
LT17	Canal-side with constructed banks	0.1				
LT18	Other canal-side type	0.5				
AR0	Rivers and streams	6		0.8	0.9	1
AR1	Headwaters	6				
AR11	Chalk headwaters	6				
AR1111	Tufa streams (Ranunculion fluitantis)	6				
AR111Z	Non-tufa Ranunculion fluitantis headwaters	6				
AR112	Other tufa streams	6				
AR11Z	Other chalk headwaters	6				
AR12	Active shingle rivers [headwaters]	6				
AR1Z	Other headwaters	6				
AR2	Chalk rivers (not including chalk headwaters)	6				
AR2Z	Other chalk rivers	6				
AR3	Active shingle rivers [non headwaters]	6				
ARZ	Other rivers and streams	6				
LT2	River-side	1	Zeale (2009) found a preference for foraging in riparian vegetation followed by broadleaved woodland			
LT21	River-side with woodland	1				
LT22	River-side with scrub or hedgerow and standard trees	1				
LT23	River-side with scrub or hedgerow	1				
LT24	River-side with layered vegetation	1				
LT25	River-side with grassland	0.5				
LT26	River-sdie with vertical banks	1				
LT27	River-side with damaged banks	0.2				
LT28	River-side with constructed banks	0				
LT29	Other river-side type	0.5				
CR0	Arable and horticulture	1	Avoids arable habitats (Zeale, 2009)			
CR1	Grass and grass-clover leys	1				
CR2	Cereal crops	1				
CR3	Non-cereal crops including woody crops	1				
CR31	Intensively managed orchards	1				
CR32	Withy beds	1				
CR33	Vineyards	1				

Code	Label	HSI	Notes	ZE	BI	GR
CR34	Game crops	1				
CR35	Miscanthus	0				
CR3Z	Other non-cereal crops including woody crops	1				
CR4	Freshly ploughed	0				
CR5	Whole field fallow	2				
CR6	Arable headland or uncultivated strip	5				
CR61	Arable field margins	5				
CR6Z	Other arable headland or uncultivated strip	5				
CR7	Freshly harvested/stubble	0				
CRZ	Other arable and horticulture	0				
CL1	Agriculture	1				
CL11	Organic agriculture	1				
CL12	Non-organic agriculture	0.75				
CL2	Market garden and horticulture	0				
CL21	Organic market garden and horticulture	0				
CL22	Non-organic market garden and horticulture	0				
CL4	Intensively managed vineyards	0				
CL4Z	Non-intensively managed vineyards	1				
CL5	Cereal crops managed for wildlife	1				
CL5Z	Cereal crops not managed for wildlife	0.5				
RE0	Inland rock	0				
RE1	Natural rock exposure features	0				
RE2	Artificial rock exposures and waste	0				
PI0	Post -industrial habitats	0				
PI1	Calaminarian grasslands of the Violetalia Calaminariae	0				
PIZ	Other rock outcrops and mine spoil rich in heavy metals	0				
PC0	Post-industrial sites	0				
PC1	Post-industrial sites of high nature conservation value	0				
PC2	Post-industrial sites of low nature conservation value	0				
LF0	Boundary and linear features	5				
LF1	Hedges / Line of trees	5				
LF11	Hedgerows	5				
LF111	Important hedgerows	5		0.9	0.8	1
LF11Z	Non-important hedgerows	4		0.4	0.6	0.8
LF12	Line of trees	5				
LF1Z	Other hedges/line of trees	4				
LF2	Other boundaries and linear features	2				
LF21	Line of trees (not originally intended to be stock proof)	5				
LF22	Bank	0				
LF23	Wall	1				
LF24	Dry ditch	1				
LF25	Grass strip	1				
LF26	Fence	0				
LF27	Transport corridors	1				
LF271	Transport corridor without associated verges	0				
LF272	Transport corridor associated verges only	1				
LF273	Transport corridor with natural land surface	2				
LH1	Intact hedge	1				
LH2	Defunct hedge	1				

Code	Label	HSI	Notes	ZE	BI	GR
LH3	Recently planted hedge	0.25				
LM1	Cut hedge	0.3	Cut hedge is specified where height is below 2 metres			
LM11	Cut hedge with standards	0.3				
LM12	Cut hedge without standards	0.2				
LM2	Uncut hedge	0.9	Uncut hedge is specified where the hedge is between 2 and metres high			
LM21	Uncut hedge with standards	0.9				
LM22	Uncut hedge without standards	0.8				
LM3	Overgrown hedge	1	Overgrown hedge is considered to be over 3 metres high			
LM31	Overgrown hedge with standards	1				
LM32	Overgrown hedge without standards	1				
LT3	Rail-side	1				
LT4	Road-side	1				
LT5	Path- and track-side	1				
LTZ	Other transport corridor verges, embankments and cuttings	1				
UL1	Railway	0				
UL2	Roadway	0				
UL3	Path and trackway	1				
ULZ	Other transport corridor	0.25				
UR0	Built-up areas and gardens	1	Avoids urban areas (Zeale, 2009)			
UA1	Agricultural	0				
UA2	Industrial/commercial	0				
UA3	Domestic	0.1				
UA31	Housing/domestic outbuildings	0.1	Buildings behind shutters and cladding are occasionally used for roosting (Boye & Dietz, 2005)			
UA32	Gardens	0.1				
UA33	Allotments	0.1				
UA34	Caravan park	0				
UA3Z	Other domestic	0				
UA4	Public amenity	0				
UA41	Churchyards and cemeteries	1				
UA4Z	Other public amenity	0.2				
UA5	Historical built environment	0				
UAZ	Other extended built environment	0				
OV0	Unknown terrestrial vegetation	1				
OV1	Other unknown terrestrial vegetation, possibly wetland	2				
OV2	Undetermined gorse	5	Gorse is an important habitat (Billington, 2000)			
OV3	Undetermined young woodland	2				
OVZ	Other unknown terrestrial vegetation	1				
SR0	Supralittoral Rock	0				
SR1	Vegetated maritime cliff and slopes	3				
SR11	Vegetated sea cliffs of the Atlantic and Baltic coasts	3				
SR1Z	Other vegetated cliffs and lichen dominated cliffs	3				
SR2	Boulders and rock above the high tide mark	0				
SRZ	Other Supralittoral rock	0				
MC1	Maritime cliff and slopes	1				
SS0	Supralittoral Sediment	0				
SS1	Coastal sand dunes	2	Three colonies have been recorded using dunes (Greenway, 2004)			
SS11	Embryonic shifting dunes	1				
SS14	Decalcified fixed dunes	2				
SS17	Humid dune slacks	2				

Code	Label	HSI	Notes	ZE	BI	GR
SS1Z	Other sand dunes	1				
SS3	Shingle above high tide mark	0				
SS31	Coastal vegetated shingle	1				
SS312	Annual vegetation of drift lines	0				
SS3Z	Other shingle above high tide mark	0				
SS4	Strandline vegetation	1				
SSZ	Other supralittoral sediment	0				
LS0	Littoral Sediment	0				
LS3	Coastal saltmarsh	2	Feeds over saltmarsh (Billington, 2000)			
LS3Z	Other saltmarsh	2				
ES1	Estuary	1	Will cross an estuary 500 metre wide (Zeale,2009)			

Appendix 3: Risk Factors for Restoring or Recreating Different Habitats

N.B.: These assignments are meant purely as an indicative guide. The starting position with regard to substrate, nutrient levels, state of existing habitat, etc. will have a major impact in the actual risk factor. Final assessments of risk may need to take other factors into account.

Habitats	Technical difficulty of recreating	Technical difficulty of restoration
Arable Field Margins	Low	n/a
Coastal and Floodplain Grazing Marsh	Low	Low
Eutrophic Standing Waters	Medium	Medium
Hedgerows	Low	Low
Lowland Beech and Yew Woodland	Medium	Low
Lowland Calcareous Grassland	Medium	Low
Lowland Dry Acid Grassland	Medium	Low
Lowland Meadows	Medium	Low
Lowland Mixed Deciduous Woodland	Medium	Low
Open Mosaic Habitats on Previously Developed Land	Low	Low
Ponds	Low	Low
Wood-Pasture & Parkland	Medium	Low

Appendix 4: Feasibility and Timescales of Restoring: examples from Europe

Ecosystem type	Time-scale	Notes
Temporary pools	1-5 years	Even when rehabilitated, may never support all pre-existing organisms.
Eutrophic ponds	1-5 years	Rehabilitation possible provided adequate water supply. Readily colonised by water beetles and dragonflies but fauna restricted to those with limited specialisations.
Mudflats	1-10 years	Restoration dependent upon position in tidal frame and sediment supply. Ecosystem services: flood regulation, sedimentation.
Eutrophic grasslands	1-20 years	Dependent upon availability of propagules. Ecosystem services: carbon sequestration, erosion regulation and grazing for domestic livestock and other animals.
Reedbeds	10-100 years	Will readily develop under appropriate hydrological conditions. Ecosystem services: stabilisation of sedimentation, hydrological processes.
Saltmarshes	10-100 years	Dependent upon availability of propagules, position in tidal frame and sediment supply. Ecosystem services: coastal protection, flood control.
Oligotrophic grasslands	20-100 years +	Dependent upon availability of propagules and limitation of nutrient input. Ecosystem services: carbon sequestration, erosion regulation.
Chalk grasslands	50-100 years +	Dependent upon availability of propagules and limitation of nutrient input. Ecosystem services: carbon sequestration, erosion regulation.
Yellow dunes	50-100 years +	Dependent upon sediment supply and availability of propagules. More likely to be restored than re-created. Main ecosystem service: coastal protection.
Heathlands	50-100 years +	Dependent upon nutrient loading, soil structure and availability of propagules. No certainty that vertebrate and invertebrate assemblages will arrive without assistance. More likely to be restored than re-created. Main ecosystem services: carbon sequestration, recreation.
Grey dunes and dune slacks	100-500 years	Potentially restorable, but in long time frames and depending on intensity of disturbance Main ecosystem service: coastal protection, water purification.
Ancient woodlands	500 – 2000 years	No certainty of success if ecosystem function is sought – dependent upon soil chemistry and mycology plus availability of propagules. Restoration is possibility for plant assemblages and ecosystem services (water regulation, carbon sequestration, erosion control) but questionable for rarer invertebrates.
Blanket/Raised bogs	1,000 – 5,000 years	Probably impossible to restore quickly but will gradually reform themselves over millennia if given the chance. Main ecosystem service: carbon sequestration.
Limestone pavements	10,000 years	Impossible to restore quickly but will reform over many millennia if a glaciation occurs.

Appendix 5: Example of HEP Calculation

The following table gives an example of the HEP calculation for a complex site which straddles two Consideration Zone bands.

Field No	Habitat	Primary Habitat		Matrix		Formation		Management / Land use		HSI Score	Density Band Score	Hectares	Habitat Units	Notes
		Code	Score	Code	Score	Code	Score	Code	Score					
F1	Miscanthus	CR35	0		0		1.00	CL12	1.00	0	2	4.975	0.00	
P2	Pond	AS0	3		0	AP1	1.00		1.00	3.00	2	0.053	0.32	
F3	Maize (Cereal crops, non-organic)	CR2	1		0		1.00	CL12	0.75	0.75	2	0.034	0.05	
F4	Mixed woodland, Mixed plantation and semi natural, high forest	WB1	4		0	WF3	0.75	WM1	1.00	3.00	2	0.362	2.17	
F5	Improved grassland, Frequent mowing (Other amenity)	GI0	2		0		1.00	GM23	0.00	0.00	2	0.344	0.00	
F6	Mixed woodland, Mixed plantation and semi natural, high forest	WB1	4		0	WF3	0.75	WM1	1.00	3.00	2	0.362	2.17	
F7	Built-up Areas and Gardens, gardens	UR0	1		0		1.00	UA32	0.00	0.00	2	0.2	0.00	
F8	Arable (wheat & barley)	CR2	1		0		1.00	CL12	0.75	0.75	2	0.086	0.13	
F9	Arable (type not stated)	CR0	1		0		1.00	CL12	0.75	0.75	2	0.154	0.23	
F10	Improved grassland; Hay Aftermath Grazing	GI0	2		0		1.00	GM3	0.20	0.40	2	3.484	2.79	
F11	Improved grassland, Silage	GI0	2		0		1.00	GM21	0.20	0.40	2	0.833	0.67	
F12	Built-up Areas and Gardens, scattered trees	UR0	1	TS0	1		1.00	UA32	0.00	0.00	1	2.844	0.00	
F13	Mixed Woodland Plantation	WB1	4		0	WF3	0.75		1.00	3.00	1	1.214	3.64	
F14	Cereal Crops, Bare Ground	CR2	1	BG1	0		1.00	CL1	1.00	1.00	1	0.642	0.64	
H1	Hedgerow, overgrown without standards	LF11	5		0		1.00	LM32	1.00	5.00	2	0.149	1.49	
H2	Hedgerow, cut without standards	LF11	5		0		1.00	LM12	0.20	1.00	2	0.58	1.16	
H3	Line of trees	LF21	5		0		1.00		1.00	5.00	2	0.203	2.03	
H4	Hedgerow, uncut without standards	LF11	5		0		1.00	LM22	0.80	4.00	2	0.04	0.32	
H5	Hedgerow, uncut with	LF11	5		0		1.00	LM21	0.90	4.50	2	0.02	0.18	

Field No	Habitat	Primary Habitat		Matrix		Formation		Management / Land use		HSI Score	Density Band Score	Hectares	Habitat Units	Notes
		Code	Score	Code	Score	Code	Score	Code	Score					
	standards													
H6	Hedgerow, cut without standards	LF11	5		0		1.00	LM12	0.20	1.00	2	0.07	0.14	
H7	Hedgerow, uncut without standards	LF11	5		0		1.00	LM22	0.80	4.00	1	0.02	0.08	
H8	Hedgerow, cut without standards	LF11	5		0		1.00	LM12	0.20	1.00	1	0.01	0.01	
												16.679	18.22	
		(Habitat required, e.g. Long sward species rich grassland)									Delivery Risk		1.5	
		(Habitat required, e.g. Long sward species rich grassland)									Temporal Risk		1.2	
											Habitat Units		32.80	
											Hectares Required		1.82	

Hestercombe House

Special Area of Conservation (SAC)

Guidance on Development

Version 2.2 – May 2019

NATURAL ENGLAND

Somerset West and Taunton

Sedgemoor IN SOMERSET

SOMERSET County Council

This guidance was prepared by Larry Burrows, Ecologist, Somerset Ecology Services, Planning Control, Somerset County Council working in partnership with North Somerset Council and Natural England

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Cover Photo: **Lesser Horseshoe Bat,** Frank Greenaway. Courtesy Vincent Wildlife Trust (http://www.vwt.org.uk/)

HESTERCOMBE HOUSE SPECIAL AREA OF CONSERVATION (SAC): GUIDANCE ON DEVELOPMENT

Contents

Hestercombe House Special Area of Conservation (SAC)

PART A

Non-technical guidance

1. Who is the guidance aimed at and why?

1.1 This advice is aimed at developers, consultants, and planners involved in planning and assessing development proposals in the landscapes surrounding the Hestercombe House SAC.

1.2 The overall aim is for a clearer approach to considering impacts of development on the SAC. The guidance provides a consistent basis for understanding how rare horseshoe bats use the landscape and where there is likely to be greater risk or opportunity for development. This will help inform strategic planning for the area's future housing needs.

1.3 The guidance will comprise a component of the development management process, to be considered in line with relevant policies, such as policy DP8 (Environment) of the of the Taunton Deane Adopted Core Strategy 2011 - 2028; policies TAU2 and TAU3 of the Taunton Deane Adopted Site Allocations and Development Management Plan; Policy D15 (Bat Consultation Zone) of the Sedgemoor District Council Local Plan; Policy DM2: Biodiversity and geodiversity of the Somerset County Council Minerals Plan; and Policy DM3: Impacts on the environment and local communities of the Somerset County Council Waste Core Strategy

1.4 At project level the guidance will help identify key issues at pre-application stage that can inform the location and sensitive design of development proposals and minimise delays and uncertainty. Within the areas identified, there will be clear requirements for survey information and a strong emphasis on retaining and enhancing key habitat for bats and effective mitigation where required. This will demonstrate that development proposals avoid harm to the designated bat populations and support them where possible.

1.5 The guidance explains how development activities can impact the SAC and the steps required to avoid or mitigate any impacts. It applies to development proposals that could affect the SAC and trigger the requirements of the Habitats Regulations (see Annex 7).The local planning authority will consider, on the basis of evidence available, whether proposals (planning applications) are likely to impact on horseshoe bats and hence require screening for Habitats Regulations Assessment (HRA). Those are the proposals to which the guidance will be applied. This will reduce the likelihood that it would be applied to minor developments which would not have an impact on the SAC.

1.6 The guidance brings together best practice and learning from areas with similar approaches, such as Somerset County Council and South Hams, and the best scientific information available at the time of writing. It will be kept under review by Somerset West and Taunton Council, Somerset County Council and their partners and is fully endorsed by Natural England. The planning guidance is part of a wider approach that is being pursued by partner organisations to safeguard and improve habitat for rare bats that includes farm management. The guidance is also consistent with Natural England's Site Improvement Plan for the SAC.

2. What is the Bats SAC?

2.1 Special Areas of Conservation (SAC) are European sites of international importance for wildlife. The SAC is important for Lesser Horseshoe bats. The SAC itself comprises the component Hestercombe House Site of Special Scientific Interest.

2.2 However the landscapes around the SACs themselves itself are also important in providing foraging habitat needed to maintain the favourable conservation status of Lesser Horseshoe bats. This is termed Functionally Linked Land. Therefore, the guidance sets out strong requirements for consultation, survey information and appropriate mitigation, to demonstrate that development proposals will not adversely impact on the designated bat populations.

3. Bat Consultation Zone

3.1 The guidance also identifies the "Bat Consultation Zone" where horseshoe bats may be found, divided into bands A, B and C, reflecting the likely importance of the habitat for the bats and proximity to maternity and other roosts.

3.2 Within the Consultation Zone development is likely to be subject to particular requirements, depending on the sensitivity of the site.

4. Juvenile Sustenance Zones

4.1 It is considered that mature woodland within 600 metres (m) of a Lesser Horseshoe bat maternity roost is also sensitive as the habitat is likely to be used by juveniles. New build developments should avoid the loss of such woodland and connecting habitat between the maternity roost and woodland.

5. Need for early consultation

5.1 Section 3 of Part B of the guidance stresses the need for pre-application consultation for development proposals.

5.2 Within bands A or B of the Consultation Zone, proposals with the potential to affect features important to bats (identified in Section B paragraph 3.2 below) should be discussed with the local authority and/or Natural England as necessary.

5.3 Within band C developers should take advice from their consultant ecologist.

6. Survey requirements

6.1 Section 3 of Part B and Annex 3 of the guidance sets out the survey requirements normally applying to development proposals within the Bat Consultation Zone. Outside the Bat Consultation Zone development proposals may still have impacts on bats, and developers should have regard to best practice guidelines, such as Bat Conservation Trust survey guidelines and Natural England's Standing Advice for Bats.

6.2 For proposals within the Consultation Zone (all Bands), developers must employ a consultant ecologist at an early stage to identify and assess any impacts.

6.3 For proposals within bands A and B of the Bat Consultation Zone, full season surveys will be needed (unless minor impacts can be demonstrated), and must include automated bat detector surveys. Survey results are crucial for understanding how bats use the site, and therefore how impacts on horseshoe bats can be avoided, minimised or mitigated. Where mitigation is needed the survey results will inform the metric for calculating the amount of habitat needed (see Annex 5).

6.4 Within band C survey effort required will depend on whether a commuting structure is present and the suitability of the adjacent habitat to support prey species hunted by horseshoe bats.

7. Proposed developments with minor impacts

7.1 In some circumstances a developer may be able to clearly demonstrate (from their qualified ecologist's site visit and report) that the impacts of a proposed development are proven to be minor and can be avoided or mitigated (or do not require mitigation) without an impact on SAC bat habitat, so a full season's survey is not needed. This should be substantiated in a suitably robust statement submitted as part of the development proposals.

8. Need for mitigation, possibly including provision of replacement habitat

8.1 Within the Bat Consultation Zone (all Bands), where SAC bats could be adversely affected by development appropriate mitigation will be required.

8.2 Development proposals should seek to retain and enhance existing habitats and / or features of value to bats such as those listed in paragraph 3.2 of Part B in this guidance. Where this is not, or is only partially possible appropriate mitigation such as the provision of replacement habitat will be required. The council's ecologist will have regard to relevant considerations in determining the mitigation requirements, including survey results and calculations relating to quantity of replacement habitat. Annex 5 sets out the methodology and metric for calculating how much replacement habitat should be provided[1].

8.3 Any replacement habitat must be accessible to the Hestercombe Lesser Horseshoe bat population.

8.4 Where the replacement provision is to be made on land off-site (outside the red line development boundary for the planning application) any existing value of that land as bat habitat will also have to be factored in to the calculation.

8.5 Where the replacement provision is to be off site, and land in a different ownership is involved, legal agreements are likely to be needed to ensure that the mitigation is secured in perpetuity.

8.6 An Ecological Management Plan for the site must be provided setting out how the site will be managed for SAC bats in perpetuity.

8.7 Where appropriate a Monitoring Strategy must also be provided to ensure continued use of the site by SAC bats and include measures to rectify the situation if negative results occur.

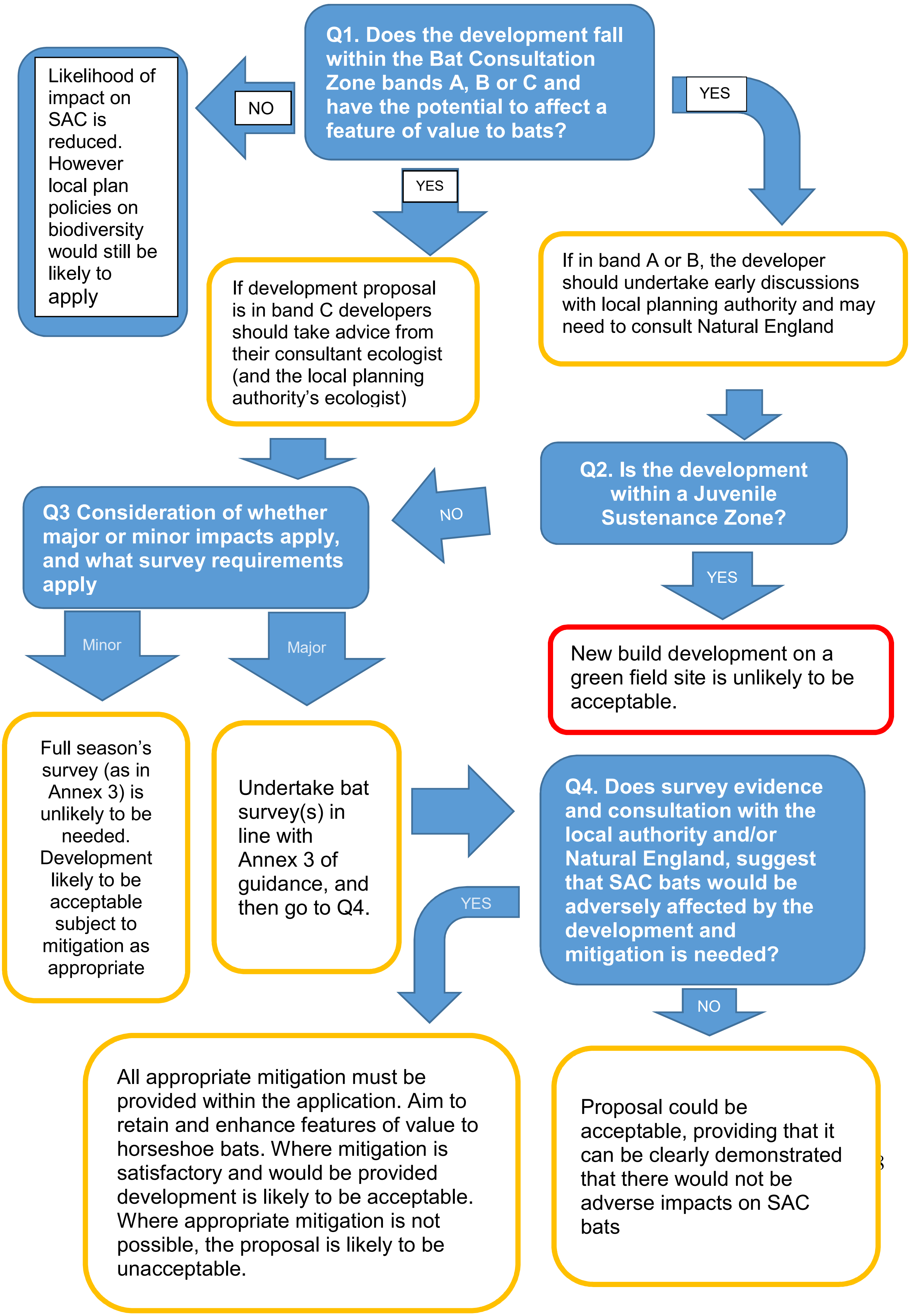
9. Enhancement

9.1 Development will be expected to provide enhancement for horseshoe bats. The National Planning Policy Framework (July 2018)[2] states that '*Planning… decisions should contribute to and enhance the natural… environment by… providing net gains for biodiversity*…' It is expected that development sides would provide a greater quantum of habitat in value than that lost due to the built development and associated infrastructure.

9.2 An example of the Excel worksheets used in calculating the quantum of replacement habitat required is given in Appendix 5 with a box showing the amount gained or lost due to a proposed development. It is expected that a percentage gain will be defined by Defra in due course.

[1] In the Somerset County area developers may ask the Local Planning Authority to carry out the calculation for the amount of habitat required to replace the value of that lost to horseshoe bats prior to the application being submitted, to check that the proposed master plan for the site has adequate land dedicated to the purpose. A charge may be levied for this service.

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf



Q1. Does the development fall within the Bat Consultation Zone bands A, B or C and have the potential to affect a feature of value to bats?
NO
Likelihood of impact on SAC is reduced. However local plan policies on biodiversity would still be likely to apply
YES
If development proposal is in band C developers should take advice from their consultant ecologist (and the local planning authority's ecologist)
YES
If in band A or B, the developer should undertake early discussions with local planning authority and may need to consult Natural England
Q2. Is the development within a Juvenile Sustenance Zone?
NO
YES
New build development on a green field site is unlikely to be acceptable.
Q3 Consideration of whether major or minor impacts apply, and what survey requirements apply
Minor
Major
Full season's survey (as in Annex 3) is unlikely to be needed. Development likely to be acceptable subject to mitigation as appropriate
Undertake bat survey(s) in line with Annex 3 of guidance, and then go to Q4.
Q4. Does survey evidence and consultation with the local authority and/or Natural England, suggest that SAC bats would be adversely affected by the development and mitigation is needed?
YES
NO
All appropriate mitigation must be provided within the application. Aim to retain and enhance features of value to horseshoe bats. Where mitigation is satisfactory and would be provided development is likely to be acceptable. Where appropriate mitigation is not possible, the proposal is likely to be unacceptable.
Proposal could be acceptable, providing that it can be clearly demonstrated that there would not be adverse impacts on SAC bats

PART B

Technical Guidance

1. Introduction

1.1 The Hestercombe House SAC is designated under the Habitats Directive 92/43/EEC, which is transposed into UK law under the Conservation of Habitats and Species Regulations 2017 ('Habitat Regulations). This means that the populations of bats supported by this site are of international importance and therefore afforded high levels of protection, placing significant legal duties on decision-makers to prevent damage to bat roosts, feeding areas and the routes used by bats to travel between these locations.

1.2 The primary reason for designation of the SAC is the Annex II species, the Lesser Horseshoe bats *Rhinolophus hipposideros*

1.3 The Conservation Objectives for the SAC[3] is: With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' which include the bat species listed above), and subject to natural change, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of habitats of the qualifying species;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which the habitats of qualifying species rely;
- The populations of qualifying species; and,
- The distribution of qualifying species within the site.

1.4 Therefore, planners and prospective developers need to be aware that the habitats and features which support the population of Lesser Horseshoe bats outside the designated site are a material consideration in ensuring the integrity of the designated site.

1.5 The purpose of this advice is not to duplicate or override existing legal requirements for protected bat species or their roosts. These aspects are well governed by the Natural England licensing procedures (Wildlife Management and Licensing Unit) for protected species.

[3] http://publications.naturalengland.org.uk/publication/5039159320248320

1.6 This document should serve as an evidence base and provide guidance on the planning implications for development control in the relevant local planning authority (LPA). There are opportunities beyond the scope of this document to use this evidence base to inform the preparation of land use plans through the local plans.

1.7 This advice is aimed at applicants, agents, consultants and planners involved in producing and assessing development proposals in the landscapes surrounding the Hestercombe House SAC. Within these areas there will be a strong requirement for survey information and mitigation for bats and their habitat in order to demonstrate that development proposals will not impact on the designated Lesser Horseshoe bat population.

1.8 The guidance explains how development activities can impact the SAC and the steps required to avoid or mitigate any impacts. It applies to development proposals that could affect the Hestercombe House SAC and trigger the requirements of the Habitats Regulations (see Annex 7).The local planning authority will consider, on the basis of evidence available, whether proposals (planning applications) are likely to impact on Lesser Horseshoe bats and hence require screening for Habitats Regulations Assessment (HRA). Those are the proposals to which the guidance will be applied. This will reduce the likelihood that it would be applied to minor developments which would not have an impact on the SAC.

1.9 An important objective of the advice is to identify areas in which development proposals might impact on the designated populations at an early stage of the planning process, in order to inform sensitive siting and design, and to avoid unnecessary delays to project plans by raising potential issues at the outset.

1.10 This technical guidance is based on the advice from experts and ecological consultants[4], current best practice and the best scientific information available at the time of writing. It will be kept under review by Somerset West and Taunton Council, Somerset County Council and Natural England.

2. Sensitive Zones for Lesser Horseshoe Bats

Introduction

2.1 To facilitate decision making and in order to provide key information for potential developers at an early stage, using the best available data a Bat Consultation Zone (See Plans 1 below) have been identified. This is based on an accumulation of known data, beginning with the on-going Somerset Bat Group monitoring of the Hestercombe House from the 1990s and including radio tracking studies of the Lesser Horseshoe bat maternity roost.[5] The data is constantly being added to and updated. Therefore, the

[4] See acknowledgements

[5] Billington, G. 2005. *Radio tracking study of Lesser Horseshoe bats at Hestercombe House Site of Special Scientific Interest, July 2005.* English Nature Somerset & Gloucestershire Team; Duvergé, L. 2008. *Report on bat surveys carried out at Hestercombe House SSSI Taunton, Somerset, in 2007 and 2008.* Cullompton: Kestrel Wildlife Consultants.

Plan reflect the current understanding of key roosts and habitat associated with the SAC.

Bat Consultation Zone (orange, yellow and pale yellow shading on Plan 1 below)

2.2 The Bat Consultation Zone illustrates the geographic area where horseshoe bats may be found. It is divided into three bands, A, B and C, reflecting the density at which horseshoe species may be found at a distance from a roost site. The basis for these distances is set out in Annex 2 and is based on the distances recorded through radio tracking studies at Hestercombe House and research into densities of occurrence throughout the species range. Note that the radio tracking studies only recorded the movements of a small number of bats from the maternity roost and therefore it is likely that any area within the Bat Consultation Zone could be exploited by Lesser Horseshoe bats.

Table 1: Band Widths for Horseshoe Bats

Band	Lesser Horseshoe bat (metres)	
	Maternity Roost	Other Roost
A	0 - 600	
B	601 - 2500	0 - 300
C	2501 - 6000	301 - 1250

2.3 The banding within the Bat Consultation Zone is centred on the maternity roosts at Hestercombe House. A smaller band is formed around the subsidiary roost in West Monkton which occurs within the bands formed from the maternity roost. Bontadina et al (2002)[6] recommended that a radius of 600 metres around a Lesser Horseshoe bat maternity roost should have special consideration. This area is particularly sensitive and new build development on green field sites should be avoided in this zone.

2.4 Band A is shown in orange shading; Band B in yellow; and Band C in pale yellow reflecting the decreasing density at which Lesser Horseshoe bats are likely to occur away from the home roost.

Horseshoe Bat 'Juvenile Sustenance Zones' (red and pink shading on Plan 2 below)

2.8 The Juvenile Sustenance Zone for Lesser Horseshoe bats includes all mature woodland within 600 metres of the maternity roost[7]. Juveniles select broadleaved woodland habitat[8]. It is highly unlikely that the biomass or shelter that such woodland provides can be replaced within development schemes. Consideration also needs to be given to connecting flight routes between the maternity roost and the woodlands.

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[6] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*.

[7] Bontadina et al recommends that conservation management should have special consideration within 600 metres of the roost. (Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*)

[8] Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.

3. Consultation and Surveys

3.1 For development proposals within the Juvenile Sustenance Zone it is essential that Natural England and the Somerset West and Taunton planning authority are consulted at an early stage of the process, as it is unlikely that new build development on or adjacent to woodland or links between the maternity roost and woodland sites could be made acceptable, due to the critical nature of the area in supporting the SAC population.

3.2 Where a proposal within Bands A or B of the Consultation Zone has the potential to affect the features identified below, early discussions with the local planning authority (who will consult Natural England as necessary) are also essential.

- Known bat roost
- On or adjacent to a Site of Special Scientific Interest (SSSI)
- Linear features: hedgerows, tree lines, watercourses, stone walls, railway cuttings
- Pasture, hay meadow, stream line, woodland, parkland, woodland edge
- Wetland habitat: ponds, marsh, reedbed, rivers, streams, rhynes
- Buildings or bridges, especially if these are not used or are undisturbed and particularly if there is a large void with potential access
- Cellars, mines, ice houses, tunnels or other structures with voids which produce tunnel-like conditions
- Development which introduces new lighting
- New wind turbine proposals (in respect of displacement)[9]

3.3 Early discussion refers to pre application stage prior to submission of a planning application; and, essentially, *before* any Master Plan proposals are submitted or finalised. This will ensure that adequate survey data is obtained. Please note that early discussions will also help inform likely mitigation requirements, and ensure, for example, that proposals seek to retain and enhance key features and habitats, and that sufficient land can be allocated for such avoidance and/or mitigation measures as may be required. This should result in appropriate bespoke mitigation measures that are designed in at an appropriately early stage. A site lighting plan with existing (pre-development) night time lux levels should also be provided.

3.4 In Band C developers should take advice from their consultant ecologist and planners from their ecologist colleagues.

3.5 Failure to provide the necessary information in support of an application is likely to lead to delays in registration and determination, and the application may need to be withdrawn. If insufficient information is submitted to allow the local planning authority

[9] Horseshoe bat casualties are very rare with only one Greater Horseshoe being recorded in Europe over the ten year period 2003 to 2013. (Eurobats. 2014. *Report of the Intercessional Working Group on Wind Turbines and Bat Populations*. EUROBATS.StC9-AC19.12)

to assess the application in accordance with the Habitats Regulations, the application is likely to be considered unacceptable.

3.6 For proposals within the Bat Consultation Zone (all Bands), an ecological consultant[10] should be commissioned at an early stage to identify and assess any impacts the proposals may have.

3.7 Surveys should determine the use of the site by Lesser Horseshoe bats, whether the site is being used as a commuting route or contains hunting territories or both. Survey results inform the metric for calculating the amount of replacement habitat required in the methodology set out in Annex 5. Consideration should be given to the site within the wider landscape.

3.8 Surveys should be carried out in accordance with the Survey Specification at Annex 3. Exact survey requirements will reflect the sensitivity of the site, and the nature and scale of the proposals. The ecological consultant will advise on detailed requirements following a preliminary site assessment and desk study.

3.9 It is essential to note that bat surveys are seasonally constrained. For proposals which have the potential to impact on the SAC, a full season (April to October inclusive) will be required, but this may not be necessary in certain circumstances, where this is demonstrable to the council's ecologist. (See Section B paragraphs 4.17 to 4.18 on minor impacts.) Winter surveys may be required for those developments in proximity to hibernation roosts. This will need to be included in the plan for project delivery at an early stage to avoid a potential 12-month delay to allow appropriate surveys to be undertaken.

3.10 Outside the Bat Consultation Zone, development proposals may still have impacts on bats. All species of bat and their roosts are protected by the Wildlife and Countryside Act (1981, as amended) and the Habitats Regulations. Further advice on potential impacts to bats is contained in Natural England's Standing Advice for Development Impacts on Bats, English Nature's Bat Mitigation Guidelines (2004) and the Bat Conservation Trust Bat Survey Guidelines for Professionals (2016).[11]

4. Mitigation within the Consultation Zone

4.1 Within the Bat Consultation Zone, where Lesser Horseshoe bats would be affected or potentially affected by development appropriate mitigation will be required. The aim should be to retain and enhance habitat and features of value to Lesser Horseshoe bats, such as those listed in paragraph 3.2 of Part B of this guidance. Where this is not possible replacement habitat may be needed. The council's ecologist will have regard to relevant considerations in determining the mitigation requirements, including

[10] Consultants should be members of CIEEM www.cieem.net or taken from the Environmental Consultants Directory www.endsdirectory.com

[11] http://www.naturalengland.org.uk/ourwork/planningdevelopment/spatialplanning/standingadvice/default.aspx ; Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition). London: Bat Conservation Trust; Mitchell-Jones, A. J. 2004. *Bat Mitigation Guidelines*. Peterborough: English Nature.[As updated]

survey results and calculations relating to replacement habitat. (See the methodology and metric in Annex 5.) The developer's ecologist should carry out the calculations when requested by the council's ecologist. Replacement habitat should always aim to be the optimal for the species affected.

4.2 The following are examples of habitats to which the above principles will apply:

- Hunting habitat such as woodland, ponds, watercourses, hedgerows, woodland edges, tree lines, rough grassland and pasture
- Connecting habitat, which is important to ensure continued functionality of commuting habitats. (Proposals should seek to retain existing linear commuting features as replacement of hedgerows is likely to require a significant period to establish).

4.3 The following are also important principles:

- Seek to maintain the quality of all semi-natural habitats and design the development around enhancing existing habitats to replace the value of that lost making sure that they remain accessible to the affected bats
- Maintain bat roosts in situ and maintain or replace night roosts, and consider enhancing provision of night roosting features. Night roosts are important for resting, feeding and grooming, particularly those located at distance from the main roost

4.4 Loss of habitat refers not only to physical removal but also from the effects of lighting. A development proposal will be expected to demonstrate that bats will not be prevented from using features by the introduction of new lighting or a change in lighting levels. Reference to specific lux levels will be expected. Lighting refers to both external and internal light sources. Applicants will be expected to demonstrate that considerations of site design, including building orientation; and the latest techniques in lighting design have been employed in order to, ideally, avoid light spill to retained bat habitats. Applicants will similarly be expected to demonstrate use of the latest techniques to avoid or reduce light spill from within buildings.

4.5 Where replacement habitat provision is necessary, the type(s) of habitat to be provided shall be agreed with the local authority's ecologist and/or Natural England as appropriate.

4.6 Where replacement habitat is required off site in mitigation the land should not be a designated Site of Special Scientific Interest, be contributing already to supporting conservation features or in countryside stewardship to enhance for bats.

4.7 Replacement habitat should aim to be the optimal for the species affected (See Annex 6). The following are examples of habitats of value to horseshoe bats and which may be created or enhanced as the replacement provision. Planting will be expected to consist of native species that produce an abundance of invertebrates, particularly lacewings, small aquatic flies and moth species.

- Woodland, especially associated with water features
- Hedgerows with trees – tall, bushy hedgerows at least 3 metres wide and 3 metres tall managed so that there are perching opportunities
- Wildflower meadow - managed for moths, e.g. Long swards

- Grazed pasture is difficult to impossible to recreate on site and only feasible with management agreements with local landowners over and above existing regimes. Even so there may be issues which prevent grazing in the future[12]
- Ponds - for drinking and a prey source for Lesser Horseshoe bats
- Provision of night roosting opportunities on site

4.8 The method for checking the adequacy of replacement habitat provided with an application or then in Master Planning of a proposed development, is given in Annex 5.

4.9 It is important that provision of the replacement habitat is carried out to timescales to be agreed by the local authority and/or Natural England as appropriate.

4.10 In the case of quarries, waste sites or other large scale sites where restoration is proposed this should not be considered as mitigation for habitat lost to horseshoe bats. The timescale to when these restorations are likely to be implemented, i.e. 40 years after the quarry has been worked, is too long to provide any replacement to maintain the existing population at the time of impact.

4.11 **It is vital that any replacement habitat is accessible to the Lesser Horseshoe bat population affected.**

4.12 A Landscape and Ecological Management Plan for the site must be provided setting out how the site will be managed for SAC bats for the duration of the development. Where appropriate a Monitoring Strategy also needs to be included in order to ensure continued use of the site by SAC bats and includes measures to rectify the situation if negative results occur.

Lighting

4.13 Lesser Horseshoe bats are known to be a very light sensitive species and are linked to linear habitat features. Recent research suggests that preferred commuting routes for Lesser Horseshoe bats are at lux levels even lower than previously thought: "*under natural, unlit conditions ... 0.04 lux*" but avoid levels above 3.6 Lux. (Stone, 2009; Stone et al, 2009) They regularly use dark hedgerows which are an average of 0.45 Lux. Stone et al (2009) stated, '*It is unsurprising that few bats flew along the unlit side of the hedge, given that light levels on the unlit side on lit nights (mean 4.17 lux) were significantly higher than those along dark hedges (mean 0.45 lux); even these relatively low light levels may make established routes unsuitable for commuting*.' They are potentially disrupted from flying along flight structures, such as hedgerows by introduced artificial light levels above 0.5 Lux. It was also found that continued disruption increased the effect, i.e. Lesser Horseshoe bats do not become habituated to the presence of artificial lighting.[13]

[12] For example see paragraphs 41 to 50 of Appeal Ref: APP/X1165/A/13/2205208 Land at Churston Golf Club, Churston, Devon, TQ5 0LA. https://acp.planninginspectorate.gov.uk/ViewCase.aspx?Caseid=2205208&CoID=0

[13] Stone, E. L. 2009. The impact of street lighting on lesser horseshoe bats *Presented at the South West Bat Conservation Trust Conference, 25 April, 2009;* Stone, E. L., Jones, G. & Harris, S. 2009. Street Lighting Disturbs Commuting Bats. *Current Biology* 19, 1123–1127, July 14, 2009; Stone, E.L 2013. *Bats and Lighting – Overview of current evidence and mitigation.* Bristol: University of Bristol)

4.14 in addition many night flying species of insect such as moths, a prey species for Lesser Horseshoe bats, are attracted to light, especially those lamps that emit a ultra-violet component and particularly if it is a single light source in a dark area. It is also considered that insects are attracted to illuminated areas from further afield resulting in adjacent habitats supporting reduced numbers of insects. This is likely to further impact on the ability of the horseshoe bats to be able to feed.[14]

4.15 A variety of techniques will be supported to facilitate development that will avoid, minimise and/or compensate for light spill:

- Use of soft white LED lights with directional baffles as required (LED light lacks a UV element and minimises insect migration from areas accessed by SAC bats)
- use of building structure, design, location and orientation to avoid/minimise lighting impacts on retained habitats
- use of landscaping and planting to protect and/or create dark corridors on site.
- use of SMART glass where appropriate
- use of internal lighting design solutions to minimise light spill from places such as windows
- use of SMART lighting solutions

See also the 'Guidance Note 08/18 Bats and artificial lighting in the UK' (Institute of Lighting Engineers/ Bat Conservation Trust, 2018) and widths of lighting zones illustrated in the Trowbridge Bat Mitigation Strategy SPD: Draft for Consultation.[15]

4.16 Prospective developers will be expected to provide evidence, ideally in the form of a lux contour plan and sensitive lighting strategy, with their application to demonstrate that introduced light levels will not affect existing and proposed features used by SAC bats to above 0.5 lux; or not exceeding baseline light levels where this is not feasible.

Proposed developments with minor impacts

4.17 In circumstances of overall less potential impact, especially in Band C, mitigation may be put forward without the need for a full season's survey. (See Annex 3) This approach will only be suitable where it can be clearly demonstrated that the impacts of a proposed development are proven to be minor and can be fully mitigated without an impact upon the existing (& likely) Lesser Horseshoe bat habitat. In order to adopt this approach, it will be necessary for a suitably qualified ecologist to visit the site and prepare a report with an assessment of existing (& likely) Lesser Horseshoe bat habitat. The information from this report should provide the basis to determine appropriate mitigation measures associated with the proposed development. The

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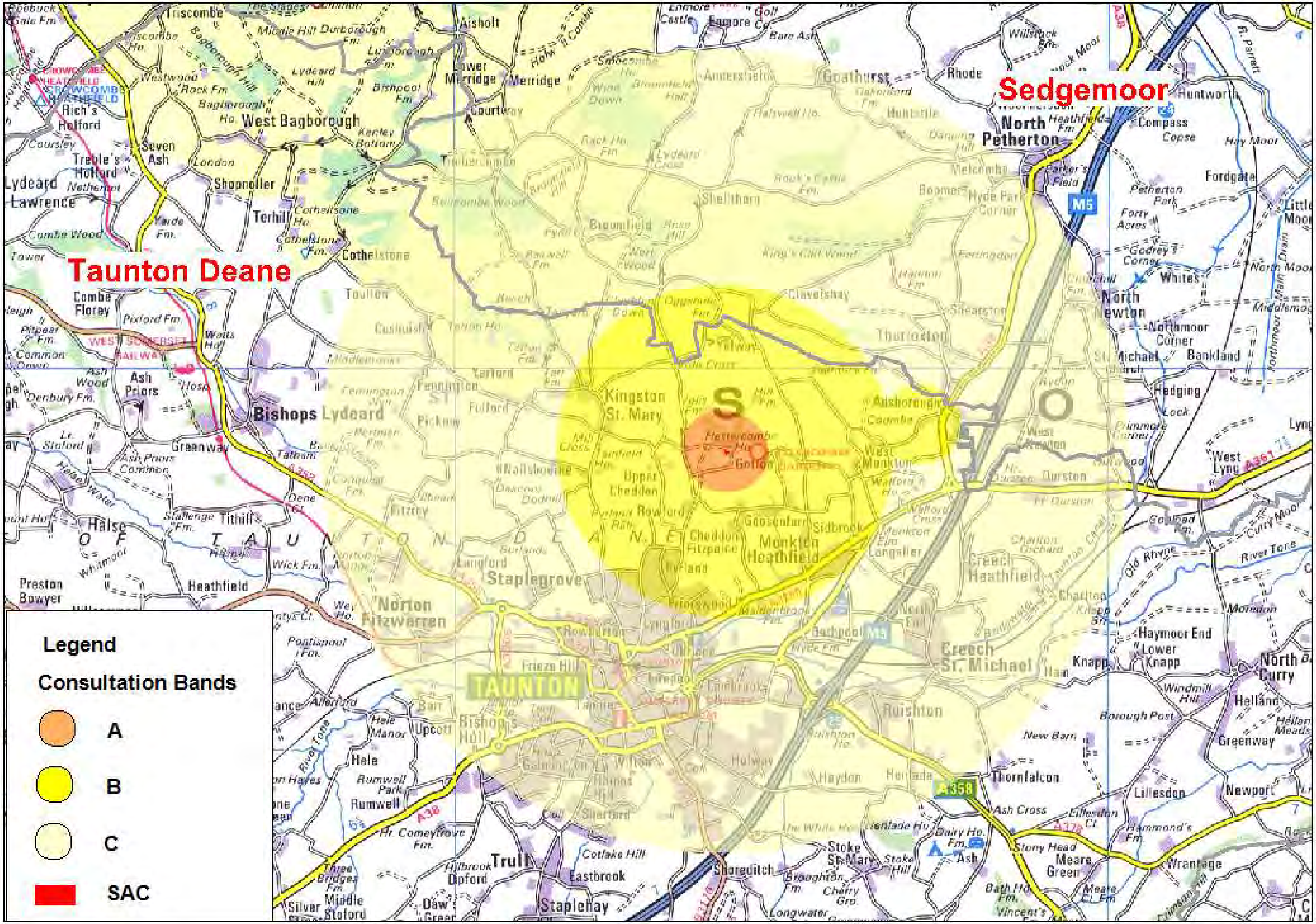
[14] Bat Conservation Trust/Institute of Lighting Engineers. 2008. *Bats and Lighting in the UK: Version 2*; pers. comm. Dr Emma Stone, University of Bristol, 2009.

[15] Institute of Lighting Engineers/ Bat Conservation Trust. 2018. *Guidance Note 08/18 Bats and artificial lighting in the UK* https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/; Bennet, J. & Mitchell, B. 2019. *Trowbridge Bat Mitigation Strategy SPD: Draft for Consultation*. Bradford-on-Avon: Johns Associates. http://wiltshire.objective.co.uk/portal/spatial_planning/spds/trowbridge_bat_mitigation_strategy_spd/the_trowbridge_bat_mitigation_strategy_spd?tab=files

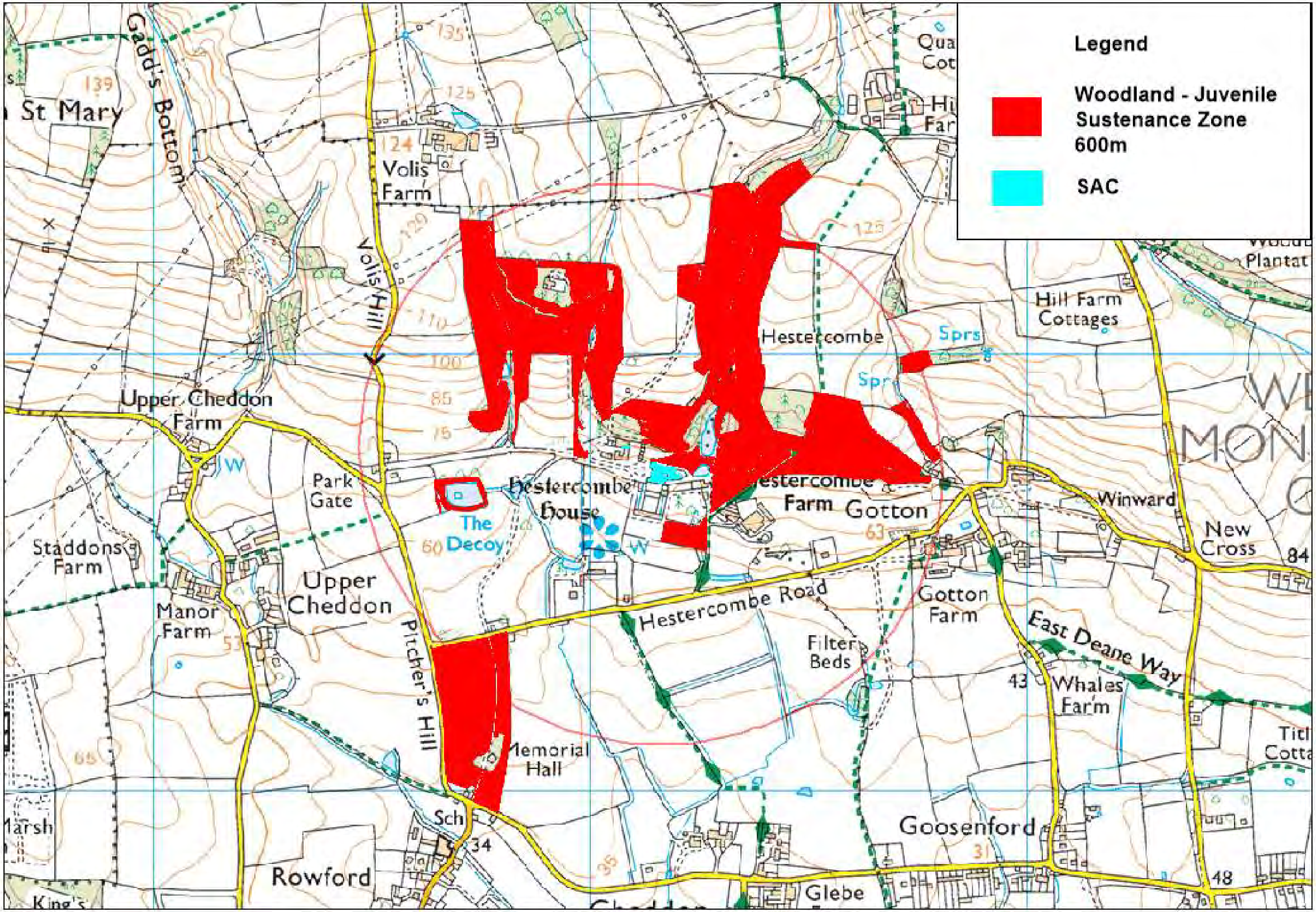
proposed mitigation should clearly demonstrate that there will be no interruption of suitable SAC bat commuting habitat. Replacement of foraging habitat may be required as appropriate.

4.18 There may also be situations where mitigation will not be required because the proposed development does not have an impact upon existing (& likely) Lesser Horseshoe bat habitat. In adopting this approach it will be necessary to substantiate this with a suitably robust statement as part of the submission of the development proposals. In terms of impacts on SAC bats and habitat, it is important to bear in mind that minor proposed developments do not necessarily equate with small developments.

Plan 1: Bat Consultation Zone



Plan 2: Juvenile Sustenance Zone



PART C Annexes

Annex 1: Details of the Hestercombe House Special Area of Conservation

A1.1 The Hestercombe House SAC is made up of 1 component Site of Special Scientific Interest (SSSI):

- Hestercombe House SSS! (TDBC)

A1.2 A large Lesser Horseshoe bat *Rhinolophus hipposideros* maternity site in the vale of Taunton Deane. The bats roost in the roof void of part of a large building. Although only a small proportion of the UK population, this site has been included as representative of the species in south-west England. The designation also covers the stable loft which has been converted to a roost for Lesser Horseshoe bats.

A1.3 The SSSI citation states, '*Hestercombe House is a former country house and estate consisting of mixed woodland, pasture, lakes and landscaped gardens. The colony of lesser horseshoes utilise two roof voids within the former stable block and domestic outbuildings as maternity (breeding) roosts during the summer months, with a small number of bats also using the roofs as hibernation sites during the winter*'.

A1.4 Natural England recorded that the baseline population as being 250 Lesser Horseshoe bats on designation16. Although there are natural fluctuations in the population size of the roost there has been a trend that shows a decline in numbers. Since 2008 when a total of around 120 bats were counted in June the trend has continued the with a total of around 90 being counted in 2010. Counts for 2009 were conducted earlier in late May and later in mid-June. In 2012 the counts for the "main roost" at the back of the house were only 47 on 6th June and 55 on the 13th June. At the stables we had 78 and 76 respectively. Although this is a slight rise in numbers from 2010 the overall trend remains downward and the count is below the starting baseline.

A1.5 Total counts of Lesser Horseshoe bats using both roosts for 2013 and 2014 in mid-June are 139 and 137 respectively. On the 14th June 2017 the number of Lesser Horseshoe bats counted emerging from the house roost was 34 and from the stables 107, a total of 141 bats. On the 22nd June the numbers were 86 from the house and 41 from the stable, a total of 127 bats. There has been an increase in numbers from 2010, which has levelled off since 2012 at around 131 to 141 Lesser Horseshoe bats annually.

A1.6 However, roost counts carried out by Gekoella in 2018 has shown that Lesser Horseshoe bats exit the house roost in other directions than that used annually by the Somerset Bat Group. This survey recorded 248 Lesser Horseshoe bats in August but would include juveniles.[17]

[16] http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0030168.pdf.
[17] Pers. Comm. Jason Ball, Gekoella, 30/08/2018

A1.7 In terms of physical area, the SAC designation applies to a very tiny element of the habitat required by the bat population (the maternity roosts and entrances to their hibernation sites). It is clear that the wider countryside supports the bat populations because of the following combination of key elements of bat habitat:

A1.8 *The area has to be large enough to provide a range of food sources capable of supporting the whole bat population; the bats feed at a number of locations through the night and will select different feeding areas through the year linked to the seasonal availability of their insect prey:*

1. Lesser Horseshoe bats regularly travel through the administrative areas of the Taunton Deane and Sedgemoor between feeding sites and their roosts via a network of established flyways. In the spring and autumn Lesser Horseshoe bats travel between hibernacula and maternity sites, and in the autumn to mating sites occupied by single males. Bats need a range of habitats during the year in response to the annual cycle of mating, hibernating, giving birth and raising young;

2. It follows that Lesser Horseshoe bats need to be able to move through the landscape between their roosts and their foraging areas in order to maintain 'Favourable Conservation Status'. They require linear features in the landscape to provide landscape permeability. Compared to most other bat species, the echolocation call of the Lesser Horseshoe bat attenuates rapidly in air due to its relatively high frequency. This means it cannot 'see' a great distance and is one reason why it tends to use landscape features to navigate, such as lines of vegetation (e.g. hedgerows, woodland edge, vegetated watercourses, etc.). The Lesser Horseshoe bat will tend to commute close to the ground up to a height of 2 metres, and mostly beneath vegetation cover. Radio tracking studies and observations in the field confirm that Lesser Horseshoe bats will regularly use the interconnected flyways associated with lines of vegetation. Further studies have shown that landscapes with broadleaved woodland, large bushy hedgerows and watercourses are important as they provide habitat continuity.[18] Habitat is therefore very important to Lesser Horseshoe bats in terms of *quality* (generation of insect prey) and *structure* (allowing them to commute and forage);

3. Lesser Horseshoe bats are sensitive to light and will avoid lit areas[19]. The interruption of a flyway by light disturbance, as with physical removal/ obstruction, would force the bat to find an alternative route which is likely to incur an additional energetic burden and will therefore be a threat to the viability of the bat colony. In some circumstances, an alternative route is not available

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[18] Billington, G. 2005. *Radio tracking study of Lesser Horseshoe bats at Hestercombe House Site of Special Scientific Interest, July 2005.* English Nature Somerset & Gloucestershire Team; Duvergé, L. 2008. *Report on bat surveys carried out at Hestercombe House SSSI Taunton, Somerset, in 2007 and 2008.* Cullompton: Kestrel Wildlife Consultants; Motte, G. & Libois, R. 2002. Conservation of the lesser horseshoe bat (Rhinolophus hipposideros Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool.,* 132 (1): 47-52.

