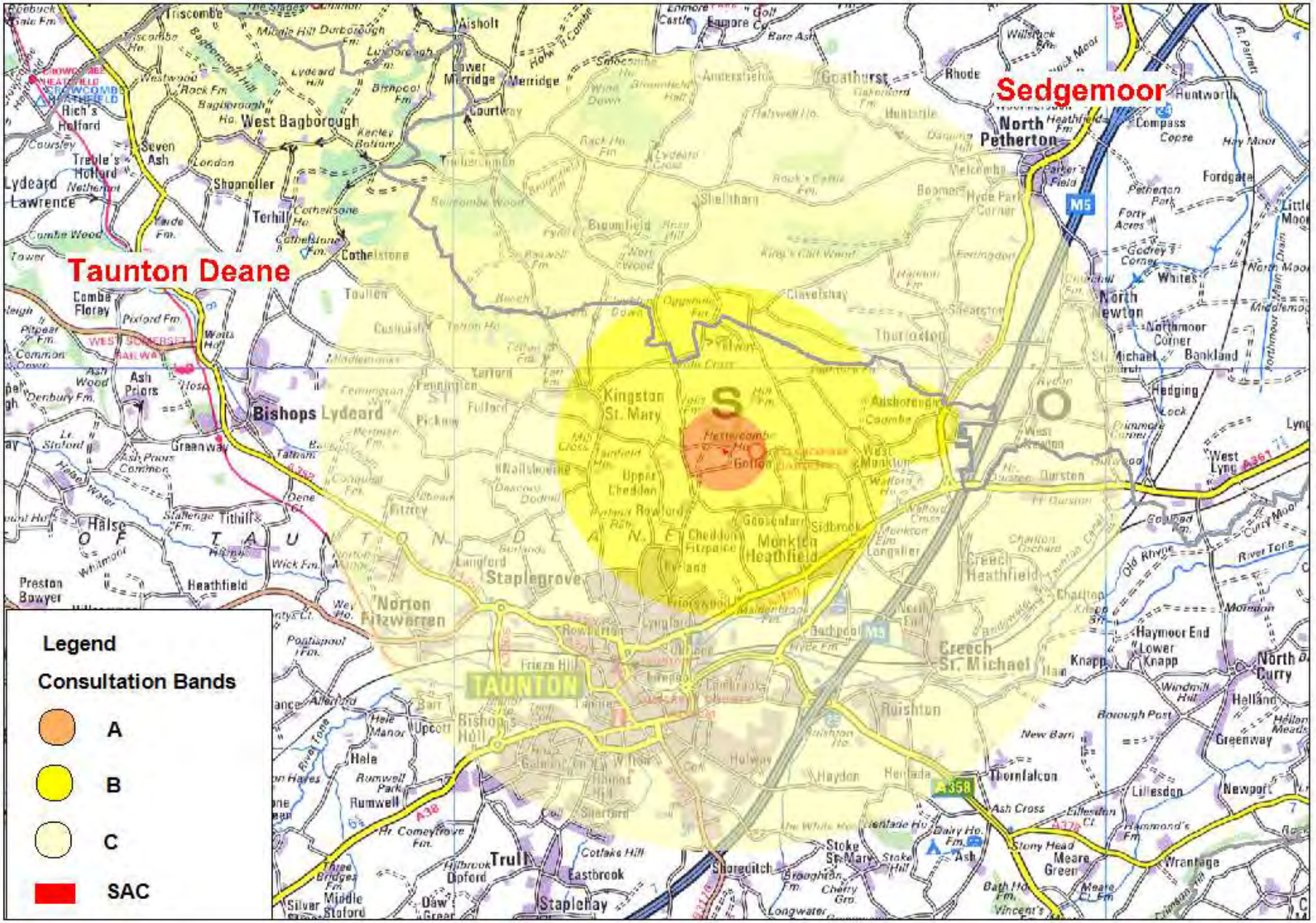
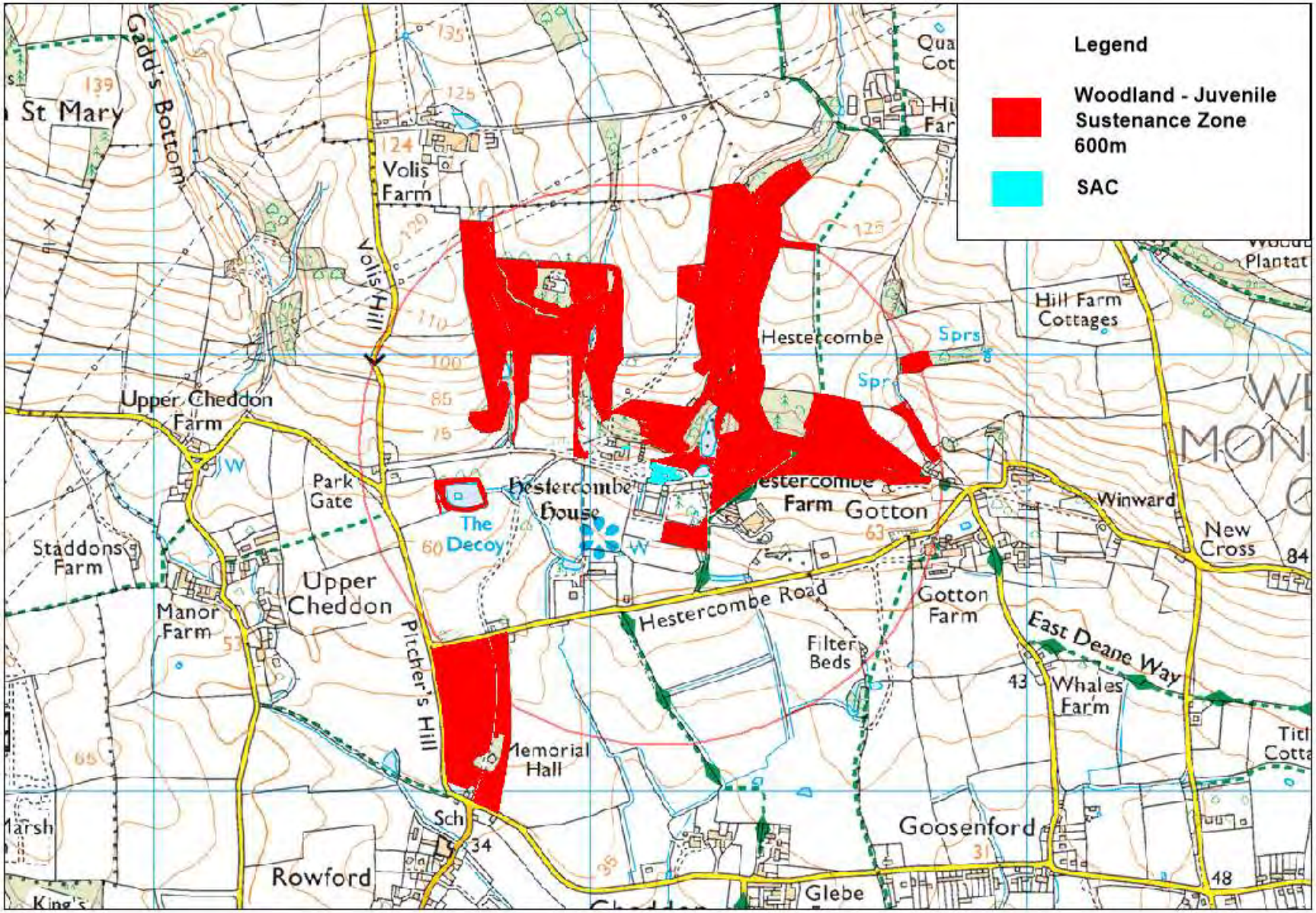
Plan 1: Bat Consultation Zone



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

[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.

[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

[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

[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.

[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 HEP calculations for development sites should be made on the basis that the total site

[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.

Delivery Risk

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*, o*verall 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			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)
WF0	Unidentified woodland formation	1	
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	
GN0	Neutral 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)
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	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			
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	
HE2	Wet heaths	1	Bog habitats are avoided by lesser horseshoe bats (Irish Bats)
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	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	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	
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	
LM12	Cut hedge without standards	0.2	Uncut hedge is specified where the hedge is between 2 and 3 metres high
LM2	Uncut hedge	0.9	
LM21	Uncut hedge with standards	0.9	
LM22	Uncut hedge without standards	0.8	Overgrown hedge is considered to be over 3 metres high
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
UA3	Domestic	0	
UA31	Housing/domestic outbuildings	0.1	Urban and sub urban areas are exploited by lesser horseshoe bats (Knight, 2006)
UA32	Gardens	0.1	
UA33	Allotments	0.1	Farmyards most used by lesser horseshoe in Ireland (McAney & Fairley, 1988). Night roosts possible
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.

Field No	Habitat	Primary Habitat		Matrix		Formation		Management / Land use		HSI Score	Density Band Score	Hectares	Habitat Units
		IHS Code	Score	IHS Code	Score	IHS Code	Score	IHS Code	Score				
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		Matrix		Formation		Management / Land use		HSI Score	Density Band Score	Hectares	Habitat Units
		IHS Code	Score	IHS Code	Score	IHS Code	Score	IHS Code	Score				
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.

$$[5.05 / (6-1)] + 5.05 = 6.06\text{ha}.$$

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

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.

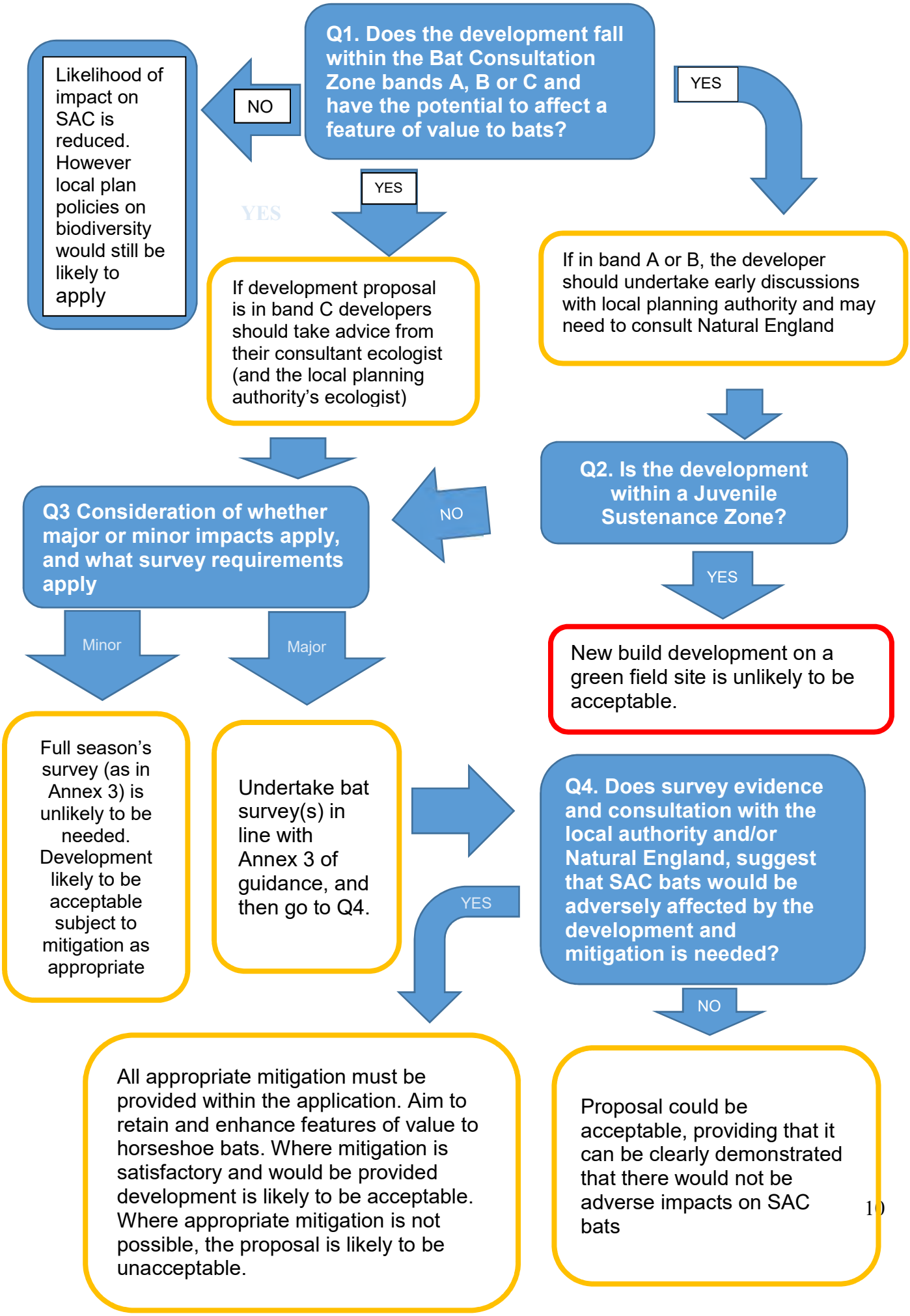
9. Enhancement

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)

[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
YES
If development proposal is in band C developers should take advice from their consultant ecologist (and the local planning authority's ecologist)
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?
YES
New build development on a green field site is unlikely to be acceptable.
NO
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 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 both bat species 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

[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).

[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.

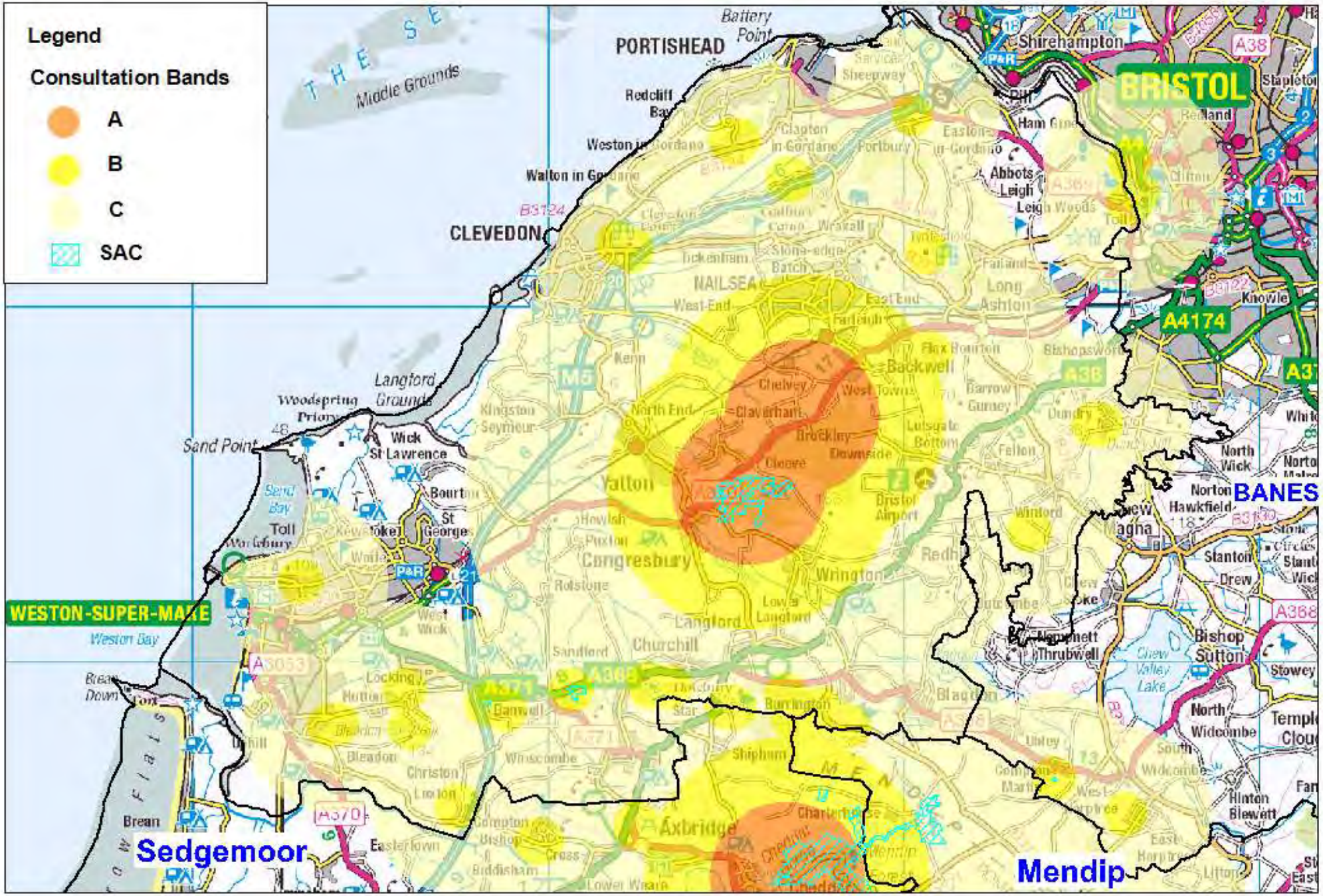
[18] Institute of Lighting Engineers/ Bat Conservation Trust. 2018. *Guidance Note 08/18 Bats and artificial lighting in the UK* https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/

demonstrate that there will be no interruption of suitable SAC bat commuting habitat. Replacement of foraging habitat may be required as appropriate.