[19] Stone, E. L., Jones, G. & Harris, S. 2009. Street Lighting Disturbs Commuting Bats. *Current Biology* 19, 1123–1127, July 14, 2009

and can lead to isolation and fragmentation of the bat population from key foraging areas and/or roosts. The exterior of roost exits must be shielded from any artificial lighting and suitable cover should be present to provide darkened flyways to assist safe departure into the wider landscape[20].

4. The feeding and foraging requirements of the Lesser Horseshoe bat have been reasonably well studied in the south west of England and Europe[21]. From this work we know that most feeding activity is concentrated in an area within 2.5km of the roost. The most important types of habitat for feeding have been shown to be woodland particularly where associated with water, and pasture. Depending upon the availability of suitable flyways and feeding opportunities, most urban areas will provide limited Lesser Horseshoe bat habitat.[22]

A1.9 The population of Lesser Horseshoes bats from the Hestercombe House SAC is currently under particular stress from a number of factors, particularly the number of development applications and proposals on the urban edges of Taunton.

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[20] see EN research reports R174

21 Motte, G. & Libois, R. 2002. Conservation of the lesser horseshoe bat (Rhinolophus hipposideros Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool*., 132 (1): 47-52; Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2003. *Foraging and Roosting Behaviour of Lesser Horseshoe Bats at Ciliau, Radnor*. Ledbury: The Vincent Wildlife Trust; Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.

[22] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that lesser horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond.* (2002) 258, 281-290; Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. *Protection et restauration des habitats de chasse du Petit rhinolophe*. Paris: Société Français pour l'Etude et la Protection des Mammifères; Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.

Annex 2: Bat Consultation Zones

A2.1 The Bat Consultation Zone density Band widths will vary from species to species depending on its characteristic use of its home range. Those for Lesser Horseshoe bats are given in the Table below. As both these species use a single focus for a population, a roost, they are likely to occur at a decreasing density in the landscape the further removed from the centre (e.g. see Rainho & Palmeirim, 2011; Rosenberg & McKelvey, 1999[23]).

A2.2 The Band widths for Lesser Horseshoe bats are derived from the radio tracking study carried out by Knight (2006)[24] for a lowland study area (as opposed to high quality and upland landscapes) which was located in North Somerset. The maximum distance travelled in this study was 4.1km for an adult female and 4.5km for a nulliparous female. The mean maximum range was 2.2km. Bontadina et al (2002)[25], whose study found a similar maximum foraging range, recommended that conservation management should be concentrated within 2.5km of the roost with special consideration within 600 metres of the roost where the colony foraged half the time. The same result was found for the North Somerset study.

A2.6 Radio tracking of Lesser Horseshoe bats carried out by Bontadina et al (2002) [26] estimated the density of Lesser Horseshoe bat foraging in their study area was 5.8 bats per hectare within 200 metres of the maternity roost, decreasing to 1 bat per hectare at 390 metres and 0.01 bats per hectare at 1200 metres. Knight (2006) [27] when carrying out a radio tracking for a Lesser Horseshoe bat roost of 200 individuals in North Somerset estimated a foraging density of 0.13 bat/hectare within 2 km of the roost and, like the Bontadina et al study, density declined sharply within the first kilometer in two of the study sites and subsequently at a lower rate out to the extent of the recorded foraging distance. A third study site in a high quality landscape showed a steadier rate of decline in density throughout the range.

Table 2: Band Widths for Horseshoe Bats

Band	Lesser Horseshoe bat (metres)	
	Maternity	Other
A	0 - 600	
B	601 - 2500	0 - 300
C	2501 - 4100	301 - 1250

[23] Rainho, A. & Palmeirim, J. W. 2011. The Importance of Distance to Resources in the Spatial Modelling of Bat Foraging Habitat. *PLoS ONE, April 2011, 6, 4, e19227*; Rosenberg, D. K. & McKelvey, K. S. 1999. Estimation of Habitat Selection for Central-place Foraging Animals. *Journal of Wildlife Management 63 (3): 1028 -1038.*
[24] Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.
[25] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290.*
[26] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290.*
[27] Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.

A2.7 The Band widths for the non-breeding roost are derived from England radio-tracking of Lesser Horseshoe bats carried out in the winter. This study revealed that they foraged on average to a maximum distance of 1.2 kilometers from the hibernation site. One bat travelled to an absolute maximum distance of 2.1 kilometers. The winter foraging range appears to be approximately half that of the distance covered in the summer months. (Bat Conservation Trust/BMT Cordah, 2005)[28] For the purposes of this study the ranges are similarly halved. A comparison of foraging ranges is given in Appendix 1.

Lesser Horseshoe Bat (Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust)

[28] Bat Conservation Trust / BMT Cordah. 2005. ***A Review and Synthesis of Published Information and Practical Experience on Bat Conservation within a Fragmented Landscape***. Cardiff: The Three Welsh National Parks, Pembrokeshire County Council, Countryside Council for Wales

Annex 3: Survey Specification for Surveys for Planning Applications Affecting SAC Consultation Zones.

A3.1 Three types of survey are required to inform the impact of proposed development. These are:

- Bat Surveys
- Habitats / Land use Surveys
- Light Surveys

Bat Surveys

A3.2 The following sets out the survey requirements for development sites within the Bat Consultation Bands A and B in part based on the guidance given by the Bat Conservation Trust (2016)[29] and on the advice of consultants experienced in surveying for horseshoe bats. Note that the objective is to detect commuting routes and foraging areas rather than roosts.

A3.3 The following specification is recommended in relation to development proposals within Bands A and B of the Bat Consultation Zone. It is also worth mentioning the difficulty associated with detecting the Lesser Horseshoe bat's echolocation call compared to most other British bat species due to the directionality and rapid attenuation of their call. This fact emphasises the requirement for greater surveying effort and the value of broadband surveying techniques. It is recommended that the most sensitive equipment available should be used. It is also recommended that the local planning authority ecologist be contacted with regard to survey effort.

(i) Surveys should pay particular attention to linear landscape features such as watercourses, transport corridors (e.g. roads, sunken lanes railways), walls, and to features that form a linear feature such as hedgerows, coppice, woodland fringe, tree lines, ditches and rhynes and areas of scrub and pasture that may provide flight lines.

(ii) The main survey effort should be that using automated detectors. Automatic bat detector systems need to be deployed at an appropriate location (i.e. on a likely flyway). Enough detectors should be deployed so that each location is monitored through the survey period in order that temporal comparisons can be made. The period of deployment should be at least 50 days from April to October and would include at least one working week in each of the months of April, May, August, September and October (50 nights out of 214; ≈25%). For development within Band B of the Bat Consultation Zone of hibernation roosts winter surveys may be required.

(iii) The number of automated detectors will vary in response to the number of linear landscape elements and foraging habitat types, the habitat structure, habitat quality, used by horseshoe bats and taking into account their flight-altitude. Every site is

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[29] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition) London: Bat Conservation Trust

different, but the objective would be to sample each habitat component equally[30]. Generally:

- With hedges it depends on the height and width, and also whether they have trees, as to how many detectors might be needed to ensure the coverage is comprehensive no matter what the wind decides to do.
- With grassland, the number depends on whether the site is grazed or not; if it is we need a comparison of the fields with livestock and the fields without.
- In a woodland situation a sample with three detectors: one on the woodland edge, two in the interior with one in the canopy and one at eye-level.
- The open areas of a quarry are sampled with two detectors reflecting the un-vegetated and vegetated cliffs so the two can be compared.

(iv) Results from automated detectors recording should be analysed to determine whether the site supports foraging or increased levels activity as this affects the Band used in calculating the amount of replacement habitat required to mitigate losses to horseshoe bats.

(v) Manual transect surveys[31] should be carried out on ten separate evenings; at least one survey should be undertaken in each month from April to October[32], as the bats' movements vary through the year. Transects should cover all habitats likely to be affected by the proposed development, including a proportion away from commuting features in field. Moreover, manual surveys only give a snap shot of activity (10 nights out of 214; ≈5%) and less effective at detecting horseshoe bats therefore automated bat detector systems should also be deployed see section (ii).

(vi) Surveys should be carried out on warm (>10 °C but >15°C in late summer), still evenings that provide optimal conditions for foraging (insect activity is significantly reduced at low temperatures; see commentary below). Details of temperature and weather conditions during surveys should be included in the final report.

(vii) Surveys should cover the period of peak activity for bats from sunset for at least the next 3 hrs.

(viii) Transect surveys should preferably be with most sensitive equipment available. Digital echolocation records of the survey should be made available with the final report; along with details of the type and serial number of the detector.

(ix) Surveys should be carried out by suitably qualified and experienced persons. Numbers of personnel involved should be agreed beforehand with the appropriate Somerset authority or Natural England, be indicated in any report and be sufficient to thoroughly and comprehensively survey the size of site in question.

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[30] Pers. Comm. Henry Andrews, AEcol, 23/09/2016

[31] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition) London: Bat Conservation Trust

[32] The active bat season can vary e.g. shortened by prolonged cold winters and lengthened by warm 'Indian summers'

(x) Surveys should also include desktop exercises in collating any records and past data relating to the site via Somerset Environmental Records Centre (SERC), etc.

(xi) All bat activity should be clearly marked on maps and included within the report.

(xii) Basic details of records for the site should be passed to SERC after determination of the application.

A3.4 Survey effort in Band C is dependent on whether commuting structure is present and the suitability of the adjacent habitat to support prey species hunted by horseshoe bats. Nonetheless this should be in accordance with Bat Conservation Trust guidelines (Collins, 2016[33])

Habitats Surveys

A3.5 Phase 1 habitat, Integrated Habitat System or UK Habitat Classification surveys should be carried out for all land use developments within the Bat Consultation Zone. Surveys should also include information on the habitats on site for the five years previous to the current survey.

A3.6 Surveys must be extended to include the management and use of each field, e.g. whether the field is grazed or used as grass ley, and the height, width and management of hedgerows in the period of bat activity. Information can be sought from the landowner. If grazed, the type of stock and management regimes should be detailed if possible. Habitat mapping should include approximate hectarage of habitats to inform the methodology for calculating replacement habitat required.

Lighting Surveys

A3.7 Surveys of existing light levels on proposed development sites should be undertaken and submitted with the planning application in accordance with guidelines given in the 'Guidance Note 08/18 Bats and artificial lighting in the UK' (Institute of Lighting Engineers/ Bat Conservation Trust, 2018)[34]. This should cover the full moon and dark of the moon periods so that an assessment of comparative SAC bat activity on a proposed site can be ascertained.

A3.8 Baseline measurements should be taken systematically across the site or features in question. At each sample location, a reading should be taken at ground level on the horizontal plane (to give illuminance hitting the ground) and vertical readings should also be taken at each sample location at 1.5m above ground level. The orientation for vertical readings should be perpendicular to the surface/edge of the habitat feature in question (such as a hedgerow) to produce a 'worst case' reading. Further measurements at other orientations may prove beneficial in capturing influence of all

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[33] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines* (3rd Edition). London: Bat Conservation Trust

[34] Institute of Lighting Engineers/ Bat Conservation Trust. 2018. *Guidance Note 08/18 Bats and artificial lighting in the UK* https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/

luminaires in proximity to the feature or principal directions of flight used by bats. This survey data can then be used to inform the masterplan of a project.

A3.9 Surveys should also consider lighting, and the absence of such where a road would be subsequently street lit post development, outside the red line boundary of the proposed development site.

A3.10 A lux contour plan of light levels at least down to 0.5 Lux, modelled at 1.5 metre above ground level, should be submitted with the application. As a guide to master planning proposed development, the desired zonation for Lux levels from built areas are shown in the Trowbridge Bat Mitigation Strategy SPD[35].

Roosting Lesser Horseshoe Bats (Photo Jim Mullholland)

[35] Bennet, J. & Mitchell, B. 2019. *Trowbridge Bat Mitigation Strategy SPD: Draft for Consultation*. Bradford-on-Avon: Johns Associates.

Annex 4: Habitat Requirements of Lesser Horseshoe bats

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Prey

A4.1 The diet of the Lesser Horseshoe bat consists mostly of Diptera of the crepuscular sub-order Nematocera. Families of Nematocera Diptera recorded in the diet include Tipulidae (crane-flies), Ceratopogonidae (biting midges), Chironomidae (non-biting midges), Culicidae (mosquitoes), and Anisopodidae (window midges). Lepidoptera (moths), Trichoptera (caddis-flies) and Neuroptera (lacewings) are also eaten.[36]

A4.2 Due to their small body size they cannot cope with large prey, such as cockchafers. By comparison they eat smaller moth species than the Greater Horseshoe bat. The principal prey species for Lesser Horseshoe bats, using data collected at Hestercombe House SAC are from the Diptera and Lepidoptera families. At this location there were seven major prey categories comprised over 70% of the diet: Tipulidae (crane flies), Anisopodidae (window gnats), Lepidoptera (moths), Culicidae (mosquitoes), Hemerobiidae (brown lacewings), Trichoptera (caddis flies) and Ichneumonidae (ichneumon wasps)[37]

General

A4.3 '*The primary foraging habitat for Lesser Horseshoe bats is broadleaf woodland where they often hunt high in the canopy. However, they will also forage along hedgerows, tree-lines and well-wooded riverbanks*.'[38] Lesser Horseshoe bats are primarily a woodland feeding bat using deciduous woodland or mixed coniferous woodland and hedgerows. It has been found that landscapes that were most important contained a high proportion of woodland, parkland and grazed pasture, linked with linear features, such as overgrown hedgerows.

Woodland

A4.4 Lesser horseshoe bats prefer to hunt in woodland interiors where micromoth abundance is greatest. In the Wye valley in Monmouthshire studies revealed that Lesser Horseshoe bats significantly spend the majority of their time foraging in woodland. Broadleaved woodland predominated over other types of woodland and was shown to be a key habitat for the species. In the core foraging areas used by bats woodland accounted for 58.7 ± 5.2% of the habitats present. Although Lesser Horseshoe bats prefer deciduous woodland as foraging habitat they will occasionally hunt in conifer plantations. However, the biomass in coniferous woodland is smaller,

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[36] Vaughan, N., Jones, G. & Harris, S. 1997. Habitat use by bats (Chirpotera) assessed by means of a broad-band acoustic method. *Journal of Applied Ecology 1997, 34, 716-730*; Boye, Dr. P. & Dietz, M. 2005. English Nature Research Reports Number 661: *Development of good practice guidelines for woodland management for bats*. Peterborough: English Nature

[37] Boye, Dr. P. & Dietz, M. 2005. English Nature Research Reports Number 661: *Development of good practice guidelines for woodland management for bats*. Peterborough: English Nature; Knight Ecology. 2008. *Hestercombe House, Taunton, Somerset: Lesser Horseshoe bat Diet Analysis*. Clutton: Knight Ecology

[38] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

but where smaller blocks are surrounded by habitat productive in insect prey they will be used.[39]

A4.5 The Ciliau SSSI, designated for its Lesser Horseshoe bats, and also the River Wye, is surrounded by predominately pastoral habitats, with cattle grazing on lowlands and sheep grazing on higher areas. There are, however, high densities of broadleaved woodland, especially along watercourses, and some conifer plantations. Again Lesser Horseshoe bats foraged predominately in broadleaved woodland along the banks of the River Wye and its tributary streams. Woodland with watercourses has more importance. They were also recorded foraging in conifer plantations.[40]

A4.6 Furthermore, radio tracking carried out in the spring also revealed that coniferous woodland appeared to be more used for foraging than deciduous woodland and that coniferous woodland close to maternity colonies may provide refuge in certain weather conditions[41]

A4.7 Although Lesser Horseshoe bats prefer woodland in which to forage there is a further requirement as to the structure of the woodland. In Bavaria, except in one area, the distance between trees was large and in dense stands no activity was recorded. In Belgium it was found that the density of taller trees, either broadleaved or coniferous, must be low enough to allow the development of an under storey of shrub and coppice.[42]

Grassland

A4.8 Radio tracking research of Lesser Horseshoe bats shows that in foraging over pasture cattle must be actively grazing the field. Once cattle are removed from a field foraging by Lesser Horseshoe bats ceases immediately. However, pasture in such use offers a valuable and predictable food source at a time of year when bats are energetically stressed (pre- to post-weaning), because they are feeding their young. The report recommended a grazing density of 0.5 -1 cows per hectare. Scatophagidae can be one of the major prey categories in the diet of Lesser Horseshoe bats. The larvae of the Yellow Dung-fly *Scatophaga stercoraria* develop in cattle dung. The presence of pasture is also indispensable to the larval stage of development for certain species

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[39] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*; Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[40] Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2003. *Foraging and Roosting Behaviour of Lesser Horseshoe bats at Ciliau, Radnor.* Ledbury: The Vincent Wildlife Trust; Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. *Protection et restauration des habitats de chasse du Petit rhinolophe*. Paris: Société Français pour l'Etude et la Protection des Mammifères.

[41] Bat Conservation Trust. 2005. A Review and Synthesis of Published Information and Practical Experience on Bat Conservation within a Fragmented Landscape. Cardiff: The Three Welsh National Parks, Pembrokeshire County Council, Countryside Council for Wales

[42] Holzhaider, J., Kriner, E., Rudolph, B-U. & Zahn, A. 2002. Radio-tracking a Lesser Horseshoe bat (Rhinolophus hipposideros) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis, 49, 47-54*; Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52.*

(Tipulids), which form a significant proportion of the prey hunted by Lesser Horseshoe bats.[43]

Hedgerows

A4.9 Belgian research similarly showed that the feeding grounds for Lesser Horseshoe bats were deciduous woodland along with copses or mixed coniferous woodland. Woodland occupied 25% of the area within 1 kilometre of the roost. However, some foraging was observed in hedgerows. Hedgerows had an average density of 47 metres per hectare. Generally, bats selected areas that were of undulating countryside with hedgerows, tree lines and woodland in preference to flat open intensively farmed areas. In Austria hedgerows, tree lines and streams were only exploited where there was less forest.[44]

A4.10 Commuting corridors, such as tall bushy hedgerows, are important features for Lesser Horseshoe bats as they avoid crossing open areas and are vulnerable to the loss of these corridors. In Belgium no bat was recorded more than 1 metre from a feature. Stonewalls have been reported in use as commuting routes in Ireland.[45]

A4.11 At Ciliau SSSI Lesser Horseshoes only crossed the River Wye when fully dark. Lesser Horseshoe bats have been observed crossing roads where the tops of trees have touched.[46]

Others

A4.12 Lesser Horseshoe bats avoid dense scrub cover[47].

A4.13 Tipulid larval development is favoured by damp conditions. Therefore, any aquatic environments and/or marshes can provide a secondary prey source. Aquatic environments could also favour the production of caddis flies in certain months, such as May and late August / September when other food supplies may be erratic. There is significant caddis fly consumption at roosts close to extensive river or lake habitats.[48]

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[43] Cresswell Associates. 2004. *Bats in the Landscape Project*. The National Trust, Sherborne Park Estate; Knight,T. 2006. *The use of landscape features and habitats by the lesser horseshoe bat* (Rhinolophus hipposideros). PhD Thesis: University of Bristol

[44] Holzhaider, J., Kriner, E., Rudolph, B-U. & Zahn, A. 2002. Radio-tracking a Lesser Horseshoe bat (Rhinolophus hipposideros) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis, 49, 47-54*; Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52*.

[45] Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52;* Biggane, S. & Dunne, J. 2002. A study of the ecology of the lesser horseshoe colony at the summer roost in Co. Clare, Ireland: In *European Bat Research Symposium (9, 2002, Le Havre). Abstracts of presentations at the 9th European Bat Research Conference, August 26-30 at Le Havre, France. Bat Research News 43(3): 77*.

[46] Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2003. *Foraging and Roosting Behaviour of Lesser Horseshoe bats at Ciliau, Radnor. Ledbury*: The Vincent Wildlife Trust;

[47] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[48] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature

Annex 5: Methodology for Calculating the Amount of Replacement Habitat Required

Introduction

A5.1 The method used to calculate the amount of habitat required to replace that lost to a horseshoe bat population due to development is based on the requirements for maintaining that needed to support viable populations. It uses an approach similar to the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service (1980) to provide '…*for mitigation and compensation that can allow fair use of the land and maintain healthy habitats for affected species'*.[49] HEP is structured around the calculation of Habitat Units (HU), which are the product of a Habitat Suitability Index (quality) and the total area of habitat (quantity) affected or required[50].

A5.2 A key assumption is that habitat type, amount and distribution influence the distribution of associated animal species. It is also important to recognise that Habitat Suitability Index (HSI) models predict habitat suitability, not actual occurrence or abundance of species populations.[51]

A5.3 The HEP uses the Integrated Habitat System (IHS) developed by Somerset Environmental Records Centre, described below. It requires a Habitat Suitability Index for the horseshoe bat species scored on IHS descriptions, which are given in Appendices 2 and 3.

A5.4 Such methods are necessary to obtain an objective quantitative assessment that provides improved confidence that the mitigation agreed is likely to be adequate; and that a development will not significantly reduce the quantity or quality of habitat available to a horseshoe bat population; whereas current ecological impact assessments are often based on subjective interpretations. In Somerset they have been used since 2009 including for effects on Lesser Horseshoe bats to inform the adequacy of replacement habitat provided by the developer. The method has gone through planning inquiries including for a Nationally Significant Infrastructure Project.

A5.5 The methodology has also been reviewed and further developed with the Bat Conservation Trust.

Integrated Habitat System Mapping

A5.6 The Integrated Habitat System coding is used as a basis for describing and calculating habitat values used as a base in applying scores in Habitat Suitability Indices. The Integrated Habitat System (IHS)[52] classification comprises over 400 habitat categories, the majority drawn from existing classifications, together with descriptions, authorities and correspondences arranged in a logical hierarchy that allow application for different

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[49] http://www.fort.usgs.gov/Products/Software/HEP/

[50] U. S. Fish and Wildlife Service. 1980. *Habitat Evaluation Procedures ESM102*. Washington, D. C.: Department of the Interior.

[51] Dijak, W. D. & Rittenhouse, C. D. 2009. Development and Application of Habitat Suitability Models to Large Landscapes: in Millspaugh, J. J. & Thompson, F. R. 2009. *Models for Planning Wildlife Conservation in Large Landscapes*. London: Academic Press.

[52] http://www.somerc.com/integrated+habitat+system/

purposes. The classification can be customised for a geographical area or special project use without losing data integrity.

A5.7 The IHS represents a coded integration of existing classifications in use in the UK with particular emphasis on Broad Habitat Types, Priority Habitat Types, Annex 1 of the Habitats Directive and Phase 1[53].

A5.8 Standard habitat definitions from these classifications are combined into a hierarchy starting at the level of Broad Habitat Types, through Priority Habitat types, Annex 1 to vegetation communities which are coded. These are the Habitat Codes.

A5.9 Within IHS Habitat Codes are hierarchical with the numbers in the code increasing as the habitat becomes more specific. Descriptions of habitats can be found in IHS Definitions (Somerset Environmental Records Centre)[54]. For example:

- WB0 Broadleaved, mixed and yew woodland (Broad Habitat Type)
- WB3 Broadleaved woodland
- WB32 Upland mixed ashwoods (Priority Habitat Type)
- WB321 Tilio-Acerion forests on slopes, screes and ravines (upland) (Annex 1 Habitat)

A5.10 As well as Habitat Codes IHS provides Matrix, Formation and Land Use/Management Codes which are added as a string to the main Habitat Code to provide further description.

A5.11 Ideally habitat information for the whole of the geographic area of the Somerset authorities should be mapped in a GIS programme, such as MapInfo or ArcGIS. However, when used in ecological impact assessment for calculating the value of impacts of habitat change on a species population then at minimum it is only necessary that IHS coding is applied to the habitat types present on the proposed development site to enable the use of Habitat Suitability Indices in the HEP metrics.

Habitat Suitability Indices

Introduction

A5.12 A form of Habitat Suitability Indices (HSI) has been used in the United States and Canada since the early 1980s as a way of assessing the impacts of development on species' populations and distributions. In addition, they have been used to predict what replacement habitat needs to be created to maintain species' populations. The process assumes that the suitableness of habitat for a species can be quantified - the HSI. The overall suitability of an area for a species can be represented as a product of the geographic extents of each habitat and the suitability of those habitats for the species[55].

[53] Phase 1 (JNCC, 1993) habitat mapping can be converted to IHS by using the software provided by Somerset Environmental Records Centre.
[54] http://www.somerc.com/integrated+habitat+system/
[55] http://www.fort.usgs.gov/Products/Software/HEP/

Description

A5.13 In constructing the HSI the index scores are applied to each Habitat, and Matrix, Formation and Land Use / Management codes in the Integrated Habitat System (IHS) based on analysis of the ecological requirements, from existing literature and professional judgement, for each species assessed or mapped.

A5.14 Each IHS ‘Habitat’ category is scored on a scale of 0 to 6 (as defined below) using a potential or precautionary approach as a starting point, e.g. Broadleaved, mixed and yew woodland is assumed to be the Annex 1 broadleaved woodland habitat unless otherwise proved not. The score will be the same across each of the hierarchical levels of the IHS Habitat coding (e.g. poor is scored as 1 whether this is at broadest habitat level or priority habitat level unless there is discernible differences in the type of habitat used, e.g. oak or beech woodland)[56]. This means that the full range of scoring is used before the modifiers (the IHS Formation and Management codes) are applied.

A5.15 The Habitat Code scoring is considered in combination with the IHS Matrix codes[57]. These are either added or subtracted from the Habitat code, e.g. grassland score 3 + scrub score 2 would equal 5. This is to account for species, for example that use grassland with a matrix of scattered scrub or single trees, which would otherwise avoid open grassland habitat.[58] Habitat Codes have a range of 0 to 6 but when considered in combination must not exceed a score of 6 or fall below a score of 0, Where there is no effect from a Matrix type then a default score of 0 is used.

A5.16 All other Codes are scored between 0 and 1 and are multipliers. Where there is no effect from Formation, Management then a default score of 1 is used.

Table 3: Example of HSI Calculation

	Habitat Code	Matrix Code	Formation Code	Land Use / Management Code	HSI Score
Code	GI0	SC2	-	GM12	
Description	Improved Grassland	Scattered Scrub	-	Sheep Grazed	
HSI Score	3	1	1	0.75	3

A5.17 Scores will be applied such that a precautionary approach or 'potential' approach is taken, e.g. if a species requires grassland which is most valuable when grazed then grassland scores the top score. This potential score will take into account a combination of the Habitat and Matrix codes. The management modifier would then

[56] The 1 to 6 scale matches Defra's habitat distinctiveness range used in its metric.
[57] IHS considers that patches of scrub and single trees are matrix habitat acting in combination with main habitats types rather than separate habitats in their own right. It is possible that further sub codes be added to the grassland habitat codes, e.g. calcareous grassland with scattered scrub, etc. but this would lead to a proliferation of coding and current IHS GIS mapping would need amending to take this into account. Therefore, by providing a positive multiplier the needs of those species which require a mosaic of grassland and scrub is taken into account.
[58] IHS considers that patches of scrub and single trees are matrix habitat acting in combination with main habitats types rather than separate habitats in their own right.

maintain the habitat score at this high level by a multiplier of 1. If the management is not grazed a decimal multiplier is applied to reduce the value of the habitat. For example a grassland habitat is valued at 6 but by applying the relevant management code, i.e. either mown or other management type, the value of the habitat will be reduced. Only one management code is allowed. An example (non-horseshoe bat) is set out in Table 3 above. The HSI has a maximum score of 6.

A5.18 The definition of poor, average, good and excellent habitat is adapted from the 'Wildlife Habitat Handbook for the Southern Interior Ecoprovince', British Columbia, Ministry of Environment[59] and expanded, in consultation with the Bat Conservation Trust, as follows:

Excellent - provides for essential life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied >70% chance of occurrence, can support positive recruitment. Can be a critical life-cycle association.
Very good - provides for essential life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied 50 - 70% chance of occurrence, can support positive recruitment.
Good - provides for a life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied 40 -50% chance of occurrence, can support a stable population.
Average - provides for moderately required life needs, including feeding, reproduction or special needs and supports a relatively moderate population density, implied 25 - 40% chance of occurrence, can support a stable population.
Marginal - provides for marginally required life needs, including feeding, reproduction or special needs and supports a relatively modest population density, implied 15 - 25% chance of occurrence, can support a small population.
Poor - provides for a non-essential life needs, including feeding, reproduction or special needs and supports a relatively low population density, implied <15% chance of occurrence.

A5.19 It is recognised that not all habitat patches of the same type have equal value in terms of resource to a species, for example see Dennis, 2010[60]. However, in scoring the overall HSI, i.e. including all Habitat, Matrix, Formation codes, etc., it is considered that a higher value is given as a precaution.

A5.20 No allowance for seasonal variations, i.e. due to the availability of prey species at different times of year, has been made in developing the HSI. It is considered a habitat valued at 6 at a particular period but not at other times will remain at a value of 6 being necessary to support that species at that time of year when other prey or other resources may not be so readily available.

A5.21 The HSI score arising from the above calculation can be joined into a GIS base habitat map and displayed using thematic mapping to give a graphical representation of the

[59] For example, http://www.env.gov.bc.ca/wld/documents/techpub/r20.pdf
[60] Dennis, R.L.H. 2010. *A Resource-Based Habitat View for Conservation. Butterflies in the British Landscape.* Chichester: Wiley-Blackwell.

value of a landscape to horseshoe bats.

A5.22 The Habitat Suitability Index for Lesser Horseshoe Bats can be found in Appendix 2.

Lighting

A5.23 The value of a habitat may be affected by lighting, either from street lighting or other sources such as security or flood lights. This would have the effect of reducing the value of a habitat to horseshoe bats. This can be accounted for by either removing the area of habitat affected from that used in the metric or reducing the HSI score. It is advised that a note is made in the Excel spreadsheet used in calculating the habitat amount (see A5.39 below).

Validation

A5.24 An HSI model can be reviewed against occurrence data held by the biological records centre. The Gulf of Maine HSI work[61] established the principle of producing several HSI models for one species and retained the model, which had the best association with known occurrences. The mapping is produced and matched with species data at the biological records centre and the model refined to fit the records with a view to errors of omission and commission.

A5.25 Garshelis (2000)[62] concluded that the '...*utility of the models is to guide further study or help make predications and decisions regarding complicated systems; they warrant testing but the testing should be viewed as a never-ending process of refinement, properly called bench-marking or calibration*.' The validation should be seen as a continuous refinement process and HSI scoring should be reviewed from time to time and up dated[63].

A5.26 In this study HSI have initially been researched and scored by the author. However, the scores can be varied through review, further research findings or to reflect local conditions based on survey. Where varied by consultants the reason for the variation should be given and supported by evidence.

Density Band

A5.27 The HSI score is multiplied by the location of the proposed site in relation to that of the horseshoe bat roost. The Consideration Zone (CZ) is divided into three Density Bands. The three Bands are, ‘A’ closest to the record, ‘B’ and ‘C’ furthest from the record valued at 3, 2 and 1 respectively. The values are given in Table 4 below.

[61] http://www.fws.gov/r5gomp/gom/habitatstudy/Gulf_of_Maine_Watershed_Habitat_Analysis.htm

[62] Garshelis, D. L. 2000. Delusions in Habitat Evaluation: Measuring Use, Selection, and Importance: in Boitam, L. & Fuller, T. K. (eds.) 2000. *Research Techniques in Animal Ecology: Controversies and Consequences*. New York: Columbia University Press.

[63] http://www.fws.gov/r5gomp/gom/habitatstudy/Gulf_of_Maine_Watershed_Habitat_Analysis.htm

Table 4: CZ Band

Band	Score
A	3
B	2
C	1

A5.27 When two Bands occur within one field take the higher value as the score. The Density Band widths can be found in Table 1 above.

A5.28 Following ecological surveys for horseshoe bats carried out for the proposed development the Density Band score may be modified up depending on whether feeding activity was recorded or not or whether absence is recorded. This reflects uneven use of a home range and refines the value of the habitat for a species (e.g. see Bontadina & Naef-Daenzer, 2002[64]). Note that sufficient automated detectors should be deployed

A5.29 The following criteria should be used to modify the Band following the results of site surveys and applied to the whole of the proposed development site:

- Not present – Where potential habitat is present reduce the Band score down by 0.5, e.g. at A from 3 to 2.5; at B from 2 to 1.5; except at C where it reduced to 0.
- Commuting only – as the Band the site falls within
- Commuting and Foraging – increase the band score by 0.5 e.g. at C from 1 to 1.5; at B from 2 to 2.5; A stays as it is.

A5.30 The identification of 'foraging' (i.e. a higher level of activity) for horseshoe bat species is defined as either:

a) The criteria for foraging for horseshoe bat species, which have low intensity calls, makes use of Miller's (2001) Activity Index.[65] '*Call sequences with a negative minute on either side (i.e. a minute in which the species was not recorded) are judged to be commuting contacts, whereas contacts in two consecutive minutes or more are judged to be foraging contacts*.' 'Foraging' is defined as 6[66] or more such minutes over any three nights in the five nights on any one automated detector during the recording period.

b) Observed hunting behaviour in the field.

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[64] For example, see Bontadina, F. & Naef-Daenzer, B. 2002. Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging: in Bontadina, F. 2002. Conservation Ecology in Horseshoe Bats. PhD thesis. Universität Bern.
[65] Miller, B. 2001. A method for determining relative activity of free flying bats using a new activity index for acoustic monitoring. *Acta Chiropterologica* 3 (1): 93 – 105.
[66] Miller uses 9 consecutive passes when recording mostly *Myotis* species. As the hunting behaviour of *Rhinolophus* species is more difficult to record the number of passes has reduced by the coefficient applied to European bats species by Barataud for open to semi open environments, *Myotis* 1.67 compared to *Rhinolophus ferrumequinum* 2.5. (Barataud, M. 2015. *Acoustic Ecology of European Bats: Species Identification, Study of their Habitats and Foraging Behaviour*. Paris: Muséum nationale d'Histpire naturelle

Calculating the Habitat Unit Value

A5.32 For information the value of the proposed site to a horseshoe bat species in Habitat Suitability value is calculated by using the HSI Score and the Density Band (See Table 7 below). The outcome of the Habitat Suitability Units used in the HEP is on a scale of 0 to 18[67].

A5.33 The habitat replacement value required is calculated by multiplying the score by the hectarage of the habitat affected (hectares x [HSI x Band]) giving figure in **Habitat Units**. For example, an HSI x Band score of 12 for an area of 1.50 hectares would give a value of 18 Habitat Units.

A5.34 The resultant total of Habitat Units for the whole proposed development site could then be divided by 18 (6 [HS] x 3 [Band]) to arrive at the minimum area in hectares of accessible replacement habitat required to develop the proposed site

Table 5: Matrix Combining Habitat Suitability Score and Density Band

		Habitat Suitability Score					
		Poor **1**	**Marginal** **2**	**Average** **3**	**Good** **4**	**Very Good** **5**	**Excellent** **6**
Band	**A (3)**	3	6	9	12	15	18
	B (2)	2	4	6	8	10	12
	C (1)	1	2	3	4	5	6

A5.35 Hedgerows and some watercourses are not mapped as separate polygons in OS Mastermap and if a width is not known a default width of 3 metres is used and multiplied by the length to give an area in hectares. These values are usually small and do not significantly affect the overall area of a site, and for simplicity's sake and considering their value to wildlife are not deducted from the area of bordering fields, compartments or OS Mastermap polygons. If preferred calculations can be carried out separately for these features using linear measurements but the end result is the same, especially if a direct replacement value of the hedgerow or watercourse is required.

A5.36 Nonetheless hedgerow and other commuting structure should be seen as having a functional role and should normally be maintained or replaced to maintain horseshoe bat commuting across a proposed development site.

A5.37 <u>HEP calculations for development sites should be made on the basis that the total site</u>

[67] This range is in line with that used for the habitat metric used by Defra in its pilot projects 2012 -2014.

area would be lost to a species and would therefore produce a maximum replacement requirement to develop the site. This saves a separate calculation for the value of the existing habitat on which enhanced habitat is created. Where habitat remains unchanged and is retained by the development it is not included in the calculation.

Summary

A5.38 each habitat type within a proposed development site. The whole proposed development site should be included in the calculation.

The HSI = Habitat Code (Range 0 to 6) + or – Matrix Code (Range 0 to 6, Default 0) x Formation Code (Range 0 to 1) x Management Code (Range 0 to 1)

HSI x Band x hectares = Habitat Units required.

Habitat Units divided by 18 = hectares required

A5.39 An Excel spread sheet in which figures used to the calculate the amount of replacement habitat required as mitigation for a proposed development is available on Local Authority websites. This also contains linked spreadsheets to calculate the value of the replacement habitat provided (see A5.40 to A5.52), on or off site and a further spreadsheet for the value for an offsite receptor site (see A5.53 to A 5.54).

Replacement Habitat

A5.40 To check whether the master plan for the development site provides enough habitat equivalent to that lost due in mitigation a second Excel spreadsheet is provided. The scores for the new habitat are entered as for the calculation for the amount required to replace that lost. These habitats should in the first instance be aimed at providing optimal foraging habitat for horseshoe bats (although it is unlikely that some habitats such as woodland with water would be possible to re-create within a development site).

A5.41 Standard prescriptions that can be used for replacement habitats can be found in Annex 6. Habitats will need to be accessible and undisturbed by introduced lighting to count towards mitigation. As all habitats are considered optimal the HSI score would automatically be 6.

A5.42 In delivering the replacement habitat there may also be an issue or risk with delivering a functional offset and the timing of the impact. A loss in biodiversity would result and there could potentially be a risk to maintaining a species population during the intervening period even though it would recover in time. Therefore, it is important and desirable that where feasible replacement habitat is in place and functional just before development commences on site. However, functionality may not be achieved until several years after replacement habitat has been created and there is a risk that it may fail due to the difficulty in recreating or restoring. To account for these possibilities Fraction Multipliers are used. These are usually applied only once to the calculation for the value of the habitat lost to horseshoe bats.

A5.43 *The aim of a multiplier is to correct for a disparity or risk. In practice this is very difficult to achieve, not least because of uncertainty in the measurement of the parameters and the complexity of gathering the required data.*'[68] In order that any habitat creation or enhancement would functionally replace habitat lost to development (and the need to take a precautionary approach in the case of horseshoe bats, as features of European sites and European protected species) a 'fraction multiplier' is applied to the resultant Habitat Units needed to replace habitat lost to development in order to provide robust mitigation, e.g. to maintain 'favourable conservation status'.

A5.44 '*There is wide acknowledgement that ratios should be generally well above 1:1. Thus, compensation ratios of 1:1 or below should only be considered when it is demonstrated that with such an extent, the measures will be 100% effective in reinstating structure and functionality within a short period of time (e.g. without compromising the preservation of the habitats or the populations of key species likely to be affected by the plan or project.*[69] The Environment Bank recommend a two for one ratio where habitats are easily re-creatable contiguous to the development or on similar physical terrain as a minimum.[70]. In many other situations a significantly higher multiplier may be appropriate[71]. *The conclusion of the BBOP* [Business Biodiversity Offsets Programme] paper *(Ekstrom et al, 2008) is that where there are real risks around the methods and certainty of restoration or creation then the Moilanen framework is applicable; but for some other situations, (averted risk ...and where restoration techniques are tried and tested), lower ratios can be used.*[72]

A5.45 Appendices 3 and 4 give a guide to difficulty in creating and restoring habitats and the time frame required to reach maturity or functionality.

<u>Delivery Risk</u>

A5.46 As different habitats have different levels of difficulty in creation or restoration there will be different risks associated with each. '*Once there is an estimate of the failure risk, it is possible to work out the necessary multiplier to achieve a suitable level of confidence (Bill Butcher pers com; Moilanen, 2009; Treweek & Butcher, 2010). The work of Moilanen provides a basis for different multipliers of various levels of risk. We have used this work to come up with categories of difficulty of restoration/expansion, and associated multipliers, as set out in* [Table 8] *below*.'[73]

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[68] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.
[69] European Communities. 2007. *Guidance document on Article 6(4) of the'Habitats Directive' 92/43/EEC: Clarification of the concepts of: alternative solutions*, *imperative reasons of overriding public interest*, *compensatory measures*, *overall coherence, opinion of the commission.* Brussels: Office for Official Publications of the European Communities.
[70] Briggs, B., Hill, D. & Gillespie, R. 2008. Habitat banking – how it could work in the U.K. http://www.environmentbank.com/docs/Habitat-banking.pdf
[71] Moilanen, A., Van Teeffelen, A., Ben-Haim, Y. & Ferrier, S. 2009. How much compensation is enough? A framework for incorporating uncertainty and time discounting when calculating offset ratios for impacted habitat. *Restoration Ecology 17, 470-478*.
[72] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.
[73] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.

A5.47 Appendix 3 gives an indicative guide to risk levels which have been assigned to habitats to these broad categories using expert opinion by Defra (2011). Factors such as substrate, nutrient levels, state of existing habitat, etc. will have an impact on the actual risk factor, which may need to be taken into account.

Table 6: Multipliers for different categories of delivery risk (Defra, 2011)

Difficulty of recreation/restoration	Multiplier
Very High	0.1
High	0.33
Medium	0.67
Low	1

Temporal Risk

A5.48 In delivering replacement habitat there may be a difference in timing between the implementation of the development and the functionality and maturity of the replacement habitat in terms of providing a resource for the affected species

. This time lag would be minimised by calculation of existing habitat value in the pre-application stage and implementation of the habitat creation and / or restoration in consultation with the local authority and other nature conservation organisations. In some cases, the replacement habitat may be planted or managed concurrently with that of the site development.

A5.49 Where a time lag occurs a multiplier will be applied to take account of the risk involved to the 'no net loss' objective. These are set out in Table 9 below. Appendix 6 gives general guidance on how long different habitats would be expected to reach maturity. The actual multiplier used needs to be judged on a case by case basis.

A5.50 It is considered that some priority habitats cannot be recreated due to the length of time that they have evolved and the irreplaceability of some constituent organisms, at least in the short and medium terms. It is also considered that in the medium and longer terms the management of any replacement habitat may be uncertain. Therefore Table 7 has been constrained to a maximum period of 20 years. In some cases, the time lag for the development of a habitat to support a population may be too long to be acceptable.

Table 7: Multipliers for different time periods using a 3.5% discount rate[74]

Years to target condition	Multiplier
1	0.965
5	0.837
10	0.70
15	0.59
20	0.49

Spatial Risk

A5.51 A factor is added for spatial risk to cover instances where the replacement habitat is provided off-site and where to site of the replacement habitat is located in another Density Band than that of the development site, for example the development occurred in Band B and the off-site replacement habitat is located in Band A.

A5.52 In all cases, the creation of replacement habitat in a lower band, i.e. Band C for a development occurring in Band B should be avoided.

Off Site Replacement Habitat

A5.53 Where there are residual offsets, i.e. where the replacement habitat cannot be created within the proposed development sites red line boundary an allowance is calculated for the value of the existing habitat on the intended habitat creation site as this will be lost or included in the value of any enhancement. Where replacement habitat is located offsite then the value of that site needs to be taken into account.

A5.54 It is critical that the replacement site where habitat has been enhanced is accessible to the population of horseshoe bats affected.

Enhancement

A5.55 The National Planning Policy Framework (July 2018) states that states that '*Planning policies and decisions should contribute to and enhance the natural… environment by… providing net gains for biodiversity*…' The result of the metric should show a gain in hectares in order that enhancement is achieved.

A5.56 In December 2018 Defra published its consultation on net gain in biodiversity[75]. This stated '*Our initial view is that a 10% gain in biodiversity units would be a suitable level of net gain to require in order to provide a high degree of certainty that overall gains will be achieved, balanced against the need to ensure any costs to developers are proportionate. In practice, this means that if a site is worth 50 biodiversity units before development, the site (and any offset sites and tariff payments) should be worth 55 units at the scheme's conclusion. The proposed 10% would be a mandatory national*

[74] http://publications.naturalengland.org.uk/publication/6020204538888192
[75] https://consult.defra.gov.uk/land-use/net-gain/supporting_documents/netgainconsultationdocument.pdf

requirement, but should not be viewed as a cap on the aspirations of developers that want to voluntarily go further or do so in the course of designing proposals to meet other local planning policies.'

Annex 6: Habitat Creation Prescriptions for Lesser Horseshoe Bats[76]

A6.1 The following are standard prescriptions that can be used as replacement habitat both on development sites and at off-site locations. They are all considered to be scoring 6 in terms of HSI.

Woodland with Water

A6.2 Lesser Horseshoe bats hunt a variety of insects which are generally smaller than those consumed by Greater Horseshoe bats. These include micromoths, gnats, midges, mosquitoes, craneflies, brown lacewings, caddis flies and ichneumon wasps. Barataud et al (2000) found that woodland associated with water was the habitat most preferred by Lesser Horseshoe bats.

A6.3 Micromoth abundance is positively related to the relative abundance of native trees[77] and unlike macromoths the percentage cover of understory in a woodland patch. Micromoth abundance was higher within the woodland interior than at the edge. The shape of the woodland patch was important particularly for woodland micromoth species, indicating that patches of compact shapes (with proportionally less edge exposed to the surrounding matrix) sustain a larger number and larger populations of woodland species of micromoths. This highlights the importance of designing patches of compact shapes, especially when the patch to be created is small. Brown lacewings can be found amongst conifers.

A6.4 Woodland trees and shrubs should be planted in naturalistic non-linear patterns. Scalloped edges and bays will provide sheltered areas with higher insect concentrations. Provide a variety of types of vegetation from trees to shrubs and rough grass. Overhanging branches and bushy shrubs should be left to provide cover. Woodland edges can be used both by bats that fly in woodland and in the open. When developed the woodland should not be coppiced.

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[76] Derived from Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. ***Protection et restauration des habitatas de chasse du Petit rhinolophe (***Rhinolophus hipposideros***) Année 2000***. Paris: Ministère de l'Environnement – Direction de la Nature et des Paysages ; Fuentes-Montemayor,E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275; Chinery, M. 2007. *Insects of Britain and Western Europe*. London: A & C Black; Fuentes-Montemayor, E., Goulsion, D.& Park, K. J. 2010, The effectiveness of agri-environment schemes for the conservation of farmland moths: assessing the importance of a landscape-scale management approach. *Journal of Applied Ecology* 48, 532-542; Entwistle, A. C., Harris, S., Hutson, A. M., Racey, P. A., Walsh, A., Gibson, S. D., Hepburn, I. & Johnston, J. 2001. *Habitat management for bats: A guide for land managers, land owners and their advisors*. Peterborough: Joint Nature Conservation Committee.

[77] '*Many native tree species (e.g. Betula sp., Quercus sp. and Salix sp.) have large numbers of moth species associated with them (i.e. feeding on them), although this is not always the case and there are native trees (e.g. Fagus sylvatica) which support relatively few moth species, comparable in number to those supported by non-native trees (e.g. Acer pseudoplatanus; Young, 1997)*' [Fuentes-Montemayor, E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275]; Entwistle, A. C., Harris, S., Hutson, A. M., Racey, P. A., Walsh, A., Gibson, S. D., Hepburn, I. & Johnston, J. 2001. *Habitat management for bats: A guide for land managers, land owners and their advisors*. Peterborough: Joint Nature Conservation Committee.

A6.5 Mosquitoes and caddies fly larvae are aquatic, as can be gnat larvae. Gnats and midges also use damp places near water to breed. Therefore the incorporation of ponds in association with the woodland habitat is likely to increase their value to Lesser Horseshoe bats. Ponds with permanent water should be created. It is possible that these could form attenuation features as part of the surface water mitigation for a development. They should be designed so that water is maintained within them throughout the year.

A6.6 Variation on the banks of ponds favours high insect and structural diversity. Design in as many natural features as possible, including varied depths, diverse aquatic and bankside vegetation, and overhanging trees. Grassy margins, scrub and overhanging vegetation provide excellent conditions for insects. Habitat diversity can often be achieved simply through allowing growth of taller vegetation. Where bank management is necessary, restrict it to a small area and work on one bank at a time. Carry out management sensitively, aiming to enhance variation in vegetation. Use fencing to prevent livestock from causing excessive damage to water margins.

Grassland

A6.7 Long sward grassland is of benefit to Lesser Horseshoe bats. The management of grassland should be as that fro Great Horseshoe bats. Rough grassland and scrub is an important predictor of micro moth abundance. Specified seed mixes should include food plants, as well as grasses, such as dandelion, dock, hawkweeds, plantains, ragwort, chickweed, fat hen, mouse-ear and red valerian and other herbaceous plants. Buddleia and bramble in particular, and other scrub species may be planted within or on the edges of the grassland. The grassland should be divided into parcels and cut in rotation once a year in October and the cuttings removed. Where grassland is established as a field margin this should be at least 6 metres wide.

Hedgerow

A6.8 Hedgerow acts as commuting structure and provides feeding perches for Lesser Horseshoe bats. Over 90% of prey caught by bats is brought in on the wind from adjacent habitats. New hedge lines could be planted off-site to divide up large grazed fields into smaller units and link them to blocks of woodland. Hedgerows should be 3 to 6 metres wide and 3 metres high with standard trees planted frequently along their length. The provision of trees increases moth abundance.

A6.9 One study found that night flying moth abundance and diversity correlated positively with the number of bramble (*Rubus fruticosus*) clumps along a hedgerow[78].

A6.9 A species-rich grass strip, a minimum of 6 metres wide, with a long sward, managed as described above, should accompany hedgerow creation as this will enhance moth abundance[79].

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[78] Coulthard, E. 2015. The Visitation of Moths (Lepidoptera) to Hedgerow Flowering Plants in Intensive Northamptonshire Farmland: in Coulthard, E. 2015. ***Habitat and landscape-scale effects on the abundance and diversity of macro-moths (Lepidoptera) in intensive farmland***. PhD. University of Northampton.

[79] Merckx, T. & Macdonald, D. W. 2015. Landscape-scale conservation of farmland moths: in Macdonald, D. W. & Feber, R. E. 2015. ***Wildlife Conservation on Farmland. Managing for Nature on Lowland Farms***. Oxford: Oxford University Press.

Annex 7: Application of the Habitats Regulations

A7.1 The Habitats Regulations protect identified *sites* by designation as Special Areas of Conservation. However, the Habitats Regulations also protects *habitat* which is important for the Favourable Conservation Status of the species.[80]

A7.2 Achieving Favourable Conservation Status of a site's features "… *will rely largely on maintaining, or indeed restoring where it is necessary, the critical components or elements which underpin the integrity of an individual site. These will comprise the extent and distribution of the qualifying features within the site and the underlying structure, functions and supporting physical, chemical or biological processes associated with that site and which help to support and sustain its qualifying features*".[81]

A7.3 Regulation 63 Habitats Regulations states that:

A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which –

(a) is likely to have a significant effect on a European Site … (either alone or in combination with other plans or projects), and
(b) is not directly connected with or necessary to the management of that site must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.

A7.4 Regulation 63 therefore describes a two-stage procedure: a screening stage where the "competent authority" has grounds to conclude whether a plan or project is likely to have a significant effect on a European site, and the appropriate assessment stage if it concludes that a significant effect is likely.

A7.5 In accordance with Regulation 63 information submitted with a planning application will be used by the Somerset Authorities to determine whether the proposal is likely to have a significant effect on the Hestercombe House SAC. The Somerset authorities will apply a "Test of Likely Significant Effect" for proposals which involve or may involve:

- the destruction of a Lesser Horseshoe bat roost (maternity, hibernation or subsidiary roost);
- loss of foraging habitat for Lesser Horseshoe bats
- fragmentation of commuting habitat for Lesser Horseshoe bats
- increase in luminance in close proximity to a roost and/or increase in luminance to foraging or commuting habitat from artificial lighting

[80] See European Site Conservation Objectives for Bath and Bradford on Avon Bats Special Area of Conservation at Annex [ ]
[81] Natural England Standard: Conservation Objectives for European Sites in England Standard 01.02.2014 V1.0 http://publications.naturalengland.org.uk/publication/6734992977690624

- impacts on foraging or commuting habitat which supports the Lesser Horseshoe bat population structurally or functionally

A7.6 The Court of Justice of the European Union clarified what is required in that there is a '…. *need to identify and examine the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of the site. Provided those implications are liable to affect the conservation objectives of the site'*[82]

A7.7 When considering whether a project is likely to have a significant effect on a European site, the competent authority in Stage 1 of the Habitats Regulations Assessment, does not take account of mitigation measures for effects on the features of the European site[83]. Where mitigation measures are required a Stage 2 Appropriate Assessment is required.

A7.8 Mitigation measures are measures which are designed to *avoid* or *reduce* adverse effects on a European site. Where compensatory measures are required (i.e. for impacts within the designated site) these will not be taken into account in Stage 2 the Appropriate Assessment. It is important to distinguish mitigation from compensatory measures which are designed to compensate for unavoidable adverse effects on a European site and follow the "3 tests"[84].

A7.9 The precautionary principle underpins the Habitats Directive[85] and hence the Habitats Regulations and must be applied by the local planning authority as Competent Authority as a matter of law.[86] It is clear that the decision whether or not an appropriate assessment is necessary must be made on a precautionary basis.[87] In addition, the Waddenzee judgement[88] requires a very high level of certainty when it comes to assessing whether a plan or project will adversely affect the integrity of a European site. The judgement states that the competent authority must be sure, certain, convinced that the scheme will not adversely affect the integrity of the site. It goes on to state that that there can be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site.

A7.10 For the Local Planning Authority to be able to conclude with enough certainty that a proposed project or development will not have a significant effect on the SAC, the proposal or project must therefore be supported by adequate evidence and bespoke, reasoned mitigation. Where appropriate a long-term monitoring plan will be expected to

[82] Court of Justice of the European Union (Holohan, Guifoyle, Guifoyle & Donegan v An Bord Pleanála. Case C-461 /17)
[83] The Court of Justice of the European Union (*People Over Wind and Sweetman v Coillte Teoranta* (C-323/17)) decision means that mitigation (avoidance and reduction) measures may no longer be taken into account by competent authorities at the HRA "screening stage" i.e. when judging whether a proposed project is likely to have a significant effect on a European site.
[84] See ODPM circular 06/2005
[85] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (known as the 'Habitats Directive')
[86] *Assessing Projects under the Habitats Directive: Guidance for Competent Authorities* 2011, CCW p.15
[87] ODPM Circular 06/2005 para13
[88] ECJ judgement: C-127/02 [2004] ECR-I

assess whether the bat populations have responded favourably to the mitigation. It is important that consistent monitoring methods are used pre- and post-development, to facilitate the interpretation of monitoring data.

A7.11 Mitigation, an Ecological Management Plan and, (where required) monitoring during and / or post development, will be secured through either planning conditions or a S106 agreement or both. Data from monitoring will be used by the Local Planning Authority to determine how the bat populations have responded to mitigation and to increase the evidence base.

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Part D: Appendices

Appendix 1: Comparison of Home Ranges of Lesser Horseshoe Bats Derived from Radio-Tracking Studies

Results	Average Distance (km)	Maximum Distance (km)	Reference
Maximum distance travelled from roost, where home range had reached asymptote 273 - 4177m, mean maximum distance 1955m. Fifty percent of tracking locations were within 600m of maternity roost.	1.96	4.177	Bontadina, F., Schofield, H., Naef-Daenzer, B., 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *Journal of Zoology* 258: 281-290.
Bats were recorded ranging 6km to the north, 1.5km east, 2km south and 5km to the west.		6	Billington, G. 2005. *Radio tracking study of Lesser Horseshoe bats at Hestercombe House Site of Special Scientific Interest, July 2005.* English Nature Somerset & Gloucestershire Team.
The bats foraged within a radius of 1.0-4.0km from the roost, with the majority remaining within 2.0km. The average foraging radius in May was slightly higher than that recorded in August (1.93km v/s 1.52km)	1.93	4	Duvergé, L. 2008. *Report on bat surveys carried out at Hestercombe House SSSITaunton, Somerset, in 2007 and 2008.* Cullompton: Kestrel Wildlife Consultants.
Lesser Horseshoe bat maximum foraging distance from the roost was 3.24km in June and 6.08km in August, with average distances being approximately 2.26km and 3.72km, respectively.	2.26	3.42	Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013*. Witham Friary: Greena Ecological Consultancy.
	3.72	6.08	
The mean maximum range distance from the maternity roost for adult females was identical in each landscape (2.0 km) although the maximum distance an individual adult female was recorded flying to did vary. The value was 4.1 km for lowland, 3.5 km for high quality and 3.3 km for upland. Nulliparous females and juveniles were recorded a maximum of 4.5 km and 3.8 km respectively from the maternity roost in the lowland landscape.	2	4.1	Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD Thesis, University of Bristol.
	2	3.5	
	2	3.3	
Maximum distance from maternity roost to centre of furthest foraging area 3.6km, 3.2km and 2.8km respectively. Mean distance from maternity roost to night roosts 1.71km ± 0.98 SD, 2.4km ± 1.44 SD and 1.34km ± 0.86 SD respectively.		3.6	Knight, T., Jones, G., 2009. Importance of night roosts for bat conservation: roosting behaviour of the Lesser Horseshoe bat *Rhinolophus hipposideros. Endangered Species Research 9: 79-86.*
		3.2	
		2.8	

Results	Average Distance (km)	Maximum Distance (km)	Reference
One individual tracked - Maximum distance travelled from roost 3.6km, mean distance between roost and foraging area (calculated using MCPs, no further info given) 2.4km	2.4	3.6	Holzhaider, J., Kriner, E., Rudolph, B.-U., Zahn, A., 2002. Radio-tracking a Lesser Horseshoe bat (*Rhinolophus hipposideros*) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis 40: 47-54*.

Appendix 2: Lesser Horseshoe Bat Habitat Suitability Index

Text Colour
Black = Habitat Codes
Blue = Matrix Codes
Green = Formation Codes
Red = Management Codes

NP = Not permissible. It is considered that the habitat is not

A complete list with full descriptions and parameters of the habitat labels can be obtained from Somerset Environmental Records Centre.