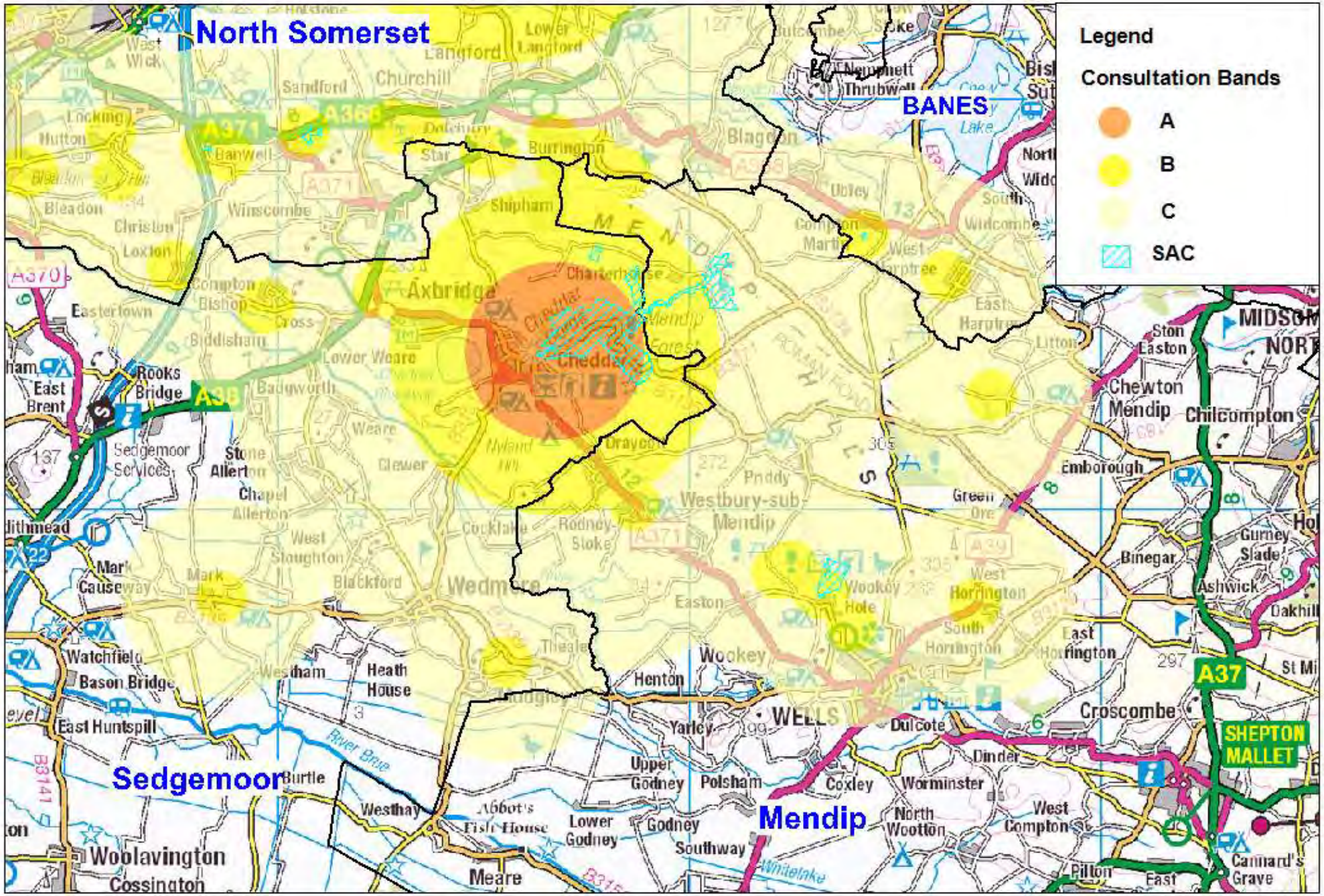
4.18 There may also be situations where mitigation will not be required because the proposed development does not have an impact upon existing (& likely) SAC bat habitat. In adopting this approach, it will be necessary to substantiate this with a suitably robust statement as part of the submission of 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)

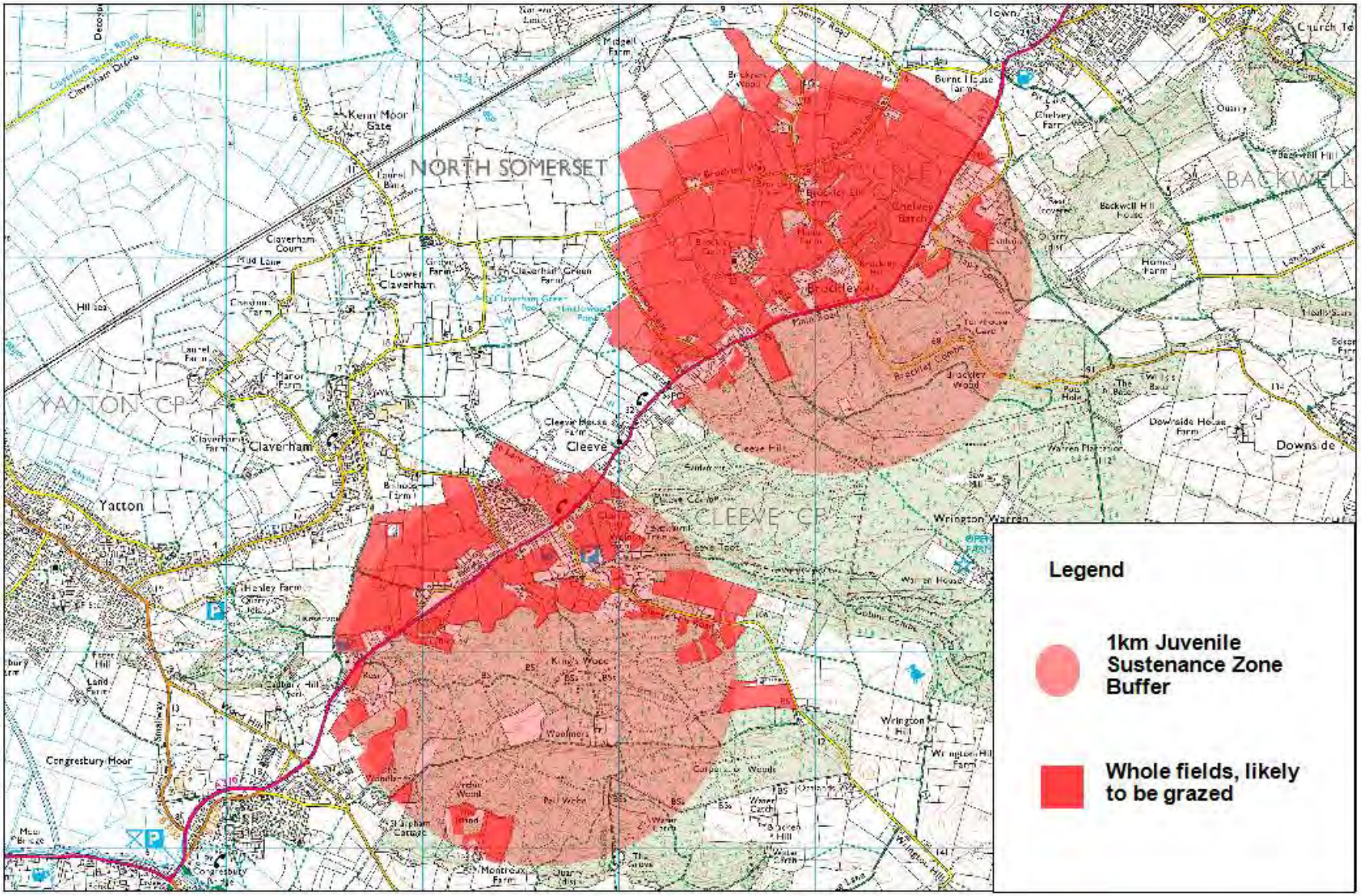
Plan 1: Greater Horseshoe Bat Consultation Zone (North Somerset)



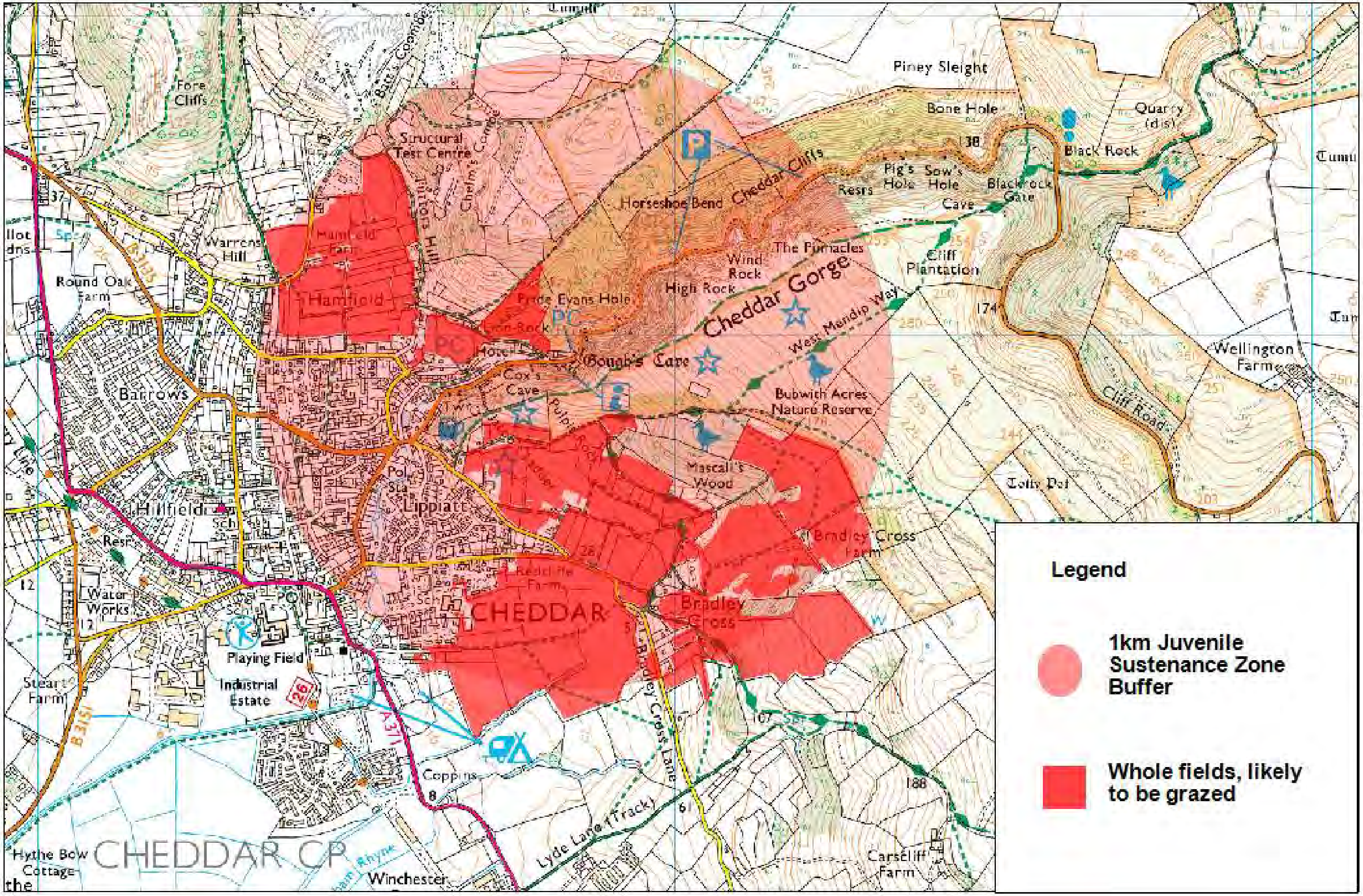
Plan 2: Greater Horseshoe Bat Consultation Zone (Sedgemoor and Mendip Districts)



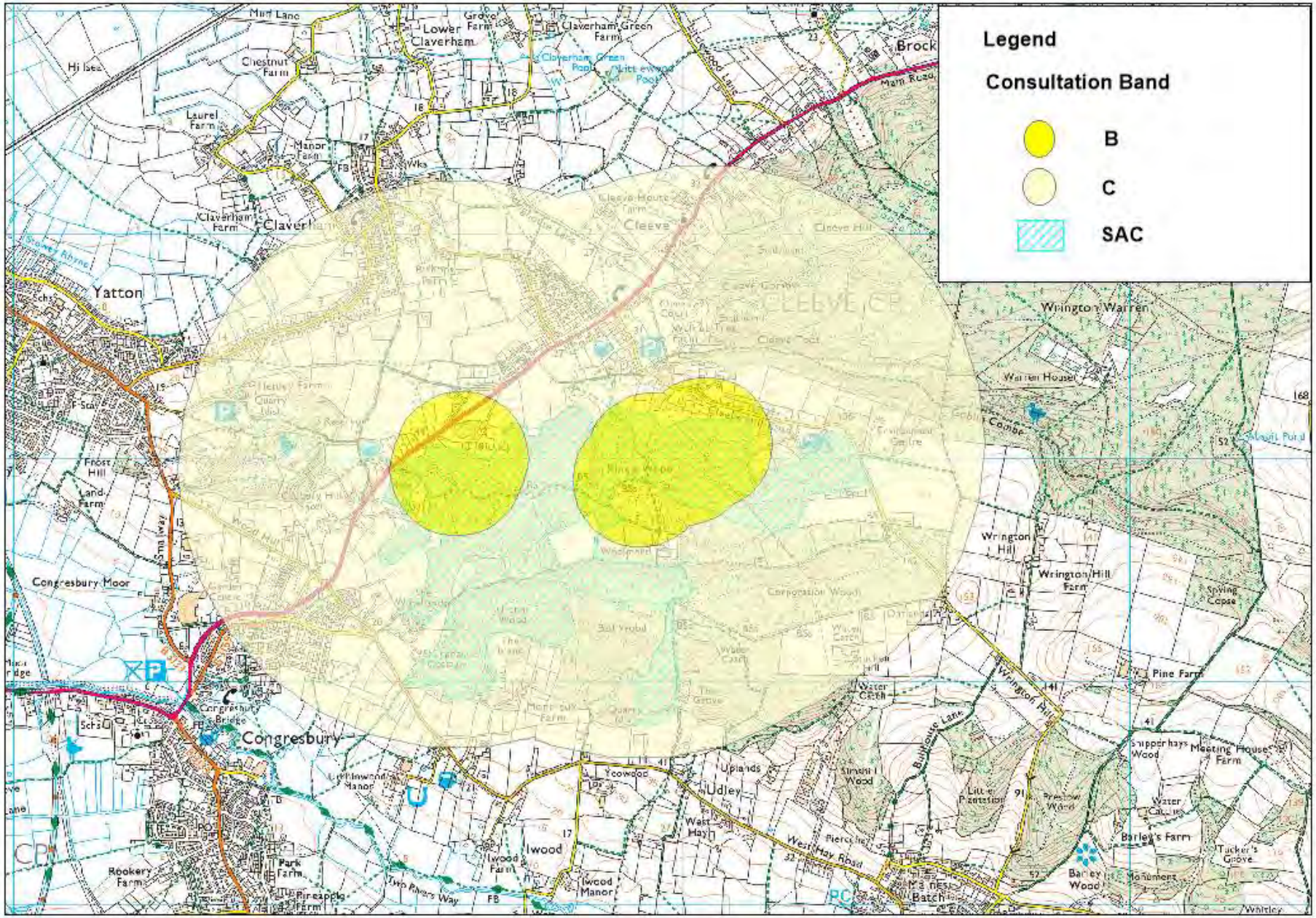
Plan 3: Juvenile Sustenance Zone (North Somerset)



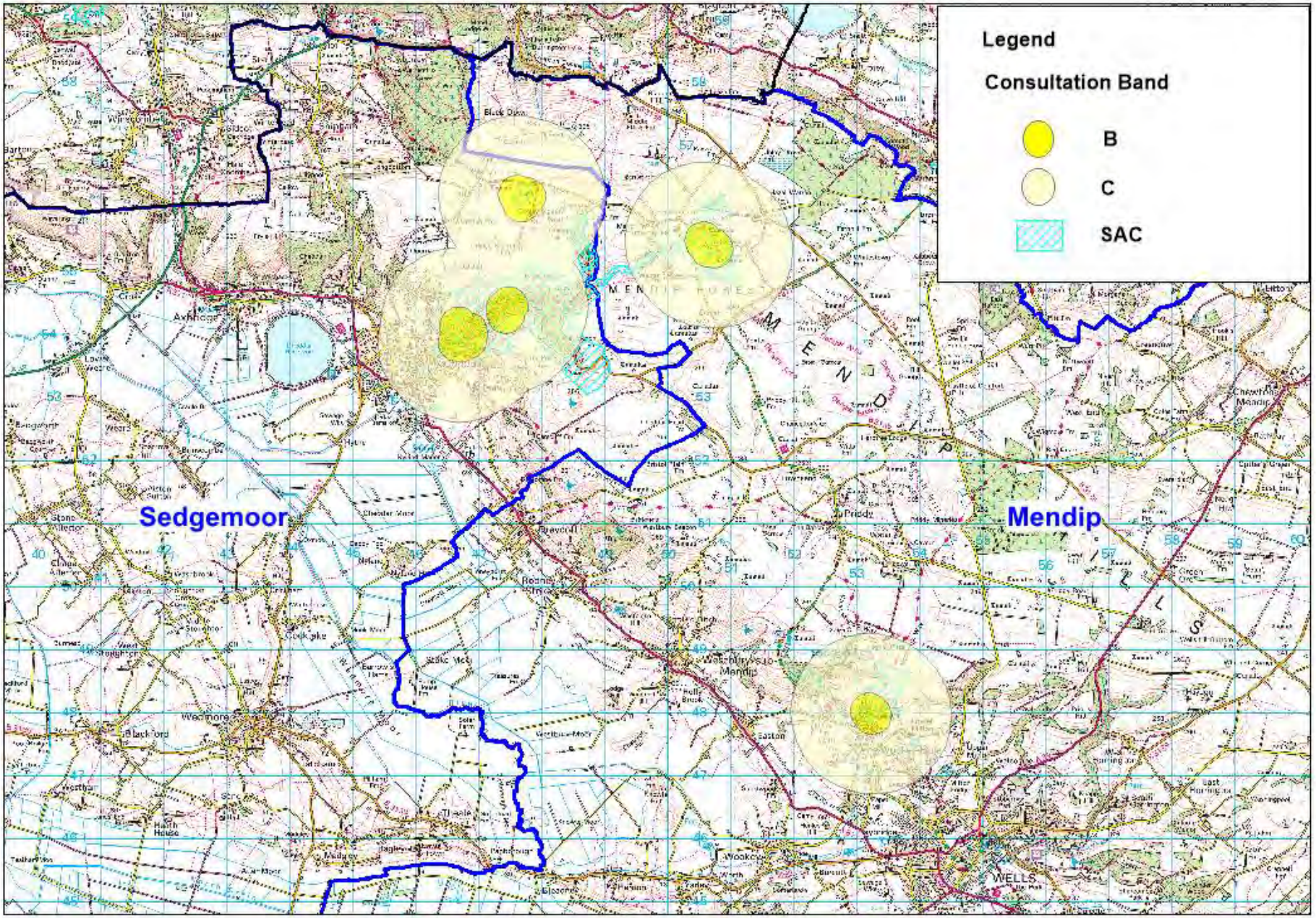
Plan 4: Juvenile Sustenance Zone (Cheddar)