Code	Label	HSI	Notes
Woodland Habitat Codes			‘ *The primary foraging habitat for lesser horseshoe bats is broadleaf woodland where they often hunt high in the canopy. However, they will also forage along hedgerows, tree-lines and well-wooded riverbanks.*’ (Schofield, 2008) In lowlands broadleaved and mixed woodland is the most used habitat (Knight, 2006) Avoids dense scrub cover (Schofield 2008), i.e. WB2 Lesser horseshoe bats are primarily a woodland feeding bat using deciduous woodland or mixed coniferous woodland and hedgerows. It has been found that habitats that were most important contained a high proportion of woodland, parkland and grazed pasture woodland, combined with linear features, such as overgrown hedgerows. Woodland with watercourses has more importance. Broadleaved woodland predominated over other types of woodland and was shown to be a key habitat for the species. In the core foraging areas used by bats woodland accounted for 58.7 ± 5.2% of the habitats present. (Barataud et al, 2000; Bontadina et al, 2002) Non-native - biomass of fir trees is 16 compared to Ash 41 and Oak 284 Window gnats present Juveniles select broadleaved woodland habitat (Knight, 2006) Broadleaved, mixed middle age mature woodland with the presence of a river or pond on at least one side most favourable (Barataud et al, 2000) In Bavaria foraged in all available forest types (semi natural mountainous beech-spruce-fir forests and more artificial spruce dominated forests except dense riparian forest. The large part of the time foraging time in forest of deciduous trees (*Fagus sylvatica*) (Holzhaider et al, 2002) A habitat index produced as a result of surveys carried out in four different habitats; plantation woodland; improved grassland, semi improved grassland and arable (root crops) produced the following index 1, 0.33, 0.2 and 0.05 for lesser horseshoe bat prey species abundance (Biron, 2007)
WB0	Broadleaved, mixed, and yew woodland	6	
WB1	Mixed woodland	6	
WB2	Scrub woodland	1	
WB3	Broadleaved woodland	6	
WB31	Upland oakwood [=Old sessile oak woods with Ilex and Blechnum in the British Isles(AN1)]	NP	
WB32	Upland mixed ashwoods	NP	
WB321	Tilio-Acerion forests of slopes, screes and ravines [upland]	NP	
WB32Z	Other upland mixed ashwoods	6	
WB33	Beech and yew woodlands	4	
WB331	Lowland beech and yew woodland	4	
WB3311	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion)	NP	
WB3312	Asperulo-Fagetum beech forests	NP	
WB3313	Taxus baccata woods of the British Isles	NP	
WB331Z	Other lowland beech and yew woodland	4	
WB33Z	Other beech and yew woodlands	4	
WB34	Wet woodland	6	
WB341	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	NP	
WB342	Bog woodland	NP	
WB34Z	Other wet woodland	6	
WB35	Upland birch woodland	6	
WB36	Lowland mixed deciduous woodland	6	
WB361	Old acidophilous oak woods with Quercus robur on sandy plains	NP	
WB362	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	NP	
WB363	Tilio-Acerion forests of slopes, screes and ravines [lowland]	NP	
WB36Z	Other lowland mixed deciduous woodland	6	
WB3Z	Other broadleaved woodland	6	
WC0	Coniferous woodland	3	
Woodland Matrix Codes			Known to make use of shrubs such as rhododendron (Robertson, 2002)
IH0	Introduced shrub	0	

Code	Label	HSI	Notes
Woodland Formation Codes			
WF0	Unidentified woodland formation	1	There was very little difference recorded in the availability of prey in woodland in Switzerland. Variation is due to woodland formation and management (Bontadina et al, 2008)
WF1	Semi-natural	1	
WF11	Native semi-natural	1	
WF111	Canopy Cover >90%	0.2	Determined by woodland habitat type
WF112	Canopy Cover 75 - 90%	0.7	
WF113	Canopy Cover 50 - 75%	1	
WF114	Canopy Cover 20 - 50%	1	
WF12	Non-native semi-natural	0.8	
WF121	Canopy Cover >90%	0.2	The density of the taller trees (either deciduous or coniferous) must be low enough to allow development of understorey of shrub and small coppice. (Motte & Libois, 2002)
WF122	Canopy Cover 75 - 90%	0.7	
WF123	Canopy Cover 50 - 75%	1	
WF124	Canopy Cover 20 - 50%	1	
WF2	Plantation	0.8	
WF21	Native species plantation	0.8	
WF22	Non-native species plantation	0.6	Uniform stands of trees are poorer in invertebrates than more diversely structured woodland (Kirby, 1988) Used conifer plantation at Ciliau but overall time in the habitat was small (Schofield et al, 2003)
WF3	Mixed plantation and semi-natural	0.8	
WF31	Mixed native species semi-natural with native species plantation	0.8	
WF32	Mixed native species semi-natural with non-native species plantation	0.7	
WF33	Mixed non-native species semi-natural with native species plantation	0.7	
WF34	Mixed non-native species semi-natural with non-native species plantation	0.6	
Woodland Management Codes			
WM0	Undetermined woodland management	1	
WM1	High forest	1	
WM2	Coppice with standards	1	
WM3	Pure coppice	1	
WM4	Abandoned coppice	1	
WM5	Wood-pasture and parkland	1	Lesser horseshoe bats hunting and swerving between branches of and in the foliage of coppice, at 1 to 4m high (Motte & Libois, 2002)
WM51	Currently managed wood pasture/parkland	1	
WM52	Relic wood pasture/parkland	1	
WM6	Pollarded woodland	1	
WM7	Unmanaged woodland	1	
WMZ	Other woodland management	1	
WG0	Unidentified woodland clearing	1	
WG1	Herbaceous woodland clearing	1	Clear cutting must be avoided (Motte & Libouis, 2002)
WG2	Recently felled/coppiced woodland clearing	0.5	
WG3	Woodland ride	1	
WG4	Recently planted trees	0.5	
WGZ	Other woodland clearings/openings	1	
Grassland Habitat Codes			The majority of foraging areas around Glynllifon are associated with semi improved pasture bounded by hedgerows and scrub (Billington & Rawlinson, 2006)
GA0	Acid grassland	3	
GC0	Calcareous grassland	3	The vast majority (over 90%) of insects found near hedges do not originate in the hedge but come from other habitats brought in on the wind (BCT, 2003)
GN0	Neutral grassland	3	
GN1	Lowland meadows	3	
GI0	Improved grassland	2	
GU0	Semi improved grassland	3	The Integrated Habitat System considers scrub as a

Code	Label	HSI	Notes
Grassland Matrix Codes			matrix habitat when less than 0.25ha. Otherwise use WB2
SC1	Dense/continuous scrub	-3	Avoids dense scrub cover (Schofield 2008)
SC11	Dense/continuous scrub: native shrubs	-3	
SC12	Dense/continuous scrub: introduced shrubs	-3	
SC2	Open/scattered scrub	1	
SC21	Open/scattered scrub: native shrubs	1	
SC22	Open/scattered scrub: introduced shrubs	1	
TS0	Scattered trees	1	
TS1	Scattered trees some veteran	1	Presence of scattered trees in grassland/arable is likely to increase opportunity for foraging and increase insect diversity/biomass. Parkland habitats have been noted for lesser horseshoe bat foraging. There are a high number of Tipulid species in this habitat
TS11	Broadleaved	1	
TS12	Mixed	1	
TS13	Coniferous	0	
TS2	Scattered trees none veteran	0	
TS21	Broadleaved	0	
TS22	Mixed	0	
TS23	Coniferous	0	
PA0	Patchy bracken	0	
OT0	Tall herb and fern (excluding bracken)	0.25	
OT3	Tall ruderal	0.25	
OT4	Non-ruderal	0.25	
OT41	Lemon-scented fern and Hard-fern vegetation (NVC U19)	0.25	
OT4Z	Other non-ruderal tall herb and fern	0.25	
OTZ	Other tall herb and fern	0.25	
HS0	Ephemeral/short perennial herb	0	Area of bare ground is not specified - assumed patchy
BG1	Bare ground	0	
Grassland Management Codes			
GM0	Undetermined grassland etc. management	1	
GM1	Grazed	1	The presence of cattle is a factor in access to foraging (Cresswell Associates, 2004). Dung flies have been shown to be an element of the diet but less so at Hestercombe House (Knight, 2008). Scatophagidae are a key element of their diet, and together with Sphaeroceridae, are frequently associated with dung (Knight, 2006)
GM11	Cattle grazed	1	
GM12	Sheep grazed	0.75	
GM13	Horse grazed	0.8	
GM14	Mixed grazing	0.8	
GM1Z	Other grazing	0.75	
GM2	Mown	0.5	The presence of pasture is indispensable to the larval stage of development for certain species (Tipulids), which form a significant part of lesser horseshoe bat diet (Motte & Libois, 2002; Boye & Dietz, 2005).
GM21	Silage	0.1	
GM22	Hay	0.6	
GM23	Frequent mowing	0.25	Possibility of presence of window gnats but heavily managed or lit. Need to have associated matrix codes TS
GM2Z	Other mowing regime	0.25	
GM3	Hay and aftermath grazing	0.8	Possibility of presence of window gnats but heavily managed or lit. Need to have associated matrix codes TS
GM4	Unmanaged	1	
GM5	Burning/swaling	0	
GMZ	Other grassland etc. management	0.5	
GL1	Amenity grassland	0.1	
GL11	Golf course	0.1	
GL12	Urban parks, playing and sports fields	0.1	
GL1Z	Other amenity grassland	0.1	
GL2	Non-amenity grassland	1	

Code	Label	HSI	Notes
GL21	Permanent agricultural grassland	1	
GL211	Arable reversion grassland	1	
GL2111	Species-rich conservation grassland	1	
GL211Z	Other arable reversion grassland	1	
GL21Z	Other permanent agricultural grassland	1	
GL2Z	Other grassland use	0.25	
CL3	Unintensively managed orchards	1	
CL31	Traditional orchards	1	
CL32	Defunct orchards	1	
CL3Z	Other unintensively managed orchards	1	
CF1	Coastal and floodplain grazing marsh	1	
Bracken Habitat Codes			
BR0	Bracken	2	Bracken cover hosts over 40 species of invertebrates. Bracken and heath are used by lesser horseshoe bats in upland areas (Knight, 2006)
Heathland Habitat Codes			
HE0	Dwarf shrub heath	2	
HE1	European dry heaths	2	Bog habitats are avoided by lesser horseshoe bats (Irish Bats)
HE2	Wet heaths	1	
Bog Habitat Codes			
EO0	Bog	NP	
Wetland Habitat Codes			
EM0	Fen, marsh and swamp	3	
EM1	Swamp	1	
EM11	Reedbeds	1	
EM12	Calcareous fens with Cladium mariscus and species of the Carex davallianae	NP	
EM1Z	Other swamp vegetation	1	
EM2	Marginal and inundation vegetation	2	
EM21	Marginal vegetation	2	
EM22	Inundation vegetation	0	
EM3	Fens	3	Fen was intensively used in Bavaria where groups of trees are present (Holzhaider et al, 2002)
EM31	Fens [and flushes - lowland]	3	
EM311	Calcareous fens with Cladium mariscus and species of the Carex davallianae	NP	
EM312	Springs	2	
EM313	Alkaline fens [lowland]	2	
EM314	Transition mires and quaking bogs [lowland]	2	
EM31Z	Other lowland fens	3	
EM3Z	Other fens, transition mires, springs and flushes	1	
EM4	Purple moor grass and rush pastures [Molinia-Juncus]	2	
EM41	Molinia meadows on calcareous, peaty or clayey-silt-laden soils [Molinia caeruleae]	NP	
EM42	Non-Annex 1 Molinia meadow and rush pasture habitats (SWT)	2	
EM421	Species-rich rush pastures (SWT)	2	
EM422	Non-Annex 1 Molinia meadows (SWT)	2	
EM4Z	Other purple moor grass and rush pastures [Molinia-Juncus]	2	
Standing Water and Canals Habitat Codes			

Code	Label	HSI	Notes
AS0	Standing open water and canals	6	Culicidae were more abundant in the Hestercombe House diet compared with previous studies in Britain (8% compared with 1%) suggesting that the colony is utilising standing water sources and adjacent areas for foraging. Caddis flies supply 5% of diet. Mayflies less than 5%. Midge larvae are small and wormlike and develop in lakes, ponds, slow-moving streams, drainage ditches, and wet mud and even in highly polluted sewage water. In Ireland activity as found to be greater around expanses of water than along roadside hedgerows. Foraging was concentrated around tree lined rivers and ponds (McAney & Fairley, 1988) The larvae of freshwater species usually live in cold clean flowing waters, but some species prefer warmer slower waters. They are very particular about water temperature and speed, dissolved minerals and pollutants, as http://animals.jrank.org/pages/2512/Caddisflies-Trichoptera.html#ixzz14E3GO5ZH An increase in the number of chironomids results from eutrophication. Daubenton's feed downstream of sewage outputs (Racey, 1998) Adults generally fly quickly from the water. Mating takes place on the ground or vegetation. Adults are commonly found near lights at night or on foliage near water. http://insects.tamu.edu/fieldguide/cimg245.html The larvae of freshwater species usually live in cold clean flowing waters, but some species prefer warmer slower waters. They are very particular about water temperature and speed, dissolved minerals and pollutants, as http://animals.jrank.org/pages/2512/Caddisflies-Trichoptera.html#ixzz14E3GO5ZH Lesser horseshoe bats are likely to use ditch and rhyne systems for foraging (greater horseshoe bats have been radio tracked doing so [Jones & Billington, 1999]. It is considered that a large roost at Theale, near Wedmore, is supported thus due to lack of woodland and hedgerow connectivity otherwise but needs to be confirmed by radio tracking and /or other surveys in the future. Watercourses are the most used habitat in uplands (Trichoptera in diet) (Knight, 2006)
AS1	Dystrophic standing water	3	
AS11	Natural dystrophic lakes and ponds	1	
AS1Z	Other dystrophic standing water	3	
AS2	Oligotrophic standing waters	4	
AS21	Oligotrophic lakes	1	
AS2Z	Other oligotrophic standing waters	4	
AS3	Mesotrophic standing waters	5	
AS31	Mesotrophic lakes	2	
AS3Z	Other mesotrophic standing waters	5	
AS4	Eutrophic standing waters	6	
AS41	Eutrophic standing waters	5	
AS4Z	Other eutrophic standing waters	6	
AS5	Marl standing water	1	
AS6	Brackish standing water with no sea connection	3	
AS7	Aquifer fed naturally fluctuating water bodies	4	
ASZ	Other standing open water and canals	6	
Standing Water and Canals Formation Codes			
AC0	Channel of unknown origin	1	
AC1	Artificial channels	1	
AC11	Drains, rhynes and ditches	1	
AC111	Species-rich drains, rhynes and ditches	1	
AC11Z	Other drains, rhynes and ditches	1	
AC12	Artificially modified channels	1	
AC13	New artificial channels	0.1	
AC14	Canals	0.3	
AC1Z	Other artificial channels	0.3	
AC2	Natural/naturalistic channels	1	
AO0	Open water of unknown origin	1	
AO1	Artificial open water	0.75	
AO11	Reservoir	1	
AO12	Gravel pits, quarry pools, mine pools and marl pits	1	
AO13	Industrial lagoon	0.2	
AO14	Scrape	1	
AO15	Moat	1	
AO16	Ornamental	0.75	
AO1Z	Other artificial open water	0.75	
AO2	Natural open water	1	
AP1	Pond	1	
AP11	Ponds of high ecological quality	1	
AP1Z	Other pond	1	
AP2	Small lake	1	
AP3	Large lake	0.5	
Standing Water and Canals Management Codes			
LT1	Canal-side	1	
LT11	Canal-side with woodland	1	
LT12	Canal-side with scrub or hedgerow and standard trees	1	

Code	Label	HSI	Notes
LT13	Canal-side with scrub or hedgerow	1	
LT14	Canal-side with layered vegetation	0.75	
LT15	Canal-side with grassland	0.5	
LT16	Canal-side with damaged banks	0	
LT17	Canal-side with constructed banks	0	
LT18	Other canal-side type	0	
Running Water Habitat Codes			
AR0	Rivers and streams	5	
AR1	Headwaters	5	Watercourses are the most used habitat in uplands (Trichoptera in diet) (Knight, 2006)
AR11	Chalk headwaters	5	
AR12	Active shingle rivers [headwaters]	5	
AR1Z	Other headwaters	5	
AR2	Chalk rivers (not including chalk headwaters)	4	
AR3	Active shingle rivers [non headwaters]	5	
ARZ	Other rivers and streams	4	
Running Water Management Codes			
LT2	River-side	1	
LT21	River-side with woodland	1	
LT22	River-side with scrub or hedgerow and standard trees	1	Broadleaved, mixed middle age mature woodland with the presence of a river or pond on at least one side most favoured habitat by lesser horseshoe bats (Barataud et al, 2000)
LT23	River-side with scrub or hedgerow	1	
LT24	River-side with layered vegetation	0.75	
LT25	River-side with grassland	0.5	
LT26	River-sdie with vertical banks	0.5	
LT27	River-side with damaged banks	0	
LT28	River-side with constructed banks	0	
LT29	Other river-side type	0	
Arable Habitat Codes			
CR0	Arable and horticulture	1	
CR1	Grass and grass-clover leys	1	
CR2	Cereal crops	1	
CR3	Non-cereal crops including woody crops	1	
CR31	Intensively managed orchards	1	
CR32	Withy beds	1	
CR33	Vineyards	1	
CR34	Game crops	2	
CR35	Miscanthus	0	Miscanthus is not palatable to most insects. This is likely to include those species preyed upon by lesser horseshoe bats
CR3Z	Other non-cereal crops including woody crops	1	
CR5	Whole field fallow	2	
CR6	Arable headland or uncultivated strip	3	
CR61	Arable field margins	3	
CR6Z	Other arable headland or uncultivated strip	2	
CRZ	Other arable and horticulture	1	
Arable Management Codes			
CL1	Agriculture	1	
CL11	Organic agriculture	1	
CL12	Non-organic agriculture	0.5	
CL2	Market garden and horticulture	0	It has been shown that organic farms are more heavily

Code	Label	HSI	Notes
CL21	Organic market garden and horticulture	0	used by bats than otherwise (Wickramasinghe et al, 2003).
CL22	Non-organic market garden and horticulture	0	
CL4	Intensively managed vineyards	0	
CL4Z	Non-intensively managed vineyards	1	
CL5	Cereal crops managed for wildlife	1	
CL5Z	Cereal crops not managed for wildlife	0.5	
Inland Rock Habitat Codes			
RE0	Inland rock	0	
RE1	Natural rock exposure features	0	
RE11	Natural rock and scree habitats	0	
RE111	Upland natural rock and scree habitats	0	
RE112	Lowland natural rock and scree habitats	0	
RE14	Caves	NP	Winter roost sites.
RE141	Caves not open to the public	NP	
RE14Z	Other caves	5	Caves occur in disused quarries in Somerset
RE15	Exposed river gravels and shingles	2	
RE1Z	Other natural rock exposure feature	0	
RE2	Artificial rock exposures and waste	0	
RE21	Quarry	2	
RE22	Spoil heap	0	
RE23	Mine	3	
RE24	Refuse tip	0	
RE2Z	Other artificial rock exposure and waste	0	
Linear Habitat Codes			
LF0	Boundary and linear features	6	In a report for the three Welsh National Parks, Pembrokeshire County Council and the Countryside Commission for Wales by the Bat Conservation Trust (2005) it is stated that in fragmented habitats linear features, such as hedgerows, provided valuable corridors between roosts and foraging areas. Commuting corridors are important features for lesser horseshoe bats as they avoid crossing open areas and are vulnerable to the loss of these corridors. Where lesser horseshoes bats foraged along linear features, such as hedgerows, it was always within 10 metres of the feature (Bat Conservation Trust, 2005). In Belgium no bat was recorded more than 1 metre from a feature (Motte & Dubois, 2002). Linking features in a landscape of fragmented woodlands are highly important to the survival of lesser horseshoe bats. Motte & Dubois (2002) in their study wrote that, '*What is striking is that all places were linked to the roost and to each other by a wooded element*.' The vast majority (over 90%) of insects found near hedges do not originate in the hedge but come from other habitats brought in on the wind (BCT, 2003) Hedges managed under Agri-environment Schemes did not offer any benefit over conventionally managed hedgerows with regard to micro and macro-moths (Fuentes-Montemayor et al, 2010)
LF1	Hedges / Line of trees	6	
LF11	Hedgerows	6	
LF111	Important hedgerows	6	
LF11Z	Non-important hedgerows	5	
LF12	Line of trees	6	
LF1Z	Other hedges/line of trees	5	
LF2	Other boundaries and linear features	4	
LF21	Line of trees (not originally intended to be stock proof)	4	
LF22	Bank	0	
LF23	Wall	1	
LF24	Dry ditch	1	
LF25	Grass strip	0	
LF26	Fence	0	
LF27	Transport corridors	0	
LF271	Transport corridor without associated verges	0	
LF272	Transport corridor associated verges only	0	
LF273	Transport corridor with natural land surface	0	
Linear Management Codes			
LH3	Recently planted hedge (Only use for existing habitat)	0.25	Cut hedge is specified where height is below 2 metres
LM1	Cut hedge	0.3	

Code	Label	HSI	Notes
LM11	Cut hedge with standards	0.3	Uncut hedge is specified where the hedge is between 2 and 3 metres high Overgrown hedge is considered to be over 3 metres high
LM12	Cut hedge without standards	0.2	
LM2	Uncut hedge	0.9	
LM21	Uncut hedge with standards	0.9	
LM22	Uncut hedge without standards	0.8	
LM3	Overgrown hedge	1	
LM31	Overgrown hedge with standards	1	
LM32	Overgrown hedge without standards	0.9	
LT3	Rail-side	0.5	
LT4	Road-side	0.5	
LT5	Path- and track-side	1	
LTZ	Other transport corridor verges, embankments and cuttings	1	
UL1	Railway	0	
UL2	Roadway	0	
UL3	Path and trackway	0	
ULZ	Other transport corridor	0	
Built Up Areas and Gardens Habitat Codes			
UR0	Built-up areas and gardens	1	
Built UP Areas and Gardens Management Codes			
UA1	Agricultural	0.1	
UA2	Industrial/commercial	0	Lesser horseshoe bat summer roosts are typically in the loft spaces of old buildings Urban and sub urban areas are exploited by lesser horseshoe bats (Knight, 2006) Farmyards most used by lesser horseshoe in Ireland (McAney & Fairley, 1988). Night roosts possible
UA3	Domestic	0	
UA31	Housing/domestic outbuildings	0.1	
UA32	Gardens	0.1	
UA33	Allotments	0.1	
UA34	Caravan park	0	
UA3Z	Other domestic	0	
UA4	Public amenity	0	
UA41	Churchyards and cemeteries	1	
UA4Z	Other public amenity	0	
UA5	Historical built environment	1	
UAZ	Other extended built environment	0	

Appendix 3: Risk Factors for Restoring or Recreating Different Habitats

N.B.: These assignments are meant purely as an indicative guide. The starting position with regard to substrate, nutrient levels, state of existing habitat, etc. will have a major impact in the actual risk factor. Final assessments of risk may need to take other factors into account.

Habitats	**Technical difficulty of recreating**	**Technical difficulty of restoration**
Arable Field Margins	Low	n/a
Coastal and Floodplain Grazing Marsh	Low	Low
Eutrophic Standing Waters	Medium	Medium
Hedgerows	Low	Low
Lowland Beech and Yew Woodland	Medium	Low
Lowland Calcareous Grassland	Medium	Low
Lowland Dry Acid Grassland	Medium	Low
Lowland Meadows	Medium	Low
Lowland Mixed Deciduous Woodland	Medium	Low
Open Mosaic Habitats on Previously Developed Land	Low	Low
Ponds	Low	Low
Wood-Pasture & Parkland	Medium	Low

Appendix 4: Feasibility and Timescales of Restoring: examples from Europe

Ecosystem type	Time-scale	Notes
Temporary pools	1-5 years	Even when rehabilitated, may never support all pre-existing organisms.
Eutrophic ponds	1-5 years	Rehabilitation possible provided adequate water supply. Readily colonised by water beetles and dragonflies but fauna restricted to those with limited specialisations.
Mudflats	1-10 years	Restoration dependent upon position in tidal frame and sediment supply. Ecosystem services: flood regulation, sedimentation.
Eutrophic grasslands	1-20 years	Dependent upon availability of propagules. Ecosystem services: carbon sequestration, erosion regulation and grazing for domestic livestock and other animals.
Reedbeds	10-100 years	Will readily develop under appropriate hydrological conditions. Ecosystem services: stabilisation of sedimentation, hydrological processes.
Saltmarshes	10-100 years	Dependent upon availability of propagules, position in tidal frame and sediment supply. Ecosystem services: coastal protection, flood control.
Oligotrophic grasslands	20-100 years +	Dependent upon availability of propagules and limitation of nutrient input. Ecosystem services: carbon sequestration, erosion regulation.
Chalk grasslands	50-100 years +	Dependent upon availability of propagules and limitation of nutrient input. Ecosystem services: carbon sequestration, erosion regulation.
Yellow dunes	50-100 years +	Dependent upon sediment supply and availability of propagules. More likely to be restored than re-created. Main ecosystem service: coastal protection.
Heathlands	50-100 years +	Dependent upon nutrient loading, soil structure and availability of propagules. No certainty that vertebrate and invertebrate assemblages will arrive without assistance. More likely to be restored than re-created. Main ecosystem services: carbon sequestration, recreation.
Grey dunes and dune slacks	100-500 years	Potentially restorable, but in long time frames and depending on intensity of disturbance Main ecosystem service: coastal protection, water purification.
Ancient woodlands	500 – 2000 years	No certainty of success if ecosystem function is sought – dependent upon soil chemistry and mycology plus availability of propagules. Restoration is possibility for plant assemblages and ecosystem services (water regulation, carbon sequestration, erosion control) but questionable for rarer invertebrates.
Blanket/Raised bogs	1,000 – 5,000 years	Probably impossible to restore quickly but will gradually reform themselves over millennia if given the chance. Main ecosystem service: carbon sequestration.
Limestone pavements	10,000 years	Impossible to restore quickly but will reform over many millennia if a glaciation occurs.

Appendix 5: Example of HEP Calculation

The following table gives an example (for Lesser Horseshoe bats) of the HEP calculation for a complex site which straddles two Consideration Zone bands.

		Primary Habitat		Matrix		Formation		Management / Land use					
Field No	Habitat	IHS Code	Score	IHS Code	Score	IHS Code	Score	IHS Code	Score	HSI Score	Density Band Score	Hectares	Habitat Units
F1	Miscanthus	CR35	0		0		1.00		1.00	0.00	2	4.975	0.00
P2	Pond	AS0	6		0	AP1	1.00		1.00	6.00	2	0.053	0.64
F3	Maize (Cereal crops, non-organic)	CR2	1		0		1.00	CL12	0.50	0.50	2	0.034	0.03
P4	Pond (Standing open water and canals)	AS0	6		0		1.00		1.00	6.00	2	0.362	4.34
F5	Improved grassland, Frequent mowing (Other amenity)	GI0	2		0		1.00	GM23	0.25	0.50	2	0.344	0.34
F6	Mixed woodland, Mixed plantation and semi natural, high forest	WB1	6		0	WF3	0.80	WM1	1.00	4.80	2	0.362	3.48
F7	Built-up Areas and Gardens, gardens	UR0	1		0		1.00	UA32	0.10	0.10	2	0.2	0.04
F8	Arable (wheat & barley)	CR2	1		0		1.00	CL12	0.50	0.50	2	0.086	0.09
F9	Arable (type not stated)	CR0	1		0		1.00		1.00	1.00	2	0.154	0.31
F10	Improved grassland; Hay aftermath grazing	GI0	2		0		1.00	GM3	0.80	1.60	2	3.484	11.15
F11	Improved grassland, Silage	GI0	2		0		1.00	GM21	0.50	1.00	2	0.833	1.67
F12	Built-up Areas and Gardens, scattered trees	UR0	1	TS0	1		1.00	UA32	0.25	0.50	1	2.844	1.42
F13	Mixed Woodland Plantation	WB1	6		0	WF3	0.80		1.00	4.80	1	1.214	5.83
F14	Cereal Crops, Bare Ground	CR2	1	BG1	0		1.00	CL1	1.00	1.00	1	0.642	0.64
H1	Hedgerow, overgrown without standards	LF11	6		0		1.00	LM32	1.00	6.00	2	0.149	1.79
H2	Hedgerow, cut without standards	LF11	6		0		1.00	LM12	0.20	1.20	2	0.58	1.39
H3	Line of trees	LF21	4		0		1.00		1.00	4.00	2	0.203	1.62
H4	Hedgerow, uncut without standards	LF11	6		0		1.00	LM22	0.80	4.80	2	0.04	0.38
H5	Hedgerow, uncut with standards	LF11	6		0		1.00	LM21	0.90	5.40	2	0.02	0.22

Field No	Habitat	Primary Habitat IHS Code	Primary Habitat Score	Matrix IHS Code	Matrix Score	Formation IHS Code	Formation Score	Management / Land use IHS Code	Management / Land use Score	HSI Score	Density Band Score	Hectares	Habitat Units
H6	Hedgerow, cut without standards	LF11	6		0		1.00	LM12	0.20	1.20	2	0.07	0.17
H7	Hedgerow, uncut without standards	LF11	6		0		1.00	LM22	0.80	4.80	1	0.02	0.10
H8	Hedgerow, cut without standards	LF11	6		0		1.00	LM12	0.20	1.20	1	0.01	0.01
													35.65
		(Habitat required, e.g. Woodland with ponds being optimal habitat for the species)									Delivery Risk		1.5
		(Habitat required, e.g. Woodland with ponds being optimal habitat for the species)									Temporal Risk		1.7
											Habitat Units		90.92
											Hectares Required		5.05

The calculation recommends that a minimum of 5.05 hectares (ha) of the 16.68ha site is needed to replace the value of the habitat lost to the species affected.

If the replacement habitat is to be provided off-site the value of the receptor site also needs to be taken into account. The calculation is as follows assuming that the replacement habitat enhancement is located on a field of low value to the species with a HSI score of 1.

[5.05 / (6-1)] + 5.05 = 6.06ha.

North Somerset and Mendip Bats Special Area of Conservation (SAC)

Guidance on Development

Version 2.1 – March 2019

North Somerset Council

Natural England

Somerset County Council

Sedgemoor in Somerset

Mendip District Council

This guidance was prepared by Larry Burrows, Ecologist, Somerset Ecology Services, Planning Control, Somerset County Council working in partnership with North Somerset Council and Natural England

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SOMERSET AND MENDIP BATS SPECIAL AREA OF CONSERVATION (SAC): GUIDANCE ON DEVELOPMENT

Contents

PART A

Non-technical guidance

1. Who is the guidance aimed at and why?

1.1 This advice is aimed at developers, consultants, and planners involved in planning and assessing development proposals in the landscapes surrounding the North Somerset and Mendip Bats SAC.

1.2 The overall aim is for a clearer approach to considering impacts of development on the SAC. The guidance provides a consistent basis for understanding how rare horseshoe bats use the landscape and where there is likely to be greater risk or opportunity for development. This will help inform strategic planning for the area's future housing needs.

1.3 The guidance will comprise a component of the development management process, to be considered in line with relevant policies, such as policy DM8 (Nature Conservation) of the adopted Development Management Policies of the North Somerset Local Plan; Policy D15 (Bat Consultation Zone) of the Revised Sedgemoor District Council Local Plan; Policy DP6 (Bat Protection Zone) of the Mendip District Council Local Plan; Policy DM2: Biodiversity and geodiversity of the Somerset County Council Minerals Plan; and Policy DM3: Impacts on the environment and local communities of the Somerset County Council Waste Core Strategy

1.4 At project level the guidance will help identify key issues at pre-application stage that can inform the location and sensitive design of development proposals and minimise delays and uncertainty. Within the areas identified, there will be clear requirements for survey information and a strong emphasis on retaining and enhancing key habitat for bats and effective mitigation where required. This will demonstrate that development proposals avoid harm to the designated bat populations and support them where possible.

1.5 The guidance explains how development activities can impact the SAC and the steps required to avoid or mitigate any impacts. It applies to development proposals that could affect the SAC and trigger the requirements of the Habitats Regulations (see Annex 7). The local planning authority will consider, on the basis of evidence available, whether proposals (planning applications) are likely to impact on horseshoe bats and hence require screening for Habitats Regulations Assessment (HRA). Those are the proposals to which the guidance will be applied. This will reduce the likelihood that it would be applied to minor developments which would not have an impact on the SAC.

1.6 The guidance brings together best practice and learning from areas with similar approaches, such as Somerset County Council and South Hams, and the best scientific information available at the time of writing. It will be kept under review by North Somerset Council and Somerset County Council and their partners and is fully endorsed by Natural England. The planning guidance is part of a wider approach that is being pursued by partner organisations to safeguard and improve habitat for rare bats that includes farm management. The guidance is also consistent with Natural England's Site Improvement Plan for the SAC.

2. What is the Bats SAC?

2.1 Special Areas of Conservation (SAC) are European sites of international importance for wildlife. The Bat SAC is important for two bat species, Greater and Lesser Horseshoe bats. The SAC itself comprises component SSSIs which in North Somerset include, for example, the two maternity roosts at the Brockley Hall Stables SSSI and King's Wood SSSI, and also hibernation roosts like the Banwell Bone Caves and, in Somerset, the maternity and hibernation roosts in the Cheddar Complex SSSI and the hibernation roosts at Wookey Hole SSSI.

2.2 However the landscapes around the SAC itself are also important in providing foraging habitat needed to maintain the favourable conservation status of the horseshoe bats. This is termed Functionally Linked Land. Therefore, the guidance sets out strong requirements for consultation, survey information and appropriate mitigation, to demonstrate that development proposals will not adversely impact on the designated bat populations.

3. Bat Consultation Zone

3.1 The guidance also identifies the "Bat Consultation Zone" where horseshoe bats may be found, divided into bands A, B and C, reflecting the likely importance of the habitat for the bats and proximity to maternity and other roosts.

3.2 Within the Consultation Zone development is likely to be subject to particular requirements, depending on the sensitivity of the site.

4. Juvenile Sustenance Zones

4.1 The guidance identifies the Juvenile Sustenance Zones of 1 kilometre (km) around the maternity roosts.

4.2 New build development on green field sites should be avoided in the Juvenile Sustenance Zones (JSZs) in view of their sensitivity and importance as suitable habitat as foraging areas for young bats, being within 1km of maternity roosts for Greater Horseshoe bats.

4.3 It is considered that mature woodland within 600 metres (m) of a Lesser Horseshoe bat maternity roost is also sensitive as the habitat is likely to be used by juveniles. New build developments should avoid the loss of such woodland and connecting habitat between the maternity roost and woodland.

5. Need for early consultation

5.1 Section 3 of Part B of the guidance stresses the need for pre-application consultation for development proposals.

5.2 Within bands A or B of the Consultation Zone, proposals with the potential to affect features important to bats (identified in Section B paragraph 3.2 below) should be discussed with the local authority and/or Natural England as necessary.

5.3 Within band C developers should take advice from their consultant ecologist.

6. Survey requirements

6.1 Section 3 of Part B and Annex 3 of the guidance sets out the survey requirements normally applying to development proposals within the Bat Consultation Zone. Outside the Bat Consultation Zone development proposals may still have impacts on bats, and developers should have regard to best practice guidelines, such as Bat Conservation Trust survey guidelines and Natural England's Standing Advice for Bats. North Somerset Council has also produced a Bat Survey Requirements leaflet.

6.2 For proposals within the Consultation Zone (all Bands), developers must employ a consultant ecologist at an early stage to identify and assess any impacts.

6.3 For proposals within bands A and B of the Bat Consultation Zone, full season surveys will be needed (unless minor impacts can be demonstrated) and must include automated bat detector surveys. Survey results are crucial for understanding how bats use the site, and therefore how impacts on horseshoe bats can be avoided, minimised or mitigated. Where mitigation is needed the survey results will inform the metric for calculating the amount of habitat needed (see Annex 5).

6.4 Within band C survey effort required will depend on whether a commuting structure is present and the suitability of the adjacent habitat to support prey species hunted by horseshoe bats.

7. Proposed developments with minor impacts

7.1 In some circumstances a developer may be able to clearly demonstrate (from their qualified ecologist's site visit and report) that the impacts of a proposed development are proven to be minor and can be avoided or mitigated (or do not require mitigation) without an impact on SAC bat habitat, so a full season's survey is not needed. This should be substantiated in a suitably robust statement submitted as part of the development proposals.

8. Need for mitigation, possibly including provision of replacement habitat

8.1 Within the Bat Consultation Zone (all Bands), where SAC bats could be adversely affected by development appropriate mitigation will be required.

8.2 Development proposals should seek to retain and enhance existing habitats and / or features of value to bats such as those listed in paragraph 3.2 of Part B in this guidance. Where this is not or is only partially possible appropriate mitigation such as the provision of replacement habitat will be required. The council's ecologist will have regard to relevant considerations in determining the mitigation requirements, including survey results and calculations relating to quantity of replacement habitat. Annex 5 sets out the methodology and metric for calculating how much replacement habitat should be provided[1].

8.3 Any replacement habitat must be accessible to the horseshoe bat population affected.

8.4 Where the replacement provision is to be made on land off-site (outside the red line development boundary for the planning application) any existing value of that land as bat habitat will also have to be factored in to the calculation.

8.5 Where the replacement provision is to be off site, and land in a different ownership is involved, legal agreements are likely to be needed to ensure that the mitigation is secured in perpetuity.

8.6 An Ecological Management Plan for the site must be provided setting out how the site will be managed for SAC bats in perpetuity.

8.7 Where appropriate a Monitoring Strategy must also be provided to ensure continued use of the site by SAC bats and include measures to rectify the situation if negative results occur.

[1] In the Somerset County area developers may ask the Local Planning Authority to carry out the calculation for the amount of habitat required to replace the value of that lost to horseshoe bats prior to the application being submitted, to check that the proposed master plan for the site has adequate land dedicated to the purpose. A charge may be levied for this service.

9. Enhancement

9.1 Development will be expected to provide enhancement for horseshoe bats. The National Planning Policy Framework (July 2018)[2] states that '*Planning… decisions should contribute to and enhance the natural… environment by… providing net gains for biodiversity*…' It is expected that development sides would provide a greater quantum of habitat in value than that lost due to the built development and associated infrastructure.

9.2 An example of the Excel worksheets used in calculating the quantum of replacement habitat required is given in Appendix 6 with a box showing the amount gained or lost due to a proposed development. It is expected that a percentage gain will be defined by Defra in due course.

Lesser Horseshoe Bats: Mother and Pup (Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust)

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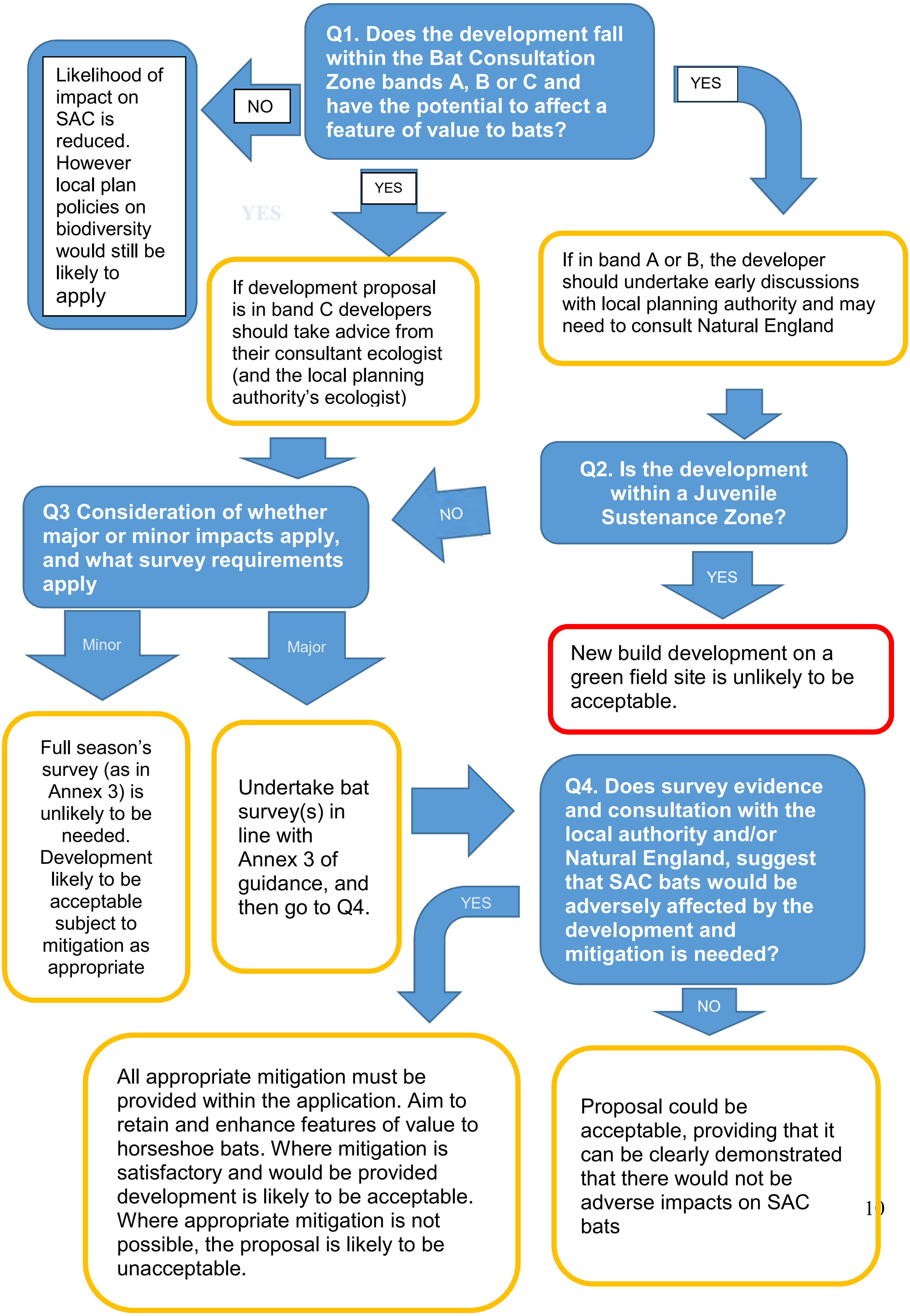
[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf



Q1. Does the development fall within the Bat Consultation Zone bands A, B or C and have the potential to affect a feature of value to bats?
NO
Likelihood of impact on SAC is reduced. However local plan policies on biodiversity would still be likely to apply
YES
If development proposal is in band C developers should take advice from their consultant ecologist (and the local planning authority's ecologist)
YES
If in band A or B, the developer should undertake early discussions with local planning authority and may need to consult Natural England
Q2. Is the development within a Juvenile Sustenance Zone?
NO
YES
New build development on a green field site is unlikely to be acceptable.
Q3 Consideration of whether major or minor impacts apply, and what survey requirements apply
Minor
Major
Full season's survey (as in Annex 3) is unlikely to be needed. Development likely to be acceptable subject to mitigation as appropriate
Undertake bat survey(s) in line with Annex 3 of guidance, and then go to Q4.
Q4. Does survey evidence and consultation with the local authority and/or Natural England, suggest that SAC bats would be adversely affected by the development and mitigation is needed?
YES
All appropriate mitigation must be provided within the application. Aim to retain and enhance features of value to horseshoe bats. Where mitigation is satisfactory and would be provided development is likely to be acceptable. Where appropriate mitigation is not possible, the proposal is likely to be unacceptable.
NO
Proposal could be acceptable, providing that it can be clearly demonstrated that there would not be adverse impacts on SAC bats

PART B

Technical Guidance

1. Introduction

1.1 The North Somerset and Mendip Bats SAC is designated under the Habitats Directive 92/43/EEC, which is transposed into UK law under the Conservation of Habitats and Species Regulations 2017 (the ‘Habitat Regulations’). This means that the populations of bats supported by this site are of international importance and therefore afforded high levels of protection, placing significant legal duties on decision-makers to prevent damage to bat roosts, feeding areas and the routes used by bats to travel between these locations.

1.2 The primary reason for designation of the bat SAC are two Annex II species:

- the Greater Horseshoe bat *Rhinolophus ferrumequinum;* and
- the Lesser Horseshoe bats *Rhinolophus hipposideros*

1.3 References in this document to ‘SAC bats’ refers to <u>both bat species</u> protected by the SAC designation. Where a distinction needs to be made between different requirements for different species, the particular species will be referred to. Greater Horseshoe bats are taken to be the most sensitive species therefore the ‘Precautionary Principle’ dictates that if their requirements are met, then the other SAC bat species are also likely to be protected. For more detail on the SAC see Annex 1.

1.4 The Conservation Objectives for the SAC[3] are: With regard to the SAC and the natural habitats and/or species for which the site has been designated (the ‘Qualifying Features’ which include the bat species listed above), and subject to natural change, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and,
- The distribution of qualifying species within the site.

[3] http://publications.naturalengland.org.uk/publication/6252034999189504

1.5 Therefore, planners and prospective developers need to be aware that the habitats and features which support the populations of SAC bats outside the designated site are a material consideration in ensuring the integrity of the designated site.

1.6 The purpose of this advice is not to duplicate or override existing legal requirements for protected bat species or their roosts. These aspects are well governed by the Natural England licensing procedures (Wildlife Management and Licensing Unit) for protected species.

1.7 This document should serve as an evidence base and provide guidance on the planning implications for development control in the relevant local planning authority (LPA). There are opportunities beyond the scope of this document to use this evidence base to inform the preparation of land use plans through the local plans. This Guidance for the North Somerset and Mendip Bats SAC should be considered to cover the Mendip Limestone Grasslands SAC which is cited for its Greater Horseshoe bat hibernation roosts. A Technical Guidance note is also available specifically for the Mendip District Council area and includes the Mells Valley SAC, which is also designated for Greater Horseshoe bats and the Bath and Bradford-on-Avon SAC Technical Guidance (Bath and North East Somerset Council / West of England).

1.8 This advice is aimed at applicants, agents, consultants and planners involved in producing and assessing development proposals in the landscapes surrounding the SAC. Within these areas there will be a strong requirement for survey information and mitigation for bats and their habitat in order to demonstrate that development proposals will not impact on the designated bat populations.

1.9 The guidance explains how development activities can impact the SAC and the steps required to avoid or mitigate any impacts. It applies to development proposals that could affect the SAC and trigger the requirements of the Habitats Regulations (see Annex 7). The local planning authority will consider, on the basis of evidence available, whether proposals (planning applications) are likely to impact on horseshoe bats and hence require screening for Habitats Regulations Assessment (HRA). Those are the proposals to which the guidance will be applied. This will reduce the likelihood that it would be applied to minor developments which would not have an impact on the SAC.

1.10 An important objective of the advice is to identify areas in which development proposals might impact on the designated populations at an early stage of the planning process, in order to inform sensitive siting and design, and to avoid unnecessary delays to project plans by raising potential issues at the outset.

1.11 This technical guidance is based on the advice from experts and ecological consultants[4], current best practice and the best scientific information available at the time of writing. It will be kept under review by North Somerset Council, Somerset County Council and Natural England.

[4] See acknowledgements

2. Sensitive Zones for Horseshoe Bats

Introduction

2.1 To facilitate decision making and in order to provide key information for potential developers at an early stage, using the best available data a Bat Consultation Zone affecting North Somerset, Sedgemoor and Mendip districts, and Juvenile Sustenance Zones affecting North Somerset and the Cheddar area (See Plans 1 to 4 below) have been identified. This is based on an accumulation of known data, beginning with the 1999 and 2001 Radio Tracking Studies of Greater Horseshoe bat maternity roosts.[5] The data is constantly being added to and updated. Therefore, the Plans reflect the current understanding of key roosts and habitat associated with the SAC.

Bat Consultation Zone (orange, yellow and pale-yellow shading on Plans 1, 2, 5 and 6 below)

2.2 The Bat Consultation Zone illustrates the geographic area where horseshoe bats may be found. It is divided into three bands, A, B and C, reflecting the density at which horseshoe species may be found at a distance from a roost site. The basis for these distances is set out in Annex 2 and is based on the distances recorded through radio tracking studies at Brockley Hall Stables and Cheddar Caves and research into densities of occurrence throughout the species range. Note that the radio tracking studies only recorded the movements of a small number of bats from each of the maternity roosts and therefore it is likely that any area within the Bat Consultation Zone could be exploited by horseshoe bats. Although it is recognised that Greater Horseshoe bats mostly forage within 2.2km of a maternity roost, i.e. within Band A, they can also make regular use of key foraging habitat within 4km, i.e. within Band B. Furthermore, some key areas in Band C can be up to 8km away.[6] The zoning band widths are set out in Table 1 below and in Annex 2.

Table 1: Band Widths for Horseshoe Bats

Band	Greater Horseshoe bat (metres)		Lesser Horseshoe bat (metres)	
	Maternity Roost	Other Roost	Maternity Roost	Other Roost
A	0 – 2200		0 - 600	
B	2201 - 4000	0 - 610	601 - 2500	0 - 300
C	4001 - 8000	611 – 2440	2501 - 4100	301 - 1250

2.3 Band A is shown in orange shading; Band B in yellow; and Band C in pale yellow reflecting the decreasing density at which Greater and Lesser Horseshoe bats are likely to occur away from the home roost.

2.4 The Bat Consultation Zone for Greater Horseshoe bats is centred on the maternity roosts at Brockley Stables, Kings Wood and in Cheddar Gorge. In North Somerset this Zone includes the urban areas of Nailsea, Congresbury, Yatton and Cheddar. Smaller bands are formed around hibernation and subsidiary roosts and these may occur within the bands formed from the maternity roosts

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[5] Billington, G. 2001. *Radio tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest, May – August 2001*.English Nature Research Report No. 442. Peterborough: English Nature; Jones, G. & Billington, G. 1999. *Radio tracking study of Greater Horseshoe bats at Cheddar, North Somerset*. Taunton: English Nature.

[6] BCT Bat Survey Guidelines and see footnote 10 above. Also Geoff Billington pers comm. 16/09/2016

2.5 The Bat Consultation Zone for Lesser Horseshoe bats is based on the winter roosting sites in the SAC boundaries (See Plans 5 and 6).

2.6 Note that not all Lesser Horseshoe bat hibernation roosts lie within the SAC's designated boundaries (See Plan's 7 and 8). It is estimated that these roosts support about 15% of the known summer populations in the geographic area covered by North Somerset and north west Somerset but the proportion of the population is likely to be less if unknown maternity roosts, male bats and bats migrating from a wider area are included. Potential significant effects within a Habitats Regulations Assessment should be considered on a case by case basis. Nonetheless, local populations, taken to be a maternity colony, are subject to assessment for 'Favourable Conservation Status' (see Appendix 7) for impacts from proposed developments prior to permission being given.

Juvenile Sustenance Zones (red and pink shading on Plans 3 and 4 below)

2.7 Juvenile Sustenance Zones within Band A are formed around maternity roosts to a distance of 1 kilometre (km) for Greater Horseshoe bats, to include whole fields that fall within that zone which have been under appropriate management.

2.8 Juvenile Greater Horseshoe bats are highly dependent on prey produced by cattle grazed pasture within this zone.[7] It is highly unlikely that this can be replaced within development proposals. These areas are particularly sensitive and new build development on green field sites should be avoided in these zones.

2.9 The Juvenile Sustenance Zone for Lesser Horseshoe bats includes all mature woodland within 600 metres of the maternity roost[8]. It is highly unlikely that the biomass or shelter that such woodland provides can be replaced within development schemes. Consideration also needs to be given to connecting flight routes between the maternity roost and the woodlands.

3. Consultation and Surveys

3.1 For development proposals within the Juvenile Sustenance Zone it is essential that Natural England and the appropriate Somerset planning authority are consulted at an early stage of the process, as it is unlikely that new build development on green field sites could be made acceptable, due to the critical nature of the area in supporting the population of a maternity roost.

3.2 Where a proposal within Bands A or B of the Consultation Zone has the potential to affect the features identified below, early discussions with the local planning authority (who will consult Natural England as necessary) are also essential.

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[7] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*: *English Nature Research Reports Number 174.* Peterborough: English Nature.

[8] Bontadina et al recommends that conservation management should have special consideration within 600 metres of the roost. (Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*)

- Known bat roost
- On or adjacent to a Site of Special Scientific Interest (SSSI)
- Linear features: hedgerows, tree lines, watercourses, stone walls, railway cuttings
- Pasture, hay meadow, stream line, woodland, parkland, woodland edge
- Wetland habitat: ponds, marsh, reedbed, rivers, streams, rhynes
- Buildings or bridges, especially if these are not used or are undisturbed and particularly if there is a large void with potential access
- Cellars, mines, ice houses, tunnels or other structures with voids which produce tunnel-like conditions
- Development which introduces new lighting
- New wind turbine proposals (in respect of displacement)[9]

3.3 Early discussion refers to pre-application stage prior to submission of a planning application; and, essentially, *before* any Master Plan proposals are submitted or finalised. This will ensure that adequate survey data is obtained. Please note that early discussions will also help inform likely mitigation requirements, and ensure, for example, that proposals seek to retain and enhance key features and habitats, and that sufficient land can be allocated for such avoidance and/or mitigation measures as may be required. This should result in appropriate bespoke mitigation measures that are designed in at an appropriately early stage. A site lighting plan with existing (pre-development) night time lux levels should also be provided.

3.4 In Band C developers should take advice from their consultant ecologist and planners from their ecologist colleagues.

3.5 Failure to provide the necessary information in support of an application is likely to lead to delays in registration and determination, and the application may need to be withdrawn. If insufficient information is submitted to allow the local planning authority to assess the application in accordance with the Habitats Regulations, the application is likely to be considered unacceptable.

3.6 For proposals within the Bat Consultation Zone (all Bands), an ecological consultant[10] should be commissioned at an early stage to identify and assess any impacts the proposals may have.

3.7 Surveys should determine the use of the site by horseshoe bats, whether the site is being used as a commuting route or contains hunting territories or both. Survey results inform the metric for calculating the amount of replacement habitat required in the methodology set out in Annex 5. Consideration should be given to the site within the wider landscape and of offsite effects, such as additional street lighting required to facilitate a development.

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[9] Horseshoe bat casualties are very rare with only one Greater Horseshoe being recorded in Europe over the ten-year period 2003 to 2013. (Eurobats. 2014. *Report of the Intercessional Working Group on Wind Turbines and Bat Populations*. EUROBATS.StC9-AC19.12)

[10] Consultants should be members of CIEEM www.cieem.net or taken from the Environmental Consultants Directory www.endsdirectory.com

3.8 Surveys should be carried out in accordance with the Survey Specification at Annex 3. Exact survey requirements will reflect the sensitivity of the site, and the nature and scale of the proposals. The ecological consultant will advise on detailed requirements following a preliminary site assessment and desk study.

3.9 It is essential to note that bat surveys are seasonally constrained. For proposals which have the potential to impact on the SAC, a full season (April to October inclusive) will be required, but this may not be necessary in certain circumstances, where this is demonstrable to the council's ecologist. (See Section B paragraphs 4.17 to 4.18 on minor impacts.) Winter surveys may be required for those developments in proximity to hibernation roosts. This will need to be included in the plan for project delivery at an early stage to avoid a potential 12-month delay to allow appropriate surveys to be undertaken.

3.10 Outside the Bat Consultation Zone, development proposals may still have impacts on bats. All species of bat and their roosts are protected by the Wildlife and Countryside Act (1981, as amended) and the Habitats Regulations. Further advice on potential impacts to bats is contained in Natural England's Standing Advice for Development Impacts on Bats, English Nature's Bat Mitigation Guidelines (2004) and the Bat Conservation Trust Bat Survey Guidelines for Professionals (2016).[11] North Somerset Council has also produced a Bat Survey Requirements leaflet.

3.11 Prospective developers will be expected to provide evidence, ideally in the form of a lux contour plan and sensitive lighting strategy, with their application to demonstrate that introduced light levels will not affect existing and proposed features used by SAC bats to above 0.5 lux; or not exceeding baseline light levels where this is not feasible. It is advised that surveys are designed in accordance with the 'Guidance Note 08/18 Bats and artificial lighting in the UK' (Institute of Lighting Engineers/ Bat Conservation Trust, 2018)[12] Note that such evidence should also take into consideration the effects from lighting outside the proposed development site, for example from installation of street lighting along previously unlit sections of highway but now required to illuminate the section to and past an application site's entrance.

3.12 Prospective developers, following the outcome of the Court of Justice of the European Union ruling in the case of Holohan v. An Bord[13] (see Annex 7) it is required that species not listed on the SAC citation but nonetheless support the conservation objectives of the SAC are assessed. In the case applicants should make an assessment of night flying insect abundances on which SAC bats feed (see Annex 4).

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[11] http://www.naturalengland.org.uk/ourwork/planningdevelopment/spatialplanning/standingadvice/default.aspx ; Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition). London: Bat Conservation Trust; Mitchell-Jones, A. J. 2004. *Bat Mitigation Guidelines*. Peterborough: English Nature [As updated]
[12] Institute of Lighting Engineers/ Bat Conservation Trust. 2018. *Guidance Note 08/18 Bats and artificial lighting in the UK* https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/
[13] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:62017CN0461&from=EN

4. Mitigation within the Consultation Zone

4.1 Within the Bat Consultation Zone, where SAC bats would be affected or potentially affected by development appropriate mitigation will be required. The aim should be to retain and enhance habitat and features of value to horseshoe bats, such as those listed in paragraph 3.2 of Part B of this guidance. Where this is not possible replacement habitat may be needed. The council's ecologist will have regard to relevant considerations in determining the mitigation requirements, including survey results and calculations relating to replacement habitat. (See the methodology and metric in Annex 5.) The developer's ecologist should carry out the calculations when requested by the council's ecologist. Replacement habitat should always aim to be the optimal for the species affected.

4.2 The following are examples of habitats to which the above principles will apply:

- Hunting habitat such as grazed pasture, hedgerows, woodland edges, tree lines, hay meadows.
- Connecting habitat, which is important to ensure continued functionality of commuting habitats. (Proposals should seek to retain existing linear commuting features as replacement of hedgerows is likely to require a significant period to establish).