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);

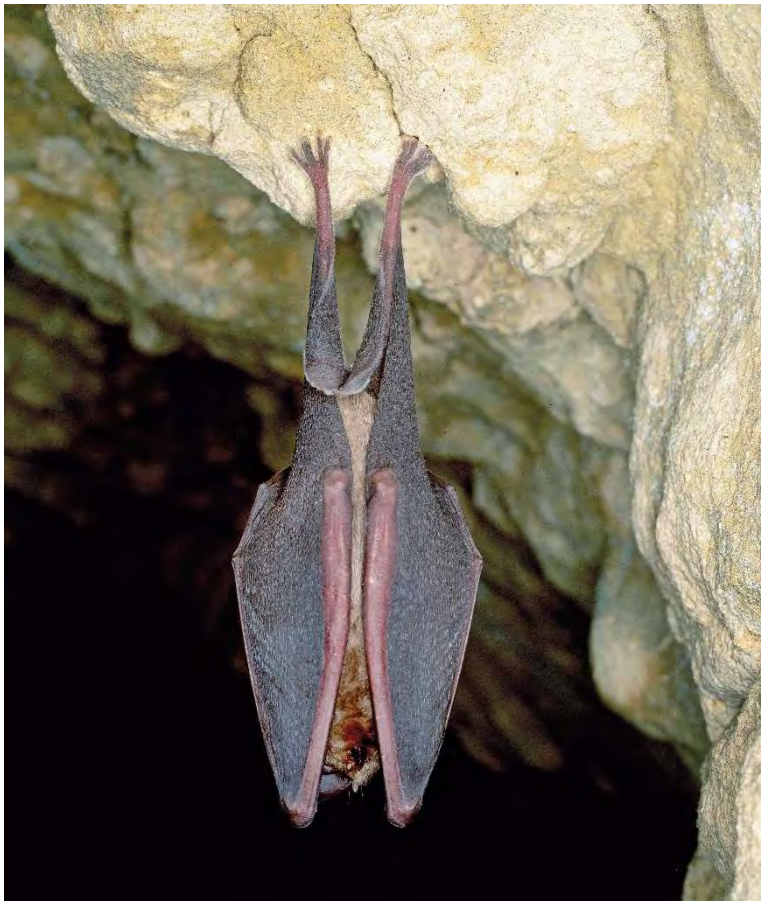
3. SAC bats are sensitive to light and will avoid lit areas[22]. The interruption of a flyway by light disturbance, as with physical removal/ obstruction, would force the bat to find an alternative route which is likely to incur an additional energetic burden and will therefore be a threat to the viability 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

[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)

[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

[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

[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]

Scrub

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]

Others

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

Prey

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,

[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]

Grassland

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

[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

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[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.

[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 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

[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.

Delivery Risk

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*, o*verall 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

[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

[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.

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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			
SC1	Dense/continuous scrub	-3	The Integrated Habitat System considers scrub as a matrix habitat when less than 0.25ha. Otherwise use WB2
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	
LF1	Hedges / Line of trees	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)
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			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) Determined by woodland habitat type 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) 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)
WF0	Unidentified woodland formation	1	
WF1	Semi-natural	1	
WF11	Native semi-natural	1	
WF111	Canopy Cover >90%	0.2	
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	
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	
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			Lesser horseshoe bats hunting and swerving between branches of and in the foliage of coppice, at 1 to 4m high (Motte & Libois, 2002) Clear cutting must be avoided (Motte & Libouis, 2002)
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	
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	
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	
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	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			
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	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	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 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 <u>significantly the local distribution or abundance</u> 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] <u>Annex IV species</u> are defined as 'animal and plant species in need of strict protection.' <u>Annex II species</u> 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'. <u>Annex IV</u> species are listed on Schedule 2 of the Conservation of Habitats and Species Regulations 2010 and includes Lesser Horseshoe bats. <u>Annex V species are</u> '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.

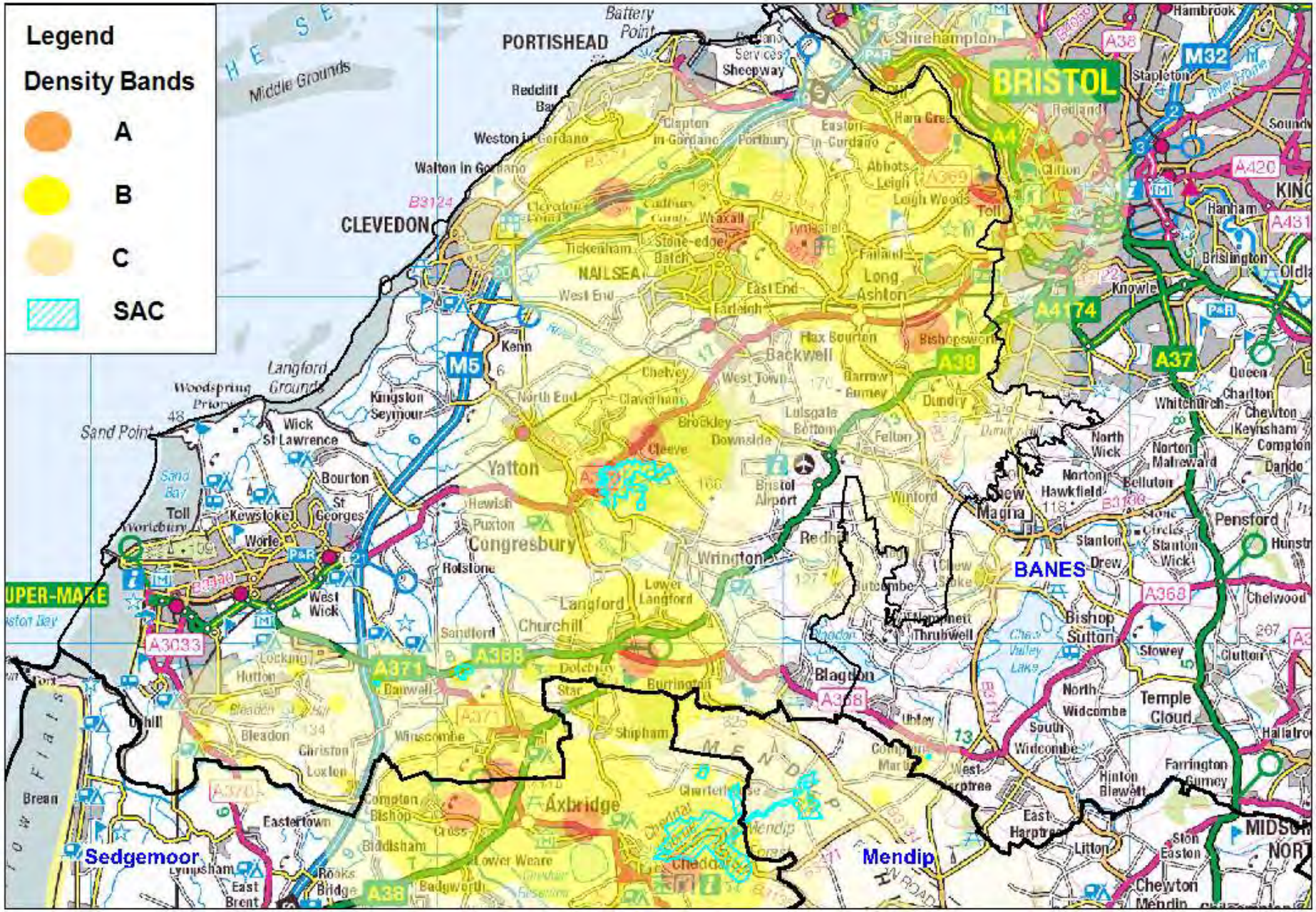
However, this should not be seen as a requirement of every development where EPS are present but, as the Supreme Court makes clear, should be judged on a case by case, species by species basis. Penny Simpson (2011)[133] writes that *"'deliberate disturbance' offence is likely to apply to an activity 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.