4.3 The following are also important principles:

- Seek to maintain the quality of all semi-natural habitats and design the development around enhancing existing habitats to replace the value of that lost making sure that they remain accessible to the affected bats
- Maintain bat roosts in situ and maintain or replace night roosts and consider enhancing provision of night roosting features. Night roosts are important for resting, feeding and grooming, particularly those located at distance from the main roost

4.4 Loss of habitat refers not only to physical removal but also from the effects of lighting. A development proposal will be expected to demonstrate that bats will not be prevented from using features by the introduction of new lighting or a change in lighting levels. Reference to specific lux levels will be expected. Lighting refers to both external and internal light sources. Applicants will be expected to demonstrate that considerations of site design, including building orientation; and the latest techniques in lighting design have been employed in order to, ideally, avoid light spill to retained bat habitats. Applicants will similarly be expected to demonstrate use of the latest techniques to avoid or reduce light spill from within buildings.

4.5 Where replacement habitat provision is necessary, the type(s) of habitat to be provided shall be agreed with the local authority's ecologist and/or Natural England as appropriate.

4.6 Where replacement habitat is required off site in mitigation the land should not be a designated Site of Special Scientific Interest, be contributing already to supporting conservation features or in countryside stewardship to enhance for bats.

4.7 Replacement habitat should aim to be the optimal for the species affected (See Annex 6). The following are examples of habitats of value to horseshoe bats and which may be created or enhanced as the replacement provision. Planting will be expected to consist of native species that produce an abundance of invertebrates, particularly moth species.

- Hedgerows with trees – tall, bushy hedgerows at least 3 metres wide and 3 metres tall managed so that there are perching opportunities
- Wildflower meadow - managed for moths, e.g. Long swards[14]
- Grazed pasture (essential for juveniles) – difficult to impossible to recreate on site and only feasible with management agreements with local landowners over and above existing regimes. Even so there may be issues which prevent grazing in the future[15]
- Ponds - for drinking and a prey source for Lesser Horseshoe bats
- Woodland / copses
- Provision of night roosting opportunities on site

4.8 The method for checking the adequacy of replacement habitat provided with an application or then in Master Planning of a proposed development, is given in Annex 5.

4.9 It is important that provision of the replacement habitat is carried out to timescales to be agreed by the local authority and/or Natural England as appropriate.

4.10 In the case of quarries, waste sites or other large-scale sites where restoration is proposed this should not be considered as mitigation for habitat lost to horseshoe bats. The timescale to when these restorations is likely to be implemented, i.e. 40 years after the quarry has been worked, is too long to provide any replacement to maintain the existing population at the time of impact.

4.11 **It is vital that any replacement habitat is accessible to the horseshoe bat population affected.**

4.12 A Landscape and Ecological Management Plan for the site must be provided setting out how the site will be managed for SAC bats for the duration of the development. Where appropriate a Monitoring Strategy also needs to be included in order to ensure continued use of the site by SAC bats and includes measures to rectify the situation if negative results occur.

Lighting

4.13 Horseshoe bats are known to be a very light sensitive species and are linked to linear habitat features. Recent research suggests that preferred commuting routes for Lesser

[14] The main species of moth species eaten by Greater Horseshoe bats are Large Yellow Underwing; Small Yellow Underwing; Heart and Dart; and Dark Arches at Woodchester (Jones, G., Barlow, K., Ransome, R. & Gilmour, L. 2015. *Greater Horseshoe bats and their insect prey: the impact and importance of climate change and agri-environment schemes*. Bristol: University of Bristol) See Annex 5 for information on habitats and food plants used by these species.

[15] For example see paragraphs 41 to 50 of Appeal Ref: APP/X1165/A/13/2205208 Land at Churston Golf Club, Churston, Devon, TQ5 0LA. https://acp.planninginspectorate.gov.uk/ViewCase.aspx?Caseid=2205208&CoID=0

Horseshoe bats are at lux levels even lower than previously thought: "*under natural, unlit conditions ... 0.04 lux*" [16]

4.14 in addition, many night flying species of insect such as moths, a key prey species for horseshoe bats, are attracted to light, especially those lamps that emit an ultra-violet component and particularly if it is a single light source in a dark area. It is also considered that insects are attracted to illuminated areas from further afield resulting in adjacent habitats supporting reduced numbers of insects. This is likely to further impact on the ability of the horseshoe bats to be able to feed.[17]

4.15 A variety of techniques will be supported to facilitate development that will avoid, minimise and/or compensate for light spill:

- Use of soft white LED lights with directional baffles as required (LED light lacks a UV element and minimises insect migration from areas accessed by SAC bats)
- use of building structure, design, location and orientation to avoid/minimise lighting impacts on retained habitats
- use of landscaping and planting to protect and/or create dark corridors on site.
- use of SMART glass where appropriate
- use of internal lighting design solutions to minimise light spill from places such as windows
- use of SMART lighting solutions

See also the 'Guidance Note 08/18 Bats and artificial lighting in the UK' (Institute of Lighting Engineers/ Bat Conservation Trust, 2018)[18]

4.16 Prospective developers will be expected to provide evidence, ideally in the form of a lux contour plan and sensitive lighting strategy, with their application to demonstrate that introduced light levels will not affect existing and proposed features used by SAC bats to above 0.5 lux; or not exceeding baseline light levels where this is not feasible.

Proposed developments with minor impacts

4.17 In circumstances of overall less potential impact, especially in Band C, mitigation may be put forward without the need for a full season's survey. (See Annex 3) This approach will only be suitable where it can be clearly demonstrated that the impacts of a proposed development are proven to be minor and can be fully mitigated without an impact upon the existing (& likely) SAC bat habitat. In order to adopt this approach, it will be necessary for a suitably qualified ecologist to visit the site and prepare a report with an assessment of existing (& likely) SAC bat habitat. The information from this report should provide the basis to determine appropriate mitigation measures associated with the proposed development. The proposed mitigation should clearly

[16] Average light levels recorded along preferred commuting routes of *Rhinolophus hipposideros* under natural unlit conditions were 0.04 lux across eight sites (Stone, E.L 2013. *Bats and Lighting – Overview of current evidence and mitigation.* Bristol: University of Bristol)

[17] Institute of Lighting Engineers/ Bat Conservation Trust. 2018. *Guidance Note 08/18 Bats and artificial lighting in the UK*; pers. comm. Dr Emma Stone, University of Bristol, 2009.

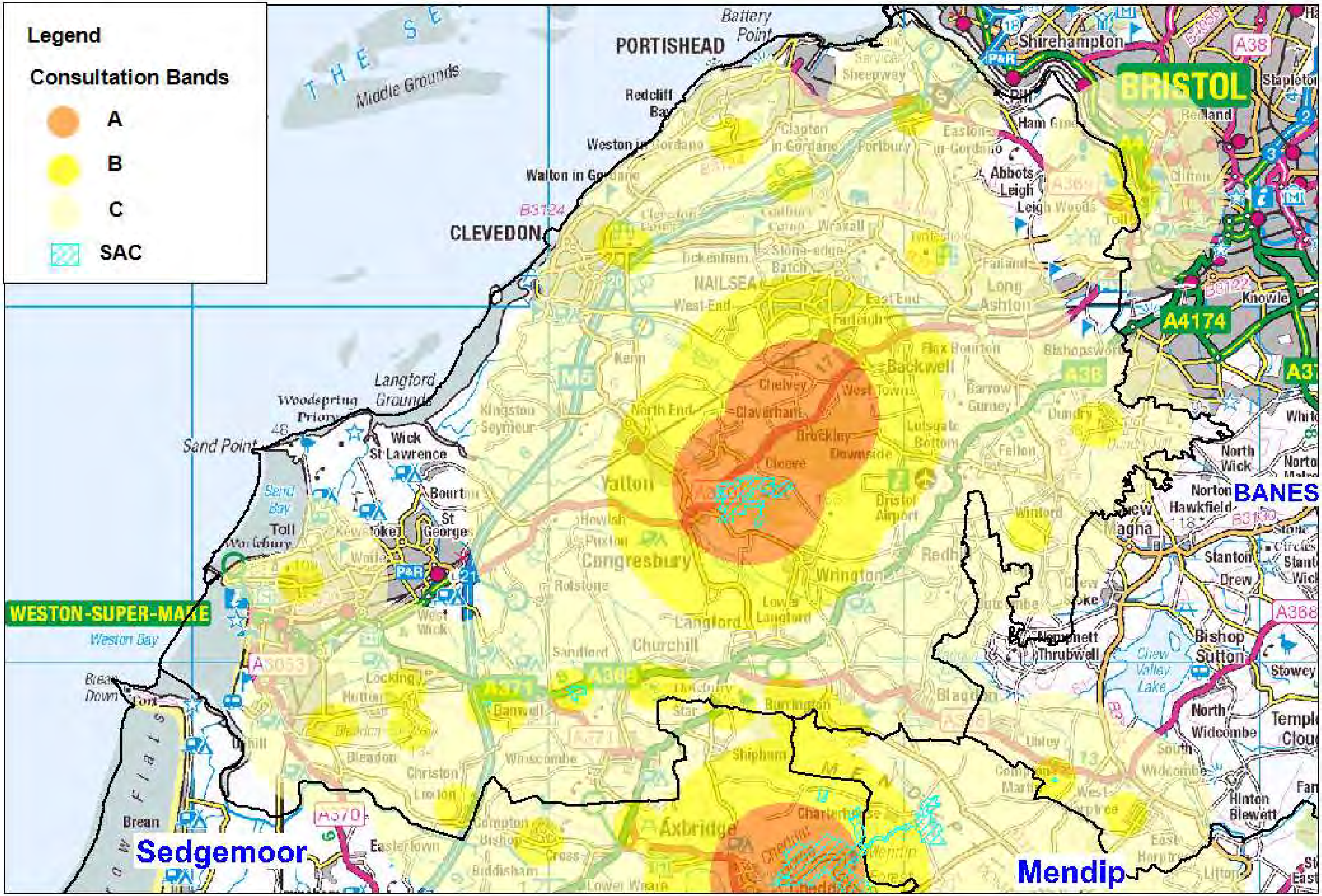
[18] Institute of Lighting Engineers/ Bat Conservation Trust. 2018. *Guidance Note 08/18 Bats and artificial lighting in the UK* https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/

demonstrate that there will be no interruption of suitable SAC bat commuting habitat. Replacement of foraging habitat may be required as appropriate.

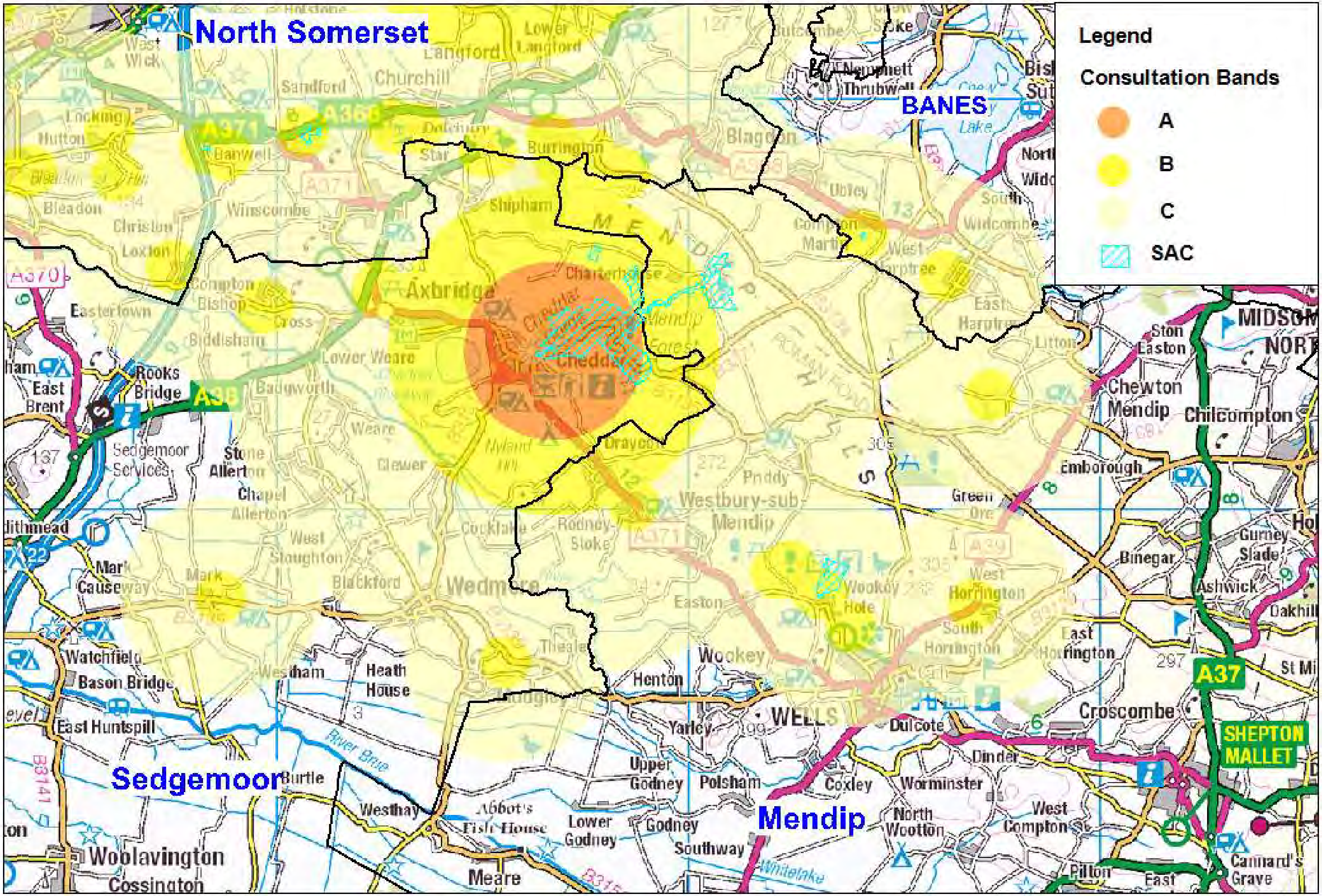
4.18 There may also be situations where mitigation will not be required because the proposed development does not have an impact upon existing (& likely) SAC bat habitat. In adopting this approach, it will be necessary to substantiate this with a suitably robust statement as part of the submission of the development proposals. In terms of impacts on SAC bats and habitat, it is important to bear in mind that minor proposed developments do not necessarily equate with small developments.

Lesser Horseshoe Bat (Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust)

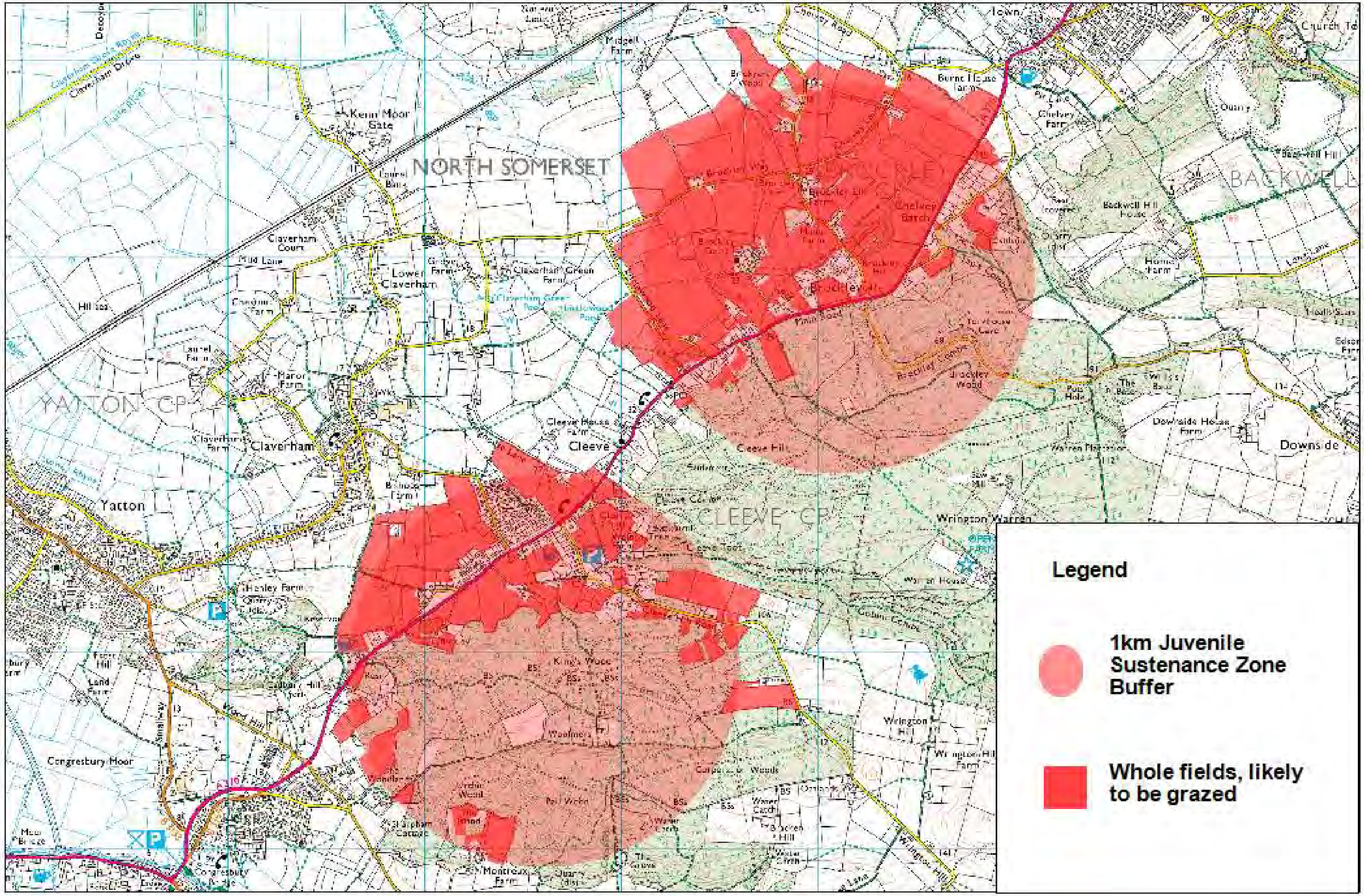
Plan 1: Greater Horseshoe Bat Consultation Zone (North Somerset)



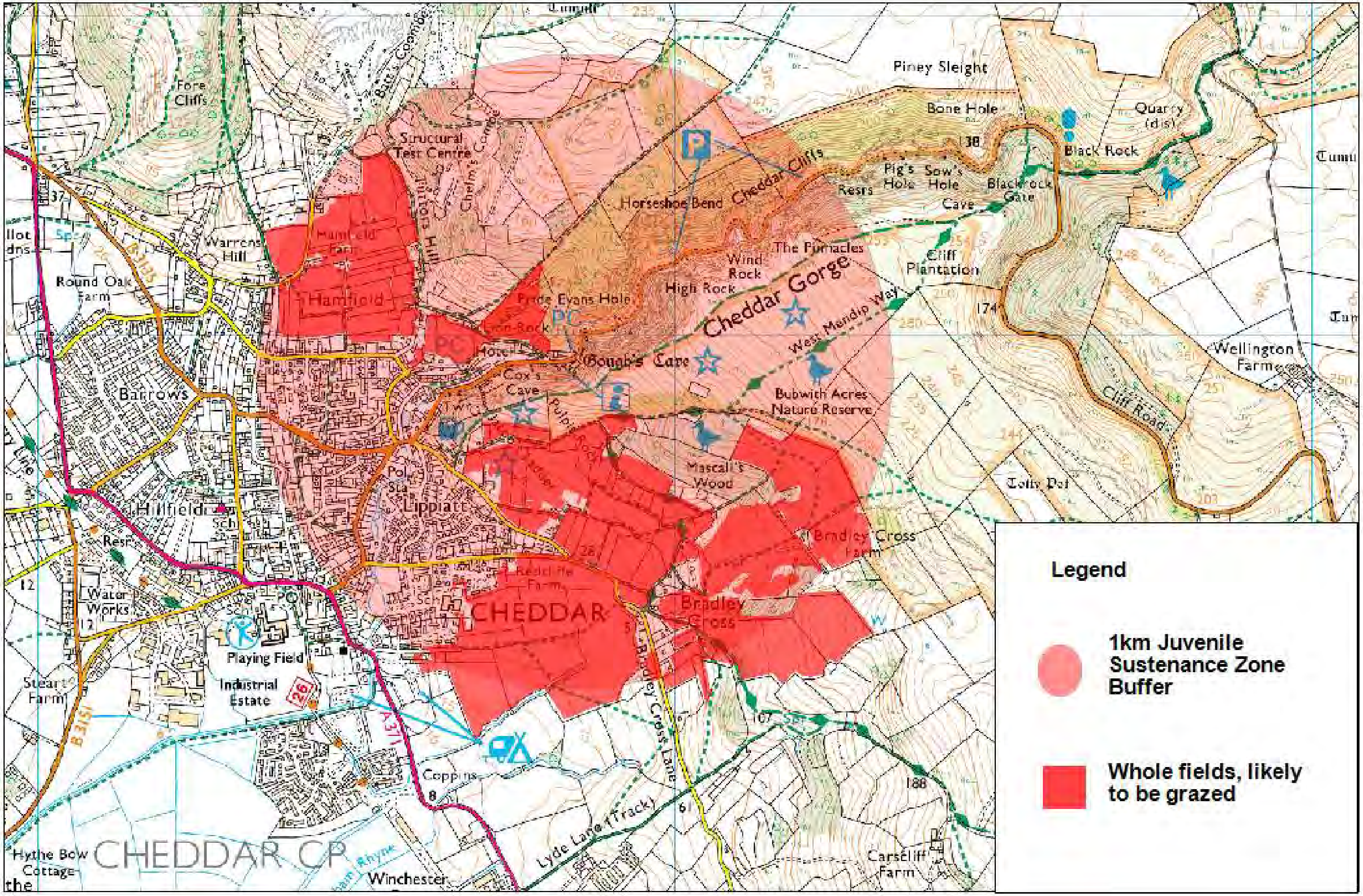
Plan 2: Greater Horseshoe Bat Consultation Zone (Sedgemoor and Mendip Districts)



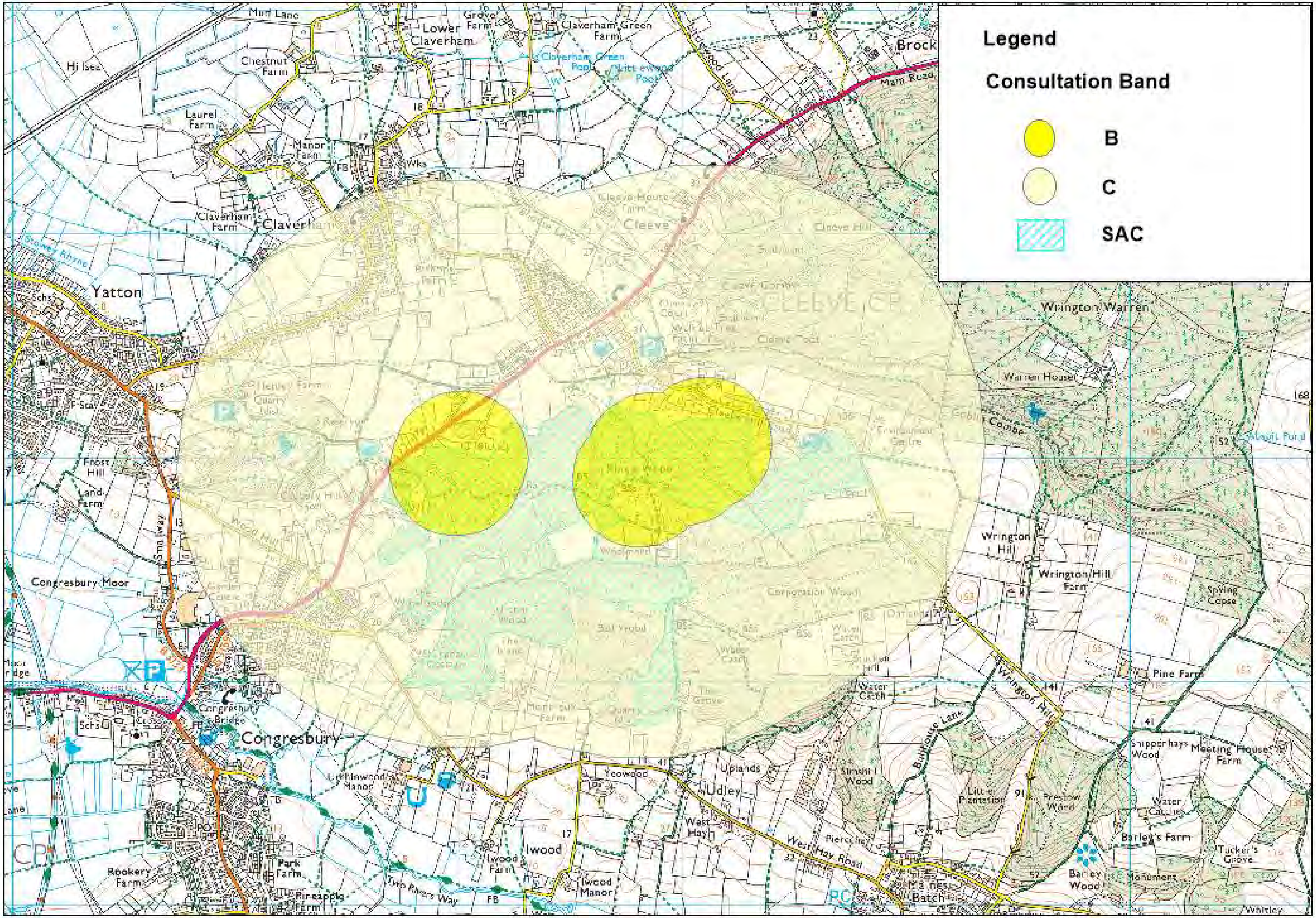
Plan 3: Juvenile Sustenance Zone (North Somerset)



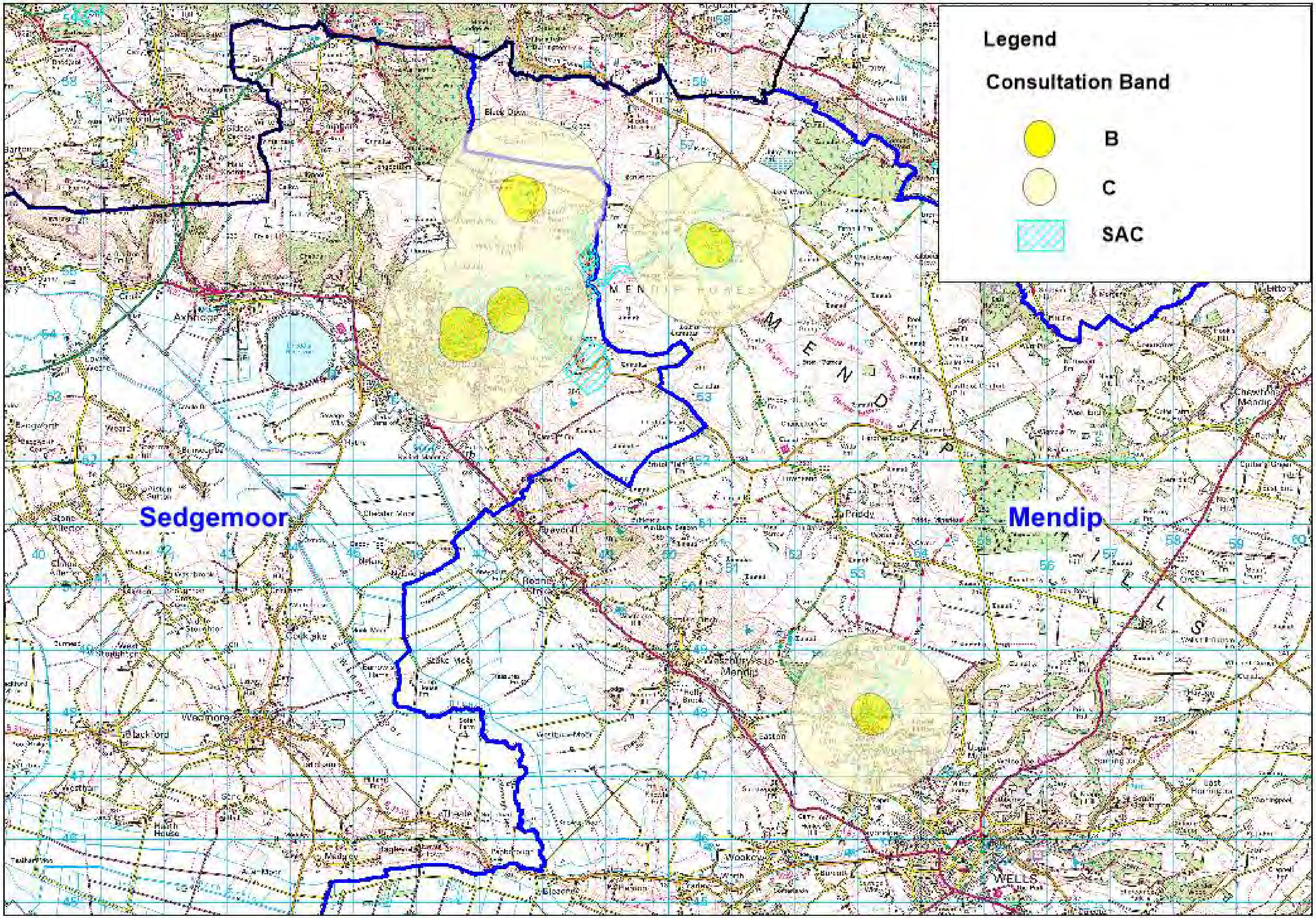
Plan 4: Juvenile Sustenance Zone (Cheddar)



Plan 5: Lesser Horseshoe Bat Consultation Zones (North Somerset)



Plan 6: Lesser Horseshoe Bat Consultation Zones (Sedgemoor and Mendip)



PART C Annexes

Annex 1: Details of the North Somerset and Mendip Bats Special Area of Conservation

A1.1 The North Somerset and Mendip Bats SAC is made up of 7 component Sites of Special Scientific Interest (SSSI):

- Compton Martin Ochre Mine SSSI (B&NES)
- Banwell Caves SSSI (NSC)
- Banwell Ochre Mine SSSI (NSC)
- Brockley Hall Stables SSSI (NSC)
- King's Wood and Urchin Wood SSSI (NSC)
- The Cheddar Complex SSSI (SCC & SDC)
- Wookey Hole SSSI (SCC & MDC)

A1.2 This site in south-west England is selected on the basis of the size of population represented (3% of the UK **Greater Horseshoe bat *Rhinolophus ferrumequinum*** population) and its good conservation of structure and function, having both maternity and hibernation sites. This site contains an exceptionally good range of the sites used by the population, comprising two maternity sites in lowland north Somerset and a variety of cave and mine hibernation sites in the Mendip Hills. The limestone caves of the Mendips provide a range of important hibernation sites for **Lesser Horseshoe bat *Rhinolophus hipposideros***.

A1.3 Greater Horseshoe bats are long lived (over 30 years in some cases) with the bats remaining faithful to these important roosting sites, returning year after year for generations.

A1.4 In terms of physical area, the SAC designation applies to a very tiny element of the habitat required by the bat population (the maternity roosts and entrances to their hibernation sites). It is clear that the wider countryside supports the bat populations because of the following combination of key elements of bat habitat:

A1.5 *The area has to be large enough to provide a range of food sources capable of supporting the whole bat population; the bats feed at a number of locations through the night and will select different feeding areas through the year linked to the seasonal availability of their insect prey:*

1. SAC bats regularly travel through the administrative areas of the Somerset authorities between feeding sites and their roosts via a network of established flyways. Radio tracking of Greater Horseshoe bats[19] has shown that they also travel greater distances between Brockley Hall Stables and Cheddar Gorge and further afield to the Bath and Bradford on Avon Bat and Mells Valley Bat SACs at certain times of the year, for example, in the spring and autumn between

[19] Billington, G. 2001. *Radio tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest, May – August 2001.* Peterborough: English Nature

hibernacula and maternity sites, and in the autumn to mating sites occupied by single males. Bats need a range of habitats during the year in response to the annual cycle of mating, hibernating, giving birth and raising young;

2. It follows that SAC bats need to be able to move through the landscape between their roosts and their foraging areas in order to maintain 'Favourable Conservation Status'. They require linear features in the landscape to provide landscape permeability. Compared to most other bat species, the echolocation call of the Greater Horseshoe bat attenuates rapidly in air due to its relatively high frequency. This means it cannot 'see' a great distance and is one reason why it tends to use landscape features to navigate, such as lines of vegetation (e.g. hedgerows, woodland edge, vegetated watercourses, etc.). The Greater Horseshoe bat will tend to commute close to the ground up to a height of 2 metres, and mostly beneath vegetation cover. Radio tracking studies[20] and observations in the field confirm that Greater Horseshoe bats will regularly use the interconnected flyways associated with lines of vegetation. Further studies[21] have shown that landscapes with broadleaved woodland, large bushy hedgerows and watercourses are important as they provide habitat continuity. Habitat is therefore very important to SAC bats in terms of *quality* (generation of insect prey) and *structure* (allowing them to commute and forage);

3. SAC bats are sensitive to light and will avoid lit areas[22]. The interruption of a flyway by light disturbance, as with physical removal/ obstruction, would force the bat to find an alternative route which is likely to incur an additional energetic burden and will therefore be a threat to the viability of the bat colony. In some circumstances, an alternative route is not available and can lead to isolation and fragmentation of the bat population from key foraging areas and/or roosts. The exterior of roost exits must be shielded from any artificial lighting and suitable cover should be present to provide darkened flyways to assist safe departure into the wider landscape[23].

4. The feeding and foraging requirements of the Greater Horseshoe bat have been reasonably well studied in the south west of England and Europe[24]. From this work we know that most feeding activity is concentrated in an area within 4km of the roost (juvenile bats will forage within 3km at a stage in their life when they are most susceptible to mortality). The most important types of habitat for feeding have been shown to be permanent pasture grazed by cattle or sheep, hay meadows, and wetland features such as stream lines and wet woodland. Depending upon the availability of suitable flyways and feeding opportunities, most urban areas will provide limited Greater Horseshoe bat habitat. The North

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[20] Radio tracking studies have been undertaken by NE in the following research reports R344, R496 & R573.
[21] A L Walsh & S Harris, (1996), Foraging habitat preferences of vespertilionid bats in Britain. *Journal of Applied Ecology, 33, 508 – 518*
[22] http://www.batsandlighting.co.uk/
[23] see EN research reports R174
[24] R D Ransome and A M Hutson, (2000), Action plan for the conservation of the greater horseshoe in Europe (Rhinolophus ferrumequinum), Convention on the Conservation of European Wildlife and Natural Habitats, Nature and Environment No 109. http://www.swild.ch/Rhinolophus/PlanII.pdf; Also see EN research reports R174, R241, R341 & R532

Somerset and Mendip Bats SAC situation is unusual in that the wintering Greater Horseshoe bat population mainly hibernates in caves in Cheddar Gorge and Wookey Hole, which are located close to urban areas and are subject to visitor disturbance. Commuting routes follow the urban edge, the Cheddar Yeo and within the urban area of Cheddar.[25]

A1.6 The populations of bats from the North Somerset and Mendips SAC are currently under stress from a number of factors, particularly the number of development applications and proposals on the urban edges of Yatton, Congresbury, Nailsea and Cheddar.

Greater Horseshoe Bat (Photo Frank Greenaway: Courtesy Vincent Wildlife Trust)

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[25] Rush, T. & Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013*. Witham Friary: Greena Ecological Consultancy

Annex 2: Bat Consultation Zones

A2.1 The Bat Consultation Zone Density Band widths will vary from species to species depending on its characteristic use of its home range. Those for Greater and Lesser Horseshoe bats are given in the Table below. As both these species use a single focus for a population, a roost, they are likely to occur at a decreasing density in the landscape the further removed from the centre (e.g. see Rainho & Palmeirim, 2011; Rosenberg & McKelvey, 1999[26]).

A2.2 Around Cheddar it was reported that Greater Horseshoe bats spent most of time roaming along hedgerows whilst foraging, moving onto different hedgerows after visiting several in their ‘patch’. Individuals use foraging areas that could be over 200 or more metres in length or over 6 to 7 hectares. Within these foraging areas each bat has localised feeding spots of about 0.35 hectares. In Germany they visit 11 – 25 such areas per night.

A2.3 A similar study of frequency of home range use away from a maternity roost site was carried out by Bontadina & Naef-Daenzer (2002)[27] at Grisons in Switzerland. It showed a higher frequency of use than would be expected at 1.2 to 1.6km distance when compared with uniform spatial use over the whole foraging range up to 4km. Above 4km the trend in spatial use declined up to the maximum range of 7.4km. In a radio tracking study carried out by Rossiter et al (2002)[28] at Woodchester Manor, overlaps in core foraging areas were nearly all within 1km of the roost with only two overlaps recorded at ~2km and then both corresponded to a mother / daughter pair.

A2.4 The bands in Table 2 below for a maternity roost of Greater Horseshoe bats are derived from radio tracking distances carried out by Billington (2001)[29] of the Brockley Hall Stables Greater Horseshoe bat roost in North Somerset. Although the Swiss study (Bontadina & Naef-Daenzer, 2002)[30] found greatest spatial density at 1.2 to 1.6km it is considered that 2.2km is used to determine the width of Band A in this case derived from Duvergé (1996)[31]. Billington notes that there has been deterioration in habitat near to the Brockley Hall roost where hedgerows have been removed, poorly managed or neglected. Duvergé (1996) carried out radio tracking studies in North Somerset where the summer foraging areas of adults were found to be located within 3 – 4 km of maternity roosts, and the mean adult range in one extensive study was 2.2km. About

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[26] Rainho, A. & Palmeirim, J. W. 2011. The Importance of Distance to Resources in the Spatial Modelling of Bat Foraging Habitat. *PLoS ONE, April 2011, 6, 4, e19227*; Rosenberg, D. K. & McKelvey, K. S. 1999. Estimation of Habitat Selection for Central-place Foraging Animals. *Journal of Wildlife Management 63 (3): 1028 -1038.*

[27] Bontadina, F. & Naef-Daenzer, B, 2002. *Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging*. PhD Thesis, Universität Bern

[28] Rossiter, S. J., Jones, G., Ransome, R. D. & Barratt, E. M. 2002 Relatedness structure and kin-based foraging in the Greater Horseshoe bat (*Rhinolophus ferrumequinum*). *Behav. Ecol. Sociobiol. (2002) 51: 510-518*

[29] Billington, G. 2001. *Radio tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest, May – August 2001.* Peterborough: English Nature.

[30] Bontadina, F. & Naef-Daenzer, B, 2002. *Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging*. PhD Thesis, Universität Bern

[31] Duvergé, L. 1996 quoted in Roger Ransome. 2009. *Bath Urban Surveys: Dusk Bat Surveys for horseshoe bats around south-western Bath. Assessments Summer 2008 & Spring 2009*. Bat Pro Ltd.

75% of the foraging areas are located within the mean adult range. A number of radio tracking studies have shown the maximum foraging range for most Greater Horseshoe bats is 4km and this distance is quoted in the requirements of habitat conservation from a roost site.[32] Billington (2001) tracked the maximum distance travelled by bats at Brockley Hall as 6.8km, discounting one bat which travelled 10.2km to Shipham and then subsequently day roosted in Cheddar Gorge. However, measuring the distances in GIS the furthest recorded bat fix was 7.8km ("as the crow flies").The Band widths for the non-breeding and winter roosts are derived from a radio tracking study of non-breeding roosts of Greater Horseshoe bats in Dorset carried out by Flanders (2008).[33] A comparison of foraging ranges from various studies on Greater Horseshoe bats is given in Appendix 1.

Table 2: Band Widths for Horseshoe Bats

Band	Greater Horseshoe bat (metres)		Lesser Horseshoe bat (metres)	
	Maternity	Other	Maternity	Other
A	0 – 2200		0 - 600	
B	2201 - 4000	0 - 610	601 - 2500	0 - 300
C	4001 - 8000	611 – 2440	2501 - 4100	301 - 1250

A2.5 The Band widths for Lesser Horseshoe bats are derived from the radio tracking study carried out by Knight (2006)[34] for a lowland study area (as opposed to high quality and upland landscapes) which was located in North Somerset. The maximum distance travelled in this study was 4.1km for an adult female and 4.5km for a nulliparous female. The mean maximum range was 2.2km. Bontadina et al (2002)[35], whose study found a similar maximum foraging range, recommended that conservation management should be concentrated within 2.5km of the roost with special consideration within 600 metres of the roost where the colony foraged half the time. The same result was found for the North Somerset study.

A2.6 Radio tracking of Lesser Horseshoe bats carried out by Bontadina et al (2002) [36] estimated the density of Lesser Horseshoe bat foraging in their study area was 5.8 bats per hectare within 200 metres of the maternity roost, decreasing to 1 bat per hectare at 390 metres and 0.01 bats per hectare at 1200 metres. Knight (2006) [37] when

[32] See Appendix 1; e.g. also see Duvergė, P. L. & Jones, G. 1994. Greater Horseshoe bats - Activity, foraging behaviour and habitat use. *British Wildlife 6, 2, 69 -77;* Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Ransome, R. 2009. *Bath Urban Surveys: Dusk Bat Surveys for horseshoe bats around south-western Bath. Assessments Summer 2008 & Spring 2009*. Bat Pro Ltd.

[33] Flanders, J. R. 2008. Roost use, ranging behaviour and diet of the Greater Horseshoe bat *Rhinolophus ferrumequinum* in Dorset: in Flanders, J. R. 2008. *An integrated approach to bat conservation: applications of ecology, phylogeny and spatial modelling of bats on the Isle of Purbeck, Dorset*. PhD Thesis, University of Bristol.

[34] Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.

[35] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290.*

[36] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290.*

[37] Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD thesis. University of Bristol.

carrying out a radio tracking for a Lesser Horseshoe bat roost of 200 individuals in North Somerset estimated a foraging density of 0.13 bat/hectare within 2 km of the roost and, like the Bontadina et al study, density declined sharply within the first kilometer in two of the study sites and subsequently at a lower rate out to the extent of the recorded foraging distance. A third study site in a high-quality landscape showed a steadier rate of decline in density throughout the range.

A2.7 The Band widths for the non-breeding roost are derived from England radio-tracking of Lesser Horseshoe bats carried out in the winter. This study revealed that they foraged on average to a maximum distance of 1.2 kilometers from the hibernation site. One bat travelled to an absolute maximum distance of 2.1 kilometers. The winter foraging range appears to be approximately half that of the distance covered in the summer months. (Bat Conservation Trust/BMT Cordah, 2005)[38] For the purposes of this study the ranges are similarly halved. A comparison of foraging ranges is given in Appendix 1.

Lesser Horseshoe Bat (Photo: Frank Greenaway. Courtesy Vincent Wildlife Trust)

[38] Bat Conservation Trust / BMT Cordah. 2005. *A Review and Synthesis of Published Information and Practical Experience on Bat Conservation within a Fragmented Landscape*. Cardiff: The Three Welsh National Parks, Pembrokeshire County Council, Countryside Council for Wales

Annex 3: Survey Specification for Surveys for Planning Applications Affecting SAC bat Consultation Zones.

A3.1 Three types of survey are required to inform the impact of proposed development. These are:

- Bat Surveys
- Habitats / Land use Surveys
- Light Surveys

Bat Surveys

A3.2 The following sets out the survey requirements for development sites within the Bat Consultation Bands A and B in part based on the guidance given by the Bat Conservation Trust (2016)[39] and on the advice of consultants experienced in surveying for horseshoe bats. Note that the objective is to detect commuting routes and foraging areas rather than roosts.

A3.3 The following specification is recommended in relation to development proposals within Bands A and B of the Bat Consultation Zone. It is also worth mentioning the difficulty associated with detecting the Greater Horseshoe bat's echolocation call compared to most other British bat species due to the directionality and rapid attenuation of their call. This fact emphasises the requirement for greater surveying effort and the value of broadband surveying techniques. It is recommended that the most sensitive equipment available should be used. It is also recommended that the local planning authority ecologist be contacted with regard to survey effort.

(i) Surveys should pay particular attention to linear landscape features such as watercourses, transport corridors (e.g. roads, sunken lanes railways), walls, and to features that form a linear feature such as hedgerows, coppice, woodland fringe, tree lines, ditches and rhynes and areas of scrub and pasture that may provide flight lines.

(ii) The main survey effort should be that using automated detectors. Automatic bat detector systems need to be deployed at an appropriate location (i.e. on a likely flyway). Enough detectors should be deployed so that each location is monitored through the survey period in order that temporal comparisons can be made. The period of deployment should be at least 50 days from April to October and would include at least one working week in each of the months of April, May, August, September and October (50 nights out of 214; ≈25%). For development within Band B of the Bat Consultation Zone of hibernation roosts winter surveys may be required.

(iii) The number of automated detectors will vary in response to the number of linear landscape elements and foraging habitat types, the habitat structure, habitat quality, used by horseshoe bats and taking into account their flight-altitude. Every site is

[39] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition) London: Bat Conservation Trust

different, but the objective would be to sample each habitat component equally[40]. Generally:

- With hedges it depends on the height and width, and also whether they have trees, as to how many detectors might be needed to ensure the coverage is comprehensive no matter what the wind decides to do.
- With grassland, the number depends on whether the site is grazed or not; if it is we need a comparison of the fields with livestock and the fields without.
- In a woodland situation a sample with three detectors: one on the woodland edge, two in the interior with one in the canopy and one at eye-level.
- The open areas of a quarry are sampled with two detectors reflecting the un-vegetated and vegetated cliffs so the two can be compared.

(iv) Results from automated detectors recording should be analysed to determine whether the site supports foraging or increased levels activity as this affects the Band used in calculating the amount of replacement habitat required to mitigate losses to horseshoe bats.

(v) Manual transect surveys[41] should be carried out on ten separate evenings; at least one survey should be undertaken in each month from April to October[42], as the bats' movements vary through the year. Transects should cover all habitats likely to be affected by the proposed development, including a proportion away from commuting features in field. Moreover, manual surveys only give a snap shot of activity (10 nights out of 214; ≈5%) and less effective at detecting horseshoe bats therefore automated bat detector systems should also be deployed see section (ii).

(vi) Surveys should be carried out on warm (>10 °C but >15°C in late summer), still evenings that provide optimal conditions for foraging (insect activity is significantly reduced at low temperatures; see commentary below). Details of temperature and weather conditions during surveys should be included in the final report.

(vii) Surveys should cover the period of peak activity for bats from sunset for at least the next 3 hrs.

(viii) Transect surveys should preferably be with most sensitive equipment available. Digital echolocation records of the survey should be made available with the final report; along with details of the type and serial number of the detector.

(ix) Surveys should be carried out by suitably qualified and experienced persons. Numbers of personnel involved should be agreed beforehand with the appropriate Somerset authority or Natural England, be indicated in any report and be sufficient to thoroughly and comprehensively survey the size of site in question.

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[40] Pers. Comm. Henry Andrews, AEcol, 23/09/2016

[41] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines*. (3rd Edition) London: Bat Conservation Trust

[42] The active bat season can vary e.g. shortened by prolonged cold winters and lengthened by warm 'Indian summers'

(x) Surveys should also include desktop exercises in collating any records and past data relating to the site via Bristol Environmental Records Centre (BRERC) or Somerset Environmental Records Centre (SERC), local Bat Groups etc.

(xi) All bat activity should be clearly marked on maps and included within the report.

(xii) Basic details of records for the site should be passed to BRERC and/or SERC after determination of the application.

A3.4 Survey effort in Band C is dependent on whether commuting structure is present and the suitability of the adjacent habitat to support prey species hunted by horseshoe bats. Nonetheless this should be in accordance with Bat Conservation Trust guidelines (Collins, 2016[43])

Habitats Surveys

A3.5 Phase 1 habitat, Integrated Habitat System or UK Habitat Classification surveys should be carried out for all land use developments within the Bat Consultation Zone. Surveys should also include information on the habitats on site for the five years previous to the current survey.

A3.6 Surveys must be extended to include the management and use of each field, e.g. whether the field is grazed or used as grass ley, and the height, width and management of hedgerows in the period of bat activity. Information can be sought from the landowner. If grazed, the type of stock and management regimes should be detailed if possible. Habitat mapping should include approximate hectarage of habitats to inform the methodology for calculating replacement habitat required.

Lighting Surveys

A3.7 Surveys of existing light levels on proposed development sites should be undertaken and submitted with the planning application in accordance with guidelines given in the 'Guidance Note 08/18 Bats and artificial lighting in the UK' (Institute of Lighting Engineers/ Bat Conservation Trust, 2018)[44]. This should cover the full moon and dark of the moon periods so that an assessment of comparative SAC bat activity on a proposed site can be ascertained.

A3.8 Baseline measurements should be taken systematically across the site or features in question. At each sample location, a reading should be taken at ground level on the horizontal plane (to give illuminance hitting the ground) and vertical readings should also be taken at each sample location at 1.5m above ground level. The orientation for vertical readings should be perpendicular to the surface/edge of the habitat feature in question (such as a hedgerow) to produce a 'worst case' reading. Further measurements at other orientations may prove beneficial in capturing influence of all

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[43] Collins, J. (ed). 2016. *Bat Survey Guidelines for Professional Ecologists: Good Practice Guidelines* (3rd Edition). London: Bat Conservation Trust

[44] Institute of Lighting Engineers/ Bat Conservation Trust. 2018. *Guidance Note 08/18 Bats and artificial lighting in the UK* https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/

luminaires in proximity to the feature or principal directions of flight used by bats. This survey data can then be used to inform the masterplan of a project.

A3.9 Surveys should also consider lighting, and the absence of such where a road would be subsequently street lit post development, outside the red line boundary of the proposed development site.

Annex 4: Habitat Requirements of Greater and Lesser Horseshoe bats

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Greater Horseshoe Bats

Prey

A4.1 Dietary analysis of Greater Horseshoe bat droppings shows three main prey items: cockchafer *Melolontha melolontha*; dung beetles *Aphodius* sp. (Coleoptera: Scarabaeidae); and moths (Lepidoptera). Of these moths form the largest part of the diet but the other two are important at certain times of year.[45] They are conservative in their food sources. Three secondary prey sources are also exploited: crane flies (Diptera: Tipulidae), ichneumonids (Hymenoptera: Ichneumonidae) of the *Ophian luteus* complex, and caddis flies (Trichoptera) [but less so at Brockley Hall Stables].[46]

General

A4.2 Greater Horseshoe bat populations are sustained by a foraging habitat which consists primarily of permanently-grazed pastures interspersed with blocks or strips of deciduous woodland, or substantial hedgerows. Such pasture/woodland habitats can generate large levels of their favoured prey, especially moths and dung beetles, but also tipulids and ichneumonids. Preferably pastures should be cattle-grazed, as their dung sustains the life-cycles of the most important beetles to Greater Horseshoe bats, but sheep and horse grazing can also be beneficial in a rotation to reduce parasite problems. Sheep-grazing, which results in a short sward, may also benefit the life-cycles of tipulids and cockchafers.

A4.3 The periods through the year when these prey species are hunted is outlined below:

(a) The preferred key prey in April for all bats that have survived the previous winter is the large dung beetle *Geotrupes*.
(b) In May, the preferred key prey is the cockchafer *Melolontha melolontha*.
(c) In April and May, in the absence of sufficient key prey, bats switch to secondary prey such as tipulids, caddis flies and the ichneumonid *Ophion*. As a last resort they eat small dipterans.
(d) In June and early July, pregnant females feed on moths, their key prey at that time, and continue to do so after giving birth, until late August. They usually avoid *Aphodius rufipes* even when they are abundant, as long as moths are in good supply. If both are in poor supply, they switch to summer chafers (*Amphimallon* or *Serica*).
(e) Moth supplies usually fall steadily in August and September, due to phonological population declines, or rapidly at a particular dawn or dusk due to temporary low temperatures. If either happens adult bats switch to secondary, single prey items, or combine moths with them. Tipulids are often the first alternative, but *Aphodius rufipes* is also taken. In very cold spells ichneumonids, of the *Ophion luteus*

[45] Ransome (1996) carried out dietary analyses of Greater Horseshoe bats in June and July and found that 60 – 80% of their diet was moths.
[46] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature.

complex are consumed. They are common prey in October and through the winter as they can fly at low ambient temperatures. However, in summer they are used as a last resort.

(f) Juvenile bats do not feed at all until they are about 29 or 30 days old, when they normally feed on *Aphodius rufipes*, which is their key prey. This dung beetle species is a fairly small (90mg), easily-caught and usually abundant prey, which reaches peak numbers at the time that the young normally start to feed in early August.[47]

A4.4 The top five feeding areas for Greater Horseshoe bats over the active period in North Somerset include:

- pasture with cattle as single stock or part of mixed stock (38.6%);
- ancient semi natural woodland (16.6%);
- pastures with stock other than cattle (10.3%);
- meadows grazed by cattle in the autumn (9.4%); and
- other meadows and broadleaved woodland (4.9%).[48]

A4.5 These habitats are not used according to the fore listed proportions throughout the year but change with the seasons. Woodlands and pasture adjoining wood are used in spring and early summer. As summer progresses, feeding switches to areas further away and tends to be fields used for grazing cattle and other types of stock. Meadows that have been cut and where animals are grazing are also used. A balance of woodland and pasture of about 50% and 50% provides optimum resources for Greater Horseshoe bats.[49] Billington (2000)[50] identified that there were four principal habitat types: scrub, meadow, deciduous woodland and grazed pasture.

A4.6 Within suitable habitat, a range of three roosts types must be present for a colony to exist. A single maternity roost, with many surrounding night roosts nearby (usually up to 4 km, but exceptionally up to 14 km) for resting between foraging bouts and a range of suitable hibernacula within a 60 km radius. Three types of hibernaculum have been identified which should be as close as possible, but within 15 km of the maternity roost.[51]

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[47] Ransome, R. D. & Priddis, D. J. 2005. *The effects of FMD-induced mass livestock slaughter on greater horseshoe bats in the Forest of Dean.* English Nature Research Reports Number 646. Peterborough : English Nature.

[48] Duvergė, P. L. & Jones, G. 1994. Greater Horseshoe bats - Activity, foraging behaviour and habitat use. *British Wildlife Vol. 6 No 2*

[49] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Bontadina, F. & Naef-Daenzer, B, 2002. *Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging*. PhD Thesis, Universität Bern

[50] Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset*. Peterborough: English Nature

[51] R D Ransome and A M Hutson, (2000), Action plan for the conservation of the greater horseshoe in Europe (Rhinolophus ferrumequinum), Convention on the Conservation of European Wildlife and Natural Habitats, Nature and Environment No 109. http://www.swild.ch/Rhinolophus/PlanII.pdf

Grassland

A4.7 The most important factor for supporting Greater Horseshoe bat populations is grazed pasture[52]. Cattle are preferred to smaller grazers, since they create the ideal structural conditions for perch-hunting bats in hedgerows and woodland edge. Within 1 kilometre of the roost the presence of permanent grazed pasture is critical for juvenile Greater Horseshoe bats. A high density of grazing animals should be present giving high presence of dung. Within the remainder of the roost foraging range grazing regimes can be more flexible provided adequate pasture is available.[53]

A4.8 *Aphodius* beetles live in cow, sheep and horse dung. Short grazed habitat, such as produced by sheep, benefits *Melontha* and Tupilid species which require short grass to oviposit. Sheep dung also provides dung-based prey. Large dung beetles, *Geotrupes* spp., can provide a major dietary component of Greater Horseshoe bats. Most favour cattle dung, but some also use sheep dung.

A4.9 Longer swards benefit the larvae of noctuid moths.[54] The main species of moth eaten by Greater Horseshoe bats at Woodchester in Gloucestershire are Large Yellow Underwing; Small Yellow Underwing; Heart and Dart; and Dark Arches. The former two species are on the increase whilst the latter two are in decline.[55]

- Large Yellow Underwing are found in a range of habitats, including agricultural land, gardens, waste ground, and has a range of food plants including dandelion, dock, grasses and a range of herbaceous plants both wild and cultivated, including dog violet and primrose. It will also visit flowers such as Buddleia, ragwort, and red valerian. The larva is one of the ‘cutworms’ causing fatal damage at the base of virtually any herbaceous plant, including hawkweeds, grasses, plantains and dandelions and a range of cultivated vegetables and flowers. This moth flies at night from July to September and is freely attracted to light.

- Small Yellow Underwing are found on flower-rich grassland, including meadows, roadside verges, open woodland and grassy embankments. The food plants are as for those listed for the Large Yellow Underwing but also include foxglove, sallow, hawthorn, blackthorn and silver birch. The larvae feed on the flowers and seeds of mouse-ear (*Cerastium spp.*), especially common mouse-ear. This moth flies in May and June in the daytime so may be gleaned at night.

- Heart and Dart are found in agricultural land, meadows, waste land, gardens and places where their food plants grow. Food plants include dock, plantain, chickweed, fat hen, turnip, sugar beet and many other herbaceous plants. The larvae feed on

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52 Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature.

53 Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature

54 Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature

55 Jones, G., Barlow, K., Ransome, R. & Gilmour, L. 2015. *Greater Horseshoe bats and their insect prey: the impact and importance of climate change and agri-environment schemes*. Bristol: University of Bristol.

various wild and garden plants. The moth flies from May to July, when it is readily attracted to light.

- Dark Arches are found in meadows and other grassy place and food plants include cocksfoot, couch grass and other grasses. The larvae feed on the bases and stems of various grasses. The moth is on the wing from July to August and is readily attracted to light.[56]

Woodland

A4.10 Rides and footpaths are used by Greater Horseshoe bats when flying in woodland feeding areas. Grassy rides and glades in woodland increase the range of food and provide opportunity for perch hunting.[57]

A4.11 Woodland supports high levels of moth abundances. Macro (and micro) moths are densest where there is grass or litter, less so where there are ferns, moss, bare ground or herbs. They are richer where there is native tree diversity and trees with larger basal areas. Species such as oak, willow and birch have large numbers of moths, whereas beech has small numbers even when compared to non-native species such as sycamore. Uniform stands of trees are poorer in invertebrates than more diversely structured woodland.[58]

A4.12 Greater Horseshoe bats feed through the winter when prey species become active, for example when *Ophian* wasps swarm in woodlands above 5˚C. They have been found to spend significant times in woodland, being sheltered, often warmer at night, and insects are much more abundant than in open fields. However, in another study Billington (2000) carried out in the summertime found that there was limited foraging of adults recorded in woodlands, of only a few minutes duration, except during medium-heavy rainfall when most of the foraging time was spent in broadleaf and coniferous woodland. Use, therefore, is likely to be dependent on season and weather conditions.[59]

Hedgerow

A4.13 Larger hedgerows are required for commuting as well as foraging by Greater Horseshoe bats. Continuous lines of vegetation of sufficient height and thickness to provide darkness when light levels are still relatively high are needed for commuting

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[56] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; http://ukmoths.org.uk/species/noctua-pronuba/; http://ukmoths.org.uk/species/panemeria-tenebrata/; http://ukmoths.org.uk/species/agrotis-exclamationis; http://ukmoths.org.uk/species/apamea-monoglypha/

[57] Duvergė, P. L. & Jones, G. 1994. Greater Horseshoe bats - Activity, foraging behaviour and habitat use. *British Wildlife Vol. 6 No 2;* Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Bontadina, F. & Naef-Daenzer, B, 2002. *Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging*. PhD Thesis, Universität Bern.

[58] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature; Fuentes-Montemayor, E., Goulson, D., Cavin, L., Wallace, J.M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation 153 (2012) 265–275*; Kirby, K. J. (ed). 1988. *A woodland survey handbook*. Peterborough: Nature Conservancy Council.

[59] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset*. Peterborough

bats. Ransome (1997) recommended the retention of existing hedgerows and tree lines linking areas of woodland, encouraging hedgerow improvement to become 3 to 6 metres wide, mean 3 metres high with frequent standard emergent trees.[60]

A4.14 Substantial broad hedgerows with frequent emergent trees can provide suitable structure for foraging conditions for Greater Horseshoe bats if woodland is scarce. Cattle are preferred to smaller grazers, since they create the ideal structural conditions for perch-hunting bats in hedgerows and woodland edge. A tall thick hedgerow is a very efficient way of producing a maximum level of insect prey using a minimum land area and important creators of physical conditions that enhance insect concentrations and reduce wind speeds for economical hunting flight. The vast majority of insects (over 90%) found near hedge lines do not originate in the hedge but come from other habitats brought in on the wind.[61]

<u>Scrub</u>

A4.15 Scrub also seems to be an important foraging habitat for Greater Horseshoe bats. Billington (2000) records the frequent use by the species during radio tracking carried out for the Mells Valley SAC in June. Scrub in disused quarries is important.[62]

A4.16 Large Yellow Underwing moths are attracted to Buddleia or Butterfly Bush. Butterfly Bush grows in abundance in limestone quarries and flowers from July to September, when demands on lactating female horseshoe bats are high. There is potential to deprive horseshoe bats of a foraging ground by restoring large areas of butterfly bush scrub all in one hit and at the wrong time of year.[63]

A4.17 However, similarly to Lesser Horseshoe bats, large areas of continuous scrub are likely to be avoided by Greater Horseshoe bats.[64]

<u>Others</u>

A4.18 Ditches and rhynes are used as flight corridors to access foraging areas in the Somerset Moors south of Cheddar, flying below ground level. This is also likely to be the case in North Somerset. They have also been radio tracked flying straight across the open water of Cheddar Reservoir.[65]

A4.19 Tipulid larval development is favoured by damp conditions. Therefore, any aquatic environments and/or marshes can provide a secondary prey source. Aquatic

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[60] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature

[61] Ransome, R. D. 1996. *The management of feeding areas for Greater Horseshoe bats*. Peterborough: English Nature; Bat Conservation Trust. 2003. *Agricultural practice and bats: A review of current research literature and management recommendations*. London: Defra project BD2005

[62] Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset.* Peterborough: English Nature

[63] Pers. comm. Henry Andrews. AEcol, 22/09/2016

[64] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[65] Jones, Dr. G. & Billington, G. 1999. *Radio tracking study of Greater Horseshoe bats at Cheddar, North Somerset*. Taunton: English Nature; Rush, T. & Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013*. Witham Friary: Greena Ecological Consultancy

environments could also favour the production of caddis flies in certain months, such as May and late August / September when other food supplies may be erratic. There is significant caddis fly consumption at roosts close to extensive river or lake habitats.[66]

A4.20 In Devon the River Dart, a large river system, mostly banked by broadleaved woodland was also found to be a key habitat.[67]

A4.21 Habitats which are of little use to Greater Horseshoe bats include urban areas, arable land and amenity areas such as playing fields. Lights, such as street lights or security lamps, are strong deterrents to Greater Horseshoe bats, both when they emerge from roosts, and when they forage. However, radio tracking shows that bats regularly pass through urban areas of Cheddar and will fly along hedgerows adjoining arable areas to reach hunting grounds. It is suspected that they will fly through (but not along) a line of street lights, probably at the darker points between lamps, as evidenced by radio tracking. In North Somerset they have been recorded within urban areas but here lights are switched off after midnight.

A4.22 During the winter period Greater Horseshoe bats are likely to forage closer to roost sites than during the summer and in areas sheltered from the wind, and on south and southwest facing slopes.[68]

Lesser Horseshoe Bats

<u>Prey</u>

A4.23 The diet of the Lesser Horseshoe bat consists mostly of Diptera of the crepuscular sub-order Nematocera. Families of Nematocera Diptera recorded in the diet include Tipulidae (crane-flies), Ceratopogonidae (biting midges), Chironomidae (non-biting midges), Culicidae (mosquitoes), and Anisopodidae (window midges). Lepidoptera (moths), Trichoptera (caddis-flies) and Neuroptera (lacewings) are also eaten.[69]

A4.24 Due to their small body size they cannot cope with large prey, such as cockchafers. By comparison they eat smaller moth species than the Greater Horseshoe bat. The principal prey species for Lesser Horseshoe bats, using data collected at Hestercombe House SAC are from the Diptera and Lepidoptera families. At this location there were seven major prey categories comprised over 70% of the diet: Tipulidae (crane flies), Anisopodidae (window gnats), Lepidoptera (moths), Culicidae (mosquitoes),

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[66] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature

[67] Billington, G. 2003. *Radio tracking study of Greater Horseshoe bats at Buckfastleigh Caves, Site of Special Scientific Interest*. Peterborough: English Nature.

[68] Ransome, R. D. 2002. *Winter feeding studies on Greater Horseshoe bats*: English Nature Research Reports Number 449. Peterborough: English Nature

[69] Vaughan, N., Jones, G. & Harris, S. 1997. Habitat use by bats (Chirpotera) assessed by means of a broad-band acoustic method. *Journal of Applied Ecology 1997, 34, 716-730*; Boye, Dr. P. & Dietz, M. 2005. English Nature Research Reports Number 661: *Development of good practice guidelines for woodland management for bats*. Peterborough: English Nature

Hemerobiidae (brown lacewings), Trichoptera (caddis flies) and Ichneumonidae (ichneumon wasps)[70]

General

A4.25 '*The primary foraging habitat for Lesser Horseshoe bats is broadleaf woodland where they often hunt high in the canopy. However, they will also forage along hedgerows, tree-lines and well-wooded riverbanks*.'[71] Lesser Horseshoe bats are primarily a woodland feeding bat using deciduous woodland or mixed coniferous woodland and hedgerows. It has been found that landscapes that were most important contained a high proportion of woodland, parkland and grazed pasture, linked with linear features, such as overgrown hedgerows.

A4.26 Downs et al (2016) identified a preference for woodland habitats above all others, particularly broadleaf woodland. Wet broadleaf woodland was used for foraging by five of the thirteen tracked bats. Parkland, grazed grassland and un-grazed grassland were also selected. Arable land was the least selected. The study revealed a preference for grazed over un-grazed grassland. Grazed grassland was also selected above parkland (only some of which was grazed), suggesting that the presence of cattle may be more important than mature parkland trees.[72]

A4.27 Downs et al (2016) also noted that comparing the sexes, females showed an increased preference for woodland and a decreased preference for grassland. They are able to forage within habitats other than woodland (such as scrub and isolated trees), and cross open gaps to reach these areas. However, these foraging situations are likely to be sub-optimal.[73]

Woodland

A4.28 Lesser horseshoe bats prefer to hunt in woodland interiors where micromoth abundance is greatest. In the Wye valley in Monmouthshire studies revealed that Lesser Horseshoe bats significantly spend the majority of their time foraging in woodland. Broadleaved woodland predominated over other types of woodland and was shown to be a key habitat for the species. In the core foraging areas used by bats woodland accounted for 58.7 ± 5.2% of the habitats present. Although Lesser Horseshoe bats prefer deciduous woodland as foraging habitat they will occasionally hunt in conifer plantations. However, the biomass in coniferous woodland is smaller,

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[70] Boye, Dr. P. & Dietz, M. 2005. English Nature Research Reports Number 661: *Development of good practice guidelines for woodland management for bats*. Peterborough: English Nature; Knight Ecology. 2008. *Hestercombe House, Taunton, Somerset: Lesser Horseshoe bat Diet Analysis*. Clutton: Knight Ecology

[71] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[72] Downs, N. C., Cresswell, W. J., Reason, P., Sutton, G., Wells, D. & Wray, S. 2016. Sex-Specific Habitat Preferences of Foraging and Commuting Lesser Horseshoe Bats Rhinolophus hipposideros (Borkhausen, 1797) in Lowland England. *Acta Chiropterologica* 18(2), (1 December 2016)

[73] Downs, N. C., Cresswell, W. J., Reason, P., Sutton, G., Wells, D. & Wray, S. 2016. Sex-Specific Habitat Preferences of Foraging and Commuting Lesser Horseshoe Bats Rhinolophus hipposideros (Borkhausen, 1797) in Lowland England. *Acta Chiropterologica* 18(2), (1 December 2016)

but where smaller blocks are surrounded by habitat productive in insect prey they will be used.[74]

A4.29 The Ciliau SSSI, designated for its Lesser Horseshoe bats, and also the River Wye, is surrounded by predominately pastoral habitats, with cattle grazing on lowlands and sheep grazing on higher areas. There are, however, high densities of broadleaved woodland, especially along watercourses, and some conifer plantations. Again, Lesser Horseshoe bats foraged predominately in broadleaved woodland along the banks of the River Wye and its tributary streams. Woodland with watercourses has more importance. They were also recorded foraging in conifer plantations.[75]

A4.30 Furthermore, radio tracking carried out in the spring also revealed that coniferous woodland appeared to be more used for foraging than deciduous woodland and that coniferous woodland close to maternity colonies may provide refuge in certain weather conditions[76]

A4.31 Although Lesser Horseshoe bats prefer woodland in which to forage there is a further requirement as to the structure of the woodland. In Bavaria, except in one area, the distance between trees was large and in dense stands no activity was recorded. In Belgium it was found that the density of taller trees, either broadleaved or coniferous, must be low enough to allow the development of an under storey of shrub and coppice.[77]

<u>Grassland</u>

A4.32 Radio tracking research of Lesser Horseshoe bats shows that in foraging over pasture cattle must be actively grazing the field. Once cattle are removed from a field foraging by Lesser Horseshoe bats ceases immediately. However, pasture in such use offers a valuable and predictable food source at a time of year when bats are energetically stressed (pre- to post-weaning), because they are feeding their young. The report recommended a grazing density of 0.5 -1 cows per hectare. Scatophagidae can be one of the major prey categories in the diet of Lesser Horseshoe bats. The larvae of the Yellow Dung-fly *Scatophaga stercoraria* develop in cattle dung. The presence of pasture is also indispensable to the larval stage of development for certain species

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[74] Bontadina, F., Schofield, H. & Naef-Daenzer, B. 2002. Radio-tracking reveals that Lesser Horseshoe bats (Rhinolophus hipposideros) forage in woodland. *J. Zool. Lond. (2002) 258, 281-290*; Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[75] Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2003. *Foraging and Roosting Behaviour of Lesser Horseshoe bats at Ciliau, Radnor.* Ledbury: The Vincent Wildlife Trust; Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. *Protection et restauration des habitats de chasse du Petit rhinolophe*. Paris: Société Français pour l'Etude et la Protection des Mammifères.

[76] Bat Conservation Trust. 2005. A Review and Synthesis of Published Information and Practical Experience on Bat Conservation within a Fragmented Landscape. Cardiff: The Three Welsh National Parks, Pembrokeshire County Council, Countryside Council for Wales

[77] Holzhaider, J., Kriner, E., Rudolph, B-U. & Zahn, A. 2002. Radio-tracking a Lesser Horseshoe bat (Rhinolophus hipposideros) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis, 49, 47-54*; Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52.*

(Tipulids), which form a significant proportion of the prey hunted by Lesser Horseshoe bats.[78]

Hedgerows

A4.33 Belgian research similarly showed that the feeding grounds for Lesser Horseshoe bats were deciduous woodland along with copses or mixed coniferous woodland. Woodland occupied 25% of the area within 1 kilometre of the roost. However, some foraging was observed in hedgerows. Hedgerows had an average density of 47 metres per hectare. Generally, bats selected areas that were of undulating countryside with hedgerows, tree lines and woodland in preference to flat open intensively farmed areas. In Austria hedgerows, tree lines and streams were only exploited where there was less forest.[79]

A4.34 Commuting corridors, such as tall bushy hedgerows, are important features for Lesser Horseshoe bats as they avoid crossing open areas and are vulnerable to the loss of these corridors. In Belgium no bat was recorded more than 1 metre from a feature. Stonewalls have been reported in use as commuting routes in Ireland.[80]

A4.35 At Ciliau SSSI Lesser Horseshoes only crossed the River Wye when fully dark. Lesser Horseshoe bats have been observed crossing roads where the tops of trees have touched.[81]

Scrub

A4.36 Lesser Horseshoe bats avoid dense scrub cover[82].

A4.37 Tipulid larval development is favoured by damp conditions. Therefore, any aquatic environments and/or marshes can provide a secondary prey source. Aquatic environments could also favour the production of caddis flies in certain months, such as May and late August / September when other food supplies may be erratic. There is significant caddis fly consumption at roosts close to extensive river or lake habitats. [83]

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[78] Cresswell Associates. 2004. *Bats in the Landscape Project*. The National Trust, Sherborne Park Estate; Knight,T. 2006. *The use of landscape features and habitats by the lesser horseshoe bat* (Rhinolophus hipposideros). PhD Thesis: University of Bristol

[79] Holzhaider, J., Kriner, E., Rudolph, B-U. & Zahn, A. 2002. Radio-tracking a Lesser Horseshoe bat (Rhinolophus hipposideros) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis, 49, 47-54*; Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52.*

[80] Motte, G. & Libois, R. 2002. Conservation of the Lesser Horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study in feeding requirements. *Belg. J. Zool., 132 (1): 47-52;* Biggane, S. & Dunne, J. 2002. A study of the ecology of the lesser horseshoe colony at the summer roost in Co. Clare, Ireland: In *European Bat Research Symposium (9, 2002, Le Havre). Abstracts of presentations at the 9th European Bat Research Conference, August 26-30 at Le Havre, France. Bat Research News 43(3): 77.*

[81] Schofield, H., Messenger, J., Birks, J. & Jermyn, D. 2003. *Foraging and Roosting Behaviour of Lesser Horseshoe bats at Ciliau, Radnor. Ledbury*: The Vincent Wildlife Trust;

[82] Schofield, H. W. 2008. *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

[83] Ransome, R. D. 1997. *The management for Greater Horseshoe bat feeding areas to enhance population levels*: English Nature Research Reports Number 241. Peterborough: English Nature

Annex 5: Methodology for Calculating the Amount of Replacement Habitat Required

Introduction

A5.1 The method used to calculate the amount of habitat required to replace that lost to a horseshoe bat population due to development is based on the requirements for maintaining that needed to support viable populations. It uses an approach similar to the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service (1980) to provide '…*for mitigation and compensation that can allow fair use of the land and maintain healthy habitats for affected species*'.[84] HEP is structured around the calculation of Habitat Units (HU), which are the product of a Habitat Suitability Index (quality) and the total area of habitat (quantity) affected or required[85].

A5.2 A key assumption is that habitat type, amount and distribution influence the distribution of associated animal species. It is also important to recognise that Habitat Suitability Index (HSI) models predict habitat suitability, not actual occurrence or abundance of species populations.[86]

A5.3 The HEP uses the Integrated Habitat System (IHS) developed by Somerset Environmental Records Centre, described below. It requires a Habitat Suitability Index for the horseshoe bat species scored on IHS descriptions, which are given in Appendices 2 and 3.

A5.4 Such methods are necessary to obtain an objective quantitative assessment that provides improved confidence that the mitigation agreed is likely to be adequate; and that a development will not significantly reduce the quantity or quality of habitat available to a horseshoe bat population; whereas current ecological impact assessments are often based on subjective interpretations. In Somerset they have been used since 2009 including for effects on Greater and Lesser Horseshoe bats to inform the adequacy of replacement habitat provided by the developer. The method has gone through planning inquiries including for a Nationally Significant Infrastructure Project.

A5.5 The methodology has also been reviewed and further developed with the Bat Conservation Trust.

Integrated Habitat System Mapping

A5.6 The Integrated Habitat System coding is used as a basis for describing and calculating habitat values used as a base in applying scores in Habitat Suitability Indices. The Integrated Habitat System (IHS)[87] classification comprises over 400 habitat categories, the majority drawn from existing classifications, together with descriptions, authorities

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[84] http://www.fort.usgs.gov/Products/Software/HEP/

[85] U. S. Fish and Wildlife Service. 1980. *Habitat Evaluation Procedures ESM102*. Washington, D. C.: Department of the Interior.

[86] Dijak, W. D. & Rittenhouse, C. D. 2009. Development and Application of Habitat Suitability Models to Large Landscapes: in Millspaugh, J. J. & Thompson, F. R. 2009. *Models for Planning Wildlife Conservation in Large Landscapes*. London: Academic Press.

[87] http://www.somerc.com/integrated+habitat+system/

and correspondences arranged in a logical hierarchy that allow application for different purposes. The classification can be customised for a geographical area or special project use without losing data integrity.

A5.7 The IHS represents a coded integration of existing classifications in use in the UK with particular emphasis on Broad Habitat Types, Priority Habitat Types, Annex 1 of the Habitats Directive and Phase 1[88].

A5.8 Standard habitat definitions from these classifications are combined into a hierarchy starting at the level of Broad Habitat Types, through Priority Habitat types, Annex 1 to vegetation communities which are coded. These are the Habitat Codes.

A5.9 Within IHS Habitat Codes are hierarchical with the numbers in the code increasing as the habitat becomes more specific. Descriptions of habitats can be found in IHS Definitions (Somerset Environmental Records Centre)[89]. For example:

- WB0 Broadleaved, mixed and yew woodland (Broad Habitat Type)
- WB3 Broadleaved woodland
- WB32 Upland mixed ashwoods (Priority Habitat Type)
- WB321 Tilio-Acerion forests on slopes, screes and ravines (upland) (Annex 1 Habitat)

A5.10 As well as Habitat Codes IHS provides Matrix, Formation and Land Use/Management Codes which are added as a string to the main Habitat Code to provide further description.

A5.11 Ideally habitat information for the whole of the geographic area of the Somerset authorities should be mapped in a GIS programme, such as MapInfo or ArcGIS. However, when used in ecological impact assessment for calculating the value of impacts of habitat change on a species population then at minimum it is only necessary that IHS coding is applied to the habitat types present on the proposed development site to enable the use of Habitat Suitability Indices in the HEP metrics.

Habitat Suitability Indices

<u>Introduction</u>

A5.12 A form of Habitat Suitability Indices (HSI) has been used in the United States and Canada since the early 1980s as a way of assessing the impacts of development on species' populations and distributions. In addition, they have been used to predict what replacement habitat needs to be created to maintain species' populations. The process assumes that the suitableness of habitat for a species can be quantified - the HSI. The overall suitability of an area for a species can be represented as a product of the geographic extents of each habitat and the suitability of those habitats for the species[90].

[88] Phase 1 (JNCC, 1993) habitat mapping can be converted to IHS by using the software provided by Somerset Environmental Records Centre.
[89] http://www.somerc.com/integrated+habitat+system/
[90] http://www.fort.usgs.gov/Products/Software/HEP/

Description

A5.13 In constructing the HSI the index scores are applied to each Habitat, and Matrix, Formation and Land Use / Management codes in the Integrated Habitat System (IHS) based on analysis of the ecological requirements, from existing literature and professional judgement, for each species assessed or mapped.

A5.14 Each IHS 'Habitat' category is scored on a scale of 0 to 6 (as defined below) using a potential or precautionary approach as a starting point, e.g. Broadleaved, mixed and yew woodland is assumed to be the Annex 1 broadleaved woodland habitat unless otherwise proved not. The score will be the same across each of the hierarchical levels of the IHS Habitat coding (e.g. poor is scored as 1 whether this is at broadest habitat level or priority habitat level unless there are discernible differences in the type of habitat used, e.g. oak or beech woodland)[91]. This means that the full range of scoring is used before the modifiers (the IHS Formation and Management codes) are applied.

A5.15 The Habitat Code scoring is considered in combination with the IHS Matrix codes[92]. These are either added or subtracted from the Habitat code, e.g. grassland score 3 + scrub score 2 would equal 5. This is to account for species, for example that use grassland with a matrix of scattered scrub or single trees, which would otherwise avoid open grassland habitat.[93] Habitat Codes have a range of 0 to 6 but when considered in combination must not exceed a score of 6 or fall below a score of 0, Where there is no effect from a Matrix type then a default score of 0 is used.

A5.16 All other Codes are scored between 0 and 1 and are multipliers. Where there is no effect from Formation, Management then a default score of 1 is used.

Table 3: Example of HSI Calculation

	Habitat Code	Matrix Code	Formation Code	Land Use / Management Code	HSI Score
Code	GI0	SC2	-	GM12	
Description	Improved Grassland	Scattered Scrub	-	Sheep Grazed	
HSI Score	3	1	1	0.75	3

A5.17 Scores will be applied such that a precautionary approach or 'potential' approach is taken, e.g. if a species requires grassland which is most valuable when grazed then grassland scores the top score. This potential score will take into account a combination of the Habitat and Matrix codes. The management modifier would then

[91] The 1 to 6 scale matches Defra's habitat distinctiveness range used in its metric.
[92] IHS considers that patches of scrub and single trees are matrix habitat acting in combination with main habitats types rather than separate habitats in their own right. It is possible that further sub codes be added to the grassland habitat codes, e.g. calcareous grassland with scattered scrub, etc. but this would lead to a proliferation of coding and current IHS GIS mapping would need amending to take this into account. Therefore, by providing a positive multiplier the needs of those species which require a mosaic of grassland and scrub is taken into account.
[93] IHS considers that patches of scrub and single trees are matrix habitat acting in combination with main habitats types rather than separate habitats in their own right.

maintain the habitat score at this high level by a multiplier of 1. If the management is not grazed a decimal multiplier is applied to reduce the value of the habitat. For example, a grassland habitat is valued at 6 but by applying the relevant management code, i.e. either mown or other management type, the value of the habitat will be reduced. Only one management code is allowed. An example (non-horseshoe bat) is set out in Table 3 above. The HSI has a maximum score of 6.

A5.18 The definition of poor, average, good and excellent habitat is adapted from the 'Wildlife Habitat Handbook for the Southern Interior Ecoprovince', British Columbia, Ministry of Environment[94] and expanded, in consultation with the Bat Conservation Trust, as follows:

Excellent - provides for essential life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied >70% chance of occurrence, can support positive recruitment. Can be a critical life-cycle association.
Very good - provides for essential life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied 50 - 70% chance of occurrence, can support positive recruitment.
Good - provides for life requisites, including feeding, reproduction or special needs and supports a relatively high population density, implied 40 -50% chance of occurrence, can support a stable population.
Average - provides for moderately required life needs, including feeding, reproduction or special needs and supports a relatively moderate population density, implied 25 - 40% chance of occurrence, can support a stable population.
Marginal - provides for marginally required life needs, including feeding, reproduction or special needs and supports a relatively modest population density, implied 15 - 25% chance of occurrence, can support a small population.
Poor - provides for a non-essential life needs, including feeding, reproduction or special needs and supports a relatively low population density, implied <15% chance of occurrence.

A5.19 It is recognised that not all habitat patches of the same type have equal value in terms of resource to a species, for example see Dennis, 2010[95]. However, in scoring the overall HSI, i.e. including all Habitat, Matrix, Formation codes, etc., it is considered that a higher value is given as a precaution.

A5.20 No allowance for seasonal variations, i.e. due to the availability of prey species at different times of year, has been made in developing the HSI. It is considered a habitat valued at 6 at a particular period but not at other times will remain at a value of 6 being necessary to support that species at that time of year when other prey or other resources may not be so readily available.

A5.21 Where Greater and Lesser Horseshoe bats occur in the same field the higher HSI score should be used taking into account the Band in which the filed falls for each species. The worksheet (see A5.39 and Appendix 6) should clearly note for each field

[94] For example http://www.env.gov.bc.ca/wld/documents/techpub/r20.pdf
[95] Dennis, R.L.H. 2010. *A Resource-Based Habitat View for Conservation. Butterflies in the British Landscape.* Chichester: Wiley-Blackwell.

which horseshoe species the score refers to.

A5.22 The Habitat Suitability Index for Greater Horseshoe Bats can be found in Appendix 2 and that for Lesser Horseshoe bats in Appendix 3.

Lighting

A5.23 The value of a habitat may be affected by lighting, either from street lighting or other sources such as security or flood lights. This would have the effect of reducing the value of a habitat to horseshoe bats. This can be accounted for by either removing the area of habitat affected from that used in the metric or reducing the HSI score. It is advised that a note is made in the Excel spreadsheet used in calculating the habitat amount (see A5.39 below).

Validation

A5.24 An HSI model can be reviewed against occurrence data held by the biological records centre. The Gulf of Maine HSI work[96] established the principle of producing several HSI models for one species and retained the model, which had the best association with known occurrences. The mapping is produced and matched with species data at the biological records centre and the model refined to fit the records with a view to errors of omission and commission.

A5.25 Garshelis (2000)[97] concluded that the '...*utility of the models is to guide further study or help make predications and decisions regarding complicated systems; they warrant testing but the testing should be viewed as a never-ending process of refinement, properly called bench-marking or calibration*.' The validation should be seen as a continuous refinement process and HSI scoring should be reviewed from time to time and up dated[98].

A5.26 In this study HSI have initially been researched and scored by the author. However, the scores can be varied through review, further research findings or to reflect local conditions based on survey. Where varied by consultants the reason for the variation should be given and supported by evidence.

Density Band

A5.27 The HSI score is multiplied by the location of the proposed site in relation to that of the horseshoe bat roost. The Consideration Zone (CZ) is divided into three Density Bands. The three Bands are, ‘A’ closest to the record, ‘B’ and ‘C’ furthest from the record valued at 3, 2 and 1 respectively. The values are given in Table 4 below.

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[96] http://www.fws.gov/r5gomp/gom/habitatstudy/Gulf_of_Maine_Watershed_Habitat_Analysis.htm

[97] Garshelis, D. L. 2000. Delusions in Habitat Evaluation: Measuring Use, Selection, and Importance: in Boitam, L. & Fuller, T. K. (eds.) 2000. *Research Techniques in Animal Ecology: Controversies and Consequences*. New York: Columbia University Press.

[98] http://www.fws.gov/r5gomp/gom/habitatstudy/Gulf_of_Maine_Watershed_Habitat_Analysis.htm

Table 4: CZ Band

Band	Score
A	3
B	2
C	1

A5.28 When two Bands occur within one field take the higher value as the score. The Density Band widths can be found in Table 1 above.

A5.29 Following ecological surveys for horseshoe bats carried out for the proposed development the Density Band score may be modified up depending on whether feeding activity was recorded or not or whether absence is recorded. This reflects uneven use of a home range and refines the value of the habitat for a species (e.g. see Bontadina & Naef-Daenzer, 2002[99]). Note that sufficient automated detectors should be deployed

A5.30 The following criteria should be used to modify the Band following the results of site surveys and applied to the whole of the proposed development site:

- Not present – Where potential habitat is present reduce the Band score down by 0.5, e.g. at A from 3 to 2.5; at B from 2 to 1.5; except at C where it reduced to 0.
- Commuting only – as the Band the site falls within
- Commuting and Foraging – increase the band score by 0.5 e.g. at C from 1 to 1.5; at B from 2 to 2.5; A stays as it is.

A5.31 The identification of 'foraging' (i.e. a higher level of activity) for horseshoe bat species is defined as either:

a) The criteria for foraging for horseshoe bat species, which have low intensity calls, makes use of Miller's (2001) Activity Index.[100] '*Call sequences with a negative minute on either side (i.e. a minute in which the species was not recorded) are judged to be commuting contacts, whereas contacts in two consecutive minutes or more are judged to be foraging contacts*.' 'Foraging' is defined as 6[101] or more such minutes over any three nights in the five nights on any one automated detector during the recording period.

b) Observed hunting behaviour in the field.

[99] Bontadina, F. & Naef-Daenzer, B. 2002. Analysing spatial data of different accuracy: the case of Greater Horseshoe bats foraging: in Bontadina, F. 2002. Conservation Ecology in Horseshoe Bats. PhD thesis. Universität Bern.

[100] Miller, B. 2001. A method for determining relative activity of free flying bats using a new activity index for acoustic monitoring. *Acta Chiropterologica* 3 (1): 93 – 105.

[101] Miller uses 9 consecutive passes when recording mostly *Myotis* species. As the hunting behaviour of *Rhinolophus* species is more difficult to record the number of passes has reduced by the coefficient applied to European bats species by Barataud for open to semi open environments, *Myotis* 1.67 compared to *Rhinolophus ferrumequinum* 2.5. (Barataud, M. 2015. *Acoustic Ecology of European Bats: Species Identification, Study of their Habitats and Foraging Behaviour*. Paris: Muséum nationale d'Histpire naturelle

Calculating the Habitat Unit Value

A5.32 For information the value of the proposed site to a horseshoe bat species in Habitat Suitability value is calculated by using the HSI Score and the Density Band (See Table 5 below). The outcome of the Habitat Suitability Units used in the HEP is on a scale of 0 to 18[102].

A5.33 The habitat replacement value required is calculated by multiplying the score by the hectarage of the habitat affected (hectares x [HSI x Band]) giving figure in **Habitat Units**. For example, an HSI x Band score of 12 for an area of 1.50 hectares would give a value of 18 Habitat Units.

A5.34 The resultant total of Habitat Units for the whole proposed development site could then be divided by 18 (6 [HS] x 3 [Band]) to arrive at the minimum area in hectares of accessible replacement habitat required to develop the proposed site

Table 5: Matrix Combining Habitat Suitability Score and Density Band

		Habitat Suitability Score					
		Poor 1	Marginal 2	Average 3	Good 4	Very Good 5	Excellent 6
Band	A (3)	3	6	9	12	15	18
	B (2)	2	4	6	8	10	12
	C (1)	1	2	3	4	5	6

A5.35 Hedgerows and some watercourses are not mapped as separate polygons in OS Mastermap and if a width is not known a default width of 3 metres is used and multiplied by the length to give an area in hectares. These values are usually small and do not significantly affect the overall area of a site, and for simplicity's sake and considering their value to wildlife are not deducted from the area of bordering fields, compartments or OS Mastermap polygons. If preferred calculations can be carried out separately for these features using linear measurements but the end result is the same, especially if a direct replacement value of the hedgerow or watercourse is required.

A5.36 Nonetheless hedgerow and other commuting structure should be seen as having a functional role and should normally be maintained or replaced to maintain horseshoe bat commuting across a proposed development site.

A5.37 <u>HEP calculations for development sites should be made on the basis that the total site area would be lost to a species and would therefore produce a maximum replacement</u>

102 This range is in line with that used for the habitat metric used by Defra in its pilot projects 2012 -2014.

requirement to develop the site. This saves a separate calculation for the value of the existing habitat on which enhanced habitat is created. Where habitat remains unchanged and is retained by the development it is not included in the calculation.

Summary

A5.38 each habitat type within a proposed development site. The whole proposed development site should be included in the calculation.

The HSI = Habitat Code (Range 0 to 6) + or – Matrix Code (Range 0 to 6, Default 0) x Formation Code (Range 0 to 1) x Management Code (Range 0 to 1)

HSI x Band x hectares = Habitat Units required.

Habitat Units divided by 18 = hectares required

A5.39 An Excel spread sheet in which figures used to the calculate the amount of replacement habitat required as mitigation for a proposed development is available on Local Authority websites. This also contains linked spreadsheets to calculate the value of the replacement habitat provided (see A5.40 to A5.52), on or off site and a further spreadsheet for the value for an offsite receptor site (see A5.53 to A 5.54).

Replacement Habitat

A5.40 To check whether the master plan for the development site provides enough habitat equivalent to that lost due in mitigation a second Excel spreadsheet is provided. The scores for the new habitat are entered as for the calculation for the amount required to replace that lost. These habitats should in the first instance be aimed at providing optimal foraging habitat for horseshoe bats (although it is unlikely that some habitats such as grazed pasture would be possible to re-create within a development site).

A5.41 Standard prescriptions that can be used for replacement habitats can be found in Annex 6. Habitats will need to be accessible and undisturbed by introduced lighting to count towards mitigation. As all habitats are considered optimal the HSI score would automatically be 6.

A5.42 In delivering the replacement habitat there may also be an issue or risk with delivering a functional offset and the timing of the impact. A loss in biodiversity would result and there could potentially be a risk to maintaining a species population during the intervening period even though it would recover in time. Therefore, it is important and desirable that where feasible replacement habitat is in place and functional just before development commences on site. However, functionality may not be achieved until several years after replacement habitat has been created and there is a risk that it may fail due to the difficulty in recreating or restoring. To account for these possibilities Fraction Multipliers are used. These are usually applied only once to the calculation for the value of the habitat lost to horseshoe bats.

A5.43 *The aim of a multiplier is to correct for a disparity or risk. In practice this is very difficult to achieve, not least because of uncertainty in the measurement of the parameters and* *the complexity of gathering the required data.'*[103] In order that any habitat creation or enhancement would functionally replace habitat lost to development (and the need to take a precautionary approach in the case of horseshoe bats, as features of European sites and European protected species) a 'fraction multiplier' is applied to the resultant Habitat Units needed to replace habitat lost to development in order to provide robust mitigation, e.g. to maintain 'favourable conservation status'.

A5.44 '*There is wide acknowledgement that ratios should be generally well above 1:1. Thus, compensation ratios of 1:1 or below should only be considered when it is demonstrated that with such an extent, the measures will be 100% effective in reinstating structure and functionality within a short period of time (e.g. without compromising the preservation of the habitats or the populations of key species likely to be affected by the plan or project.*[104] The Environment Bank recommend a two for one ratio where habitats are easily re-creatable contiguous to the development or on similar physical terrain as a minimum.[105]. In many other situations a significantly higher multiplier may be appropriate[106]. *The conclusion of the BBOP* [Business Biodiversity Offsets Programme] paper *(Ekstrom et al, 2008) is that where there are real risks around the methods and certainty of restoration or creation then the Moilanen framework is applicable; but for some other situations, (averted risk ...and where restoration techniques are tried and tested), lower ratios can be used.*[107]

A5.45 Appendices 4 and 5 give a guide to difficulty in creating and restoring habitats and the time frame required to reach maturity or functionality.

<u>Delivery Risk</u>

A5.46 As different habitats have different levels of difficulty in creation or restoration there will be different risks associated with each. '*Once there is an estimate of the failure risk, it is possible to work out the necessary multiplier to achieve a suitable level of confidence (Bill Butcher pers com; Moilanen, 2009; Treweek & Butcher, 2010). The work of Moilanen provides a basis for different multipliers of various levels of risk. We have used this work to come up with categories of difficulty of restoration/expansion, and associated multipliers, as set out in* [Table 6] *below*.'[108]

A5.47 Appendix 4 gives an indicative guide to risk levels which have been assigned to habitats to these broad categories using expert opinion by Defra (2011). Factors such as substrate, nutrient levels, state of existing habitat, etc. will have an impact on the

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[103] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.

[104] European Communities. 2007. *Guidance document on Article 6(4) of the'Habitats Directive' 92/43/EEC: Clarification of the concepts of: alternative solutions*, *imperative reasons of overriding public interest*, *compensatory measures*, *overall coherence, opinion of the commission.* Brussels: Office for Official Publications of the European Communities.

[105] Briggs, B., Hill, D. & Gillespie, R. 2008. Habitat banking – how it could work in the U.K. http://www.environmentbank.com/docs/Habitat-banking.pdf

[106] Moilanen, A., Van Teeffelen, A., Ben-Haim, Y. & Ferrier, S. 2009. How much compensation is enough? A framework for incorporating uncertainty and time discounting when calculating offset ratios for impacted habitat. *Restoration Ecology 17, 470-478*.

[107] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.

[108] Defra. 2011. *Biodiversity Offsetting. Technical paper: proposed metric for the biodiversity pilot in England.* London: Department for Environment, Food and Rural Affairs.

actual risk factor, which may need to be taken into account.

Table 6: Multipliers for different categories of delivery risk (Defra, 2011)

Difficulty of recreation/restoration	Multiplier
Very High	0.1
High	0.33
Medium	0.67
Low	1

Temporal Risk

A5.48 In delivering replacement habitat there may be a difference in timing between the implementation of the development and the functionality and maturity of the replacement habitat in terms of providing a resource for the affected species
. This time lag would be minimised by calculation of existing habitat value in the pre-application stage and implementation of the habitat creation and / or restoration in consultation with the local authority and other nature conservation organisations. In some cases, the replacement habitat may be planted or managed concurrently with that of the site development.

A5.49 Where a time lag occurs a multiplier will be applied to take account of the risk involved to the 'no net loss' objective. These are set out in Table 7 below. Appendix 5 gives general guidance on how long different habitats would be expected to reach maturity. The actual multiplier used needs to be judged on a case by case basis.

A5.50 It is considered that some priority habitats cannot be recreated due to the length of time that they have evolved and the irreplaceability of some constituent organisms, at least in the short and medium terms. It is also considered that in the medium and longer terms the management of any replacement habitat may be uncertain. Therefore Table 7 has been constrained to a maximum period of 20 years. In some cases, the time lag for the development of a habitat to support a population may be too long to be acceptable.

Table 7: Multipliers for different time periods using a 3.5% discount rate

Years to target condition	Multiplier
5	0.83
10	0.71
15	0.59
20	0.5

Spatial Risk

A5.51 A factor is added for spatial risk to cover instances where the replacement habitat is provided off-site and where to site of the replacement habitat is located in another Density Band than that of the development site, for example the development occurred in Band B and the off-site replacement habitat is located in Band A.

A5.52 In all cases, the creation of replacement habitat in a lower band, i.e. Band C for a development occurring in Band B should be avoided.

Off Site Replacement Habitat

A5.53 Where there are residual offsets, i.e. where the replacement habitat cannot be created within the proposed development sites red line boundary an allowance is calculated for the value of the existing habitat on the intended habitat creation site as this will be lost or included in the value of any enhancement. Where replacement habitat is located offsite then the value of that site needs to be taken into account.

A5.54 It is critical that the replacement site where habitat has been enhanced is accessible to the population of horseshoe bats affected.

Enhancement

A5.55 The National Planning Policy Framework (July 2018) states that states that '*Planning policies and decisions should contribute to and enhance the natural… environment by… providing net gains for biodiversity*…' The result of the metric should show a gain in hectares in order that enhancement is achieved.

A5.56 In December 2018 Defra published its consultation on net gain in biodiversity[109]. This stated '*Our initial view is that a 10% gain in biodiversity units would be a suitable level of net gain to require in order to provide a high degree of certainty that overall gains will be achieved, balanced against the need to ensure any costs to developers are proportionate. In practice, this means that if a site is worth 50 biodiversity units before development, the site (and any offset sites and tariff payments) should be worth 55 units at the scheme's conclusion. The proposed 10% would be a mandatory national requirement, but should not be viewed as a cap on the aspirations of developers that want to voluntarily go further or do so in the course of designing proposals to meet other local planning policies*.'

[109] https://consult.defra.gov.uk/land-use/net-gain/supporting_documents/netgainconsultationdocument.pdf

Annex 6: Habitat Creation Prescriptions

A6.1 The following are standard prescriptions that can be used as replacement habitat both on development sites and at off-site locations. They are all considered to be scoring 6 in terms of HSI.

Greater Horseshoe Bats[110]

Pasture

A6.2 Ideally grazed pasture should be created or existing enhanced for Greater Horseshoe bats. It is unlikely that a grazing regime could continue within a development site and the following is more likely to constitute off site enhancements. Ransome (1996) set out prescriptions for grazing regimes:

Enhancement within 3 kilometres of the roost preferably revert arable to grassland managed to be improved by non-hazardous methods to provide high levels of grass productivity to cope with high densities of livestock between July and September. Where currently grazed the existing regime should be adjusted so that between March and May these pastures should be stocked with cattle, sheep and possibly a few horses at 1.4 cattle/ha or 8 sheep/ha as the weather permits and rotated between cattle and sheep in specific fields to keep a short, but not seriously damaged sward. The fields should be rested in June to allow grass growth to recover, which is likely to be necessary, Silage cutting should not be permitted. From the first of July until mid-September grazing should be at least at 2-3 cattle/ha or cattle mixed with 11-16 plus sheep/ha (maximum level depending on quality and quantity of grass). If weather permits, continue grazing at lower levels into early October. From July onwards primarily mature cattle, in either beef or milking herds, should be used. NB stocking levels may need to be adjusted in the light of climatic conditions influencing the growth of grass in a particular summer.

Grazing has been shown to have a detrimental effect on moth abundance. Outside the 3 kilometres zone in the wider roost sustenance zone cattle may be grazed at 1/ha and sheep at 5/ha. At these lower grazing rates longer swards are likely to be maintained to the benefit of Noctuid moths.

Ivermectin is a broad spectrum antiparasitic drug approved for the use in cattle, sheep and horses. The drug is absorbed systemically after administration and is excreted mainly in the faeces. Being insecticidal, residues of ivermectin in cow dung can reduce the number of dung beetles, appearing to inhibit larval development and/or prevent

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[110] Derived from Ransome, R. D. 1996. The management of feeding areas for greater horseshoe bats. English Nature research report No.174. Peterborough: English Nature; Fuentes-Montemayor, E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275; Merckx, T. & Macdonald, D. W. 2015. Landscape-scale conservation of farmland moths: in Macdonald, D. W. & Feber, R. E. (eds) 2015. *Wildlife Conservation on Farmland. Managing for Nature on Lowland Farms*. Oxford: Oxford University Press; Fuentes-Montemayor, E., Goulsion, D.& Park, K. J. 2010, The effectiveness of agri-environment schemes for the conservation of farmland moths: assessing the importance of a landscape-scale management approach. *Journal of Applied Ecology* 48, 532-542

pupation from taking place and thus could reduce prey availability to Greater Horseshoe bats.[111] In one study higher numbers of *Aphodius* sp. were found in dung in long swards from cattle treated with ivermectin[112]. However, it appears that smaller numbers emerge from the dung, compared with the dung of untreated cattle, as the number of eggs per female *A. rufipes* can be significantly reduced but the magnitude of the decline is not large[113].

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However, it must be emphasised there are inherent issues in using third parties to create new pasture as replacement habitat in perpetuity in terms of reasonableness and enforceability. These were highlighted in the Churston Golf Club planning appeal which was refused as grazing could not be sustained.[114]

Grassland

A6.3 The creation of species rich grassland is likely to be more feasible in response to providing replacement habitat to mitigate the impacts of a development. This will need to be managed to produce a long sward to support an abundance of Noctuid moths, one of the main prey items hunted by Greater Horseshoe bats. Specified seed mixes should include food plants, as well as grasses, such as dandelion, dock, hawkweeds, plantains, ragwort, chickweed, fat hen, mouse-ear and red valerian and other herbaceous plants. Buddleia and bramble, in particular, and other scrub species may be planted within or on the edges of the grassland. The grassland should be divided into parcels and cut in rotation once a year in October and the cuttings removed. Where grassland is established as a field margin this should be at least 6 metres wide.

Woodland

A6.4 Again off-site the replacement of coniferous woodland with broad-leaved woodland would benefit Greater Horseshoe bats. This should be carried out gradually over a period of time to avoid extensive clear-felling. Macro moth abundance is higher at the edge of woodland than in the interior. All woodlands should be permeated by grassy rides and contain grassy glades. They should be managed without insecticide treatments. Glades probably need to be 10 - 15 metres across before they will be used by the bats for feeding. Macro moth abundance and species richness were positively affected by tree species richness and by the relative abundance of native trees in a woodland patch. Of dominant ground types, ‘grass’ and ‘litter’ had higher abundances and species richness than bare ground, herbs, moss or ferns. Woodland size is positively related to macro moth abundance.

Woodlands over 5ha have the highest values of moth diversity and abundance. However, relatively small patches (e.g. woodlands between 1 and 5 ha) seem to contain relatively large moth populations.

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[111] http://jncc.defra.gov.uk/page-2736

[112] Foster, G., Bennett, J. & Bateman, M. 2014. Effects of ivermectin residues on dung invertebrate communities in a UK farmland habitat. *Insect Conservation and Diversity*, 7 (1): 64-72; Beynon, S.A., Peck, M., Mann, D.J. & Lewis, O.T. 2012. Consequences of alternative and conventional endoparasite control in cattle for dung-associated invertebrates and ecosystem functioning. *Agriculture, Ecosystems & Environment*, 162, 36-44.

[113] O’Hea, N.M., Kirwan, L., Giller, P.S. & Finn, J.A. 2010. Lethal and sub-lethal effects of ivermectin on north temperate dung beetles, *Aphodius ater* and *Aphodius rufipes* (Coleoptera: Scarabaeidae). http://repository.wit.ie/1974/2/Bioassays_final.pdf

[114] See paragraphs 41 to 50 of Appeal Ref: APP/X1165/A/13/2205208 Land at Churston Golf Club, Churston, Devon, TQ5 0LA. https://acp.planninginspectorate.gov.uk/ViewCase.aspx?Caseid=2205208&CoID=0

However, when creating woodland for horseshoe bats the target species should be considered as the specification will be different (see Lesser Horseshoe bats below)

Hedgerow

A6.5 Hedgerow acts as commuting structure and provides feeding perches for Greater Horseshoe bats. Over 90% of prey caught by bats is brought in on the wind from adjacent habitats. New hedge lines could be planted off-site to divide up large grazed fields into smaller units and link them to blocks of woodland. Hedgerows should be 3 to 6 metres wide and 3 metres high with standard trees planted frequently along its length. The provision of trees increases moth abundance. Cutting should be restricted to the minimum needed to ensure visibility or retain hedgerow structure. Hedgerows are best cut every 2-3 years, working on only one part or side at any time.

A6.6 One study found that night flying moth abundance and diversity correlated positively with the number of bramble (*Rubus fruticosus*) clumps along a hedgerow[115]. Another study found that macro moth abundance was related to the frequency of trimming hedgerows and that at least a three-year cycle was required to produce an abundance favourable to bats[116].

A6.7 A species-rich grass strip, a minimum of 6 metres wide, with a long sward, managed as described above, should accompany hedgerow creation as this will enhance moth abundance[117].

Lesser Horseshoe Bats[118]

Woodland with Water

A6.8 Lesser Horseshoe bats hunt a variety of insects which are generally smaller than those consumed by Greater Horseshoe bats. These include micromoths, gnats, midges, mosquitoes, craneflies, brown lacewings, caddis flies and ichneumon wasps. Barataud et al (2000) found the woodland associated with water was the most preferred habitat by Lesser Horseshoe bats.

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115 Coulthard, E. 2015. The Visitation of Moths (Lepidoptera) to Hedgerow Flowering Plants in Intensive Northamptonshire Farmland: in Coulthard, E. 2015. ***Habitat and landscape-scale effects on the abundance and diversity of macro-moths (Lepidoptera) in intensive farmland***. PhD. University of Northampton.

116 Froidevaux, J. S. P., Broyles, M. & Jones, G. 2019. Moth responses to sympathetic hedgerow management in temperate farmland. *Agriculture, Ecosystems and Environment,* 270 -271 (2019), 55 - 64

117 Merckx, T. & Macdonald, D. W. 2015. Landscape-scale conservation of farmland moths: in Macdonald, D. W. & Feber, R. E. 2015. *Wildlife Conservation on Farmland. Managing for Nature on Lowland Farms*. Oxford: Oxford University Press.

118 Derived from Barataud, M., Faggio, G., Pinasseau, E. & Roué, S. G. 2000. *Protection et restauration des habitatas de chasse du Petit rhinolophe (*Rhinolophus hipposideros*) Année 2000*. Paris : Ministère de l'Environnement – Direction de la Nature et des Paysages ; Fuentes-Montemayor,E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275; Chinery, M. 2007. *Insects of Britain and Western Europe*. London: A & C Black; Fuentes-Montemayor, E., Goulsion, D.& Park, K. J. 2010, The effectiveness of agri-environment schemes for the conservation of farmland moths: assessing the importance of a landscape-scale management approach. *Journal of Applied Ecology* 48, 532-542; Entwistle, A. C., Harris, S., Hutson, A. M., Racey, P. A., Walsh, A., Gibson, S. D., Hepburn, I. & Johnston, J. 2001. *Habitat management for bats: A guide for land managers, land owners and their advisors*. Peterborough: Joint Nature Conservation Committee.

A6.9 Micromoth abundance is positively related to the relative abundance of native trees[119] and unlike macro moths the percentage cover of understory in a woodland patch. Micromoth abundance was higher within the woodland interior than at the edge. The shape of the woodland patch was important particularly for woodland micromoth species, indicating that patches of compact shapes (with proportionally less edge exposed to the surrounding matrix) sustain a larger number and larger populations of woodland species of micromoths. This highlights the importance of designing patches of compact shapes, especially when the patch to be created is small. Brown lacewings can be found amongst conifers.

A6.10 Woodland trees and shrubs should be planted in naturalistic non-linear patterns. Scalloped edges and bays will provide sheltered areas with higher insect concentrations. Provide a variety of types of vegetation from trees to shrubs and rough grass. Overhanging branches and bushy shrubs should be left to provide cover. Woodland edges can be used both by bats that fly in woodland and in the open. When developed the woodland should not be coppiced.

A6.11 Mosquitoes and caddies fly larvae are aquatic, as can be gnat larvae. Gnats and midges also use damp places near water to breed. Therefore, the incorporation of ponds in association with the woodland habitat is likely to increase their value to Lesser Horseshoe bats. Ponds with permanent water should be created. It is possible that these could form attenuation features as part of the surface water mitigation for a development. They should be designed so that water is maintained within them throughout the year.

A6.12 Variation on the banks of ponds favours high insect and structural diversity. Design in as many natural features as possible, including varied depths, diverse aquatic and bankside vegetation, and overhanging trees. Grassy margins, scrub and overhanging vegetation provide excellent conditions for insects. Habitat diversity can often be achieved simply through allowing growth of taller vegetation. Where bank management is necessary, restrict it to a small area and work on one bank at a time. Carry out management sensitively, aiming to enhance variation in vegetation. Use fencing to prevent livestock from causing excessive damage to water margins.

Grassland

A6.13 Long sward grassland is also of benefit to Lesser Horseshoe bats as that described above for Greater Horseshoe bats. The management of grassland should be as that for Great Horseshoe bats. Rough grassland and scrub are an important predictor of micro moth abundance

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[119] '*Many native tree species (e.g. Betula sp., Quercus sp. and Salix sp.) have large numbers of moth species associated with them (i.e. feeding on them), although this is not always the case and there are native trees (e.g. Fagus sylvatica) which support relatively few moth species, comparable in number to those supported by non-native trees (e.g. Acer pseudoplatanus; Young, 1997)*' [Fuentes-Montemayor, E., Goulson, D.,Cavin, L., Wallace, J. M. & Park, K. J. 2012. Factors influencing moth assemblages in woodland fragments on farmland: Implications for woodland management and creation schemes. *Biological Conservation* 153 (2012) 265–275]; Entwistle, A. C., Harris, S., Hutson, A. M., Racey, P. A., Walsh, A., Gibson, S. D., Hepburn, I. & Johnston, J. 2001. *Habitat management for bats: A guide for land managers, land owners and their advisors*. Peterborough: Joint Nature Conservation Committee.

Hedgerow

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Annex 7: Application of the Habitats Regulations

A7.1 The Habitats Regulations protect identified *sites* by designation as Special Areas of Conservation. However, the Habitats Regulations also protects *habitat* (Functionally Linked Land) which is important for the Favourable Conservation Status of the species.[120]

A7.2 Achieving Favourable Conservation Status of a site's features "… *will rely largely on maintaining, or indeed restoring where it is necessary, the critical components or elements which underpin the integrity of an individual site. These will comprise the extent and distribution of the qualifying features within the site and the underlying structure, functions and supporting physical, chemical or biological processes associated with that site and which help to support and sustain its qualifying features*".[121]

A7.3 Regulation 63 Habitats Regulations states that:

A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which –

(a) is likely to have a significant effect on a European Site … (either alone or in combination with other plans or projects), and
(b) is not directly connected with or necessary to the management of that site must make an appropriate assessment of the implications for that site in view of that site's conservation objectives.

A7.4 Regulation 63 therefore describes a two-stage procedure: (Stage 1) a screening stage where the "competent authority" has grounds to conclude whether a plan or project is likely to have a significant effect on a European site, and (Stage 2) the appropriate assessment stage if it concludes that a significant effect is likely.

A7.5 In accordance with Regulation 63 information submitted with a planning application will be used by the Somerset Authorities to determine whether the proposal is likely to have a significant effect on the SAC. The Somerset authorities carry out a Habitats Regulations Assessment for proposals which involve or may involve:

- the destruction of a Greater Horseshoe and/or Lesser Horseshoe bat roost (maternity, hibernation or subsidiary roost);
- loss of foraging habitat for SAC bats
- fragmentation of commuting habitat for SAC bats
- increase in luminance in close proximity to a roost and/or increase in luminance to foraging or commuting habitat

[120] See European Site Conservation Objectives for North Somerset and Mendip Bats Special Area of Conservation at Part B, paragraph 1.4
[121] Natural England Standard: Conservation Objectives for European Sites in England Standard 01.02.2014 V1.0 http://publications.naturalengland.org.uk/publication/6734992977690624

- impacts on foraging or commuting habitat which supports the SAC bat populations structurally or functionally

A7.6 The Court of Justice of the European Union clarified what is required in that there is a '…. *need to identify and examine the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of the site. Provided those implications are liable to affect the conservation objectives of the site'*[122]

A7.7 When considering whether a project is likely to have a significant effect on a European site, the competent authority in Stage 1 of the Habitats Regulations Assessment, does not take account of mitigation measures for effects on the features of the European site[123]. Where mitigation measures are required a Stage 2 Appropriate Assessment is required.

A7.8 Mitigation measures are measures which are designed to *avoid* or *reduce* adverse effects on a European site. Where compensatory measures are required (i.e. for impacts within the designated site) these will not be taken into account in Stage 2 the Appropriate Assessment. It is important to distinguish mitigation from compensatory measures which are designed to compensate for unavoidable adverse effects on a European site and follow the "3 tests"[124].

A7.9 The precautionary principle underpins the Habitats Directive[125] and hence the Habitats Regulations and must be applied by the local planning authority as Competent Authority as a matter of law.[126] It is clear that the decision whether or not an appropriate assessment is necessary must be made on a precautionary basis.[127] In addition, the Waddenzee judgement[128] requires a very high level of certainty when it comes to assessing whether a plan or project will adversely affect the integrity of a European site. The judgement states that the competent authority must be sure, certain, convinced that the scheme will not adversely affect the integrity of the site. It goes on to state that that there can be no reasonable scientific doubt remaining as to the absence of adverse effects on the integrity of the site.

A7.10 For the Somerset authorities to be able to conclude with enough certainty that a proposed project or development will not have a significant effect on the SAC, the proposal or project must therefore be supported by adequate evidence and bespoke, reasoned mitigation. Where appropriate a long-term monitoring plan will be expected to assess whether the bat populations have responded favourably to the mitigation. It is

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[122] Court of Justice of the European Union (Holohan, Guifoyle, Guifoyle & Donegan v An Bord Pleanála. Case C-461 /17)
[123] A decision by the Court of Justice of the European Union (*People Over Wind and Sweetman v Coillte Teoranta* (C-323/17)) means that mitigation (avoidance and reduction) measures may no longer be taken into account by competent authorities at the HRA "screening stage" i.e. when judging whether a proposed project is likely to have a significant effect on a European site.
[124] See ODPM circular 06/2005
[125] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (known as the 'Habitats Directive')
[126] *Assessing Projects under the Habitats Directive: Guidance for Competent Authorities* 2011, CCW p.15
[127] ODPM Circular 06/2005 para13
[128] ECJ judgement: C-127/02 [2004] ECR-I

important that consistent monitoring methods are used pre- and post-development, to facilitate the interpretation of monitoring data.

A7.11 Mitigation, an Ecological Management Plan and, (where required) monitoring during and / or post development, will be secured through either planning conditions or a S106 agreement or both. Data from monitoring will be used by the Somerset Authorities to determine how the bat populations have responded to mitigation and to increase the evidence base.