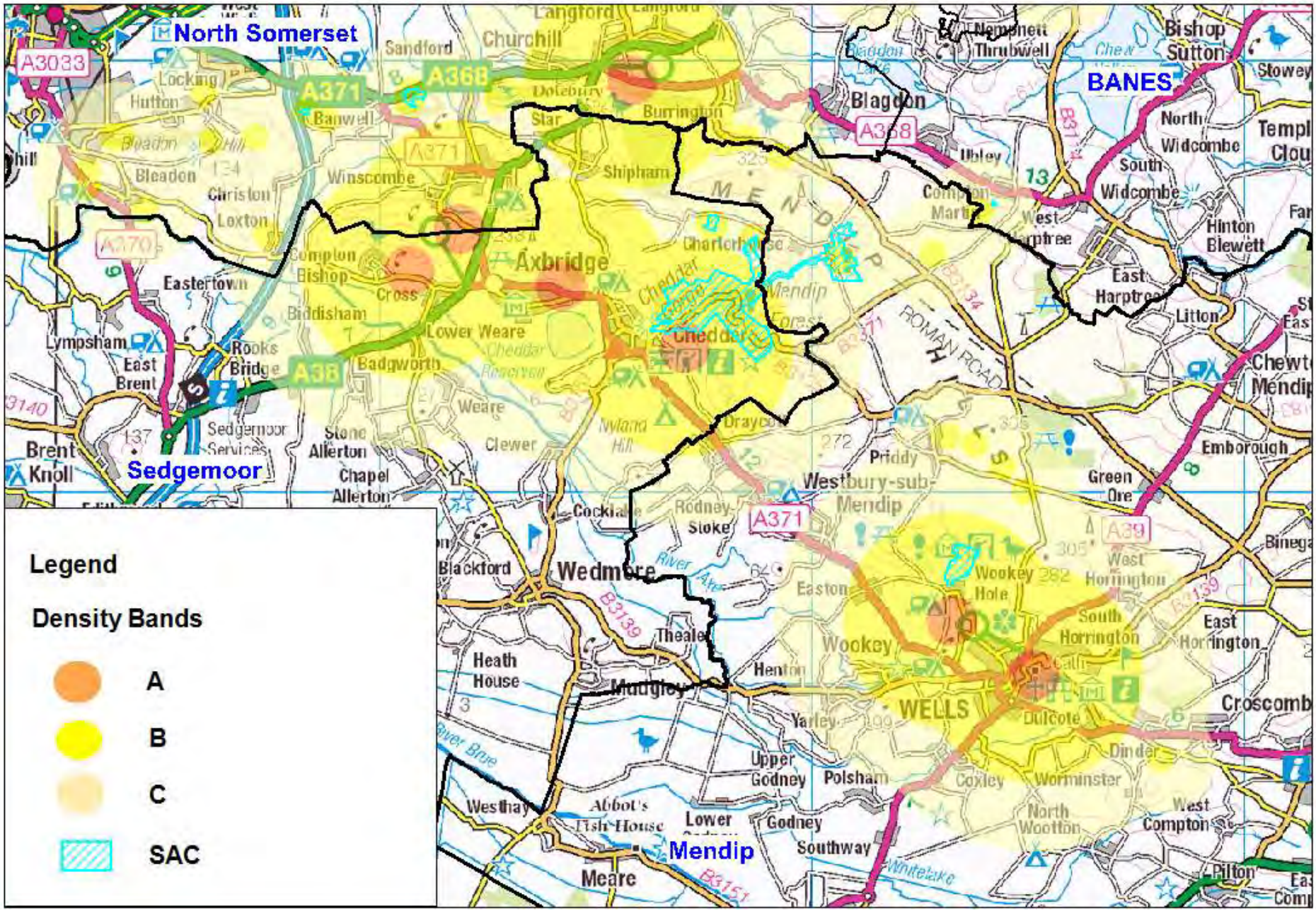
Plans 7 and 8 below show the distribution of known Lesser Horseshoe bats in North Somerset, Sedgemoor and Mendip council areas

[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
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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.

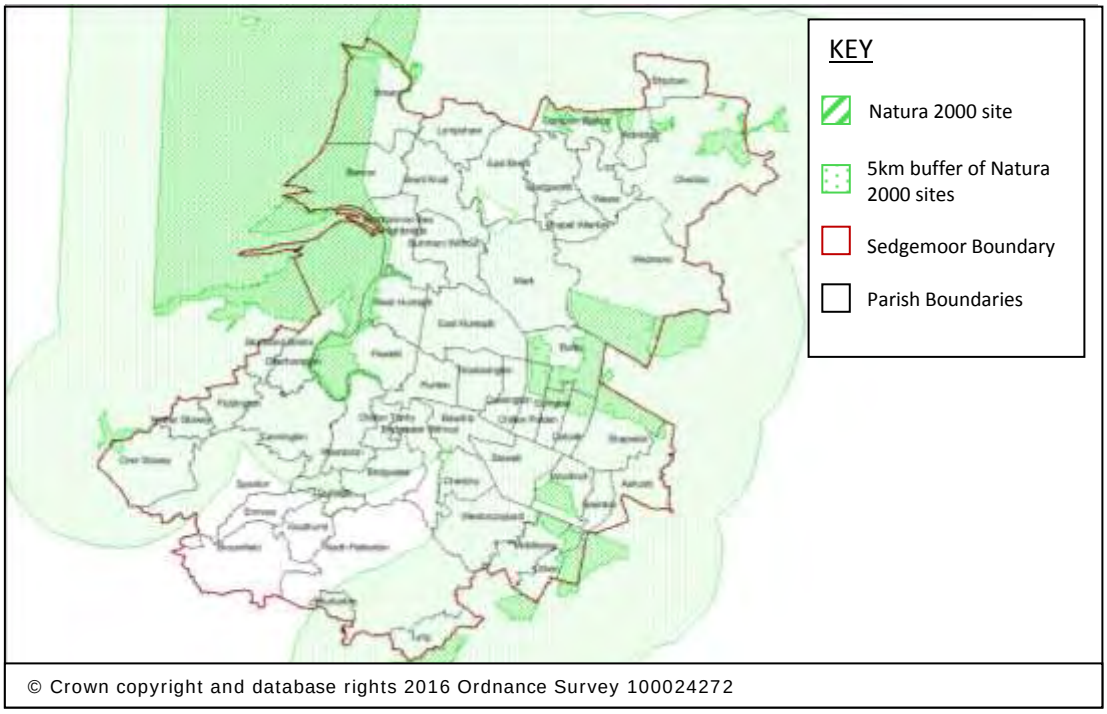


Figure 1 – 5km boundary of Natura 2000 sites

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.

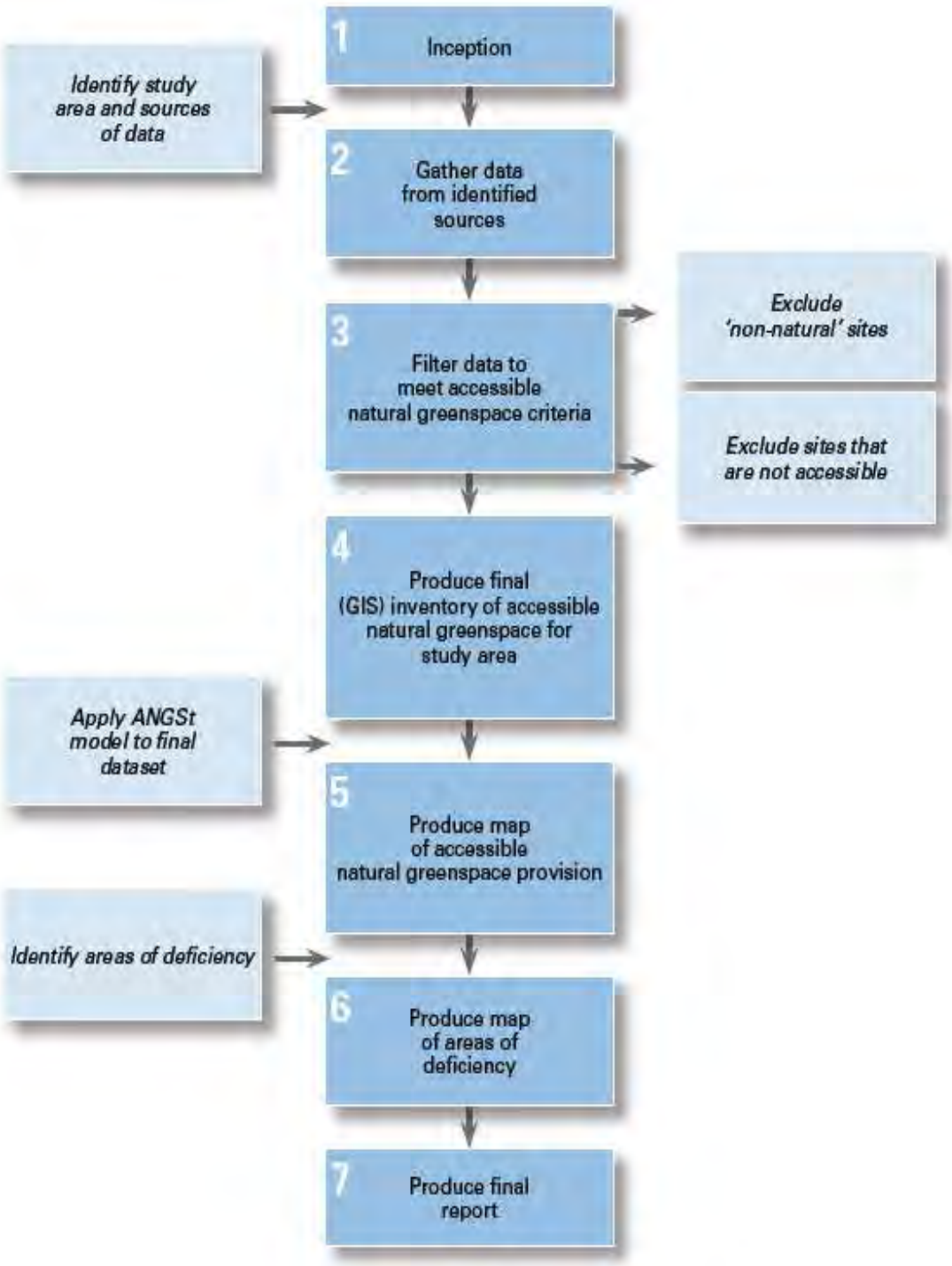


Figure 3.1: ANGSt analysis toolkit (Handley et al, 2003)

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.