Part D: Appendices

Appendix 1: Comparison of Home Ranges of Horseshoe Bats Derived from Radio-Tracking Studies

Greater Horseshoe Bats

Results	Average Distance (km)	Maximum Distance (km)	Reference
Non-Breeding Roost			
Mean maximum distance from roost to foraging area (maximum distance for each tracked individual averaged over the colony, foraging areas estimated used 90% cluster analysis) 2.17km, range 0.95-2.93km (Boar Mill) and 2.44km, range 0.61-3.76 (Creech).	2.17	2.93	Flanders, J. & Jones, G., 2009. Roost use, ranging behaviour and diet of Greater Horseshoe bats (*Rhinolophus ferrumequinum)* using a transitional roost. *Journal of Mammalogy* 90: 888-896.
	2.44	3.76	
Maternity Roosts			
Maximum distance travelled from roost 4km for juveniles and 8km for adults. Majority of foraging areas are within 6km of roost.		8	Billington, G. 2003. *Radio tracking study of Greater Horseshoe bats at Buckfastleigh Caves Site of Special Scientific Interest*: English Nature Research Report no. 573. Peterborough: English Nature.
Maximum distance travelled from roost 7.5km for adult bats. The majority of foraging areas are within 5km of roost.		7.5	English Nature Research Report no. 496
Maximum distance travelled from roost 6.8km, mean 1.9km (22 May-5 June), 13.9km, mean 6.2km (18-31 July). Overall 92% of foraging time spent within 6km of the roost and 60% within 4km. In May-June 92.7% foraging was within 3km, in July only 9.7% occurred within 3km. Only one bat flew further than 6km during May.	1.9	6.8	Robinson, M. F., Webber, M. & Stebbins, R. E. 2000. *Dispersal and foraging behaviour of Greater Horseshoe bats, Brixham, Devon*. English Nature Research Report No. 344. Peterborough: English Nature.
Maximum distance travelled from roost 4.5km (juvenile) and 6.8km (adult). Majority of time spent within 4km. However,, measured in GIS the range is 8km		8.0	Billington, G. 2001. *Radio tracking study of Greater Horseshoe bats at Brockley Hall Stables Site of Special Scientific Interest, May – August 2001*.English Nature Research Report No. 442. Peterborough: English Nature.
Maximum distance travelled from roost 3.6km (juvenile) 4.5km (adult).	2.2	4.5	Duverge, P., 1996. Foraging activity, habitat use, development of juveniles, and diet of the Greater Horseshoe bat (*Rhinolophus ferrumequinum* - Schreber 1774) in south-west England. PhD Thesis, University of Bristol.
Maximum distance travelled from roost 5.52km, mean distance from roost to foraging event (extended period of relatively stable signal strength indicating foraging behaviour), averaged over all fixes of all individuals tracked 1.68km ± 0.09.		5.52	Rossiter, S.J., Jones, G., Ransome, R.D., Barratt, E.M., 2002. Relatedness structure and kin-biased foraging in the Greater Horseshoe bat (*Rhinolophus ferrumequinum*). *Behavioural Ecology and Sociobiology* 51: 510-518.

Results	Average Distance (km)	Maximum Distance (km)	Reference
Maximum distance 5.75km measured from radio tracking fixes in GIS		5.75	Jones, Dr. G. & Billington, G. 1999. *Radio tracking study of Greater Horseshoe bats at Cheddar, North Somerset*. Taunton: English Nature.
Greater Horseshoe bat maximum foraging distance from the roost was 5.81km in June and 5.98km in August, with average distances being approximately 3.58km and 3.83km, respectively. These are similar figures to the 1999 study, where greater horseshoes were proven to forage up to 5.75km from the roost (Jones and Billington, 1999).	3.58	5.81	Rush,T. & Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August 2013*. Witham Friary: Greena Ecological Consultancy.
	3.83	5.98	
Maximum distance 4km measured from radio tracking fixes in GIS		4	Billington, G. 2000. *Radio tracking study of Greater Horseshoe bats at Mells, Near Frome, Somerset*. Peterborough: English Nature
Average distance to foraging areas was <3km until the end of May and after that it was around 5km. The longest distance travelled by one bat was 10.5km.		5	Billington, G. 2000. *Combe Down Greater Horseshoe bats: radio tracking study*. Bat Pro Ltd on behalf of Bath & North East Somerset Council
Maximum distance travelled from roost 7.4km. 50% of bat locations were within 1.7km of the roost.	1.7	7.4	Bontadina, F. 2002. Conservation ecology in the horseshoe bats *Rhinolophus ferrumequinum* and *Rhinolophus hipposideros*. PhD Thesis, University of Bern.

Lesser Horseshoe Bats

Results	Average Distance (km)	Maximum Distance (km)	Reference
Maximum distance travelled from roost, where home range had reached asymptote 273 - 4177m, mean maximum distance 1955m. Fifty percent of tracking locations were within 600m of maternity roost.	1.96	4.177	Bontadina, F., Schofield, H., Naef-Daenzer, B., 2002. Radio-tracking reveals that Lesser Horseshoe bats (*Rhinolophus hipposideros*) forage in woodland. *Journal of Zoology* 258: 281-290.
Bats were recorded ranging 6km to the north, 1.5km east, 2km south and 5km to the west.		6	Billington, G. 2005. *Radio tracking study of Lesser Horseshoe bats at Hestercombe House Site of Special Scientific Interest, July 2005.* English Nature Somerset & Gloucestershire Team.
The bats foraged within a radius of 1.0-4.0km from the roost, with the majority remaining within 2.0km. The average foraging radius in May was slightly higher than that recorded in August (1.93km v/s 1.52km)	1.93	4	Duvergé, L. 2008. *Report on bat surveys carried out at Hestercombe House SSSI Taunton, Somerset, in 2007 and 2008.* Cullompton: Kestrel Wildlife Consultants.
Lesser Horseshoe bat maximum foraging distance from the roost was 3.24km in June and 6.08km in	2.26	3.42	Billington, G. 2013. *Cheddar Reservoir 2: Radio tracking studies of greater horseshoe and Lesser Horseshoe bats, June and August*

Results	Average Distance (km)	Maximum Distance (km)	Reference
August, with average distances being approximately 2.26km and 3.72km, respectively.	3.72	6.08	*2013*. Witham Friary: Greena Ecological Consultancy.
The mean maximum range distance from the maternity roost for adult females was identical in each landscape (2.0 km) although the maximum distance an individual adult female was recorded flying to did vary. The value was 4.1 km for lowland, 3.5 km for high quality and 3.3 km for upland. Nulliparous females and juveniles were recorded a maximum of 4.5 km and 3.8 km respectively from the maternity roost in the lowland landscape.	2	4.1	Knight, T. 2006. *The use of landscape features and habitats by the Lesser Horseshoe bat* (Rhinolophus hipposideros). PhD Thesis, University of Bristol.
	2	3.5	
	2	3.3	
Maximum distance from maternity roost to centre of furthest foraging area 3.6km, 3.2km and 2.8km respectively. Mean distance from maternity roost to night roosts 1.71km ± 0.98 SD, 2.4km ± 1.44 SD and 1.34km ± 0.86 SD respectively.		3.6	Knight, T., Jones, G., 2009. Importance of night roosts for bat conservation: roosting behaviour of the Lesser Horseshoe bat *Rhinolophus hipposideros*. *Endangered Species Research 9: 79-86.*
		3.2	
		2.8	
One individual tracked - Maximum distance travelled from roost 3.6km, mean distance between roost and foraging area (calculated using MCPs, no further info given) 2.4km	2.4	3.6	Holzhaider, J., Kriner, E., Rudolph, B.-U., Zahn, A., 2002. Radio-tracking a Lesser Horseshoe bat (*Rhinolophus hipposideros*) in Bavaria: an experiment to locate roosts and foraging sites. *Myotis 40: 47-54.*

Appendix 2: Greater Horseshoe Bat Habitat Suitability Index

Text Colour
Black = Habitat Codes
Blue = Matrix Codes
Green = Formation Codes
Red = Management Codes

NP = Not permissible. It is considered that the habitat is not replaceable

A complete list with full descriptions and parameters of the habitat labels can be obtained from Somerset Environmental Records Centre[129].

Code	Label	HSI	Notes
Woodland Habitat Codes			Four principal habitat types: scrub, meadow, deciduous woodland and grazed pasture (Billington, 2000b) High over grown hedges and tree lines surrounding pasture, rough grassland or scrub, with nearby woodland edge and riparian habitat (Billington, 2003; Billington, 2000a) Limited foraging recorded within woodland itself (Billington, 2003) Macro and micro moths densest where grass or litter, less so where there are ferns, moss, bare ground, herbs. Richer where native tree diversity and larger basal area. Species such as oak, willow and birch have large numbers of moths whereas beech has little comparable to non-native species such as sycamore (Fuentes-Montemayor et al, 2012) Woodland has high levels of moths (Ransome, 1997a) Have been found to spend significant times in woodland, being sheltered, often warmer at night, and insects are much more abundant than open fields (Billington, 2000) Support the retention of all mature ancient semi natural deciduous woodland, old orchards and parkland (Ransome, 1997) Extensive use of woodland edge (Ransome, 1997) Limited foraging of adults was recorded in woodlands of only a few minutes duration
WB0	Broadleaved, mixed, and yew woodland	6	
WB1	Mixed woodland	5	
WB2	Scrub woodland	1	
WB3	Broadleaved woodland	6	
WB31	Upland oakwood [=Old sessile oak woods with Ilex and Blechnum in the British Isles (AN1)]	NP	
WB32	Upland mixed ashwoods	NP	
WB33	Beech and yew woodlands	3	
WB331	Lowland beech and yew woodland	NP	
WB3311	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)	NP	
WB3312	Asperulo-Fagetum beech forests	NP	
WB3313	Taxus baccata woods of the British Isles	NP	
WB331Z	Other lowland beech and yew woodland	3	
WB33Z	Other beech and yew woodlands	3	
WB34	Wet woodland	3	
WB341	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	NP	
WB342	Bog woodland	NP	
WB34Z	Other wet woodland	3	
WB36	Lowland mixed deciduous woodland	6	
WB361	Old acidophilous oak woods with Quercus robur on sandy plains	NP	
WB362	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	NP	

129 http://www.somerc.com/products-services/integrated-habitat-system-ihs/ and http://www.somerc.com/wp-content/uploads/2019/01/IHS-Definitions.pdf

Code	Label	HSI	Notes
WB363	Tilio-Acerion forests of slopes, screes and ravines [lowland]	NP	except during medium-heavy rainfall when most of the foraging time was spent in broadleaf and coniferous woodland (Billington, 2000)
WB36Z	Other lowland mixed deciduous woodland	6	
WB3Z	Other broadleaved woodland	6	
WC0	Coniferous woodland	1	
WCZ	Other coniferous woodland	1	
Woodland Matrix Codes			Note: Introduced shrub can include Buddleia, which attracts Large Yellow Underwing. If present the HSI score should +1 or 2 according to abundance
IH0	Introduced shrub	0	
Woodland Formation Codes			Uniform stands of trees are poorer in invertebrates than more diversely structured woodland (Kirby, 1988). Support the retention of all mature ancient semi natural deciduous woodland, old orchards and parkland (Ransome, 1997a)
WF0	**Unidentified woodland formation**	1	
WF1	Semi-natural	1	
WF11	Native semi-natural	1	
WF111	Canopy Cover >90%	0.1	
WF112	Canopy Cover 75 - 90%	0.25	
WF113	Canopy Cover 50 - 75%	0.75	
WF114	Canopy Cover 20 - 50%	1	
WF12	Non-native semi-natural	1	
WF121	Canopy Cover >90%	0.1	
WF122	Canopy Cover 75 - 90%	0.25	
WF123	Canopy Cover 50 - 75%	0.75	
WF124	Canopy Cover 20 - 50%	1	
WF2	Plantation	0.75	
WF21	Native species plantation	0.75	
WF22	Non-native species plantation	0.25	
WF3	Mixed plantation and semi-natural	0.75	
WF31	Mixed native species semi-natural with native species plantation	0.75	
WF32	Mixed native species semi-natural with non-native species plantation	0.5	
WF33	Mixed non-native species semi-natural with native species plantation	0.25	
WF34	Mixed non-native species semi-natural with non-native species plantation	0.1	
Woodland Management Codes			Deer and sheep grazing in woodland results in short cropped open glades (Ransome, 2007a) In woodland mainly used clearings and woodland edge (Billington, 2009) Rides, footpaths … were used by greater horseshoe bats when flying in these feeding areas. (Duvergé & Jones, 1994)
WM0	Undetermined woodland management	1	
WM1	High forest	1	
WM2	Coppice with standards	0.25	
WM3	Pure coppice	0.25	
WM4	Abandoned coppice	0.25	
WM5	Wood-pasture and parkland	1	
WM51	Currently managed wood pasture/parkland	1	
WM52	Relic wood pasture/parkland	1	
WM6	Pollarded woodland	0.75	
WM7	Unmanaged woodland	1	
WMZ	Other woodland management	1	
WG0	Unidentified woodland clearing	1	
WG1	Herbaceous woodland clearing	1	

Code	Label	HSI	Notes
WG2	Recently felled/coppiced woodland clearing	1	
WG3	Woodland ride	1	
WG4	Recently planted trees	0.5	
WGZ	Other woodland clearings/openings	1	
Grassland Habitat Codes			
GA0	Acid grassland	6	
GA1	Lowland dry acid grassland	6	
GC0	Calcareous grassland	6	
GC1	Lowland calcareous grassland	6	
GC11	Semi-natural dry grasslands and scrubland facies on calcareous substrates [Festuco-Brometalia]	NP	
GC12	Semi-natural dry grasslands and scrubland facies on calcareous substrates [Festuco-Brometalia] [important orchid sites]	NP	
GN0	Neutral grassland	6	
GN1	Lowland meadows	6	
GN11	Lowland hay meadows [Alopecurus pratensis, Sanguisorba officinalis]	NP	
GI0	Improved grassland	3	
GU0	Semi improved grassland	4	
Grassland Matrix Codes			The Integrated Habitat System considers scrub as a matrix habitat when less than 0.25ha. Otherwise use WB2
SC1	Dense/continuous scrub	-3	
SC11	Dense/continuous scrub: native shrubs	-3	
SC12	Dense/continuous scrub: introduced shrubs	-3	
SC2	Open/scattered scrub	1	
SC21	Open/scattered scrub: native shrubs	1	
SC22	Open/scattered scrub: introduced shrubs	1	
TS0	Scattered trees	0	
TS1	Scattered trees some veteran	1	
TS11	Broadleaved	1	
TS12	Mixed	0	
TS13	Coniferous	0	
TS2	Scattered trees none veteran	0	
TS21	Broadleaved	0	
TS22	Mixed	0	
TS23	Coniferous	0	
PA0	Patchy bracken	0	
PA1	Patchy bracken communities with a diverse vernal flora (NVC U20a)	0	
PA2	Small continuous bracken stands	0	
PA3	Scattered bracken	0	
OT0	Tall herb and fern (excluding bracken)	0	
OT3	Tall ruderal	0	
OT4	Non-ruderal	0	
OT41	Lemon-scented fern and Hard-fern vegetation (NVC U19)	0	
OT4Z	Other non-ruderal tall herb and fern	0	
OTZ	Other tall herb and fern	0	

Code	Label	HSI	Notes
HS0	Ephemeral/short perennial herb	0	
BG1	Bare ground	0	
Grassland Management Codes			
GM0	Undetermined grassland etc. management	1	Most important factor is grazed pasture (Ransome, 1997) Within 1 kilometre of the roost the presence of permanent grazed pasture is critical for juvenile greater horseshoe bats. A high density of grazing animals should be present giving high presence of dung. Within the remainder of the roost foraging range grazing regimes can be more flexible provided adequate pasture is available. Longer swards benefit the larvae of noctuid moths. (Ransome, 1996) The short turf produced by sheep grazing may be responsible for high *Melolontha* levels (Ransome, 1997) Sheep dung provides prey Short grazed habitat for *Melolontha* and Tupilids. All species requires short grass to oviposit. (Ransome, 1997; Ransome, 1997) *Aphodius* live in cow, sheep and horse dung (Ransome, 1997) Meadows which have been cut, and where animals are grazing, were also used (Duverge & Jones, 1994)
GM1	Grazed	1	
GM11	Cattle grazed	1	
GM12	Sheep grazed	0.75	
GM13	Horse grazed	0.8	
GM14	Mixed grazing	0.8	
GM1Z	Other grazing	0.75	
GM2	Mown	0.3	
GM21	Silage	0.2	
GM22	Hay	0.3	
GM23	Frequent mowing	0	
GM2Z	Other mowing regime	0.2	
GM3	Hay and aftermath grazing	0.8	
GM4	Unmanaged	1	
GM5	Burning/swaling	0	
GMZ	Other grassland etc. management	0	
GL1	Amenity grassland	0.1	
GL11	Golf course	0.25	
GL12	Urban parks, playing and sports fields	0	
GL1Z	Other amenity grassland	0.1	
GL2	Non-amenity grassland	1	
GL21	Permanent agricultural grassland	1	
GL211	Arable reversion grassland	1	
GL2111	Species-rich conservation grassland	1	
GL211Z	Other arable reversion grassland	1	
GL21Z	Other permanent agricultural grassland	1	
GL2Z	Other grassland use	0.25	
CL3	Un-intensively managed orchards	1	Support the retention of all old orchards (Ransome, 1997)
CL31	Traditional orchards	1	
CL32	Defunct orchards	1	
CL3Z	Other un-intensively managed orchards	1	
CF1	Coastal and floodplain grazing marsh	1	
Bracken Habitat Code			
BR0	Bracken	0	
Heathland Habitat Codes			
HE0	Dwarf shrub heath	0	
HE1	European dry heaths	0	
HE2	Wet heaths	0	
Wetland Habitat Codes			
EO0	Bog	NP	Tipulid larval development is favoured by damp conditions, any aquatic environments and/or marshes should be retained Aquatic environments will also favour the production of caddis flies (Trichoptera) (Ransome, 1997b; Ransome, 1997a) in certain months, May and late August/September when
EM0	Fen, marsh and swamp	2	
EM1	Swamp	0	
EM11	Reedbeds	0	
EM2	Marginal and inundation vegetation	1	
EM21	Marginal vegetation	1	

Code	Label	HSI	Notes
EM22	Inundation vegetation	0	other food supplies may be erratic (Ransome 1997a)
EM3	Fens	2	
EM31	Fens [and flushes - lowland]	2	
EM312	Springs	1	
EM313	Alkaline fens [lowland]	1	
EM4	Purple moor grass and rush pastures [Molinia-Juncus]	1	
Standing Open Water and Canals Habitat Codes			Significant Trichopteran consumption at roosts close to extensive river or lake habitats (Ransome, 1997)
AS0	Standing open water and canals	4	
AS1	Dystrophic standing water	2	
AS11	Natural dystrophic lakes and ponds	2	
AS1Z	Other dystrophic standing water	2	
AS2	Oligotrophic standing waters	3	
AS21	Oligotrophic lakes	2	
AS3	Mesotrophic standing waters	4	
AS31	Mesotrophic lakes	2	
AS3Z	Other mesotrophic standing waters	2	
AS4	Eutrophic standing waters	3	
AS5	Marl standing water	2	
AS6	Brackish standing water with no sea connection	0	
AS7	Aquifer fed naturally fluctuating water bodies	2	
ASZ	Other standing open water and canals	2	
Standing Open Water Formation Codes			Used for commuting. to cross the central Moors south of Cheddar where the bats frequently fly below ground level in drainage channels such as the Cheddar Canal (Jones & Billington, 1999)
AC0	Channel of unknown origin	1	
AC1	Artificial channels	1	
AC11	Drains, rhynes and ditches	1	
AC111	Species-rich drains, rhynes and ditches	1	
AC11Z	Other drains, rhynes and ditches	1	
AC12	Artificially modified channels	1	
AC13	New artificial channels	0.75	
AC14	Canals	0.5	
AC1Z	Other artificial channels	1	
AC2	Natural/naturalistic channels	1	
AO0	Open water of unknown origin	0.25	
AO1	Artificial open water	0.25	
AO11	Reservoir	0.25	
AO12	Gravel pits, quarry pools, mine pools and marl pits	0.25	
AO13	Industrial lagoon	0	
AO14	Scrape	0	
AO15	Moat	0.5	
AO16	Ornamental	0	
AO1Z	Other artificial open water	0	
AO2	Natural open water	0.25	
AP1	Pond	0.1	
AP11	Ponds of high ecological quality	0.5	
AP1Z	Other pond	0.1	
AP2	Small lake	0.25	
AP3	Large lake	0.25	

Code	Label	HSI	Notes
Standing Open Water Management Codes			
LT1	Canal-side	0.25	
LT11	Canal-side with woodland	1	
LT12	Canal-side with scrub or hedgerow and standard trees	1	
LT13	Canal-side with scrub or hedgerow	1	
LT14	Canal-side with layered vegetation	0.8	
LT15	Canal-side with grassland	0.5	
LT16	Canal-side with damaged banks	0.25	
LT17	Canal-side with constructed banks	0	
LT18	Other canal-side type	0.25	
Rivers and Streams Habitat Codes			
AR0	Rivers and streams	3	The River Dart, a large river system, mostly banked by broadleaved woodland was also a key habitat (Billington, 2003)
AR1	Headwaters	3	
AR11	Chalk headwaters	3	
AR12	Active shingle rivers [headwaters]	3	
AR1Z	Other headwaters	3	
AR2	Chalk rivers (not including chalk headwaters)	3	
AR21	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation (chalk substrate)	3	
AR2Z	Other chalk rivers	3	
AR3	Active shingle rivers [non headwaters]	3	
ARZ	Other rivers and streams	3	
Rivers and Streams Management Codes			
LT2	River-side	1	
LT21	River-side with woodland	1	
LT22	River-side with scrub or hedgerow and standard trees	1	
LT23	River-side with scrub or hedgerow	1	
LT24	River-side with layered vegetation	0.8	
LT25	River-side with grassland	0.5	
LT26	River-sdie with vertical banks	1	
LT27	River-side with damaged banks	0.25	
LT28	River-side with constructed banks	0	
LT29	Other river-side type	0.25	
Arable Habitat Codes			
CR0	Arable and horticulture	1	
CR1	Grass and grass-clover leys	1	
CR2	Cereal crops	1	
CR3	Non-cereal crops including woody crops	1	
CR31	Intensively managed orchards	1	
CR32	Withy beds	1	
CR33	Vineyards	2	The caterpillar of Large Yellow Underwing can feed on grape vines
CR34	Game crops	1	
CR35	Miscanthus	0	
CR3Z	Other non-cereal crops including woody crops	1	
CR5	Whole field fallow	2	
CR6	Arable headland or uncultivated strip	4	

Code	Label	HSI	Notes
CR61	Arable field margins	4	
CR6Z	Other arable headland or uncultivated strip	4	
CRZ	Other arable and horticulture	0	
Arable Management Codes			
CL1	Agriculture	1	
CL11	Organic agriculture	1	
CL12	Non-organic agriculture	0.5	
CL2	Market garden and horticulture	0	
CL21	Organic market garden and horticulture	0	
CL22	Non-organic market garden and horticulture	0	
CL3	Un-intensively managed orchards	1	
CL31	Traditional orchards	1	
CL32	Defunct orchards	1	
CL3Z	Other un-intensively managed orchards	1	
CL4	Intensively managed vineyards	0	
CL4Z	Non-intensively managed vineyards	0	
CL5	Cereal crops managed for wildlife	0.75	
CL5Z	Cereal crops not managed for wildlife	0.25	
Inland Rock Habitat Codes			
RE0	Inland rock	0	
RE1	Natural rock exposure features	0	
RE11	Natural rock and scree habitats	0	
RE112	Lowland natural rock and scree habitats	0	
RE14	Caves	6	
RE141	Caves not open to the public	NP	
RE14Z	Other caves	5	
RE15	Exposed river gravels and shingles	0	
RE1Z	Other natural rock exposure feature	0	
RE2	Artificial rock exposures and waste	1	
RE21	Quarry	1	
RE22	Spoil heap	0	
RE23	Mine	5	
RE24	Refuse tip	0	
RE2Z	Other artificial rock exposure and waste	0	
Linear Habitat Codes			
LF0	Boundary and linear features	6	Support the retention of existing hedgerows and tree lines linking areas of woodland. Encourage hedgerow improvement to become 3 to 6 metres wide, mean 3 metres high with frequent standard emergent trees (Ransome, 1997) Hedges used as perching sites (Duverge & Jones, 1994) The vast majority (over 90%) of insects found near hedges do not originate in the hedge but come from other habitats brought in on the wind (BCT, 2003)
LF1	Hedges / Line of trees	6	
LF11	Hedgerows	6	
LF111	Important hedgerows	6	
LF11Z	Non-important hedgerows	5	
LF12	Line of trees	4	
LF1Z	Other hedges/line of trees	4	
LF2	Other boundaries and linear features	3	
LF21	Line of trees (not originally intended to be stock proof)	3	
LF22	Bank	0	
LF23	Wall	2	
LF24	Dry ditch	1	

Code	Label	HSI	Notes
LF25	Grass strip	0	Hedges managed under agri-environment Schemes did not offer any benefit over conventionally managed hedgerows with regard to macro-moths (Fuentes-Montemayor et al, 2010)
LF26	Fence	1	
LF27	Transport corridors	0	
LF271	Transport corridor without associated verges	0	
LF272	Transport corridor associated verges only	0	
LF273	Transport corridor with natural land surface	0	
Linear Management Codes			
LH3	Recently planted hedge (Only use for existing habitat)	0.2	
LM1	Cut hedge	0.3	Cut hedge is specified where height is below 2 metres
LM11	Cut hedge with standards	0.3	
LM12	Cut hedge without standards	0.2	
LM2	Uncut hedge	0.9	Uncut hedge is specified where the hedge is between 2 and 3 metres high
LM21	Uncut hedge with standards	0.9	
LM22	Uncut hedge without standards	0.8	
LM3	Overgrown hedge	1	Overgrown hedge is considered to be over 3 metres high
LM31	Overgrown hedge with standards	1	
LM32	Overgrown hedge without standards	0.9	
LT3	Rail-side	0.5	
LT4	Road-side	0.5	
LT5	Path- and track-side	1	
LTZ	Other transport corridor verges, embankments and cuttings	0.5	
UL1	Railway	0	
UL2	Roadway	0	
UL3	Path and trackway	0	
ULZ	Other transport corridor	0	
Built Up Area and Gardens Habitat Codes			
UR0	Built-up areas and gardens	1	
Built Up Area and Gardens Management Codes			
UA1	Agricultural	0.1	
UA2	Industrial/commercial	0	
UA3	Domestic	0	
UA31	Housing/domestic outbuildings	0	
UA32	Gardens	0	
UA33	Allotments	0	
UA34	Caravan park	0	
UA3Z	Other domestic	0	
UA4	Public amenity	0	
UA41	Churchyards and cemeteries	0.1	
UA4Z	Other public amenity	0	
UA5	Historical built environment	1	
UAZ	Other extended built environment	0	

Appendix 3: Lesser Horseshoe Bat Habitat Suitability Index

Text Colour
Black = Habitat Codes
Blue = Matrix Codes
Green = Formation Codes
Red = Management Codes

NP = Not permissible. It is considered that the habitat is not

A complete list with full descriptions and parameters of the habitat labels can be obtained from Somerset Environmental Records Centre.

Code	Label	HSI	Notes
Woodland Habitat Codes			‘ *The primary foraging habitat for lesser horseshoe bats is broadleaf woodland where they often hunt high in the canopy. However, they will also forage along hedgerows, tree-lines and well-wooded riverbanks.*’ (Schofield, 2008) In lowlands broadleaved and mixed woodland is the most used habitat (Knight, 2006) Avoids dense scrub cover (Schofield 2008), i.e. WB2 Lesser horseshoe bats are primarily a woodland feeding bat using deciduous woodland or mixed coniferous woodland and hedgerows. It has been found that habitats that were most important contained a high proportion of woodland, parkland and grazed pasture woodland, combined with linear features, such as overgrown hedgerows. Woodland with watercourses has more importance. Broadleaved woodland predominated over other types of woodland and was shown to be a key habitat for the species. In the core foraging areas used by bats woodland accounted for 58.7 ± 5.2% of the habitats present. (Barataud et al, 2000; Bontadina et al, 2002) Non-native - biomass of fir trees is 16 compared to Ash 41 and Oak 284 Window gnats present Juveniles select broadleaved woodland habitat (Knight, 2006) Broadleaved, mixed middle age mature woodland with the presence of a river or pond on at least one side most favourable (Barataud et al, 2000) In Bavaria foraged in all available forest types (semi natural mountainous beech-spruce-fir forests and more artificial spruce dominated forests except dense riparian forest. The large part of the time foraging time in forest of deciduous trees (*Fagus sylvatica*) (Holzhaider et al, 2002) A habitat index produced as a result of surveys carried out in four different habitats; plantation woodland; improved grassland, semi improved grassland and arable (root crops) produced the following index 1, 0.33, 0.2 and 0.05 for lesser horseshoe bat prey species abundance (Biron, 2007)
WB0	Broadleaved, mixed, and yew woodland	6	
WB1	Mixed woodland	6	
WB2	Scrub woodland	1	
WB3	Broadleaved woodland	6	
WB31	Upland oakwood [=Old sessile oak woods with Ilex and Blechnum in the British Isles(AN1)]	NP	
WB32	Upland mixed ashwoods	NP	
WB321	Tilio-Acerion forests of slopes, screes and ravines [upland]	NP	
WB32Z	Other upland mixed ashwoods	6	
WB33	Beech and yew woodlands	4	
WB331	Lowland beech and yew woodland	4	
WB3311	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion)	NP	
WB3312	Asperulo-Fagetum beech forests	NP	
WB3313	Taxus baccata woods of the British Isles	NP	
WB331Z	Other lowland beech and yew woodland	4	
WB33Z	Other beech and yew woodlands	4	
WB34	Wet woodland	6	
WB341	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	NP	
WB342	Bog woodland	NP	
WB34Z	Other wet woodland	6	
WB35	Upland birch woodland	6	
WB36	Lowland mixed deciduous woodland	6	
WB361	Old acidophilous oak woods with Quercus robur on sandy plains	NP	
WB362	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	NP	
WB363	Tilio-Acerion forests of slopes, screes and ravines [lowland]	NP	
WB36Z	Other lowland mixed deciduous woodland	6	
WB3Z	Other broadleaved woodland	6	
WC0	Coniferous woodland	3	
Woodland Matrix Codes			Known to make use of shrubs such as rhododendron (Robertson, 2002)
IH0	Introduced shrub	0	

Code	Label	HSI	Notes
Woodland Formation Codes			
WF0	Unidentified woodland formation	1	There was very little difference recorded in the availability of prey in woodland in Switzerland. Variation is due to woodland formation and management (Bontadina et al, 2008)
WF1	Semi-natural	1	
WF11	Native semi-natural	1	
WF111	Canopy Cover >90%	0.2	Determined by woodland habitat type
WF112	Canopy Cover 75 - 90%	0.7	
WF113	Canopy Cover 50 - 75%	1	
WF114	Canopy Cover 20 - 50%	1	
WF12	Non-native semi-natural	0.8	
WF121	Canopy Cover >90%	0.2	The density of the taller trees (either deciduous or coniferous) must be low enough to allow development of understorey of shrub and small coppice. (Motte & Libois, 2002)
WF122	Canopy Cover 75 - 90%	0.7	
WF123	Canopy Cover 50 - 75%	1	
WF124	Canopy Cover 20 - 50%	1	
WF2	Plantation	0.8	
WF21	Native species plantation	0.8	
WF22	Non-native species plantation	0.6	Uniform stands of trees are poorer in invertebrates than more diversely structured woodland (Kirby, 1988) Used conifer plantation at Ciliau but overall time in the habitat was small (Schofield et al, 2003)
WF3	Mixed plantation and semi-natural	0.8	
WF31	Mixed native species semi-natural with native species plantation	0.8	
WF32	Mixed native species semi-natural with non-native species plantation	0.7	
WF33	Mixed non-native species semi-natural with native species plantation	0.7	
WF34	Mixed non-native species semi-natural with non-native species plantation	0.6	
Woodland Management Codes			
WM0	Undetermined woodland management	1	
WM1	High forest	1	
WM2	Coppice with standards	1	
WM3	Pure coppice	1	
WM4	Abandoned coppice	1	
WM5	Wood-pasture and parkland	1	Lesser horseshoe bats hunting and swerving between branches of and in the foliage of coppice, at 1 to 4m high (Motte & Libois, 2002)
WM51	Currently managed wood pasture/parkland	1	
WM52	Relic wood pasture/parkland	1	
WM6	Pollarded woodland	1	
WM7	Unmanaged woodland	1	
WMZ	Other woodland management	1	
WG0	Unidentified woodland clearing	1	
WG1	Herbaceous woodland clearing	1	Clear cutting must be avoided (Motte & Libouis, 2002)
WG2	Recently felled/coppiced woodland clearing	0.5	
WG3	Woodland ride	1	
WG4	Recently planted trees	0.5	
WGZ	Other woodland clearings/openings	1	
Grassland Habitat Codes			The majority of foraging areas around Glynllifon are associated with semi improved pasture bounded by hedgerows and scrub (Billington & Rawlinson, 2006) The vast majority (over 90%) of insects found near hedges do not originate in the hedge but come from other habitats brought in on the wind (BCT, 2003)
GA0	Acid grassland	3	
GC0	Calcareous grassland	3	
GN0	Neutral grassland	3	
GN1	Lowland meadows	3	
GI0	Improved grassland	2	
GU0	Semi improved grassland	3	

Code	Label	HSI	Notes
Grassland Matrix Codes			The Integrated Habitat System considers scrub as a matrix habitat when less than 0.25ha. Otherwise use WB2
SC1	Dense/continuous scrub	-3	
SC11	Dense/continuous scrub: native shrubs	-3	Avoids dense scrub cover (Schofield 2008)
SC12	Dense/continuous scrub: introduced shrubs	-3	
SC2	Open/scattered scrub	1	
SC21	Open/scattered scrub: native shrubs	1	
SC22	Open/scattered scrub: introduced shrubs	1	
TS0	Scattered trees	1	
TS1	Scattered trees some veteran	1	
TS11	Broadleaved	1	Presence of scattered trees in grassland/arable is likely to increase opportunity for foraging and increase insect diversity/biomass. Parkland habitats have been noted for lesser horseshoe bat foraging. There are a high number of Tipulid species in this habitat
TS12	Mixed	1	
TS13	Coniferous	0	
TS2	Scattered trees none veteran	0	
TS21	Broadleaved	0	
TS22	Mixed	0	
TS23	Coniferous	0	
PA0	Patchy bracken	0	
OT0	Tall herb and fern (excluding bracken)	0.25	
OT3	Tall ruderal	0.25	
OT4	Non-ruderal	0.25	
OT41	Lemon-scented fern and Hard-fern vegetation (NVC U19)	0.25	
OT4Z	Other non-ruderal tall herb and fern	0.25	
OTZ	Other tall herb and fern	0.25	
HS0	Ephemeral/short perennial herb	0	
BG1	Bare ground	0	Area of bare ground is not specified - assumed patchy
Grassland Management Codes			
GM0	Undetermined grassland etc. management	1	
GM1	Grazed	1	The presence of cattle is a factor in access to foraging (Cresswell Associates, 2004). Dung flies have been shown to be an element of the diet but less so at Hestercombe House (Knight, 2008). Scatophagidae are a key element of their diet, and together with Sphaeroceridae, are frequently associated with dung (Knight, 2006)
GM11	Cattle grazed	1	
GM12	Sheep grazed	0.75	
GM13	Horse grazed	0.8	
GM14	Mixed grazing	0.8	
GM1Z	Other grazing	0.75	The presence of pasture is indispensable to the larval stage of development for certain species (Tipulids), which form a significant part of lesser horseshoe bat diet (Motte & Libois, 2002; Boye & Dietz, 2005).
GM2	Mown	0.5	
GM21	Silage	0.1	
GM22	Hay	0.6	
GM23	Frequent mowing	0.25	Possibility of presence of window gnats but heavily managed or lit. Need to have associated matrix codes TS
GM2Z	Other mowing regime	0.25	Possibility of presence of window gnats but heavily managed or lit. Need to have associated matrix codes TS
GM3	Hay and aftermath grazing	0.8	
GM4	Unmanaged	1	
GM5	Burning/swaling	0	
GMZ	Other grassland etc. management	0.5	
GL1	Amenity grassland	0.1	
GL11	Golf course	0.1	
GL12	Urban parks, playing and sports fields	0.1	
GL1Z	Other amenity grassland	0.1	
GL2	Non-amenity grassland	1	

Code	Label	HSI	Notes
GL21	Permanent agricultural grassland	1	
GL211	Arable reversion grassland	1	
GL2111	Species-rich conservation grassland	1	
GL211Z	Other arable reversion grassland	1	
GL21Z	Other permanent agricultural grassland	1	
GL2Z	Other grassland use	0.25	
CL3	Unintensively managed orchards	1	
CL31	Traditional orchards	1	
CL32	Defunct orchards	1	
CL3Z	Other unintensively managed orchards	1	
CF1	Coastal and floodplain grazing marsh	1	
Bracken Habitat Codes			Bracken cover hosts over 40 species of invertebrates. Bracken and heath are used by lesser horseshoe bats in upland areas (Knight, 2006)
BR0	Bracken	2	
Heathland Habitat Codes			Bog habitats are avoided by lesser horseshoe bats (Irish Bats)
HE0	Dwarf shrub heath	2	
HE1	European dry heaths	2	
HE2	Wet heaths	1	
Bog Habitat Codes			
EO0	Bog	NP	
Wetland Habitat Codes			Fen was intensively used in Bavaria where groups of trees are present (Holzhaider et al, 2002)
EM0	Fen, marsh and swamp	3	
EM1	Swamp	1	
EM11	Reedbeds	1	
EM12	Calcareous fens with Cladium mariscus and species of the Carex davallianae	NP	
EM1Z	Other swamp vegetation	1	
EM2	Marginal and inundation vegetation	2	
EM21	Marginal vegetation	2	
EM22	Inundation vegetation	0	
EM3	Fens	3	
EM31	Fens [and flushes - lowland]	3	
EM311	Calcareous fens with Cladium mariscus and species of the Carex davallianae	NP	
EM312	Springs	2	
EM313	Alkaline fens [lowland]	2	
EM314	Transition mires and quaking bogs [lowland]	2	
EM31Z	Other lowland fens	3	
EM3Z	Other fens, transition mires, springs and flushes	1	
EM4	Purple moor grass and rush pastures [Molinia-Juncus]	2	
EM41	Molinia meadows on calcareous, peaty or clayey-silt-laden soils [Molinia caeruleae]	NP	
EM42	Non-Annex 1 Molinia meadow and rush pasture habitats (SWT)	2	
EM421	Species-rich rush pastures (SWT)	2	
EM422	Non-Annex 1 Molinia meadows (SWT)	2	
EM4Z	Other purple moor grass and rush pastures [Molinia-Juncus]	2	
Standing Water and Canals Habitat Codes			

Code	Label	HSI	Notes
AS0	Standing open water and canals	6	Culicidae were more abundant in the Hestercombe House diet compared with previous studies in Britain (8% compared with 1%) suggesting that the colony is utilising standing water sources and adjacent areas for foraging. Caddis flies supply 5% of diet. Mayflies less than 5%. Midge larvae are small and wormlike and develop in lakes, ponds, slow-moving streams, drainage ditches, and wet mud and even in highly polluted sewage water. In Ireland activity as found to be greater around expanses of water than along roadside hedgerows. Foraging was concentrated around tree lined rivers and ponds (McAney & Fairley, 1988) The larvae of freshwater species usually live in cold clean flowing waters, but some species prefer warmer slower waters. They are very particular about water temperature and speed, dissolved minerals and pollutants, as http://animals.jrank.org/pages/2512/Caddisflies-Trichoptera.html#ixzz14E3GO5ZH An increase in the number of chironomids results from eutrophication. Daubenton's feed downstream of sewage outputs (Racey, 1998) Adults generally fly quickly from the water. Mating takes place on the ground or vegetation. Adults are commonly found near lights at night or on foliage near water. http://insects.tamu.edu/fieldguide/cimg245.html The larvae of freshwater species usually live in cold clean flowing waters, but some species prefer warmer slower waters. They are very particular about water temperature and speed, dissolved minerals and pollutants, as http://animals.jrank.org/pages/2512/Caddisflies-Trichoptera.html#ixzz14E3GO5ZH Lesser horseshoe bats are likely to use ditch and rhyne systems for foraging (greater horseshoe bats have been radio tracked doing so [Jones & Billington, 1999]. It is considered that a large roost at Theale, near Wedmore, is supported thus due to lack of woodland and hedgerow connectivity otherwise but needs to be confirmed by radio tracking and /or other surveys in the future. Watercourses are the most used habitat in uplands (Trichoptera in diet) (Knight, 2006)
AS1	Dystrophic standing water	3	
AS11	Natural dystrophic lakes and ponds	1	
AS1Z	Other dystrophic standing water	3	
AS2	Oligotrophic standing waters	4	
AS21	Oligotrophic lakes	1	
AS2Z	Other oligotrophic standing waters	4	
AS3	Mesotrophic standing waters	5	
AS31	Mesotrophic lakes	2	
AS3Z	Other mesotrophic standing waters	5	
AS4	Eutrophic standing waters	6	
AS41	Eutrophic standing waters	5	
AS4Z	Other eutrophic standing waters	6	
AS5	Marl standing water	1	
AS6	Brackish standing water with no sea connection	3	
AS7	Aquifer fed naturally fluctuating water bodies	4	
ASZ	Other standing open water and canals	6	
Standing Water and Canals Formation Codes			
AC0	Channel of unknown origin	1	
AC1	Artificial channels	1	
AC11	Drains, rhynes and ditches	1	
AC111	Species-rich drains, rhynes and ditches	1	
AC11Z	Other drains, rhynes and ditches	1	
AC12	Artificially modified channels	1	
AC13	New artificial channels	0.1	
AC14	Canals	0.3	
AC1Z	Other artificial channels	0.3	
AC2	Natural/naturalistic channels	1	
AO0	Open water of unknown origin	1	
AO1	Artificial open water	0.75	
AO11	Reservoir	1	
AO12	Gravel pits, quarry pools, mine pools and marl pits	1	
AO13	Industrial lagoon	0.2	
AO14	Scrape	1	
AO15	Moat	1	
AO16	Ornamental	0.75	
AO1Z	Other artificial open water	0.75	
AO2	Natural open water	1	
AP1	Pond	1	
AP11	Ponds of high ecological quality	1	
AP1Z	Other pond	1	
AP2	Small lake	1	
AP3	Large lake	0.5	
Standing Water and Canals Management Codes			
LT1	Canal-side	1	
LT11	Canal-side with woodland	1	
LT12	Canal-side with scrub or hedgerow and standard trees	1	

Code	Label	HSI	Notes
LT13	Canal-side with scrub or hedgerow	1	
LT14	Canal-side with layered vegetation	0.75	
LT15	Canal-side with grassland	0.5	
LT16	Canal-side with damaged banks	0	
LT17	Canal-side with constructed banks	0	
LT18	Other canal-side type	0	
Running Water Habitat Codes			
AR0	Rivers and streams	5	
AR1	Headwaters	5	Watercourses are the most used habitat in uplands (Trichoptera in diet) (Knight, 2006)
AR11	Chalk headwaters	5	
AR12	Active shingle rivers [headwaters]	5	
AR1Z	Other headwaters	5	
AR2	Chalk rivers (not including chalk headwaters)	4	
AR3	Active shingle rivers [non headwaters]	5	
ARZ	Other rivers and streams	4	
Running Water Management Codes			
LT2	River-side	1	
LT21	River-side with woodland	1	
LT22	River-side with scrub or hedgerow and standard trees	1	Broadleaved, mixed middle age mature woodland with the presence of a river or pond on at least one side most favoured habitat by lesser horseshoe bats (Barataud et al, 2000)
LT23	River-side with scrub or hedgerow	1	
LT24	River-side with layered vegetation	0.75	
LT25	River-side with grassland	0.5	
LT26	River-sdie with vertical banks	0.5	
LT27	River-side with damaged banks	0	
LT28	River-side with constructed banks	0	
LT29	Other river-side type	0	
Arable Habitat Codes			
CR0	Arable and horticulture	1	
CR1	Grass and grass-clover leys	1	
CR2	Cereal crops	1	
CR3	Non-cereal crops including woody crops	1	
CR31	Intensively managed orchards	1	
CR32	Withy beds	1	
CR33	Vineyards	1	
CR34	Game crops	2	Miscanthus is not palatable to most insects. This is likely to include those species preyed upon by lesser horseshoe bats
CR35	Miscanthus	0	
CR3Z	Other non-cereal crops including woody crops	1	
CR5	Whole field fallow	2	
CR6	Arable headland or uncultivated strip	3	
CR61	Arable field margins	3	
CR6Z	Other arable headland or uncultivated strip	2	
CRZ	Other arable and horticulture	1	
Arable Management Codes			
CL1	Agriculture	1	
CL11	Organic agriculture	1	
CL12	Non-organic agriculture	0.5	
CL2	Market garden and horticulture	0	

Code	Label	HSI	Notes
CL21	Organic market garden and horticulture	0	It has been shown that organic farms are more heavily used by bats than otherwise (Wickramasinghe et al, 2003).
CL22	Non-organic market garden and horticulture	0	
CL4	Intensively managed vineyards	0	
CL4Z	Non-intensively managed vineyards	1	
CL5	Cereal crops managed for wildlife	1	
CL5Z	Cereal crops not managed for wildlife	0.5	
Inland Rock Habitat Codes			
RE0	Inland rock	0	
RE1	Natural rock exposure features	0	
RE11	Natural rock and scree habitats	0	
RE111	Upland natural rock and scree habitats	0	
RE112	Lowland natural rock and scree habitats	0	
RE14	Caves	NP	Winter roost sites.
RE141	Caves not open to the public	NP	
RE14Z	Other caves	5	Caves occur in disused quarries in Somerset
RE15	Exposed river gravels and shingles	2	
RE1Z	Other natural rock exposure feature	0	
RE2	Artificial rock exposures and waste	0	
RE21	Quarry	2	
RE22	Spoil heap	0	
RE23	Mine	3	
RE24	Refuse tip	0	
RE2Z	Other artificial rock exposure and waste	0	
Linear Habitat Codes			
LF0	Boundary and linear features	6	In a report for the three Welsh National Parks, Pembrokeshire County Council and the Countryside Commission for Wales by the Bat Conservation Trust (2005) it is stated that in fragmented habitats linear features, such as hedgerows, provided valuable corridors between roosts and foraging areas. Commuting corridors are important features for lesser horseshoe bats as they avoid crossing open areas and are vulnerable to the loss of these corridors. Where lesser horseshoes bats foraged along linear features, such as hedgerows, it was always within 10 metres of the feature (Bat Conservation Trust, 2005). In Belgium no bat was recorded more than 1 metre from a feature (Motte & Dubois, 2002). Linking features in a landscape of fragmented woodlands are highly important to the survival of lesser horseshoe bats. Motte & Dubois (2002) in their study wrote that, '*What is striking is that all places were linked to the roost and to each other by a wooded element*.' The vast majority (over 90%) of insects found near hedges do not originate in the hedge but come from other habitats brought in on the wind (BCT, 2003) Hedges managed under Agri-environment Schemes did not offer any benefit over conventionally managed hedgerows with regard to micro and macro-moths (Fuentes-Montemayor et al, 2010)
LF1	Hedges / Line of trees	6	
LF11	Hedgerows	6	
LF111	Important hedgerows	6	
LF11Z	Non-important hedgerows	5	
LF12	Line of trees	6	
LF1Z	Other hedges/line of trees	5	
LF2	Other boundaries and linear features	4	
LF21	Line of trees (not originally intended to be stock proof)	4	
LF22	Bank	0	
LF23	Wall	1	
LF24	Dry ditch	1	
LF25	Grass strip	0	
LF26	Fence	0	
LF27	Transport corridors	0	
LF271	Transport corridor without associated verges	0	
LF272	Transport corridor associated verges only	0	
LF273	Transport corridor with natural land surface	0	
Linear Management Codes			
LH3	Recently planted hedge (Only use for existing habitat)	0.25	
LM1	Cut hedge	0.3	Cut hedge is specified where height is below 2 metres

Code	Label	HSI	Notes
LM11	Cut hedge with standards	0.3	Uncut hedge is specified where the hedge is between 2 and 3 metres high Overgrown hedge is considered to be over 3 metres high
LM12	Cut hedge without standards	0.2	
LM2	Uncut hedge	0.9	
LM21	Uncut hedge with standards	0.9	
LM22	Uncut hedge without standards	0.8	
LM3	Overgrown hedge	1	
LM31	Overgrown hedge with standards	1	
LM32	Overgrown hedge without standards	0.9	
LT3	Rail-side	0.5	
LT4	Road-side	0.5	
LT5	Path- and track-side	1	
LTZ	Other transport corridor verges, embankments and cuttings	1	
UL1	Railway	0	
UL2	Roadway	0	
UL3	Path and trackway	0	
ULZ	Other transport corridor	0	
Built Up Areas and Gardens Habitat Codes			
UR0	Built-up areas and gardens	1	
Built UP Areas and Gardens Management Codes			
UA1	Agricultural	0.1	
UA2	Industrial/commercial	0	Lesser horseshoe bat summer roosts are typically in the loft spaces of old buildings Urban and sub urban areas are exploited by lesser horseshoe bats (Knight, 2006) Farmyards most used by lesser horseshoe in Ireland (McAney & Fairley, 1988). Night roosts possible
UA3	Domestic	0	
UA31	Housing/domestic outbuildings	0.1	
UA32	Gardens	0.1	
UA33	Allotments	0.1	
UA34	Caravan park	0	
UA3Z	Other domestic	0	
UA4	Public amenity	0	
UA41	Churchyards and cemeteries	1	
UA4Z	Other public amenity	0	
UA5	Historical built environment	1	
UAZ	Other extended built environment	0	

Appendix 4: Risk Factors for Restoring or Recreating Different Habitats

N.B.: These assignments are meant purely as an indicative guide. The starting position with regard to substrate, nutrient levels, state of existing habitat, etc. will have a major impact in the actual risk factor. Final assessments of risk may need to take other factors into account.

Habitats	**Technical difficulty of recreating**	**Technical difficulty of restoration**
Arable Field Margins	Low	n/a
Coastal and Floodplain Grazing Marsh	Low	Low
Eutrophic Standing Waters	Medium	Medium
Hedgerows	Low	Low
Lowland Beech and Yew Woodland	Medium	Low
Lowland Calcareous Grassland	Medium	Low
Lowland Dry Acid Grassland	Medium	Low
Lowland Meadows	Medium	Low
Lowland Mixed Deciduous Woodland	Medium	Low
Open Mosaic Habitats on Previously Developed Land	Low	Low
Ponds	Low	Low
Wood-Pasture & Parkland	Medium	Low

Appendix 5: Feasibility and Timescales of Restoring: examples from Europe

Ecosystem type	Time-scale	Notes
Temporary pools	1-5 years	Even when rehabilitated, may never support all pre-existing organisms.
Eutrophic ponds	1-5 years	Rehabilitation possible provided adequate water supply. Readily colonised by water beetles and dragonflies but fauna restricted to those with limited specialisations.
Mudflats	1-10 years	Restoration dependent upon position in tidal frame and sediment supply. Ecosystem services: flood regulation, sedimentation.
Eutrophic grasslands	1-20 years	Dependent upon availability of propagules. Ecosystem services: carbon sequestration, erosion regulation and grazing for domestic livestock and other animals.
Reedbeds	10-100 years	Will readily develop under appropriate hydrological conditions. Ecosystem services: stabilisation of sedimentation, hydrological processes.
Saltmarshes	10-100 years	Dependent upon availability of propagules, position in tidal frame and sediment supply. Ecosystem services: coastal protection, flood control.
Oligotrophic grasslands	20-100 years +	Dependent upon availability of propagules and limitation of nutrient input. Ecosystem services: carbon sequestration, erosion regulation.
Chalk grasslands	50-100 years +	Dependent upon availability of propagules and limitation of nutrient input. Ecosystem services: carbon sequestration, erosion regulation.
Yellow dunes	50-100 years +	Dependent upon sediment supply and availability of propagules. More likely to be restored than re-created. Main ecosystem service: coastal protection.
Heathlands	50-100 years +	Dependent upon nutrient loading, soil structure and availability of propagules. No certainty that vertebrate and invertebrate assemblages will arrive without assistance. More likely to be restored than re-created. Main ecosystem services: carbon sequestration, recreation.
Grey dunes and dune slacks	100-500 years	Potentially restorable, but in long time frames and depending on intensity of disturbance Main ecosystem service: coastal protection, water purification.
Ancient woodlands	500 – 2000 years	No certainty of success if ecosystem function is sought – dependent upon soil chemistry and mycology plus availability of propagules. Restoration is possibility for plant assemblages and ecosystem services (water regulation, carbon sequestration, erosion control) but questionable for rarer invertebrates.
Blanket/Raised bogs	1,000 – 5,000 years	Probably impossible to restore quickly but will gradually reform themselves over millennia if given the chance. Main ecosystem service: carbon sequestration.
Limestone pavements	10,000 years	Impossible to restore quickly but will reform over many millennia if a glaciation occurs.

Appendix 6: Example of HEP Calculation

The following table gives an example of the HEP calculation.

Field No	Habitat	Primary Habitat		Matrix		Formation		Management / Land use		HSI Score	Density Band Score	Hectares	Habitat Units
		Code	Score	Code	Score	Code	Score	Code	Score				
F1	Semi improved acid grassland	GU0	4		0		1.00		1.00	4.00	3.0	0.4	4.80
F2a	Semi improved grassland, dense scrub	GU0	4	SC11	-3		1.00		1.00	1.00	3.0	0.11	0.33
F2b	Semi improved grassland, tall ruderal	GU0	4	OT3	0		1.00		1.00	4.00	3.0	0.2	2.40
F3	Improved grassland, cattle grazed	GI0	3		0		1.00	GM11	1.00	3.00	3.0	1.51	13.59
HR1	Non-important hedgerow, cut with trees	LF11Z	5		0		1.00	LM11	0.30	1.50	3.0	0.022	0.10
HR2	Non-important hedgerow cut without trees	LF11Z	5		0		1.00	LM12	0.20	1.00	3.0	0.044	0.13
HR4	Non-important hedgerow overgrown with trees	LF11Z	5		0		1.00	LM31	1.00	5.00	3.0	0.02	0.30
HR5	Non-important hedgerow overgrown with trees	LF11Z	5		0		1.00	LM31	1.00	5.00	3.0	0.023	0.35
HR6	Non-important hedgerow cut without trees	LF11Z	5		0		1.00		1.00	5.00	3.0	0.015	0.23
												1.944	
											Habitat Units		22.22
											Hectares Required		**1.23**

Value from 'Replacement Habitat' worksheet

Equivalent Hectares Provided	1.05

Note: Where there is significant residual replacement habitat that cannot be accommodated within the proposed development site off site enhancement will be needed. The amount required will be increased by the value of the existing habitat on the receptor site (see A5.54 in the Technical Guidance)

If required, Value from Receptor Habitat Worksheet

Equivalent Hectares of Existing Habitat on Receptor Site	0.00

Gain/ Deficit	-0.19

If deficit then further input is required into either 'Replacement Habitat' and/or Off-site Replacement Habitat' worksheets until an equal or gain is provided. (Non-significant amounts of loss need to be agreed with planning authority ecologist)

Habitat	Primary Habitat		Matrix		Formation		Management / Land use		HSI Score	Hectares	Delivery Risk	Temporal Risk	Spatial Risk		Equivalent Hectares
	IHS Code	Score	Code	Score	Code	Score	Code	Score					Development Site Band Score	Replacement Site Band Score	
Species rich long sward grassland with scattered scrub and trees		6		0		1.00		1.00	6.00	1.260	1.00	0.83	3.0	3.0	6.27
										1.260					
					Value of Habitat Provided in Hectares										1.046

The calculation recommends that a minimum of 1.23 hectares (ha) of the 2.22ha site is needed to replace the value of the habitat lost to the species affected. If the replacement habitat is to be provided off-site the value of the receptor site also needs to be taken into account. In this a deficit has been recorded and may need enhancement off-site or a change to the masterplan.

Appendix 7: 'Favourable Conservation Status' and Lesser Horseshoe Bats

The Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') under Article 1 set out the requirements for the protection of species of Community interest, listed under Annex II, IV and/or V[130]. These species are required to be maintained at 'favourable conservation status' (FCS), which is defined as when:

- the population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and

- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and

- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The goals of the Habitats Directive for species conservation require two basic conditions[131]:

- Quality of habitat (allowing enough for reproduction)
- Habitat area (to prevent extinction by accident)

The Conservation of Habitats and Species Regulations state under Regulation 43 that it is an offence to deliberately disturb wild animals of a European Protected Species (EPS), such as Lesser Horseshoe bats, in such a way as to be likely to:

a) impair their ability—
    (i) to survive, to breed or reproduce, or to rear or nurture their young; or
    (ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
(b) affect significantly the local distribution or abundance of the species to which they belong.

Regulation 9(5) requires that all public bodies have regard to the requirements of the Habitats Directive when carrying out their functions. Recent court cases (Regina versus Cheshire East Borough Council and Morge V Hampshire County Council) and a Supreme Court judgement have '… *confirmed that the judgement is one for the relevant decision maker to make (e.g. the local planning authority) based on all the facts of the case*.'[132]

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130 Annex IV species are defined as 'animal and plant species in need of strict protection.' Annex II species are those for whose conservation require the designation of Special Areas of Conservation (SAC). Any potential impacts affecting the integrity of a SAC, including those designated for Annex II species, are required to undergo a 'Habitats Regulations Assessment'. Annex IV species are listed on Schedule 2 of the Conservation of Habitats and Species Regulations 2010 and includes Lesser Horseshoe bats. Annex V species are 'Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures' which are likewise required to be maintained at 'Favourable Conservation Status'.

131 Opdam, P., Steingröver, E., Vos, C. & Prins, D. 2002. *Effective protection of the Annex IV species of the EU-Habitats Directive: The landscape approach*. Wageningen: Alterra. http://www.ocs.polito.it/biblioteca/ecorete/590.pdf

132 Simpson, P. 2011.*Supreme Court rules on Habitats Directive*. DLA Piper, UK

It is the local planning authority's responsibility to ensure that the FCS of local populations of EPS is maintained, aside from any subsequent licensing requirement. Before granting planning permission to a development the local authority needs to ensure that the proposed development is not detrimental to the affected population of Lesser Horseshoe bats' FCS, i.e. that there are no adverse effects on the habitat to support and hence abundance of the local population from the proposed development. The Council must be satisfied that each of the three tests for EPS is met which besides FCS includes statements concerning whether 'the development is of overriding public interest' and whether 'there are no satisfactory alternatives. These should be reported in the officer's report to the planning committee.

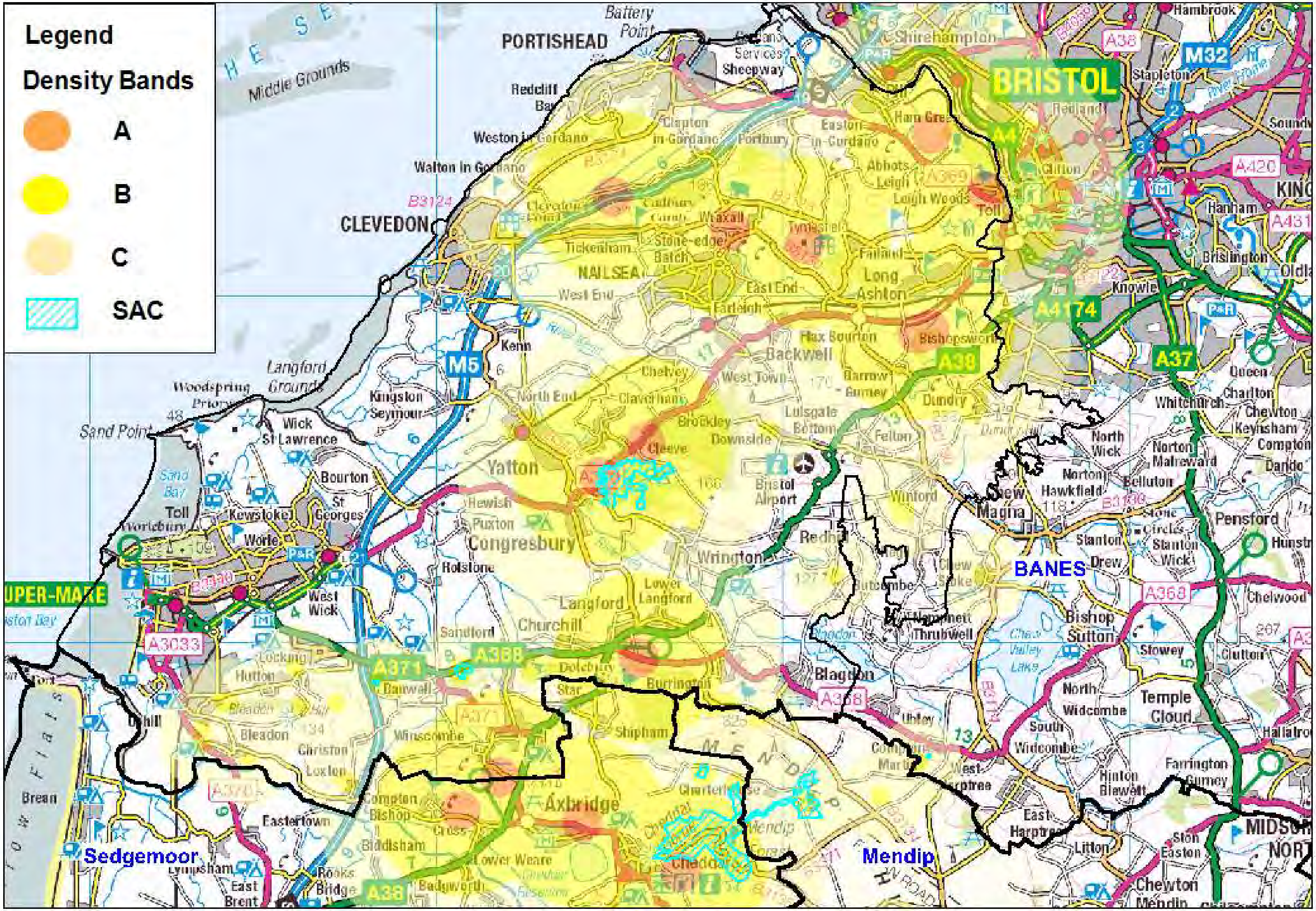
However, this should not be seen as a requirement of every development where EPS are present but, as the Supreme Court makes clear, should be judged on a case by case, species by species basis. Penny Simpson (2011)[133] writes that *"'deliberate disturbance' offence is likely to apply to an activity which is likely to negatively impact on the demography (survival and breeding) of the species at the local population level… disturbing one of two individuals is not necessarily below the threshold (i.e. outside the offence) because for a rare species, a species in decline, or a species at the edge of its range, a harmful disturbing impact on a very small number of individuals may impact negatively on the demography of the local population*".

Ideally the forward planning process, such as consideration of development sites for allocation, should be informed by a sound knowledge of the distribution of EPS within a geographic area. Awareness of the maps in this guidance would help towards that, regarding horseshoe bats. This would help local authorities to exercise their functions in line with the Conservation of Habitats and Species Regulations 2017, Regulations 9 (1) and 9(3). It would also help the local authorities meet Article 16 of the Habitats Directive, since consideration of the maps in the allocation process could potentially help to avoid adverse impacts on horseshoe bats in the first place, although it is recognised that this is not always possible due to other factors such as the need for transport infrastructure.

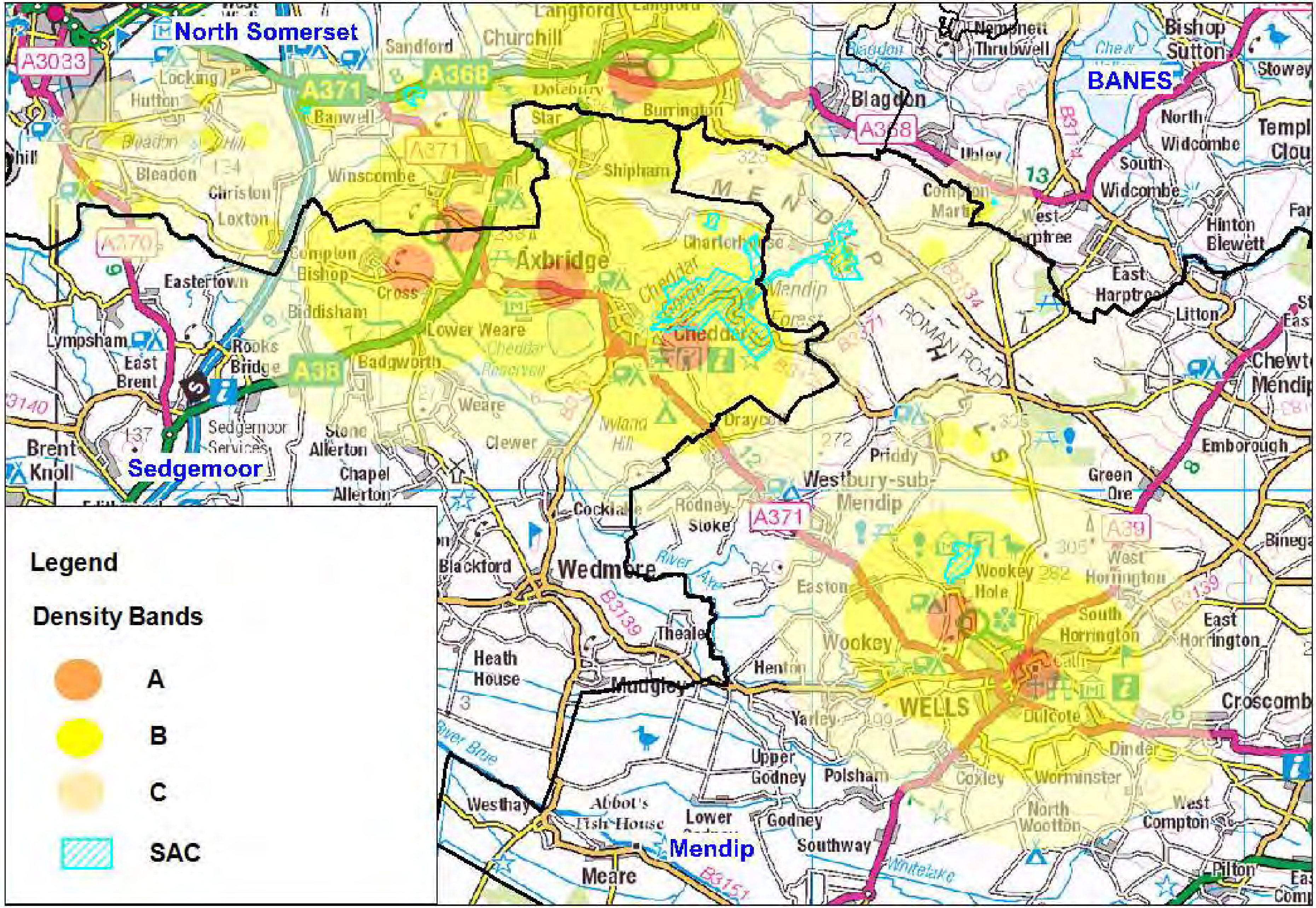
Plans 7 and 8 below show the distribution of known Lesser Horseshoe bats in North Somerset, Sedgemoor and Mendip council areas

[133] Simpson, P. 2011.*Supreme Court rules on Habitats Directive*. DLA Piper, UK

Plan 7: Lesser Horseshoe Bats (North Somerset)



Plan 8: Lesser Horseshoe Bats (Sedgemoor and Mendip)



Roosting Lesser Horseshoe Bats (Photo Jim Mullholland)

ANNEX 9

ANG Guidance published by Sedgemoor District Council

An analysis of Accessible Natural Greenspace provision in Sedgemoor

February 2017

Contents Page No.

Sedgemoor District Council Project: Document Title:	Strategy and Development LDF Assessment of Sedgemoor's compliance with Natural England's Accessible Natural Greenspace Standards
Author or Owner:	Stephanie Parker-Stephenson, Environmental Planner
Current version and status:	Version 1.06: Revised final draft
Location:	H:Planning Policy\ANGSt\ANGSt Assessment
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Distribution: Required Authorisation:	V 1.01 NT, JC, SM, PG V1.02 SPS V1.03 NT V1.04 NT, AR, SM,LDF working party, CDW team, NE, SWT, The Woodland Trust, FC, SCCecologist, EA, HE, SE, FiT, SCCPRoW and Canal & River Trust Nick Tait, Service Manager - Policy

Summary

The purpose of this analysis is to determine how well Sedgemoor meets Natural England's Accessible Natural Greenspace Standard. The Habitat Regulations Assessment of the Core Strategy required proposals for large (20+ units) housing developments within 5km of a Natura 2000 site to meet the ANG standard (to reduce recreational pressure on the designated conservation areas) and this analysis provides the data source needed to assess development applications against.

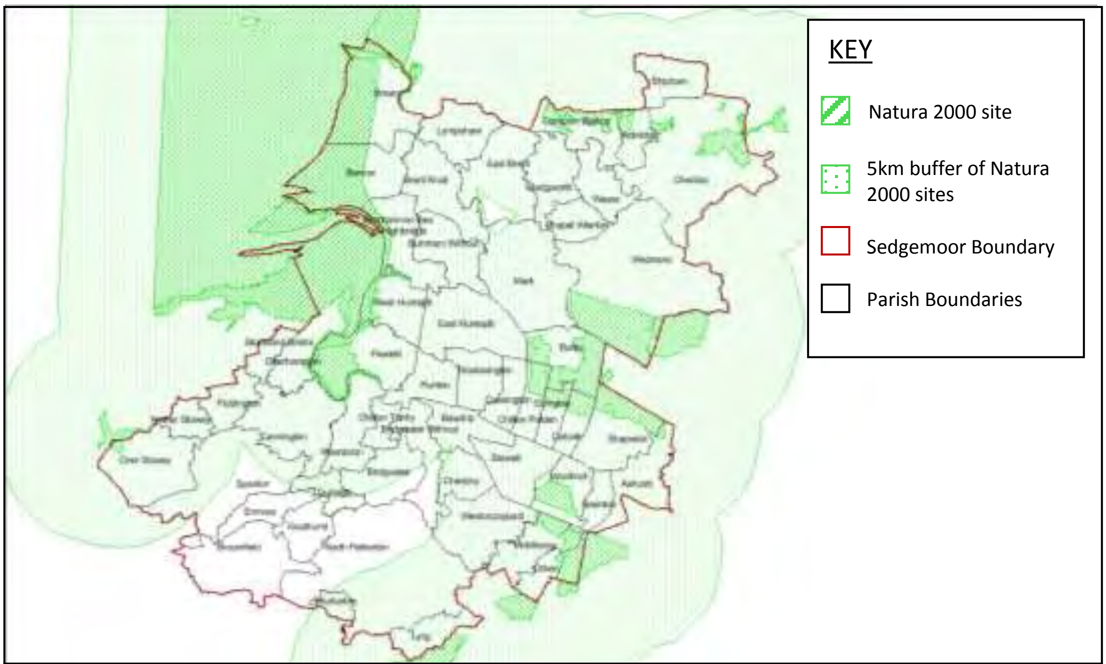


Figure 1 – 5km boundary of Natura 2000 sites

The greenspace typologies that can qualify as ANG are Nature Conservation areas, Local Wildlife Sites, Nature Reserves, Woodland, Formal and Informal public space, Rivers and Canals, Country Parks, Open Access land, Allotments, Churchyards and Cemeteries and Formal Recreation Space as long as they meet the criteria for naturalness, accessibility and size. To meet the standard there should be a qualifying ANG site:

- of at least 2 hectares in size, no more than 300 metres (5 minute walk) from home;
- of at least 20 hectares in size within two kilometres of home;
- of at least 100 hectares in size within five kilometres of home; and
- of at least 500 hectares in size within ten kilometres of home; plus
- a minimum of one hectare of statutory Local Nature Reserve per thousand population.

This report describes the national and local context for the analysis and the rationale for carrying out the analysis. Natural England has provided guidance ('Nature Nearby') on the importance of incorporating accessible natural greenspace in to residential areas. The benefits of accessible natural greenspace for health and well-being, biodiversity and climate change adaptation are also recognised in the National Planning Policy Framework and National Planning Practice Guidance.

The methodology used in the preparation of this report is based on the ANGSt analysis tool kit developed by Handley et al (2003), as recommended in Natural England's 'Nature Nearby' report. The report illustrates the toolkit methodology (Figure 3.1) and describes the Sedgemoor approach to analysing ANG provision within the district. GIS data has been sourced from a number of organisations; assessment of each of the sites to determine whether they qualify as an ANG site has been carried out by Council officers.

The findings of the analysis will be used to inform the Local Plan review. The analysis identifies areas of deficiency that should be prioritised when identifying projects that will help the district to meet the ANG standard. The findings will also inform the assessment of proposals for strategic housing sites by identifying whether the site would meet the ANG standard and might also inform place-making policy where a need is identified. The mapping can also be used to demonstrate whether major housing developments are compliant with ANGSt as required by Monitoring Indicator M44 of the Authority Monitoring Report. The report also retrospectively assesses the compliance of major housing developments approved since April 2011.

The key findings of the report are:

Sedgemoor residents have access to 307 qualifying ANG sites (covering a total area of 16871.48 hectares).

This broadly equates to 141 hectares of accessible natural greenspace per 1000 population but there are localised deficiencies where not all levels of the standard are met.

22.8% of the households in Sedgemoor do not meet the 2Ha within 300m standard

75.7% of households meet all of the ANG standards (excluding the Local Nature Reserve Standard)

More than two thirds of the dwellings in Bridgwater Without, East Huntspill, Lympsham, Othery and Pawlett do not meet the 2Ha within 300m standard.

All of the dwellings in Axbridge, Chilton Trinity, Chapel Allerton, Goathurst, Moorlinch, Otterhampton and Shipham meet the 2Ha within 300m standard.

6 major housing developments (out of 44 approved since April 2011) do not meet Natural England's 2Ha within 300m standard. These sites account for 2117 out of 4870 approved dwellings (or 43%).

55% of the total area of ANG is provided by nature conservation areas.

Sedgemoor has a population of 119,057* and a total of 45.12 hectares of Local Nature Reserve, this equates to 1Ha of Nature Reserve per 2639 of population or 0.38 hectares per 1000 of population which does not satisfy the requirement for 1 hectare per 1000 of population.**

*** 2014 mid-year estimate**
**** Aisholt Wood LNR in Spaxton, Screech Owl LNR in North Petherton and Berrow Dunes LNR in Berrow.**

1. Introduction

The purpose of this assessment is to map and analyse the provision of accessible natural greenspace within Sedgemoor in order to support the development of improved planning policy as part of the Core Strategy review. Sedgemoor's Planning Policy Team have carried out the analysis with support from the Community Development and Wellbeing Team and will use the findings as an evidence base against which planning policy implementation can be monitored and will be instrumental in identifying priority areas for improving greenspace provision.

What is the accessible natural greenspace standard?

The Habitat Regulation Assessment of the Core Strategy identified a need to ensure that open space provided by new housing developments of 20 or more units within 5km of Natura 2000 sites (see Figure 1) complied with the Natural England standards for Accessible Natural Greenspace as an approach for reducing the pressure of increased recreational disturbance on sensitive nature conservation sites.

The ANG Standard recommends that everyone, wherever they live, should have an accessible natural greenspace:

- of at least 2 hectares in size, no more than 300 metres (5 minute walk) from home;
- at least one accessible 20 hectare site within two kilometres of home;
- one accessible 100 hectare site within five kilometres of home; and
- one accessible 500 hectare site within ten kilometres of home; plus
- a minimum of one hectare of statutory Local Nature Reserve per thousand population.

This analysis will determine whether Sedgemoor District meets the Accessible Natural Greenspace Standards set by Natural England, with a particular focus on the 2 hectares within 300m standard as this level of assessment was not carried out as part of the Green Infrastructure Strategy published in 2011 and was only partially carried out as part of the Green Space strategies in 2009. The analysis is not a comprehensive Open Space audit which would focus on the quality and quantity of space for play and sport within the district.

Meeting the ANG standard is important for reducing recreational pressure on designated nature conservation sites, for improving health and wellbeing and for adapting to climate change.

> '*ANGSt is a powerful tool in assessing current levels of accessible natural greenspace, and planning for better provision. It identifies those sites that might be considered natural sites, and areas within other green spaces that have a value for nature, and more importantly it identifies areas of nature deficiency where the standard is not met and where actions may be put in place to address this*.'
> (Natural England, 2010)

The analysis covers the whole district and the assessment results for accessible natural greenspace provision and deficiency are given at a parish level and so can also be used by Parish Councils and Neighbourhood Planning Groups to assist them in developing Neighbourhood Plans and in prioritising the projects they wish to fund from monies received from the Community Infrastructure Levy.

The assessment will be accompanied by an interactive mapping tool that will allow developers and planners to ascertain whether a prospective development site meets the ANG standard or whether it is within a 'Zone of Deficiency'.

All major housing developments, consented since the implementation of the Core Strategy, have been assessed to determine whether their location and the proposed green space provision were compliant with the Accessible Natural Greenspace standard. This information will retrospectively satisfy Monitoring Indicator M44 of the AMR as there has not been a data source for this indicator since its introduction in 2011.

2. Context

National Context

The 'Promoting healthy communities' topic discussed in the **National Planning Policy Framework** (2012) highlights the importance of the planning system in "*facilitating social interaction and creating healthy, inclusive communities*.". The planning system can facilitate the provision of accessible natural greenspaces which have the potential to achieve these aims.

The 'Conserving and enhancing the natural environment' topic in the NPPF states that local planning authorities "*should set out a strategic approach in their Local Plans, planning positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure*".

The Ecological Networks project carried out by Somerset County Council and the Somerset Wildlife Trust fulfils the biodiversity element of this requirement and the Green Infrastructure Strategy carried out for Sedgemoor in 2011 partially achieves the green infrastructure element of this requirement but this additional analysis will provide local level detail of the greenspace provision across the whole district. Meeting the ANG standard at a local level and developing policy that supports compliance with the ANG standard for strategic housing sites will assist in delivering an enhanced green infrastructure network.

The **Planning Practice Guidance** states that local planning authorities should assess the need for open space and opportunities for new provision [paragraph: 001 Ref ID: 37-001-20140306]. The PPG does not provide specific guidance on how to assess provision of open space but it does advise that;

1. Open space should be taken in to account for new development and considering proposals that may affect existing open space;
2. Open space is defined as open space of public value, including; formal sports pitches, open areas within a development, linear corridors and country parks;
3. Regard should be had to the duty to cooperate where open space serves a wider area; and
4. Regard should be had to Local Green Space designations (and potential designations).

The PPG provides guidance on delivering green infrastructure and describes it as "*a network of multifunctional green space, urban and rural, which is capable of delivering a wide range of* *environmental and quality of life benefits for local communities*". The provision of green infrastructure should be planned for alongside other infrastructural requirements. Carrying out an analysis of the Accessible Natural Greenspace standard at the local (2Ha within 300m) level will identify the areas where improvements are needed if the provision of a comprehensive network of green infrastructure is to be delivered.

The Natural England guidance document **Nature Nearby** states that "*everyone should have access to good quality natural greenspace near to where they live*". The ANG standards refer to accessibility and quantity but the guidance also states that certain types of open space should aim to achieve other nationally recognised standards such as the National Nature Reserve service standards, Country Park accreditation and the Green and Blue Flag Awards.

The Nature Nearby document gives a definition of accessible greenspace as: "*for general public use, free of charge and compliant with the requirements under the Disability Discrimination Act*" and the definition of natural greenspace is given as: "*human control and activities are not intensive*".

Natural England have categorised the different types of greenspace in to four levels of land use "*as a proxy for a feeling of naturalness*" with level one considered to be the most natural land uses and level four being the greenspaces with the least natural land uses:

Level One

- Nature Conservation Areas, including SSSI's
- Local wildlife sites (including local wildlife sites and RIG's)
- Local Nature Reserves and National Nature Reserves
- Woodland
- Remnant countryside (within urban and urban fringe areas)

Level Two

- Formal and informal open space
- Unimproved farmland
- Rivers and canals
- Unimproved grassland
- Disused/Derelict land, mosaics of formal and informal scrub etc.
- Country Parks

- Open Access land

Level Three

- Allotments
- Churchyards and cemeteries
- Formal recreation space

Level Four

- Improved farmland

The ANGSt categories are closely aligned with the now abandoned Planning Policy Guidance No.17 (PPG17) although the PPG17 categories included civil spaces and indoor sports which are not included within the ANGSt categories because they are not considered to be greenspaces. The guidance suggests that existing PPG data is likely to be "a good starting point" when looking to map areas of natural greenspace. ANGSt is based on three principles; **improving access**, **improving naturalness** and **improving connectivity**.

The guidance argues that "*accessible natural greenspace can be seen to provide a range of social, economic and environmental benefits*" which are the three pillars of sustainability and so should be incorporated into development schemes in an effort to achieve sustainable development through improved health, well-being, quality of life and protection of nature.

The guidance also acknowledges other open space standards that should be taken in to consideration by developers alongside the ANGSt, such as:

- the six acre standard – 2.4ha of recreational space is required per 1000 of population;
- 'beyond the six acre standard' – updated guidance from Fields in Trust:

Open Space Typology	**Quantity (Ha/1000 population)**	**Walking Distance (m from dwellings)**
Playing pitches (recreation grounds, playing fields, football, rugby, hockey and cricket)	1.20	1200
All outdoor sports (incl tennis courts, bowling greens	1.60	1200

and athletics tracks)		
Equipped/designated play areas (LAP's, LEAP's and NEAP's)	0.25	LAPs 100 LEAPs 400 NEAPs 1000
Other outdoor provision (MUGAs and skateboard parks)	0.30	700
Parks and Gardens (urban parks, country parks, forest parks and formal gardens)	0.80	710
Amenity Green Space (informal recreation space, communal greenspace, village greens, churchyards and allotments)	0.60	480
Natural and Semi-Natural (woodland, scrub, grassland, wetland, open & running water, open access land, green corridors, beaches and sand dunes)	1.80	720

- the 'towards a level playing field' standard – uses a toolkit to calculate future demand for pitches per 1000 of population;
- the 'woodland access standard' - at least one 2 hectare accessible woodland site within 500m of home and at least one 20 hectare accessible woodland site within 4km of home; and
- the 'national allotment standard' – 20 plots of 250 sqm per 1000 households

The Natural England document acknowledges that "*the wider community benefits of providing sufficient quality ANG spaces are:*

- *Protecting important habitats, landscapes and promoting biodiversity;*
- *Improved health;*
- *Improved quality of life for older people;*
- *Strengthening communities (through forming community management groups);*
- *Local food production;*
- *Education and outdoor learning;*

- *Improved quality of new housing developments;*
- *Economic benefits; and*
- *Adaptation to climate change (flood water retention, infiltration capacity, evaporative cooling and shading by tree canopies*)"

The document attempts to identify clear distinctions between the subtle differences in objectives of open space strategies, green space strategies and green infrastructure strategies:

"*Open/green space strategies work within the typology of recreational, amenity and public open spaces that was identified by PPG17: Planning for open space, sport and recreation (2002). They evaluate publicly accessible open space provision within these typologies at the local authority scale, noting issues in relation to condition, quality and access, often to inform a strategy and action plan that sets out future management and regeneration policies. They form a complementary strategy to rights of way improvement plans."*

"Green infrastructure strategies go beyond the site-specific, considering also the 'big picture' of landscape context, hinterland and setting, as well as strategic links of sub-regional scale and beyond. Green infrastructure considers private as well as public assets and provides a multi-functional, connected network delivering ecosystem services."

Accessible Natural Greenspace Standards are relevant to a number of planning issues such as green infrastructure, natural environment, health and well-being and open space, sport and recreation and can be used to establish planning policies that set provision standards for accessible green spaces and/or levels of developer contributions. They can also contribute to design guidance that seeks to achieve particular outcomes such as; biodiversity, health opportunities, flood alleviation, ecosystem services and community cohesion.

The guidance provides advice on delivery mechanisms; these include working in partnership with other organisations, setting up innovative management models and accessing new streams of funding.

This assessment focusses on the local level of the standard by identifying opportunities to enhance smaller sites closer to home. The larger strategic greenspace sites are considered through Sedgemoor's Green Infrastructure Strategy.

In addition to national policy and guidance the Woodland Trust have carried out research that shows that less than 17% of the population of England has access to local woodland within 500m of their home and across Sedgemoor District Council this figure is even lower at 4.6% (The Woodland Trust, 2015). The Woodland Trust has developed the **Woodland Access Standard** (WASt) for public bodies and local authorities to aim for and Natural England have endorsed the standard as complementary to ANGSt, making it a useful addition to existing policy-making tools.

The Woodland Trust Woodland Access Standard recommends that:

- no person should live more than 500m from at least one area of accessible woodland of no less than 2ha in size
- there should also be at least one area of accessible woodland of no less than 20Ha within 4km (8km round-trip) of people's homes.

Local Context

There are a number of local policies, supplementary planning documents and strategies that relate to this accessible natural greenspace provision analysis, such as:

- Bridgwater & Wembdon and Burnham-on-Sea & Highbridge Green Space Strategies (2009);
- Green Infrastructure Strategy (2011);
- Outdoor Space for Sport and Children's Play in New Housing Development SPD (2007);
- Sports & Recreation Strategy (2014); and the
- Somerset Woodland Strategy (2010).

The **Greenspace strategies** (for Bridgwater & Wembdon and Burnham-on-Sea & Highbridge) were produced to support the development of planning policies, to support funding bids and for wider greenspace management, maintenance and development. Like the **Green Infrastructure Strategy** the green space strategies draw on demographic and IMD data. The reports use the PPG17 typologies but they have been slightly modified for local relevance. The reports also use a hierarchy (Town, Neighbourhood, Local and Incidental) to classify the types of green space. The study did not disregard sites that were less than 2 hectares in size as is required by the ANGSt assessment.

There is greater emphasis on understanding the quantity of the different types of publicly accessible space whereas the ANGSt assessment is less prescriptive about the typology and is more concerned with the size, accessibility and naturalness of a site than its function as a recreational resource. The study area is bound by ward areas rather than specific distance buffers like the ANGSt analysis. The report also discusses the six acre standard.

The green space strategies consider the Accessible Natural Greenspace Standards but they do not consider the higher levels (i.e. 100 hectares within 5km and 500 hectares within 10km). The ANGSt assessment it carries out only takes in to consideration the natural and semi-natural greenspaces identified by the PPG17 survey. The report identified a number of 'severance factors' that impeded access to a site, these were: the M5 motorway, the canal and the River Parrett.

The criteria used to assess and score the quality of a site was based on the Green Flag Award assessment criteria, only the criteria that could be assessed on site were used i.e. not those criteria that can only be ascertained by referring to the Site Management Plan. Only a sample of 21 sites had been assessed rather than each individual site.

The reports also include a methodology for assessing the value of a site based on accessibility, proximity, quantity, hierarchy, level of use, ecological benefits, education benefits, social inclusion, cultural and heritage benefits, wildlife benefits and linear green space.

Sedgemoor's current **Core Strategy** (adopted in 2011) sets out policy that supports the provision of accessible natural green space (see Appendix C). Preparation of the emerging Local Plan will involve reviewing the content of these policies. This analysis will inform some of the changes.

3. Methodology

With the lack of explicit instructions on carrying out an open space assessment and the fact that this analysis has a different purpose than a full open space audit it has been decided that a suitable assessment methodology would be to follow Natural England's Accessible Natural Greenspace Guidance – 'Nature Nearby' (Natural England, 2010a). This analysis report is therefore based on the methodology set out within that guidance document. The methodology does not constitute a full quantitative and qualitative assessment of open space surpluses and deficits but it does allow a district wide analysis of the accessibility and naturalness of the greenspace element of open space.

The method for assessing accessible natural greenspace in Sedgemoor is based on Natural England's 'Nature Nearby' guidance which in turn was based on the ANGSt Analysis toolkit (Handley et al, 2003) but the Sedgemoor methodology has also been influenced by a review of other ANGSt assessments (see Bibliography for details). Figure 3.1 illustrates the analysis process.

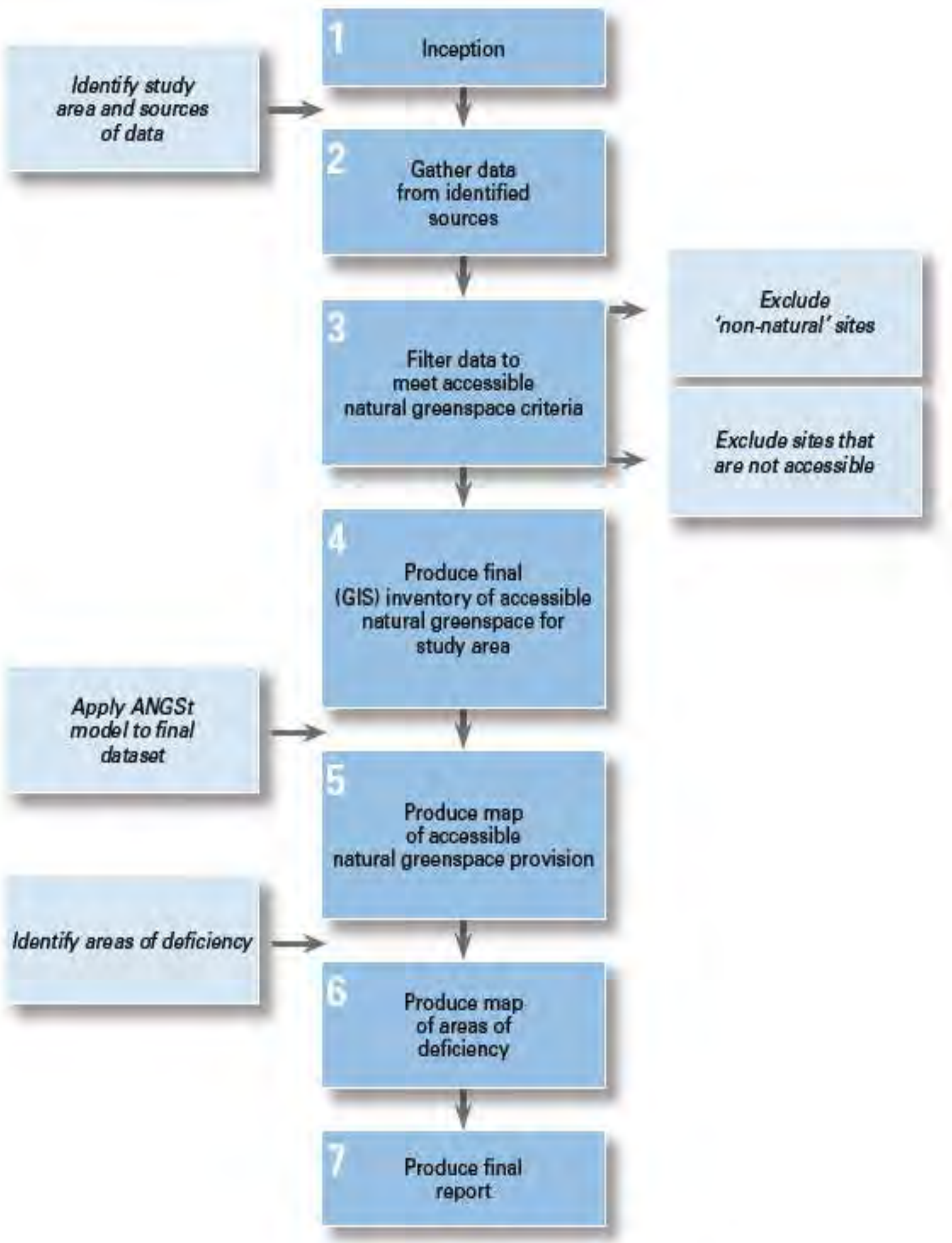


Figure 3.1: ANGSt analysis toolkit (Handley et al, 2003)

Sedgemoor methodology

Inception

The need for this assessment has been identified through the annually published Authority Monitoring Report. The Accessible Natural Greenspace monitoring indicator, which is intended to demonstrate compliance with the HRA requirement, has not been fulfilled due to a lack of data. The Green infrastructure strategy carried out in 2011 did not provide the necessary mapping required to determine whether development proposals are compliant with the standard.

Identify Study Area

The study will provide an analysis for the whole of Sedgemoor and for the individual parishes within Sedgemoor. As the focus of this analysis is to ascertain how well Sedgemoor meets the 2Ha within 300m standard a buffer of only 300m has been applied to the Sedgemoor district boundary rather than the recommended 10km buffer.

Identify sources and gather data

The natural land uses identified within the four levels of naturalness (page 7 of this report) were the starting point for sourcing data to be used in this accessible natural greenspace analysis.

Nature Conservation Areas

- The Council has access to local GIS data provided by Natural England for Special Protection Areas, Special Areas of Conservation, Sites of Special Scientific Interest and Ramsar sites. These sites were included for their 'naturalness' but only sites that are accessible by a public right of way or form part of the vista from a public right of way were included in the analysis [*their inclusion in this analysis does not alter the existing public access rights and restrictions for these sites, i.e. for most sites access is only permitted along the public right of way route but the presence of the nature conservation site creates the sense of naturalness for the route and so it is considered to make an important visual contribution in terms of ANGSt*].

Local Wildlife sites

- The Council has access to local GIS data provided by Somerset Environmental Records Centre for County Wildlife Sites. These sites were included for their 'naturalness' but only sites that are accessible by a public right of way or form part of the vista from a public right of way were included in the analysis [*their inclusion in this analysis does not alter the existing public access rights and restrictions for these sites, i.e. for most sites access is only permitted along the public right of way route but the presence of the local wildlife site creates the sense of naturalness for the route and so it is considered to make an important visual contribution in terms of ANGSt*].

Nature Reserves

- The Council has access to local GIS data for Local Nature Reserves, Somerset Wildlife Trust Nature Reserves and National Nature Reserves; the data is provided by Somerset Environmental Records Centre and the Somerset Wildlife Trust.

Woodland

- Many Woodland sites have been plotted on GIS as part of the County Wildlife Site dataset. The Council also has access to an Ancient Woodland dataset that is provided by Natural England through their Open Government Licence. [*The Woodland Trust has been contacted as they also provide GIS data for woodlands, however due to limited council resources the Council has been unable to agree their terms of use in time for publication of this report. The Woodland Trust data will be included within the proposed annual data update].* [T*heir inclusion in this analysis does not alter the existing public access rights and restrictions for these sites, i.e. for most sites access is only permitted along the public right of way route but the presence of the woodland site creates the sense of naturalness for the route and so it is considered to make an important visual contribution in terms of ANGSt*].

Remnant countryside (within urban and urban fringe areas)

- Many of these areas of remnant countryside around urban developments have been plotted as part of the PPG17 assessment. These areas have been retained as public open space for the purpose of this analysis and additional sites have been plotted for the areas of land around newer housing developments that have been built since the PPG17 assessment was carried out.

Formal and informal open space

- The definition of <u>formal</u> open space for the purpose of this assessment has been:

sports pitches;
commons; and
village greens.

The source of the data for formal open space has been the PPG17 assessment data although the data has been updated where necessary.

- The definition of informal open space for the purpose of this assessment has been
  - footpaths (PROW's);
  - parks and gardens;
  - amenity green space (grass verges, roundabouts etc.);
  - rough open grassland; and
  - unimproved farmland

The source of the data for informal open space has been the PPG17 assessment data although the data has been updated where necessary. The PPG17 data does not provide data for rough open grassland or unimproved farmland and unfortunately no other data source has been identified. The Council has access to local Public Right of Way data that has been provided by Somerset County Council.

Rivers and canals

- The Council has access to GIS data for Main Rivers and the Detailed River Network that is provided by the Environment Agency. However, the data provided is simply a polyline that depicts the route of the river network; the data has been replotted to allow the calculation of the the area of land that the river and canal network covers. The Action for Access website has been a useful resource for determining whether a river has 'paddle rights', and those that do not have been excluded where the banks are also inaccessible by public right of way.

Unimproved grassland

- No data source has been identified for this land use, however, the Local wildlife sites dataset has identified a number of unimproved grassland sites but as wildlife sites these have been included in the higher level classification of naturalness.

Disused/Derelict land, mosaics of formal and informal scrub etc.

- No data source has been identified for this land use.

Country Parks

- There are no registered Country Parks within Sedgemoor, however an area of remnant countryside has been designated for use as a country park as part of the planning permission granted for the South Bridgwater housing development. Whilst the site has not been registered officially as a country park yet the site does have permissive access and so has been included as an acceptable area of greenspace for the purpose of this analysis.

Open Access land

- The Council has access to the CRoW Act 2000 Access Layer GIS data that is provided by Natural England.

Allotments

- Whilst allotment sites were considered within the PPG17 assessment an additional data source (the Somerset Community Food website) was also used to confirm the current status of each of the sites.

Churchyards and cemeteries

- The PPG17 assessment identified churchyards and cemeteries, a scan of the entire map of Sedgemoor also identified additional sites that had not been previously identified by the PPG17 assessment.

Formal recreation space

- The PPG17 assessment identified playing fields and children's play areas and a scan of the entire map of Sedgemoor also identified additional sites that are new or had not previously been identified by the PPG17 assessment.

Improved farmland

- No data source has been identified for this land use.

Demographic data

- the number of households was calculated for Sedgemoor as a whole and for each of the parishes by performing mapping queries on the AddressBasePremium data for the district. Mapping software was also used to calculate the size of each of the parishes, the parish boundary data is owned by Sedgemoor District Council.

Land uses that have been excluded from the analysis include: docks, outdoor sports courts (bowls, tennis, basketball, skate-park and MUGAs), golf courses, school grounds, hospital grounds, civic spaces and market squares.

Filter data to meet accessible natural greenspace criteria

Sites that do not meet the required 2 hectares in size have been mapped separately as they provide potential areas where improvements could be made and they could also form part of the open space provision that may be assessed separately to the ANGSt compliant provision.

The sites that were larger than 2 hectares and qualified as green space were assessed for their naturalness and accessibility (the assessment tables can be found at Appendix B). Those sites that did not meet the standard were removed from the ANGSt dataset but retained within the Open Space dataset.

All sites classified as level one were assumed to be suitably natural in character, the naturalness of the level two and three sites was determined with the combined use of aerial photography, site visits and local knowledge. A site was considered to be sufficiently natural if it contained features suitable for wildlife habitats such as rough grass, trees, hedgerows and ponds. Sites that only consisted of mown grass were not considered to be of high enough biodiversity value and so were excluded.

A site was recorded as accessible if it was open to the public without charge and the site could be accessed either by car from the public highway (where there is parking provision) or on foot/bicycle/watercraft by permissive access or rights of way routes. The Action for Access website has been a useful resource for determining whether a river has 'paddle rights', and those that do not have been excluded where the banks are also inaccessible by public right of way. For wildlife and nature conservation sites that do not permit public access the site was recorded as accessible if the site formed part of the vista of a public right of way, i.e. the site was visually accessible, and created a sense of naturalness for users of the public right of way. *This analysis does not alter any existing public access rights or restrictions*.

Public rights of way have initially been included automatically and have been plotted as continuous networks where there are clear connections between the route segments provided by SCC GIS data. If the routes are separated by a major road, railway or river with no clear passage across then they are treated as two separate networks. If issues such as difficult landowners, poor signage and poorly maintained paths are identified in the future then those routes will be removed from the ANGSt dataset (during a proposed annual update of the dataset) due to a lack of accessibility. The Woodland Trust has provided ‘walkers welcome’ signage for paths that are accessible to walkers.

School playgrounds and playing fields have been excluded due to the lack of accessibility for the general public.

Church buildings have been excluded but church grounds, cemeteries and crematoriums have been included if they meet the size criteria.

Small amenity spaces in and around residential estates have been combined to count as one site where there have been justifiable links or short distances between the individual pockets of green space

Children’s play areas and sports facilities within holiday parks have been excluded

Produce final GIS inventory of accessible natural greenspace for study area

Appendix B provides the tables containing the full inventory for each of the sites that have been considered as part of this analysis. The Location given in table 1 of Appendix B refers to the Parish that either the site (or the majority of the site) is located within or the Parish that the central point of the site is located in (depending on the shape and size of the site and how many Parish boundaries it crosses).

The table has been sorted alphabetically by Location and then ascending numerically by Site Area. Each site is assigned a tri-part code, the first number is the ANGSt ‘naturalness’ level, the second is the green space type within that level and the third number is the sequential number for that type.

Tables 2 to 4 in Appendix B contain details about the sites that do not qualify as accessible natural green space sites.

Apply ANGSt model to final dataset

Using GIS software, the sites were grouped (with any overlapping areas of the same typology aggregated) into their individual typologies; each typology was allocated a colour code and was then split into five size categories (under 2Ha, 2-20Ha, 20-100Ha, 100Ha – 500Ha and over 500Ha). The four levels of ‘naturalness’ were allocated a pattern so that the typologies within each level had a resemblance even though they each had a different colour, see the table below for details.

Category	Style	Types of green space
Naturalness Level 1		
Nature Conservation Areas	Spots – Dark Green	AONB’s, SAC’s, SPA’s, Ramsar and SSSI’s
Local wildlife sites	Spots – Light Green	County wildlife sites and Somerset Wildlife Trust sites
Nature Reserves	Spots - Yellow	Local Nature Reserves and National Nature Reserves
Woodland	Spots - Brown	Woodland, forests and copses
Naturalness Level 2		
Formal Public Space	Stripes - Red	Sports pitches Commons Village Green
Informal Public Space	Stripes – Red	Footpaths (PROW’s) Parks and gardens Amenity green space (grass verges, roundabouts etc.) Rough open grassland
Rivers and canals	Stripes - Blue	Rivers, canals & coast
Country Parks	Stripes – Light Blue	Proposed Country Parks
Open Access Land	Stripes – Mustard Yellow	Conclusive open country, registered common land, S15 and S16 land (excluding section 28, military byelaw, racecourses and aerodromes).
Naturalness Level 3		
Allotments	Hash - Fuschia	Allotments and community orchards or food growing projects
Churchyards and cemeteries	Hash - Grey	Churchyards, cemeteries and Crematoriums
Formal recreation space	Hash – Purple Hash - Lilac	Playing Fields (excluding school fields) Playing Areas Play Areas

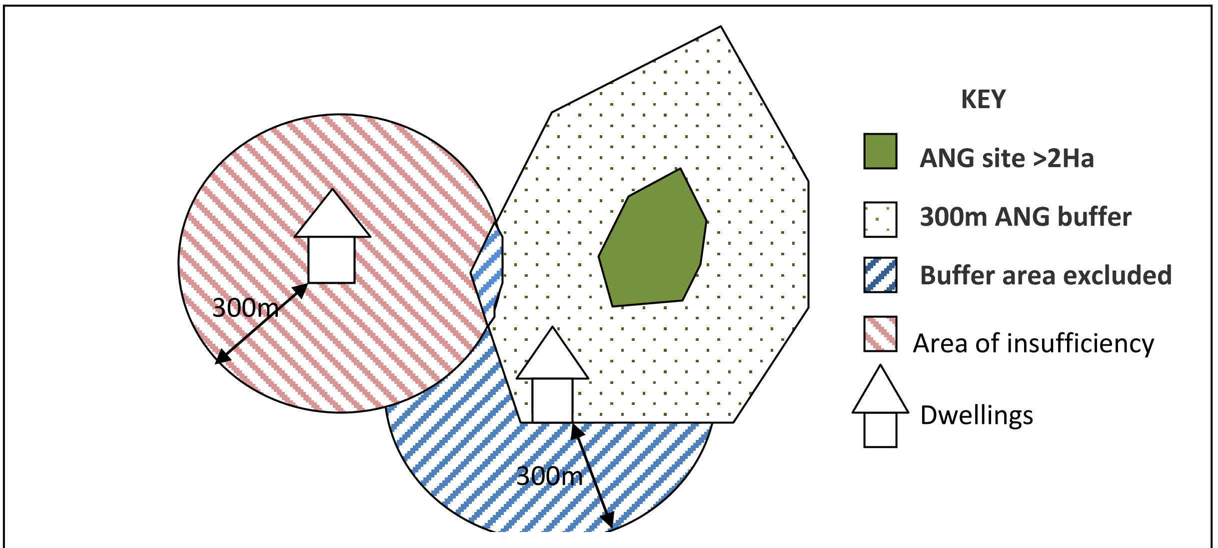
After the sites under 2 hectares in size or that were assessed to be un-natural or inaccessible were removed from the dataset, buffer zones were created for each of the remaining eligible sites. A buffer of 300m was applied to all the sites greater than 2Ha, a 2km buffer was applied to those greater than 20Ha, a 5km buffer was applied to those greater than 100Ha and a 10km buffer was applied to those greater than 500Ha. Figure 4.1 in the Results section shows all of the accessible natural greenspace within Sedgemoor (plus 300m); Appendix A shows maps of the accessible natural greenspace sites within each Parish.

Identify area of deficiency

To determine the existing standard of accessible natural greenspace provision it is necessary to compare the location of the identified greenspace sites in relation to address data. The Council uses the Ordnance Survey product AddressBase Premium to digitally represent the addresses within the district. GIS analysis was applied to the AddressBase Premium database to remove any non-residential addresses. The number of dwellings within each parish was extracted, along with the number of dwellings within and not within each of the ANG buffers.

To determine which areas of the district have existing dwellings that are not within 300 metres of a qualifying 2 hectare accessible natural greenspace site a number of processing actions needed to be applied to the GIS data:

1. A 300m buffer was applied to all qualifying ANG sites greater than 2 hectares in size.
2. A query was run to identify all dwellings within a parish.
3. A 300m buffer was then applied to all dwellings.
4. A further query was run to remove all parts of the dwelling buffers that were within 300m of an ANG site or that were part of a buffer zone around a property that is within a 300m ANG buffer zone. The diagram below (Figure 3.2) illustrates those areas that were removed and the remaining areas that qualify as having an ANG insufficiency at the 2Ha within 300m level.



~~Figure 3.2: Plotting the existing ANGSt deficient areas in Sedgemoor~~

The areas within Sedgemoor that do not meet the 2 hectare within 300m standard are shown in Figures 4.2 and 4.3 of the Result section. Figure 4.2 shows where existing requirements are not being met, Figure 4.3 shows all of the land outside of the 300m ANG buffer. It is this second map against which future housing development proposals should be assessed when it comes to deciding if a proposal is ANGSt compliant as sought by monitoring indicator M44 in the Authority Monitoring Report

Produce final report

This report was finalised following receipt of technical advice and comments from the following consultation bodies (in September 2016):

- Natural England
- The Woodland Trust
- The Forestry Commission
- Somerset Wildlife Trust
- Somerset County Council Ecology Officer
- Somerset County Council Public Rights of Way Officer
- Environment Agency
- Fields in Trust
- Canal & River Trust

Recommendations for further work

- A full open space/greenspace audit would be unachievable on a district scale but it is recommended that a full open space/greenspace audit is carried out for those settlements that are likely to be subjected to housing site allocations, i.e. Cheddar and North Petherton and a refresh of the audits carried out for Bridgwater and Burnham-on-Sea & Highbridge.

Recommendations for Local Plan policy

- Develop policy that supports/prioritises meeting the ANGSt requirement within new developments and addresses existing ANGSt deficiencies
- Include policy wording that requires developers to submit a non-compliance statement if they are unable to meet ANGSt.

- Develop a criteria based policy for Tier 2 settlements to address deficiencies and provide a framework for communities to address ANGSt at the local level through neighbourhood planning
- Seek opportunities to identify key projects/areas within the place-making policies that would improve compliance with ANGSt
- Establish a delivery strategy for improving existing deficits through CIL receipts (in partnership with Parish Councils)

4. Assessment Results

Whole of Sedgemoor	Site Area (Hectares)	Number of sites	Proportion of total ANG area (%)
All accessible natural greenspace (Ha) sites	16871.48	307	100
Total area of overlapping (multi-functional) accessible natural greenspace (Ha)	6066.08	-	35.95
Nature Conservation Sites (excl AONB)	9,334.68	22	55.33
Local Wildlife Sites	3158.1	115	18.72
Nature Reserve sites	3950.51	15	23.42
Woodland sites	1528.36	50	9.06
Public Space sites	464.725	44	2.76
River and Canal sites	428.18	9	2.54
Country park sites	40.24	1	0.24
Access Land sites	3965.37	32	23.50
Allotment Sites	2.04	1	0.01
Churchyard and Cemetery Sites	9.38	3	0.06
Formal Recreation Space Sites	55.97	15	0.33

Table 4.1 – Qualifying ANG sites (by typology)

Size range (Ha) of ANG sites	No. of sites	% of total area of all sites
2Ha to 20Ha	**202**	**7.88**
20Ha to 100Ha	**74**	**19.42**
100Ha to 500Ha	**23**	**33.95**
Over 500Ha	**8**	**74.70**

Table 4.2 – Qualifying ANG sites (by size category)

Table 4.3 – percentage and number of dwellings meeting each of the ANG standards (for the district and each parish)

Parish	Number of households (March 2016)	Parish Area (Hectares)	Dwellings not within 300m of a 2Ha site		Dwellings within 300m of a 2Ha+ site		Dwellings within 2km of a 20Ha+ site		Dwellings within 5km of a 100Ha+ site		Dwellings within 10km of a 500Ha+ site		Dwellings meeting all of the ANGSt	
			%	No.	%	No.	%	No	%	No	%	No	%	No.
Sedgemoor	**51930**	**60587.402**	**22.80**	**11833**	**77.21**	**40097**	**99.11**	**51470**	**99.98**	**51919**	**99.09**	**51456**	**75.7**	**39321**
Ashcott	506	963.584	3.8	19	96.25	487	87.5	443	100.0	506	100	506	84.98	430
Axbridge	883	474.202	0.0	0	100.0	883	100.0	883	100.0	883	100	883	100	883
Badgworth	201	935.259	44.3	89	55.7	112	100.0	201	100.0	201	100	201	55.7	112
Bawdrip	218	740.158	21.1	46	78.9	172	99.5	217	100.0	218	100	218	78.44	171
Berrow	696	1715.663	1.7	12	98.3	684	100.0	696	100.0	696	100	696	98.3	684
Brean	337	1728.796	3.9	13	96.1	324	100.0	337	100.0	337	100	337	96.1	324
Brent Knoll	481	1172.092	16.0	77	84.0	404	100.0	481	100.0	481	100	481	84	404
Bridgwater	16282	949.481	15.5	2521	84.5	13761	100.0	16282	100.0	16282	100	16282	84.5	13761
Bridgwater Without	551	837.869	84.0	463	16.0	88	100.0	551	100.0	551	100	551	16	88
Broomfield	92	1731.65	30.4	28	69.6	64	100.0	92	100.0	92	100	92	69.6	64
B-o-S & Highbridge	9267	1048.859	35.5	3293	64.5	5974	100.0	9267	100.0	9267	100	9267	64.5	5974
Burnham Without	748	953.078	23.7	177	76.3	571	99.5	744	100.0	748	100	748	76.3	571
Burtle	146	1068.854	30.8	45	69.2	101	100.0	146	100.0	146	100	146	69.2	101
Cannington	953	1640.825	1.9	18	98.1	935	98.2	936	100.0	953	100	953	96.64	921
Catcott	211	421.472	16.1	34	83.9	177	100.0	211	100.0	211	100	211	83.9	177
Chapel Allerton	143	526.058	0.0	0	100.0	143	100.0	143	100.0	143	100	143	100	143
Cheddar	2553	3470.8	11.5	293	88.5	2260	100.0	2553	100.0	2553	99.8	2547	88.5	2260
Chedzoy	177	613.96	10.7	19	89.3	158	100.0	177	100.0	177	100.0	177	89.3	158
Chilton Polden	308	466.678	17.9	55	82.1	253	96.4	297	100.0	308	100.0	308	78.6	242
Chilton Trinity	104	340.904	0.0	0	100.0	104	100.0	104	100.0	104	100.0	104	100	104
Compton Bishop	251	861.261	0.4	1	99.6	250	100.0	251	100.0	251	99.6	250	99.2	249
Cossington	306	514.687	45.1	138	54.9	168	72.2	221	100.0	306	100	306	31.4	96
Durleigh	247	425.15	38.9	96	61.1	151	100.0	247	100.0	247	100	247	61.1	151
East Brent	523	1516.233	49.9	261	50.1	262	88.7	464	99.2	519	100	523	47.8	250
East Huntspill	488	1573.9	70.7	345	29.3	143	100.0	488	100.0	488	100	488	29.3	143
Edington	152	377.334	54.6	83	45.4	69	95.4	145	100.0	152	100	152	40.8	62
Enmore	97	585.112	26.8	26	73.2	71	99.0	96	96.9	94	100	97	69	67
Fiddington	103	578.473	10.7	11	89.3	92	53.4	55	100.0	103	100	103	47.6	49
Goathurst	88	645.476	0.0	0	100.0	88	100.0	88	100.0	88	100	88	100	88
Greinton	63	355.947	1.6	1	98.4	62	100.0	63	100.0	63	100	63	98.4	62
Lympsham	335	918.348	69.6	233	30.4	102	89.9	301	100.0	335	100	335	21.8	73
Lyng	126	592.559	54.8	69	45.2	57	100.0	126	100.0	126	100	126	45.2	57
Mark	558	2145.339	29.4	164	70.6	394	96.4	538	99.6	556	100	558	68.3	381
Middlezoy	311	842.951	31.5	98	68.5	213	100.0	311	100.0	311	100	311	68.5	213
Moorlinch	107	818.322	0.0	0	100.0	107	100.0	107	100.0	107	100	107	100	107
Nether Stowey	710	405.904	31.8	226	68.2	484	100.0	710	100.0	710	100	710	68.2	484
North Petherton	3645	4252.236	24.4	889	75.6	2756	100.0	3645	100.0	3645	100	3645	75.6	2756
Othery	253	552.531	95.3	241	4.7	12	100.0	253	100.0	253	100	253	4.7	12
Otterhampton	358	2642.068	0.0	0	100.0	358	100.0	358	100.0	358	100	358	100	358
Over Stowey	158	1496.122	1.3	2	98.7	156	100.0	158	100.0	158	100	158	98.7	156
Pawlett	458	1406.917	93.7	429	6.3	29	100.0	458	100.0	458	100	458	6.3	29
Puriton	878	686.954	21.5	189	78.5	689	100.0	878	100.0	878	100	878	78.5	689
Shapwick	203	1264.854	18.2	37	81.8	166	100.0	203	100.0	203	100	203	81.8	166
Shipham	467	737.341	0.0	0	100.0	467	100.0	467	100.0	467	0	0	0	0
Spaxton	423	2289.57	33.3	141	66.7	282	88.7	375	99.5	421	100	423	57.9	245
Stawell	159	950.841	8.8	14	91.2	145	93.7	149	100.0	159	100	159	86.2	137
Stockland Bristol	64	334.691	26.6	17	73.4	47	100.0	64	100.0	64	100	64	73.4	47
Thurloxton	67	227.842	25.4	17	74.6	50	100.0	67	100.0	67	100	67	74.6	50
Weare	252	700.052	3.2	8	96.8	244	100.0	252	100.0	252	100	252	96.8	244
Wedmore	1316	4165.367	0.9	12	99.1	1304	100.0	1316	100.0	1316	100	1316	99.1	1304
Wembdon	1510	947.311	0.5	8	99.5	1502	100.0	1510	100.0	1510	100	1510	99.5	1502
West Huntspill	614	883.92	2.3	14	97.7	600	100.0	614	100.0	614	100	614	97.7	600
Westonzoyland	777	1374.922	60.5	470	39.5	307	100.0	777	100.0	777	100	777	39.5	307
Woolavington	1006	716.625	38.9	391	61.1	615	94.8	954	100.0	1006	100	1006	61.1	615

Less than one third of the parish population is not within 300m of a >2Ha site

One to two thirds of the parish population is not within 300m of a >2Ha site

More than two thirds of the parish population is not within 300m of a >2Ha site

* Number of dwellings as at 31st March 2016 based on AddressBasePremium codes R, RD, RD01, RD02, RD03, RD04, RD06, RH & RI01.