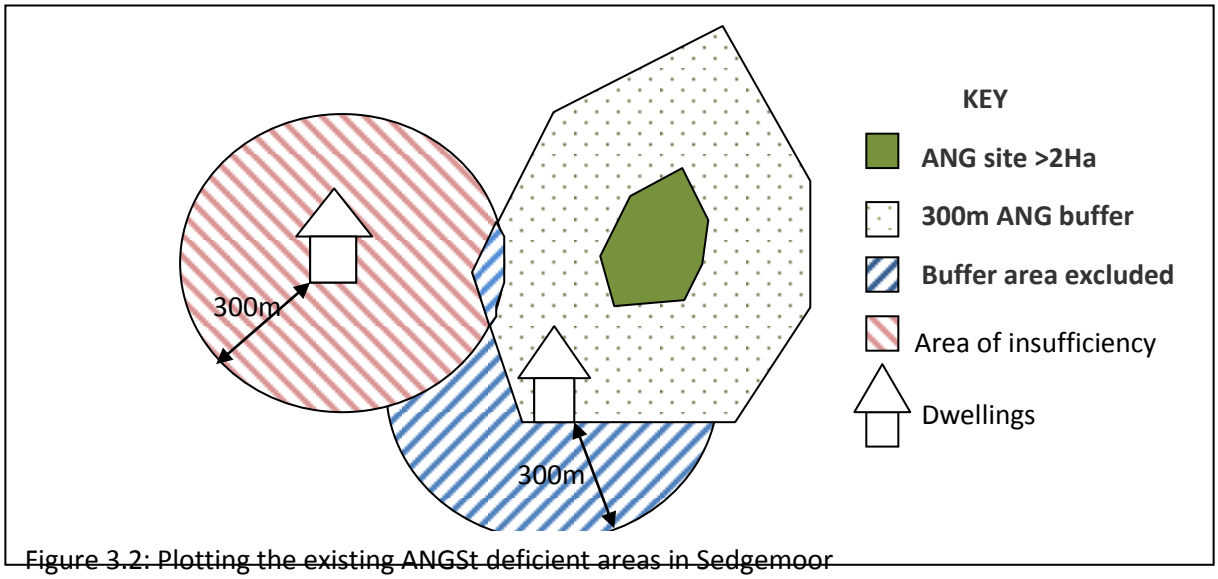


Figure 3.2: Plotting the existing ANGSt deficient areas in Sedgemoor

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

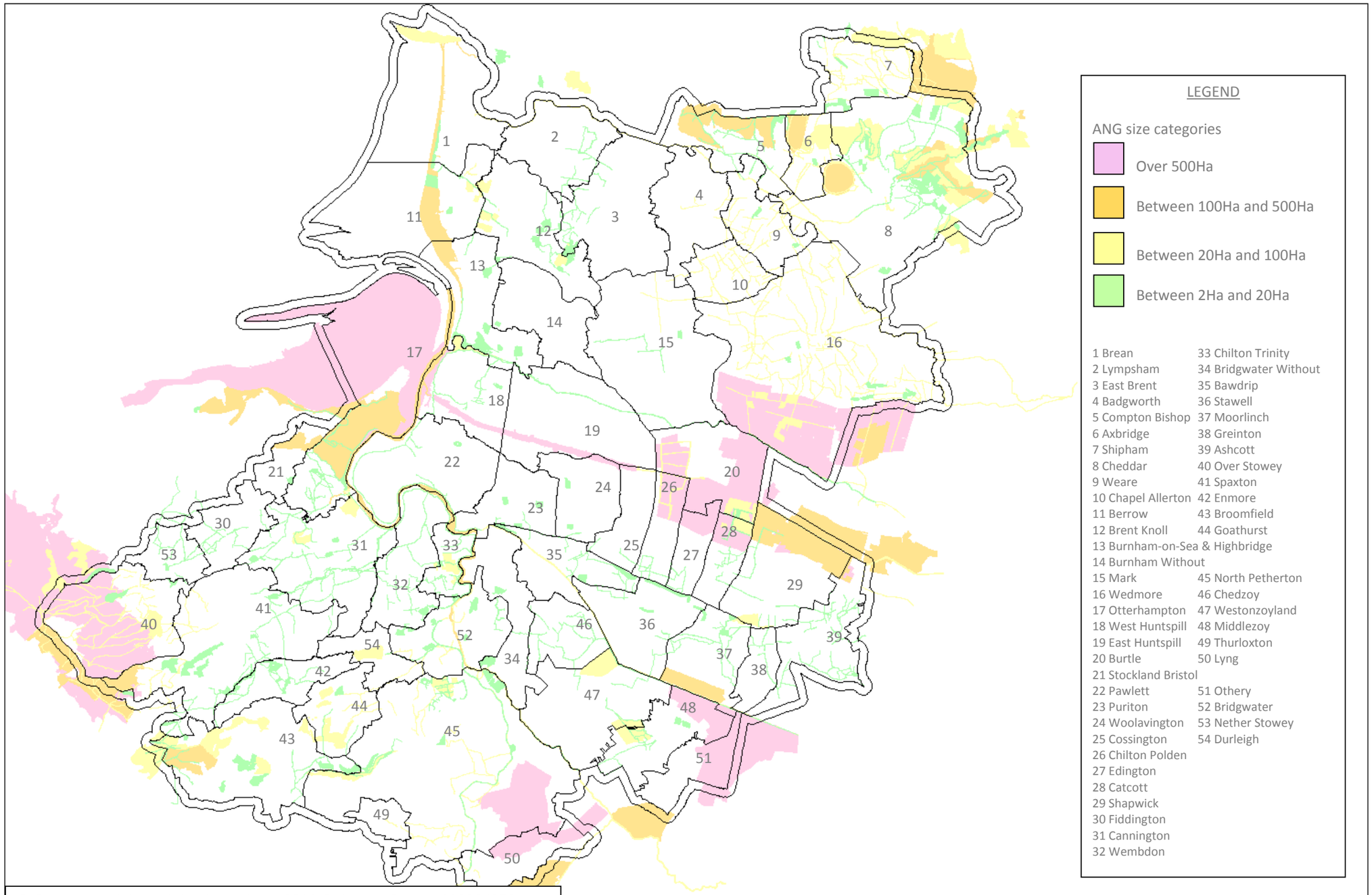


Figure 4.2: Map of the areas in Sedgemoor that do not meet the 2 hectares within 300m standard (insufficiency for existing dwellings)

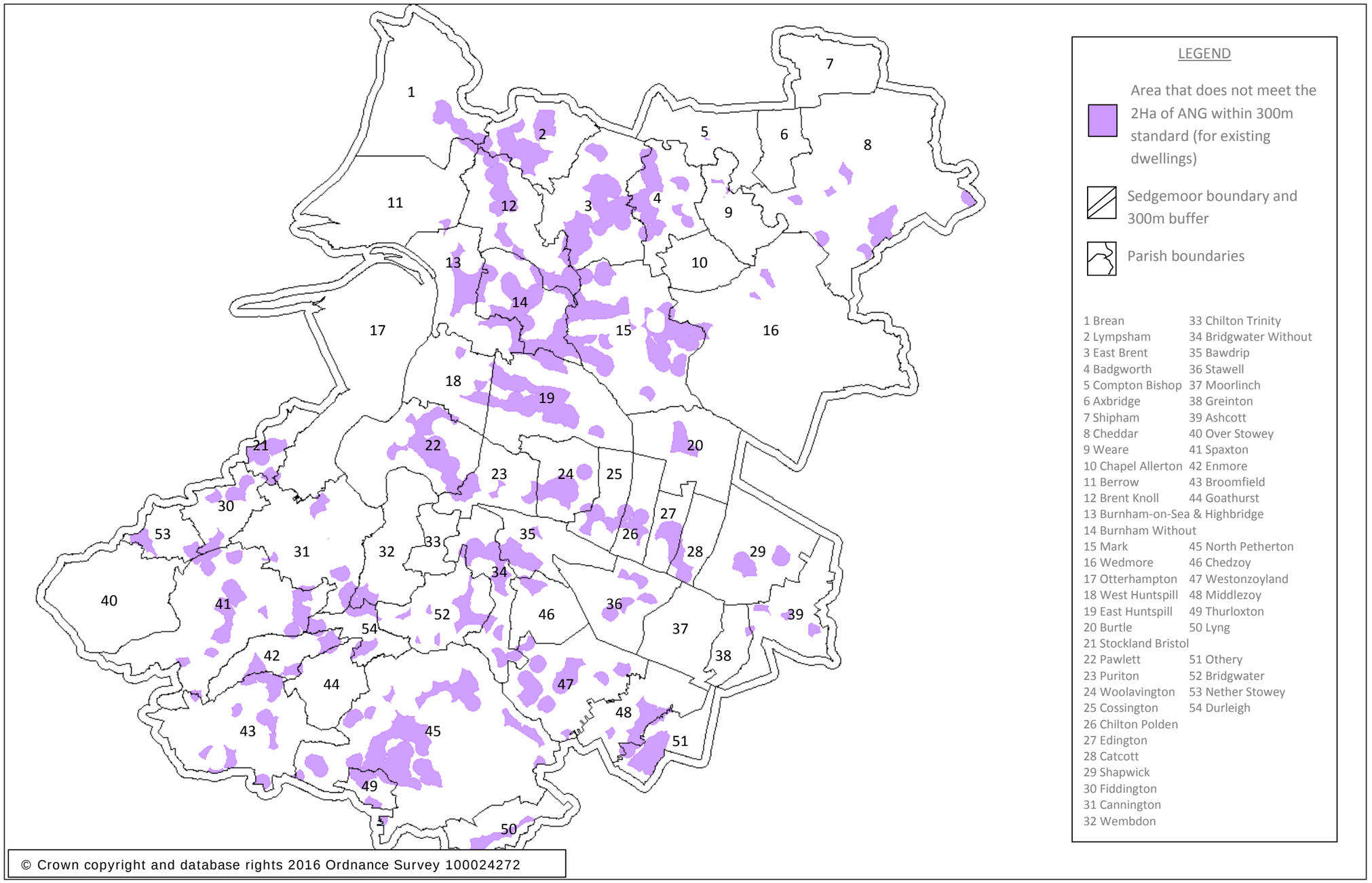


Figure 4.3: Map of the areas in Sedgemoor that do not meet the 2 hectares within 300m standard (for assessing future housing proposals against)

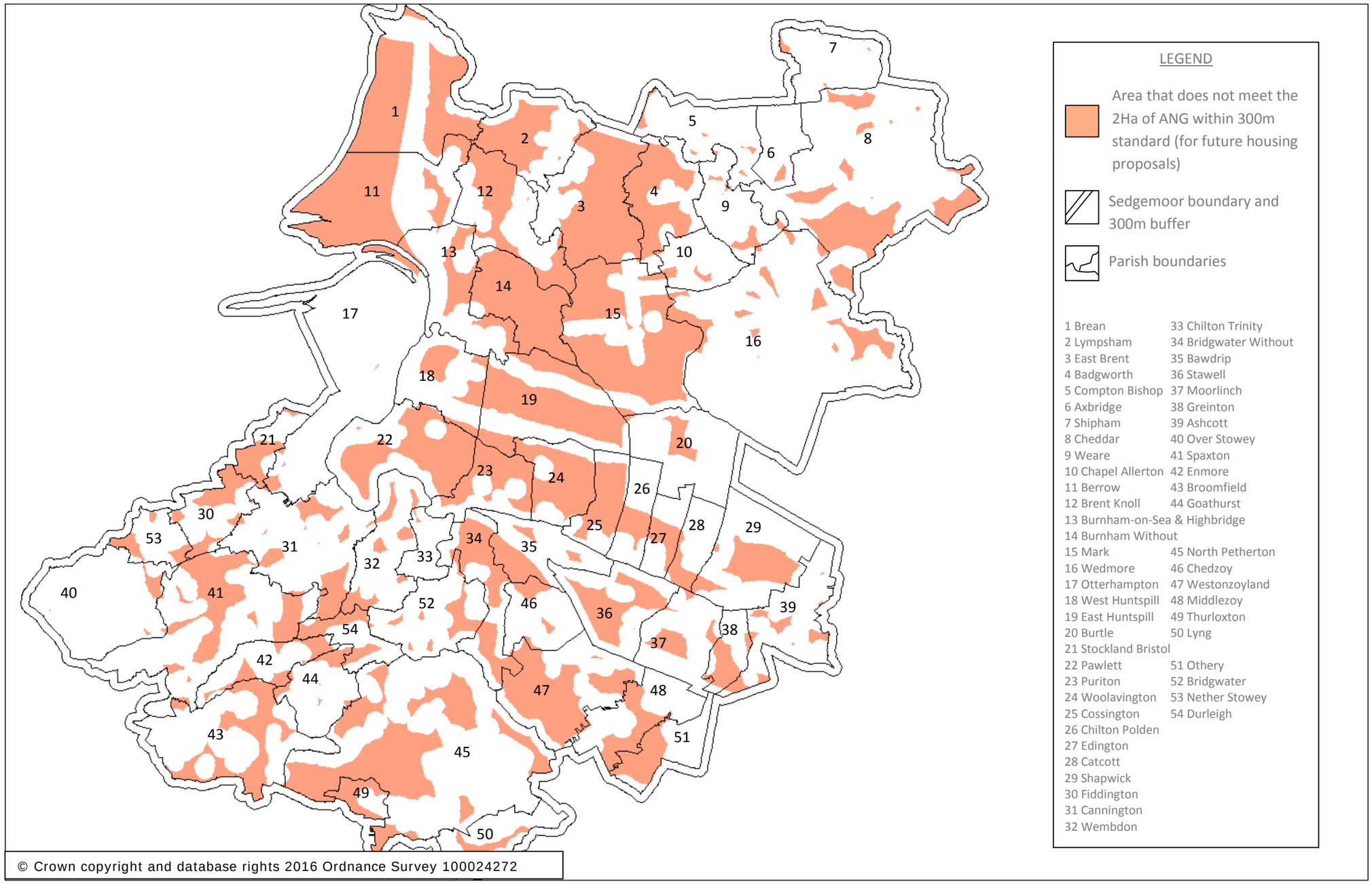
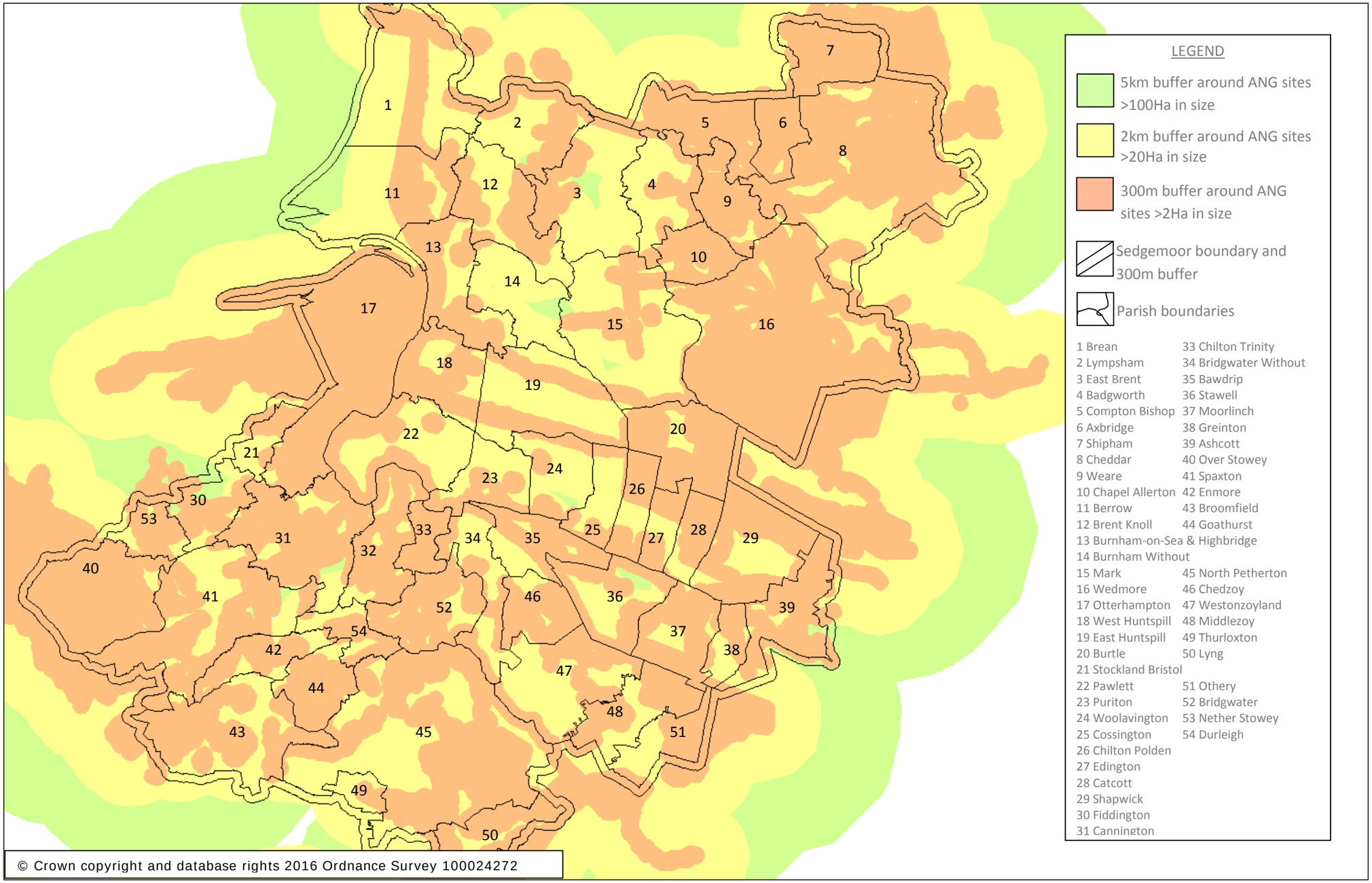


Figure 4.4: Map of the accessible natural greenspace buffers in Sedgemoor



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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