Table 4.4 - ANG sites (by typology) within each of the parishes with a higher tier settlement within it

Parish	Total Parish Area (Ha)	Total Number of households	Total area of ANG within the Parish (Ha)	% of the Parish Area that is ANG	Area of ANG overlap (i.e. multi-functional land use) (Ha)	Total Area of ANG within the parish by typology (Ha)										
						Nature Conservation Area	Local Wildlife Site	Nature Reserve	Woodland	Public Space	Rivers and Canals	Country Park	Access Land	Allotments	Churchyards and Cemeteries	Formal Recreation Space
Parishes with Principle Town																
Bridgwater	949.481	16282	59.6	6.3	0.8	None	0.2	None	None	16.7	24.2	0.0284	None	None	7.1	12.3
Bridgwater Without	837.869	551	43.1	5.1	12.6	None	23.5	None	0.1	11.1	20.9	None	None	None	None	None
Parishes with larger towns and villages																
Burnham-on-Sea and Highbridge	1048.859	9267	141.5	13.5	37.3	45.7	28.3	0.0083	None	63.1	35.1	None	None	None	None	6.5
Burnham Without	953.078	748	2.0	0.2	0	None	None	None	None	2.0	None	None	None	None	None	None
North Petherton	4252.236	3645	608.2	14.3	36	433.7	106.9	12.4	6.7	22.9	17.2	40.2	2.0	None	None	2.2
Cheddar	3470.8	2553	875.3	25.2	486.5	614.5	233.7	123.0	76.2	28.1	6.5	None	277.8	2.0	None	None
Parishes with medium-sized villages																
Axbridge	474.202	883	157.2	33.2	96.7	136.3	None	None	0.0005	10.6	0.0003	None	107.0	None	None	None
Berrow	1715.663	696	179.3	10.5	53.9	153.6	18.3	16.6	None	40.9	None	None	None	None	None	3.8
Cannington	1640.825	953	87.0	5.3	30.7	None	61.2	None	26.2	10.5	13.7	None	None	None	None	6.1
Nether Stowey	405.904	710	5.0	1.2	0.0138	None	0.0104	None	0.0106	2.7	None	None	None	None	None	2.3
Puriton	686.954	878	32.4	4.7	4.7058	None	9.4	None	4.8	1.4	17.3	None	None	None	None	4.3
Wedmore	4165.367	1316	1005.3	24.1	72.2	948.8	88.3	None	None	31.5	6.3	None	None	None	None	2.7
Woolavington	716.625	1006	28.0	3.9	0	None	5.1	19.9	None	0.5	None	None	None	None	None	2.5
Parishes adjoining Bridgwater																
Wembdon	947.311	1510	34.4	3.6	1.058	None	3.2	1.2	None	8.2	17.5	None	None	None	None	5.3
Chilton Trinity	340.904	104	57.21	16.8	2.7	None	29.84	1.64	None	6.91	21.53	None	None	None	None	None
Durleigh	425.15	247	37.8	8.9	0.0	None	37.0	None	None	0.6	0.2	None	None	None	None	None

Table 4.5 – Where to find the data for each category of site

Natural/Accessible sites	Natural/Inaccessible
See Maps 1 to 54 in Appendix A and Table 1 of Appendix B	See Maps 55 to 108 in Appendix A and Table 2 of Appendix B
Non-natural/Accessible sites	Non-natural/Inaccessible sites
No sites	See Maps 55 to 108 in Appendix A and Table 3 of Appendix B

Table 4.6 - Major large-scale Housing development applications approved between April 2011 and January 2016 *(HRA recommends developments over 20 dwellings and within 5km of a Natura 2000 site should be ANGSt compliant)*								
Application number	**Site name**	**Parish**	**Number of dwellings**	**Date of approval**	**Within 300m of a >2Ha ANG site (Yes or No)**	**Type of Permission**	**Current status**	**Proposed green space provision**
01/14/00033	Charity Farm	Ashcott	21	25/03/2015	Yes	Outline	Expires March 2018	Attenuation pond, play area and communal open space. All unlikely to be large enough to meet the 2Ha standard.
05/14/00022	Rose Tree Paddock	Berrow	25	14/01/2016	The East half of the site is within ANG deficiency	Full	Expires Jan 2019	Small play area and greenspace along the course of the rhyne but neither connect to existing qualifying ANG sites.
08/08/00006	Bigwood & Staple	Bridgwater	86	03/09/2013	Yes	Full	Expires Sept 2018. Construction has not yet commenced.	A small area (<2Ha) of amenity space is proposed.
08/10/00073 and 08/12/00048 (amendment)	Federal Mogul	Bridgwater	126	24/06/2011	Only the north and west edge of the site is outside the deficiency zone	Full	Partially built out.	A small (<0.5Ha) community green and additional POS included in the amendment but still less than 0.5Ha.
08/11/00094 (renewal of 08/08/00017)	Railway Station	Bridgwater	10	15/10/2012	Yes	Full	Approval lapsed Oct 2015.	Small area (<0.5Ha) of amenity greenspace proposed.
08/11/00129 and 08/12/00200 (partial revision to add extra 6 dwellings	Gerber Foods	Bridgwater	40	27/04/2012	Yes	Full	Built out.	None.
08/12/00143 and 23/12/00004 (The Meads Ecopark permission)	Durleigh Road	Bridgwater	120	24/12/2013	Yes	Full	Partially built out.	New copses, ponds, greenspace and foot/cycle paths - Durleigh Park (2.5Ha) links to the Meads proposal.
08/12/00172	9-11 Northfield	Bridgwater	18	24/06/2013	Yes	Full	Unknown	None.
08/12/00182 and 23/12/00004 (The Meads Ecopark permission)	Haygrove Road	Bridgwater	186	07/04/2014	Yes	Full	Expires April 2017. Construction has not yet commenced.	New copses, ponds, greenspace and foot/cycle paths - Durleigh Park (2.5Ha) links to the Meads proposal.
08/12/00210	Westgate House	Bridgwater	22	04/03/2013	Yes	Full	Partially converted?	None. RLT2 & RLT3 paid.
08/12/00222	Paragon Laundry	Bridgwater	36	23/01/2014	Yes	Full	Expires Jan 2017. Construction has not yet commenced.	None. RLT2 & RLT3 agreed in S106.
08/13/00096	Kings Place	Bridgwater	15	25/10/2013	Yes	Full	Unknown	None. RLT2 & RLT3 contribution received.
08/13/00133	Monmouth Street	Bridgwater	37	31/03/2015	Yes	Full	Expires March 2018. Construction has not yet begun on site.	None. Payment secured for play space via S106.
08/13/00163	Cattle Market	Bridgwater	200	20/08/2015	Yes but the proposal results in the loss of a large (1.4Ha) area of amenity greenspace which may result in a larger deficiency zone elsewhere	Full	Expires August 2018. Construction has not yet begun on site.	Two public green spaces proposed but combined they are less than 0.5Ha.
08/13/00179	Hamp Street	Bridgwater	10	13/05/2014	Yes	Outline	RM to be submitted by May 2017.	None. Payment secured for play space via S106.
08/14/00037	Northgate Police station	Bridgwater	37	06/01/2015	Yes	Full	Under construction (May 2016)	Onsite greenspace is less than 0.5Ha.
08/14/00171	Ivy House, Friarn Street	Bridgwater	13	31/03/2015	Yes	Full	Expires March 2018. Construction has not yet begun (May 2016).	None (private gardens only). Payment secured for play space via S106.
08/14/00184	Pig & Whistle	Bridgwater	17	16/04/2015	No	Full	Has demolition/construction started on site?	Small (<0.5Ha) area of amenity greenspace and private gardens.
09/08/00017 (Outline) and 09/14/00010 (RM)	North East Bridgwater	Bridgwater Without	2000 (67)	02/07/2010 (09/10/2014)	No	Outline	Partially constructed.	None (private gardens only)

11/07/00192	Boatyard	Highbridge	90	18/12/2014	Yes	Outline	RM to be submitted by Dec 2017.	Proposed publicly accessible green corridor along the south boundary linking in to Apex park
11/08/00137	W of Ben Travers	Burnham-on-Sea	17	19/02/2014	No	Outline	RM to be submitted by Feb 2017.	Less than 0.5Ha proposed on site.
11/11/00107 and 11/12/00024 (ecological mitigation)	Brue Farm	Highbridge	550	12/03/2013	Yes	Outline	RM to be submitted by March 2016.	Green corridor (65Ha) along north and east boundary (Riverside park) and along the rhyne routes (SUDs)
11/11/00131	Clyce Road	Highbridge	85	27/01/2015	Yes	Outline	RM to be submitted by Jan 2018	None
11/13/00028	Highbridge Hotel	Highbridge	59	03/12/2013	Yes	Full	Partially constructed	Site includes a small extension to Jubilee Gardens
11/13/00078	Morlands	Highbridge	62	15/09/2014	Yes	Full	Expires Sept 2017	None. Payment secured for play space via S106
11/14/00087	Cattle Market	Highbridge	10	18/12/2014	Yes	Full	Expires Dec 2017. Partially completed.	Site includes a small extension to Jubilee Gardens
12/10/00022	Lawrence Close	Burnham-on-Sea	48	09/10/2013	Yes	Full	Expires Oct 2016. Complete?	Links directly in to POS.
13/14/00030	Main Road	Cannington	16	31/03/2015	Yes	Full	Expires March 2018	Green corridor <0.5Ha
17/09/00105	Sharpham Road	Cheddar	23	28/03/2013	Yes	Full	Complete?	None
17/08/00103	Steart Bushes	Cheddar	18	18/10/2011	Yes	Full	Expired Oct 2014. Not started.	0.1Ha of amenity and play space
17/11/00011	Lower New Road	Cheddar	21	09/11/2011	Yes	Full	Complete	None
20/10/00010 and 20/14/00005 (alternate scheme)	Brickworks	Chilton Trinity	~~67~~ 58	~~24/05/2013~~ 13/03/2015	Yes	Full	Partially complete	Village green and play area <0.5Ha
24/12/00030	Ashlawn Farm	East Brent	11	16/08/2013	No	Full	Complete	Informal play space <0.5Ha
36/12/00013	Stogursey Lane	Nether Stowey	20	15/07/2013	Yes	Full	Complete	None
37/10/00117	Wilstock (Phase 3)	North Petherton	330	08/06/2012	Yes	Outline	Under construction	3Ha Open Space
37/11/00020 and 37/13/00082 and 37/14/00010	Wilstock (Phase 2c)	North Petherton	152	04/08/2011	Yes	Reserved Matters	Approaching completion (May 2016)	Two areas of amenity greenspace both <0.1Ha
37/11/00071	Stockmoor	North Petherton	14	27/11/2012	Yes	Full	Permission lapsed in Nov 2015	None
37/12/00040	Wilstock (Phase 3a)	North Petherton	71	13/06/2013	Yes	Reserved Matters	Under construction	0.5Ha of accessible amenity greenspace connecting to existing PROW
37/13/00025	1 Rhyne Bridge	North Petherton	28	25/03/2014	Yes	Full	Expires March 2017	Less than 0.5Ha amenity greenspace
37/13/00050	Stockmoor	North Petherton	10	20/11/2013	Yes	Full	Under construction	None
41/13/00010	Chapel Road	Pawlett	27	20/06/2014	No	Full	Expires June 2017	None
42/14/00016	Riverton Road	Puriton	49	31/03/2015	Yes	Full	Expires March 2018	0.5ha of amenity greenspace and attenuation pond
50/14/00071	The Lerburne	Wedmore	55	30/03/2015	Yes	Outline	RM to be submitted by March 2018	Amenity greenspace <0.5Ha
51/12/00014	Homberg Way	Wembdon	11	07/03/2013	Yes but proposal results in the loss of 0.3Ha of amenity greenspace	Full	Under construction	10Ha of public open space
52/11/00009	Alstone Lane	West Huntspill	10	08/11/2013	Yes	Outline	RM to be submitted by Nov 2016	None
54/12/00009 (Outline) and 54/14/00020 (Reserved Matters)	Crockers Hill	Woolavington	45	25/03/2013	No	Outline and RM	Under construction	LAP, Orchard and Allotment <0.5Ha do not connect to existing ANG

Table 4.7 - Proposed Submission strategic housing allocation options for the Local Plan Review (due to be adopted in 2018)				
SHLAA code and Site name	Parish	Proposed number of dwellings	Within 300m of a >2Ha ANG site (Yes or No)	Opportunities to connect to or improve existing ANG
H021	Wembdon		No	Improve access to PROW and comprehensive and accessible GI
H182	Wembdon		Yes	
H234	Wembdon		West side of site is in deficiency zone	Improve access to PROW and comprehensive and accessible GI
H022	Wembdon		No	Improve access to PROW and comprehensive and accessible GI
H308a&b	Wembdon		No	Improve access to PROW and comprehensive and accessible GI
H022	Wembdon		No	Improve access to PROW and comprehensive and accessible GI
H112	Wembdon		West side of site is in deficiency zone	Improve access to PROW and comprehensive and accessible GI
H107	North Petherton		Yes	
H206 and H215b	North Petherton		Yes	
H397	North Petherton		Yes	
H228	Bridgwater Without		East side of site is in deficiency zone	Green bridge over the motorway connecting the site to existing PROW
H081	Bridgwater Without		No	Green bridge over the motorway connecting the site to existing PROW
H111	Bridgwater Without		North part of site is in deficiency zone	Green bridge over the motorway connecting the site to existing PROW
H100	Bridgwater Without		Yes	
H474	Bridgwater Without		No	Green bridge over the motorway connecting the site to existing PROW
H452	Bridgwater Without		No	Green bridge over the motorway connecting the site to existing PROW
H494	Bridgwater Without		No	Green bridge over the motorway connecting the site to existing PROW
H141 ad H031b	West Huntspill		North part of site is in deficiency zone	Improvements (i.e. nature areas) and extension of existing playing field, improve access to the Brue
H189	Burnham-on-Sea and Highbridge		No	Improve connectivity to existing ANG?
H123	Cheddar		Yes	
H250 & H128	Cheddar		Yes	
H313	Cheddar		Yes	
H288	North Petherton		No	H460 is within flood zone and not considered suitable for housing but as a part of the site as a whole there is potential for this area to deliver accessible natural greenspace to meet the needs of the housing in the developable areas.
H394	North Petherton		No	H460 is within flood zone and not considered suitable for housing but as a part of the site as a whole there is potential for this area to deliver accessible natural greenspace to meet the needs of the housing in the developable areas.
H461	North Petherton		No	H460 is within flood zone and not considered suitable for housing but as a part of the site as a whole there is potential for this area to deliver accessible natural greenspace to meet the needs of the housing in the developable areas.
H470	North Petherton		No	H460 is within flood zone and not considered suitable for housing but as a part of the site as a whole there is potential for this area to deliver accessible natural greenspace to meet the needs of the housing in the developable areas.
H460	North Petherton		No	H460 is within flood zone and not considered suitable for housing but as a part of the site as a whole there is potential for this area to deliver accessible natural greenspace to meet the needs of the housing in the developable areas.
H471	North Petherton		No	H460 is within flood zone and not considered suitable for housing but as a part of the site as a whole there is potential for this area to deliver accessible natural greenspace to meet the needs of the housing in the developable areas.
H397	North Petherton		Yes	

Figure 4.1: Map of all accessible natural greenspace provision within Sedgemoor

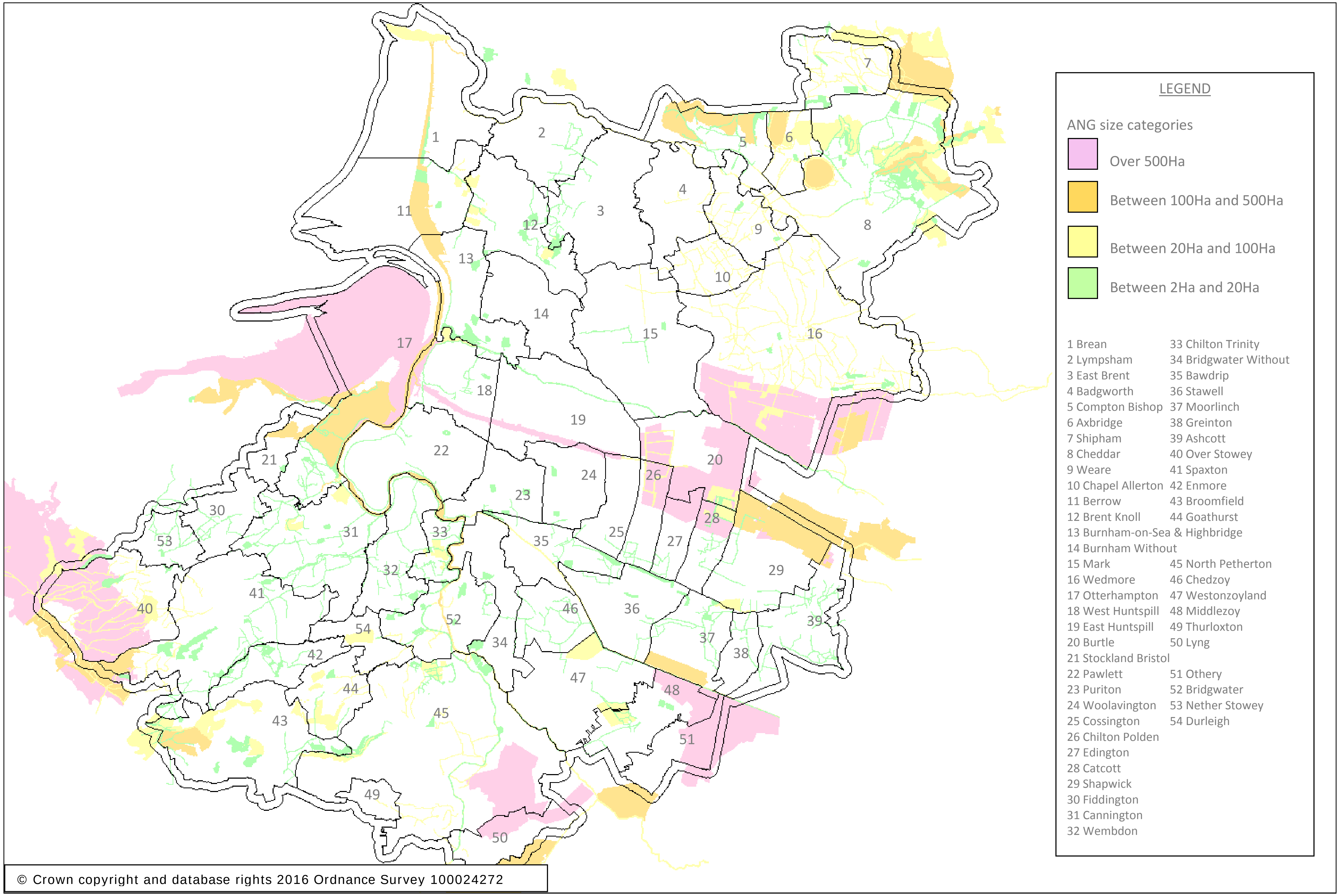


Figure 4.2: Map of the areas in Sedgemoor that do not meet the 2 hectares within 300m standard (insufficiency for existing dwellings)

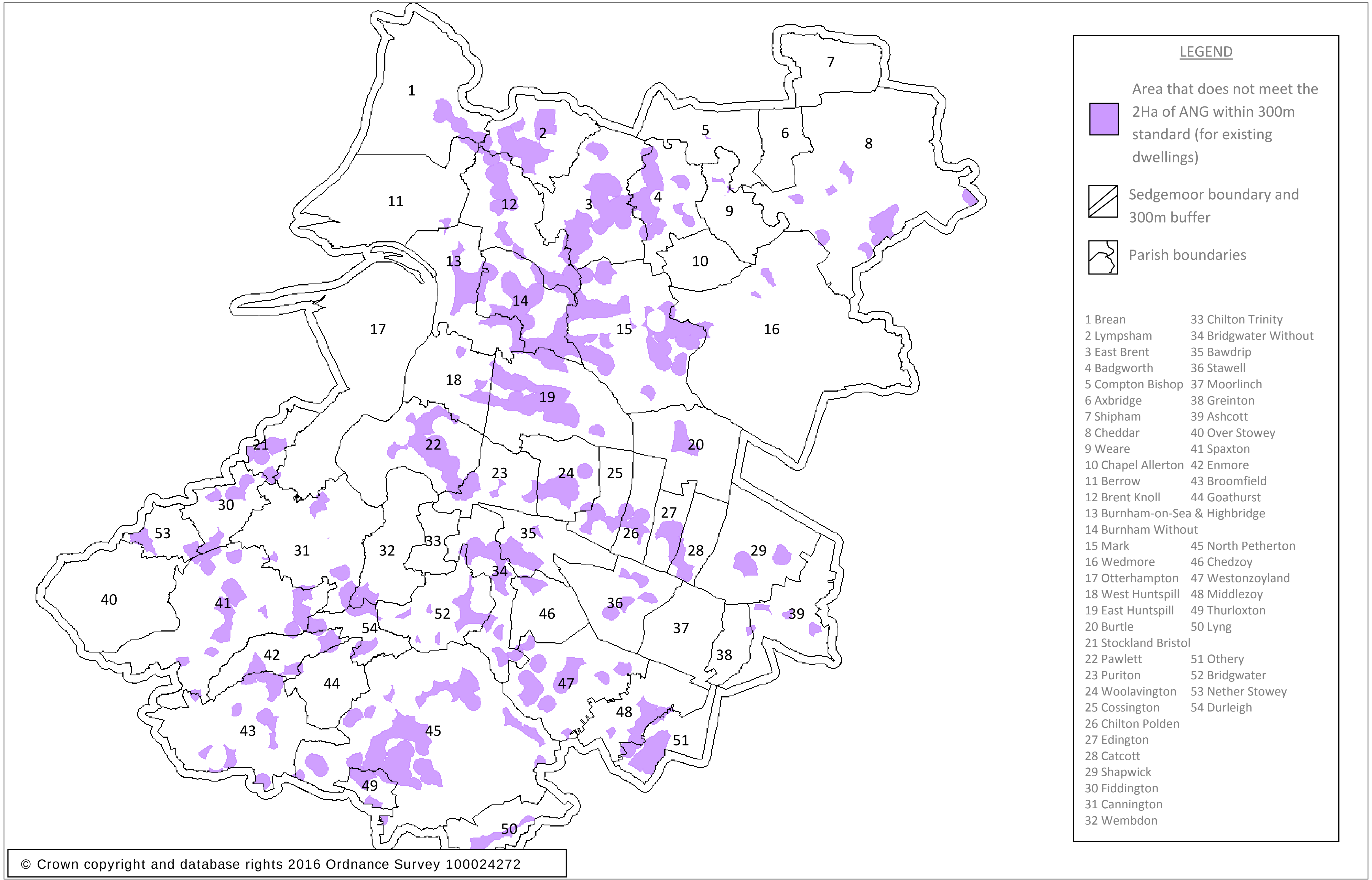


Figure 4.3: Map of the areas in Sedgemoor that do not meet the 2 hectares within 300m standard (for assessing future housing proposals against)

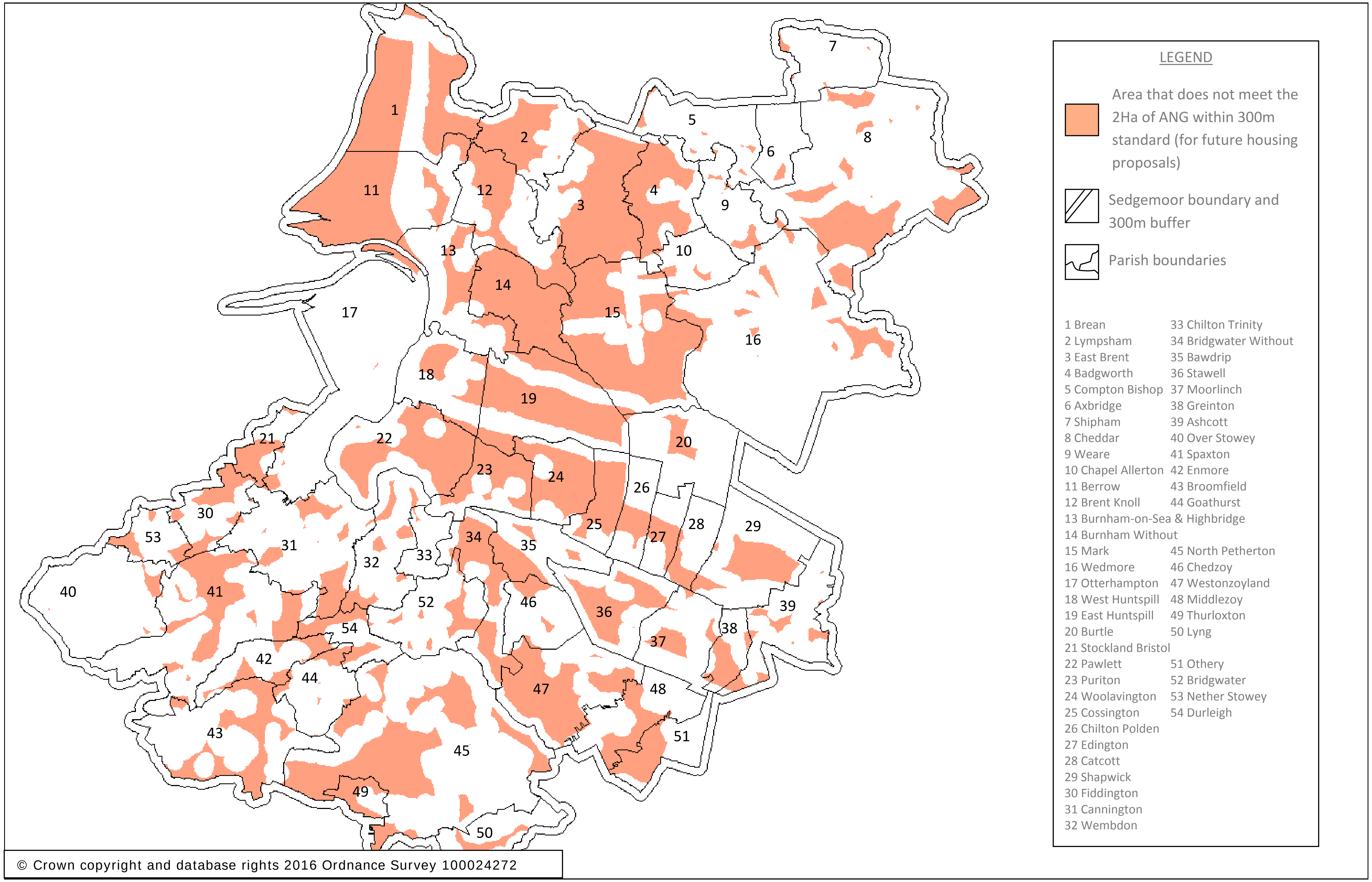
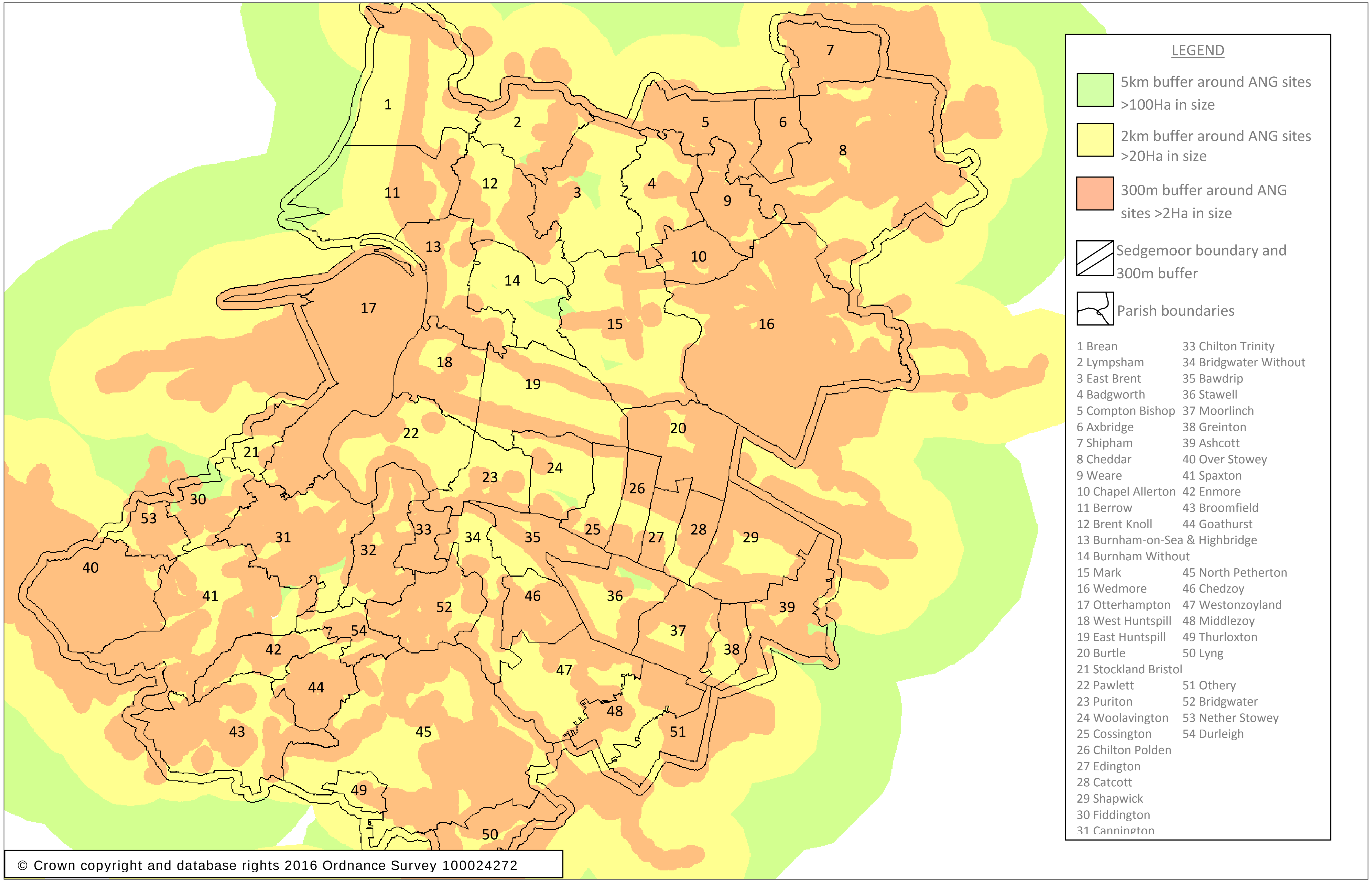


Figure 4.4: Map of the accessible natural greenspace buffers in Sedgemoor



District-wide Results

76.6% of all households in Sedgemoor have access to a natural greenspace site of at least 2 hectares within 300 metres.

All households in Sedgemoor have access to at least one site which satisfies at least one of the accessible natural greenspace standards.

Sedgemoor has a population of 119,057 (2014 mid-year estimate) and a total of 45.12 hectares of Local Nature Reserve*, this equates to 1Ha of Nature Reserve per 2639 of population or 0.38 hectares per 1000 of population which does not satisfy the requirement for 1 hectare per 1000 of population.

*Aisholt Wood LNR in Spaxton, Screech Owl LNR in North Petherton and Berrow Dunes LNR in Berrow.

The deficiency zones are determined by address data and so a number of isolated farmhouses across the district have been identified as having an ANG deficit. It is unlikely that these households have an ANG deficiency in real terms as they are likely to have access to large areas of the countryside that have not been mapped as part of this analysis because there is no evidence of general public access.

Whilst it has been considered unnecessary to remove these properties from the ANG database, for completeness, it is unlikely that future planning policy will focus on addressing the 'deficit' for isolated farmhouses outside of recognised settlements. The main purpose of the ANGSt analysis and the likely focus of emerging planning policy is to improve the access and naturalness of greenspace for residents within existing urban areas and for those in future strategically planned housing developments.

A description of ANGSt provision and deficiency for each parish within the district is given below, it is advised to read the descriptions in conjunction with the Maps provided in Appendix A (the maps should be provided as an online digital map when the final report is published). The descriptions include details of the sites that provide accessible natural greenspace within each parish but in some cases residents of one parish may be within 300m of an accessible natural greenspace site that is actually in another parish (or district).

Parishes with Principle Towns

Bridgwater

15.5% of the households in the parish of Bridgwater do not meet the local level ANG standard (2Ha within 300m).

The largest area of Bridgwater that does not meet the standard is an area between Ruborough Road, Bower Lane and Bath Road towards the east of the parish. The area sits within the wards of Eastover, Dunwear and Fairfax.

There are five smaller pockets of deficiency centred over the High Street in Westover ward, Ladymead Close and Park Avenue in Wyndham ward and Penlea Close and King George Avenue in Hamp ward. Whilst King George Avenue is adjacent to Mansfield playing field the site unfortunately does not qualify as an acceptable ANG site because it is smaller than 2 Hectares in size.

There have been 16 major housing developments (973 dwellings) approved in Bridgwater since April 2011, only one of these proposals (for 17 dwellings on the site of the Pig & Whistle public house) does not meet the ANG standard.

The 59 hectares of Accessible Natural Greenspace provision within Bridgwater includes Victoria Park, Redmoor, the River Parrett, the Bridgwater and Taunton canal towpaths, Public Open Space at Whitegates, green corridor at Eastern Avenue, Eastover Park, Bristol Road and Quantock Road cemeteries, St Matthews playing field and Bristol Road playing field.

Bridgwater Without

84% of the households in the parish of Bridgwater Without do not meet the local level ANG standard (2Ha within 300m).

The deficiency covers the majority of the parish but particularly affects properties along River Lane, Bower Lane, Horsey Lane, Chedzoy Lane, Dunwear Lane and all of the new build properties at the North-East Bridgwater development.

The North East Bridgwater development (outline permission for 2000 houses and Reserved Matters approval for 67) is still being constructed and so this situation may improve after the creation of the proposed green infrastructure elements of the proposal. However, the green infrastructure that has been proposed appears to be landscaping of residual land rather than purposeful provision of natural public green space (asides from the sports pitches which do not qualify as suitable ANG).

The 43 hectares of Accessible Natural Greenspace provision within Bridgwater Without includes the wildlife sites at Cellophane Pits and Dunwear Ponds. The parish also contains portions of the River Parrett and the King Sedgemoor Drain and part of a substantial length of public right of way traverses through the parish.

Parishes with larger towns and villages

Burnham-on-sea and Highbridge

35.5% of the households in the parish of Burnham-on-Sea and Highbridge do not meet the local level ANG standard (2Ha within 300m).

There is a concentration of housing centred over the Clover Way and Donstan Road area within the deficiency zone and also the whole of the eastern edge of the Highbridge and Burnham Marine ward. The whole of the central and north-east portion of the Burnham Central ward is within the deficiency zone as is the central and south-east portion of the Burnham North ward. There is also a small pocket of deficiency centred over Martin's Close to the north of the parish.

There have been 8 major housing developments (921 dwellings) approved in Burnham-on-Sea and Highbridge since April 2011, only one of these proposals (outline permission for 17 dwellings on a site West of Ben Travers Way) does not meet the ANG standard.

The 141.5 hectares of accessible natural greenspace within Burnham-on-Sea and Highbridge includes the Berrow dunes, the beach, the Brue estuary, public rights of way, Apex park, the BASC, Burnham Road playing field, Newtown lake, Walrow Ponds and Highbridge Pits.

Burnham Without

23.7% of the households in the parish of Burnham Without do not meet the local level ANG standard (2Ha within 300m).

The majority of the deficiency zone is centred over Stodden's Lane, Edithmead Lane and Bristol Road. There is a small pocket in the west of the parish, centred over a concentration of dwellings at Havage Close and Worston Road and all the properties in the Watchfield area of Burnham Without are within the deficiency zone.

The new public open space to the west of Lawrence Close accounts for the 2 hectares of accessible natural greenspace of sufficient size within Burnham Without parish. There are however a number of public rights of way within the parish that could be extended or enhanced to enable them to meet the ANG standard.

North Petherton

24.4% of the households in the parish of North Petherton do not meet the local level ANG standard (2Ha within 300m).

There are two large areas of deficiency and seven smaller pockets of deficiency within the parish of North Petherton. The largest area covers the area of the town centre (and the remainder of the parish including the western and southern arms of North Newton) that is to the south-west of Mill Street. The second largest zone covers the households at Huntworth and a few dwellings along the A38 to the north of the town centre.

The seven smaller pockets of deficiency are centred on North Moor Green, The Elms, Adsborough, Clavelshay, Hill Barn Farm, Gooding’s Farm and Woolmersdon.

There have been 6 major housing developments (605 dwellings) approved in North Petherton since April 2011; all of these proposals met the ANG standard.

The 608 hectares of accessible natural greenspace within North Petherton parish includes most of the North Moor SSSI, a number of local wildlife sites, the Screech Owl local nature reserve, part of the Bridgwater & Taunton canal, part of the River Parrett, Kings Cliff wood and quarry, Parkers field, public open space at Stockmoor and Wilstock, a substantial public right of way route and the emerging Country Park between Wilstock and Stockmoor.

Cheddar

11.5% of the households in the parish of Cheddar do not meet the local level ANG standard (2Ha within 300m).

There are seven pockets of deficiency within the parish of Cheddar but only two affect properties within the core urban area of Cheddar village, the pockets affect dwellings on The Barrows, Greenhayes, Norville Lane, The Hayes and Hythe Wood.

There have been 3 major housing developments (62 dwellings) approved in Cheddar since April 2011; all of these proposals met the ANG standard. There is currently a proposal for 90 dwellings being considered at Upper New Road in Cheddar, if this application is approved it will also be in a location that meets the ANG standard.

The extensive 875 hectares of accessible natural greenspace within the parish of Cheddar includes a number of SSSI's (Cheddar Complex, Cheddar Woods, Cheddar Reservoir etc), a number of local wildlife sites and Somerset Wildlife Trust sites, the Cheddar valley railway path, a substantial public right of way network, five Access Land sites and the Allotment gardens at Upper New Road.

Parishes with medium-sized villages

Axbridge

All of the households in the parish of Axbridge meet the local level ANG standard (2Ha within 300m), there are no deficiency zones within Axbridge.

There have been no major housing proposals approved within Axbridge since April 2011.

The 157 hectares of accessible natural greenspace within the parish of Axbridge includes the Axbridge Hill and Fry's Hill SSSI's, the playing fields, two substantial Public Right of Way networks within the Mendip Hills AONB and an Access Land site at Fry's Hill.

Berrow

1.7% of the households in the parish of Berrow do not meet the local level ANG standard (2Ha within 300m). The area of ANG deficiency affects a small number of houses along Brent Road.

There has been 1 major housing development (25 dwellings) approved in Berrow since April 2011. The eastern edge of the development site is within an ANG deficient area and the proposal does not include the provision of greenspace that would contribute to the enhancement of the existing network.

The 179 hectares of accessible natural greenspace within the parish of Berrow includes the Berrow Dunes and Beach, Ford Common, public rights of way, local wildlife sites and the playing fields.

Cannington

1.9% of the households in the parish of Cannington do not meet the local level ANG standard (2Ha within 300m). The main urban area of Cannington meets the ANG standard, the areas of deficiency affect a few isolated properties but as mentioned previously it is unlikely that isolated rural properties and farms experience an ANG deficiency in real terms as they are likely to have direct access to the countryside.

There has been 1 major housing development (16 dwellings) approved in Cannington since April 2011, the proposal complies with the accessible natural greenspace standard.

The 87 hectares of accessible natural greenspace within the parish of Cannington includes the Cannington Brook, Furze Covert, Cannington Park, public rights of way and the Playing Fields

Nether Stowey

31.8% of the households in the parish of Nether Stowey do not meet the local level ANG standard (2Ha within 300m). The area of deficiency sits over the western section of the village however this location does have partial access to The Mount, the site of the remains of Nether Stowey castle. The Mount is visible from the public footpath that loops around it but the remainder of the site is private property and therefore does not qualify as an accessible natural greenspace site. Due to the fragmented nature of the public right of way network to the west of the village the loop around The Mount does not link directly (or rather safely) to the wider public right of way network within the surrounding Quantock Hills AONB.

There has been 1 major housing development (20 dwellings) approved in Nether Stowey since April 2011, the proposal complies with the accessible natural greenspace standard.

The 5 hectares of accessible natural greenspace within the parish of Nether Stowey includes the playing fields and the public right of way network to the east of the village.

Puriton

21.5% of the households in the parish of Puriton do not meet the local level ANG standard (2Ha within 300m). The ANG deficiency area affects the properties at Down End and a strip of properties through the middle of the village extending north-east from the primary school up towards Northmead Drove.

There has been 1 major housing development (49 dwellings) approved in Puriton since April 2011, the development complies with the accessible natural greenspace standard. There is currently a proposal for 59 dwellings being considered by the local planning authority, if the proposal is granted it will also comply with the accessible natural greenspace standard.

The 32 hectares of accessible natural greenspace within the parish of Puriton includes public rights of way, local wildlife sites and the recreation ground.

Wedmore
0.9% of the households in the parish of Wedmore do not meet the local level ANG standard (2Ha within 300m). The main settlement of Wedmore meets the ANG standard, the small pockets of deficiency affect a few properties at Pool Bridge, Snipefield Lane and Stoughton Cross.

There has been 1 major housing development (55 dwellings) approved in Wedmore since April 2011, the proposal complies with the accessible natural greenspace standard.

The 1005 hectares of accessible natural greenspace within the parish of Wedmore includes a number of local wildlife sites and Somerset wildlife trust sites, Mudgley Orchard, public rights of way, a section of the River Brue, a section of the River Axe and the recreation ground.

Woolavington
38.9% of the households in the parish of Woolavington do not meet the local level ANG standard (2Ha within 300m). The ANG deficiency affects properties in the northern area of the village (north of Clark Close and Broad Lawn) and a number of properties on Woolavington Hill

There has been 1 major housing development (45 dwellings) approved in Woolavington since April 2011, the proposal does not comply with the accessible natural greenspace standard. The proposal includes the provision of a LAP, an orchard and an allotment garden but these amount to less than 0.5Ha and do not connect to an existing component of the accessible natural greenspace network.

The 28 hectares of accessible natural greenspace within the parish of Woolavington includes the Borrow Pit (a local wildlife site) and the Playing Field.

Parishes with smaller villages

Ashcott
3.8% of the households in the parish of Ashcott do not meet the local level ANG standard (2Ha within 300m). There are three pockets of deficiency within Ashcott, one affecting properties between Pedwell Hill and Bath Road, one affecting a few properties south of The Batch and one centred over The Pipers public house.

There has been 1 major housing development (21 dwellings) approved in Ashcott since April 2011, the development complies with the accessible natural greenspace standard.

The provision of accessible natural greenspace within Ashcott comes from public rights of way, local wildlife sites and part of the Shapwick Heath nature reserve (also a SSSI and Ramsar site).

Badgworth

44.3% of the households in the parish of Badgworth do not meet the local level ANG standard (2Ha within 300m). Whilst the village of Badgworth is not in an area of ANGSt deficiency there are a number of dwellings along the A38 towards Rooksbridge that are in an ANGSt deficiency area as well as a number of dwellings along Biddisham Lane and a few isolated properties along the A38 towards Lower Weare. The provision of accessible natural greenspace within Badgworth comes from public rights of way and paddle rights on the River Axe.

Bawdrip

21.1% of the households in the parish of Bawdrip do not meet the local level ANG standard (2Ha within 300m). The dwellings within the area of ANGSt deficiency are not within the main village of Bawdrip but are situated between New Road and Bath Road, along Bath Road towards Horsey and along Bradney Lane. The provision of accessible natural greenspace within Bawdrip comes from public rights of way, the Kings Sedgemoor Drain, a few local wildlife sites and an area of Access Land (south of A39 and west of Southview).

Brean

3.9% of the households in the parish of Brean do not meet the local level ANG standard (2Ha within 300m). The few properties that are within the ANGSt deficiency area are to the east of the main residential area, along Weston Road, at Diamond Meadow and to the north of Wick Road. The provision of accessible natural greenspace within Brean includes Brean Down, Brean Dunes and the beach.

Brent Knoll

16% of the households in the parish of Brent Knoll do not meet the local level ANG standard (2Ha within 300m). The properties affected by the ANG deficiency are on the periphery of the main settlement at Station Road, Laurel Avenue, Brent Street, Harp Road and Wick Lane. The provision of accessible natural greenspace within Brent Knoll includes a number of local wildlife sites as well as the Access Land on the Knoll and a public right of way network.

Broomfield

30.4% of the households in the parish of Broomfield do not meet the local level ANG standard (2Ha within 300m). There are numerous accessible natural greenspace sites within Broomfield and so the pockets of deficiency are small and dispersed. The largest area of deficit is situated between Durrett's Farm and the Coach House and then extends westward towards Smocombe. The provision of accessible natural greenspace within Broomfield includes numerous local wildlife sites (mostly woodland), public rights of way and three Access Land sites at Broomfield Common, Broomfield Hill and Merridge Hill.

Burtle

30.8% of the households in the parish of Burtle do not meet the local level ANG standard (2Ha within 300m). The dwellings within the area of deficiency are on Station Road and Robin's Drive, with a few dispersed properties affected along Mark Road and the south side of Burtle Road. The provision of accessible natural greenspace within Burtle includes the Moors and Heath nature conservation area and the Catcott Reserve Somerset Wildlife Trust site.

Catcott

16.1% of the households in the parish of Catcott do not meet the local level ANG standard (2Ha within 300m). The area of deficiency is a strip of land that extends along Old School Lane and Manor Road between Lippetts Way and Catcott Primary School. The provision of accessible natural greenspace within Catcott includes public rights of way and the access land at Catcott Heath.

Chapel Allerton

All of the households in the parish of Chapel Allerton meet the local level ANG standard (2Ha within 300m). The provision of accessible natural greenspace within Chapel Allerton consists of a substantial public right of way network.

Chedzoy

10.7% of the households in the parish of Chedzoy do not meet the local level ANG standard (2Ha within 300m). The area of deficiency affects the few properties situated to the north west of Moggs Farm along Higher Road. The provision of accessible natural greenspace within Chedzoy consists of a substantial public right of way network and part of the King's Sedgemoor Drain.

Chilton Polden

17.9% of the households in the parish of Chilton Polden do not meet the local level ANG standard (2Ha within 300m). The ANG deficiency affects the area to the north of the main village and a strip that runs centrally through the village between Orchard Rise and Scruibbitts Lane. The provision of accessible natural greenspace within Chilton Polden includes a public right of way network and the nature conservation areas around and including the access land at Chilton Moor.

Chilton Trinity

All of the households in the parish of Chilton Trinity meet the local level ANG standard (2Ha within 300m). The provision of accessible natural greenspace within Chilton Trinity includes a public right of way network, Chilton Trinity Ponds, Sutton's Ponds and part of the River Parrett.

There has been 1 major housing development (58 dwellings) approved in Chilton Trinity since April 2011. The proposal complies with the accessible natural greenspace standard and also proposes to provide a village green and play area.

Compton Bishop

0.4% of the households in the parish of Compton Bishop do not meet the local level ANG standard (2Ha within 300m). The area of deficiency affects just one property on Big Tree Close. The provision of accessible natural greenspace within Compton Bishop includes the Crook Peak to Shute Shelve Hill SSSI, Kings Wood and the access land at Wavering Down and Shute Shelve Hill.

Cossington

45.1% of the households in the parish of Cossington do not meet the local level ANG standard (2Ha within 300m). The deficiency area affects a few farms on the periphery of the village, a handful of properties along Middle Road to the east of the village and a wide strip of properties through the centre of the village from Manor Close on the west to Millmoot Lane to the east. The provision of accessible natural greenspace within Cossington consists of access to the public right of way network, a section of the Huntspill River crosses through the north of the parish but is not close enough to the village core to provide ANG at the local level (2ha within 300m).

Durleigh

38.9% of the households in the parish of Durleigh do not meet the local level ANG standard (2Ha within 300m). The area of deficiency affects the properties at Rexworthy Farm, properties in the area of Holford Road and Pyrland Walk and a few properties along Rhode Lane although these properties are unlikely to experience an ANG deficiency in real terms. The provision of accessible natural greenspace within Durleigh includes public rights of way and the Durleigh Reservoir.

East Brent

49.9% of the households in the parish of East Brent do not meet the local level ANG standard (2Ha within 300m). The majority of East Brent village is not within an area of deficiency but there are a large number of dispersed properties within the parish that are affected by the ANG deficiency, although potentially not in real terms as they may be farms that would not perceive to be affected by ANG deficiency as they have their own access to the countryside. Properties along the Old Bristol Road, Bristol road and within the village of Rooksbridge are within areas of accessible natural greenspace deficiency at the local level. The provision of accessible natural greenspace within East Brent includes a local wildlife site, the Brent Knoll and a public right of way network.

There has been one major housing proposal (11 dwellings) approved in East Brent since April 2011, the scheme does not comply with the accessible natural greenspace standard. The proposal includes an area of informal play space but the area is less than 0.5Ha in size.

East Huntspill

70.7% of the households in the parish of East Huntspill do not meet the local level ANG standard (2Ha within 300m). The majority of the properties in the parish of East Huntspill are in ANGSt deficiency, only those properties that are within 300m of the River Brue and the Huntspill River are not in ANGSt deficiency. There are no other qualifying accessible natural greenspace sites within the parish.

Edington

54.6% of the households in the parish of Edington do not meet the local level ANG standard (2Ha within 300m). The properties in the north and east of the village are within the ANG deficiency area (i.e. north of Suprema Avenue and east of Holy Well Road). The provision of accessible natural greenspace within Edington includes public rights of way and the Edington Moor Nature Conservation Area.

Enmore

26.8% of the households in the parish of Enmore do not meet the local level ANG standard (2Ha within 300m). The few properties that are within the ANG deficiency area are situated to the south of Enmore Road, there are also a few near to Quantock Farm and in the east of the parish along Enmore Road (near to Troakes Farm). There are a number of accessible natural greenspace sites within Enmore, including Enmore Park, public rights of way, local wildlife sites, woodlands and Barford Park.

Fiddington

10.7% of the households in the parish of Fiddington do not meet the local level ANG standard (2Ha within 300m). The main village of Fiddington is not in the ANGSt deficiency area and there are only 11 properties in the parish that are within the deficiency zone. A few of those properties are within the small hamlets of Coultings, Keenthorne and Whitnell but the remainder are dispersed dwellings that are unlikely to hold the perception that they have insufficient access to natural greenspace.

Goathurst

All of the households in the parish of Goathurst meet the local level ANG standard (2Ha within 300m). The provision of accessible natural greenspace within Goathurst includes public rights of way and extensive woodlands.

Greinton

1.6% of the households in the parish of Greinton do not meet the local level ANG standard (2Ha within 300m). The only property affected by the deficiency is a farm to the east of the village. The provision of accessible natural greenspace within Greinton includes public rights of way and a section of the King's Sedgemoor Drain.

Lympsham

69.6% of the households in the parish of Lympsham do not meet the local level ANG standard (2Ha within 300m). The area of deficiency affects properties along the Bridgwater Road between Honeymeade Farm and The Crescent and the majority of the core area of Lympsham village except for properties in Eastertown and along South Road. The provision of accessible natural greenspace within Lympsham consists of public rights of way.

Lyng

54.8% of the households in the parish of Lyng do not meet the local level ANG standard (2Ha within 300m). The area of deficiency runs along the main Road between West Lyng Farm and the junction with Cuts Road in East Lyng. Properties at Outwood and a few south of Main Road in East Lyng are not within the ANGSt deficiency area. The provision of accessible natural greenspace within Lyng includes public rights of way, the North Moor SSSI and a section of the Bridgwater and Taunton canal.

Mark

29.4% of the households in the parish of Mark do not meet the local level ANG standard (2Ha within 300m). There are a number of pockets within the parish of Mark that are within the ANGSt deficiency area, these include a handful of dwellings along the Mark Causeway, a strip of dwellings through the centre of the main village of Mark, a number of properties along Yarrow Road, Southwick Road and Northwick Road as well as numerous more dispersed rural properties and the hamlet of Vole. The provision of accessible natural greenspace within Mark includes public rights of way and the playing fields.

Middlezoy

31.5% of the households in the parish of Middlezoy do not meet the local level ANG standard (2Ha within 300m). The south-east corner of Middlezoy village is affected by the deficiency along with a few isolated farms and part of the Broadfield residential caravan park. The provision of accessible natural greenspace within Middlezoy includes public rights of way and designated conservation areas.

Moorlinch

All of the households in the parish of Moorlinch meet the local level ANG standard (2Ha within 300m). The provision of accessible natural greenspace within Moorlinch includes public rights of way, local wildlife sites, woodland and the Greylake RSPB Reserve.

Othery

95.3% of the households in the parish of Othery do not meet the local level ANG standard (2Ha within 300m). Othery has a short public right of way network that connects the village to nearby Middlezoy but it is poorly connected (i.e. only via the public highway) to the public right of way network and designated nature conservation areas to the east and south of the village.

Otterhampton

All of the households in the parish of Otterhampton meet the local level ANG standard (2Ha within 300m). Residents of Combwich and Steart within the parish of Otterhampton have access to the Bridgwater Bay nature reserve, the newly created Steart Marshes nature reserve, public right of way routes, the River Parrett and Combwich Common.

Over Stowey

1.3% of the households in the parish of Over Stowey do not meet the local level ANG standard (2Ha within 300m). The provision of accessible natural greenspace within Over Stowey includes designated nature conservation areas (the Quantocks SSSI), woodland, local wildlife sites, public rights of way and access land at Beacon Hill, Longstone Hill, Shervage Wood, Weacombe Hill and Adder Wood.

Pawlett

93.7% of the households in the parish of Pawlett do not meet the local level ANG standard (2Ha within 300m). Whilst Pawlett has a few small recreational areas they are all less than 2 hectares in size. The village is also close to the River Parrett but unfortunately the off-road public right of way network does not extend into the boundary of the village. The only accessible natural greenspace site that is larger than 2 hectares within the parish of Pawlett is the Crematorium. Whilst this type of accessible greenspace does contribute to the overall provision it obviously cannot satisfy the recreational needs of the village and due to the use of the site it is purposefully located away from the main village (it is actually within 300m of only 2 dwellings).

There has been one major housing proposal (27 dwellings) approved within Pawlett since April 2011, the proposal does not comply with the accessible natural greenspace standard and no additional accessible natural greenspace will be provided as part of the development.

Shapwick

18.2% of the households in the parish of Shapwick do not meet the local level ANG standard (2Ha within 300m). The dwellings that are within the area of deficiency are in the north of the village, north of St Mary’s Church. The provision of accessible natural greenspace in Shapwick includes the South Drain, Loxley Wood and Shapwick Heath national nature reserve.

Shipham

All of the households in the parish of Shipham meet the local level ANG standard (2Ha within 300m). The provision of accessible natural greenspace within the parish of Shipham includes public rights of way, local wildlife sites, woodland and Access Land.

Spaxton

33.3% of the households in the parish of Spaxton do not meet the local level ANG standard (2Ha within 300m). Dwellings located in the west of Spaxton village, a large proportion of the dwellings within the hamlet of Four Forks and a number of dispersed properties across the parish are within the area of ANG deficiency. The provision of accessible natural greenspace within the parish of Spaxton includes Hawkridge Reservoir, Ashford Reservoir, numerous local wildlife sites (woodland and meadow), public rights of way, a playing field and access land at Marrow Hill.

Stawell

8.8% of the households in the parish of Stawell do not meet the local level ANG standard (2Ha within 300m). The affected properties sit within 5 small pockets of deficiency, only one of which is within

Stawell village itself. The areas affect a handful of properties on Stawell Road towards the east of the village, three farmsteads and one isolated property. However, as stated previously it is unlikely that these isolated properties and farms experience an ANG deficiency in real terms as they are likely to have access to privately-owned natural greenspace. The provision of accessible natural greenspace within Stawell parish includes local wildlife sites, part of the King's Sedgemoor Drain and Access Land at Cock Hill.

Stockland Bristol

26.6% of the households in the parish of Stockland Bristol do not meet the local level ANG standard (2Ha within 300m). The main village of Stockland Bristol is not within ANGST deficiency area, the affected properties are those more rural dispersed properties that are located south of the main village across the rest of the parish. The provision of accessible natural greenspace within Stockland Bristol parish includes Lodge Wood and part of Steart Marshes reserve.

Thurloxton

25.4% of the households in the parish of Thurloxton do not meet the local level ANG standard (2Ha within 300m). The deficiency affects properties on the western edge of the village and properties south of the village near Pether's Farm. The provision of accessible natural greenspace within Thurloxton consists of public rights of way.

Weare

3.2% of the households in the parish of Weare do not meet the local level ANG standard (2Ha within 300m). The deficiency affects a handful of dwellings on Notting Hill Way in Lower Weare and a handful of dwellings on Pipers Close in Weare. The provision of accessible natural greenspace within the parish of Weare includes local wildlife sites and an Access Land site.

Wembdon

0.5% of the households in the parish of Wembdon do not meet the local level ANG standard (2Ha within 300m). The few properties that are within the area of ANGSt deficiency are located along Skimmerton Lane, the village of Wembdon is not in ANGSt deficiency. The provision of accessible natural greenspace within Wembdon includes public rights of way, the playing fields and part of the River Parrett.

There has been one major housing proposal (11 dwellings) approved in Wembdon since April 2011. The proposal results in the loss of 0.3ha of accessible natural greenspace but it is part of a wider proposal that improves the accessibility of 10ha of greenspace as part of the village hall and playing field development.

West Huntspill

2.3% of the households in the parish of West Huntspill do not meet the local level ANG standard (2Ha within 300m). None of the properties within the main village of West Huntspill are within the ANGSt deficiency area. The provision of accessible natural greenspace within West Huntspill includes part of the Bridgwater Bay NNR, public rights of way and the memorial playing field.

There has been one major housing proposal (10 dwellings) approved in West Huntspill since April 2011. The proposal complies with accessible natural greenspace standards but does not provide any additional accessible natural greenspace.

Westonzoyland

60.5% of the households in the parish of Westonzoyland do not meet the local level ANG standard (2Ha within 300m). The core of the main village and a number of dispersed isolated properties are in ANGSt deficiency within the parish of Westonzoyland. Whilst properties on the periphery of the village (to the east and west) have good access to public right of way networks the properties in the centre of the village do not have access to accessible natural greenspace of sufficient size within 300m of home. The provision of accessible natural greenspace within the parish of Westonzoyland includes Langmead and Weston level SSSI, Lang Moor local wildlife site and public rights of way.

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Ecology Solutions Limited | Farncombe House | Farncombe Estate | Broadway | Worcestershire | WR12 7LJ

01451 870767 | info@ecologysolutions.co.uk | www.ecologysolutions.co.uk