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PROTECTED SPECIES SURVEY REPORT:

RED HALL
SHEPHERD'S LANE
PLAS BOSTOCK
HOLT
WREXHAM
LL13 9SW

Report No: 2016(17)/VC/53CO

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Date: May 2016

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Date of Issue: 23 rd June 2016	

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1 INTRODUCTION

1.1 BACKGROUND

Val Cooper was commissioned to undertake a protected species survey and habitat inspection at the Red Hall, Plas Bostock, near Wrexham. The survey was in respect of a proposed planning application for the site. The Ordnance Survey reference for the site is SJ380528.

The survey was conducted to determine the potential of the site and site buildings to support protected species and where possible, to investigate the presence/absence of these species on or close to proposed development. An inspection and one pond assessment was completed on 5th May 2016. Following this initial inspection a remote recorder, an ANABAT Express, was placed in the barn from 28th May to 3rd June 2016.

1.2 PERSONNEL

Val Cooper is a professional consultant and bat specialist. She has over 18 years experience in surveying and conservation work on mammals and amphibians, and holds licences for surveying bats and great crested newts. She is experienced in preparing and delivering protected species licences. She has a BSc in Zoology/Psychology (Joint Honours) and MSc (with distinction) in Restoration Ecology. She has been a licensed bat worker and member of the Cheshire Bat Group since 1994. She works as a Voluntary Bat Warden for Natural England and participates in the annual National Bat Monitoring Programme of the Bat Conservation Trust. She holds a Class 2 survey licence for bats reference: 2015 13095 CLS, Class 1 for great crested newts (ref 2015-17464-CLS-CLS) and Class Survey Licence WML-CL29 for barn owls number CL29/00135. She is a full member of the Chartered Institute of Ecology and Environmental Management. She holds a Welsh bat licence from NRW, number 71872:OTH:CSAB:2016

Bobby Smith is an ecologist with a BSc in Ecology and Conservation Biology. He has over 3 years' experience in surveying UK protected species including bats, great crested newts, birds and badgers. He has carried out field research in tropical ecosystems and marine environments whilst on location in Central America. He holds Class 1 bat licence from NE and a class 1 GCN licence.

1.3 PROPOSED WORKS

The south section of a brick barn is to be refurbished to provide one dwelling.

1.4 AIMS OF STUDY

The surveys were conducted to investigate the status of the site in respect to protected species. It was to:

- gather information to make an informed assessment as to the use of the site by protected species
- inform an assessment of potential impacts on any species found on site and establish whether there may be a requirement for further survey work to achieve this
- establish the potential for the presence / absence of protected species on the site
- assess the requirement for a European Protected Species Licence (EPSL) for the development.

Any other protected species issues were identified and addressed.

2 SITE DESCRIPTION

2.1 SITE LOCATION AND AREA

Red Hall is situated in a rural location 2.5km from Wrexham in the west and Holt, a small village, in the east. It is along Shepherd's Lane, just off the main Wrexham to Nantwich Road, A534. The landscape is agricultural, with open fields bordered with hedgerows and occasional trees.

The existing location plan is shown in **Figure 1**.

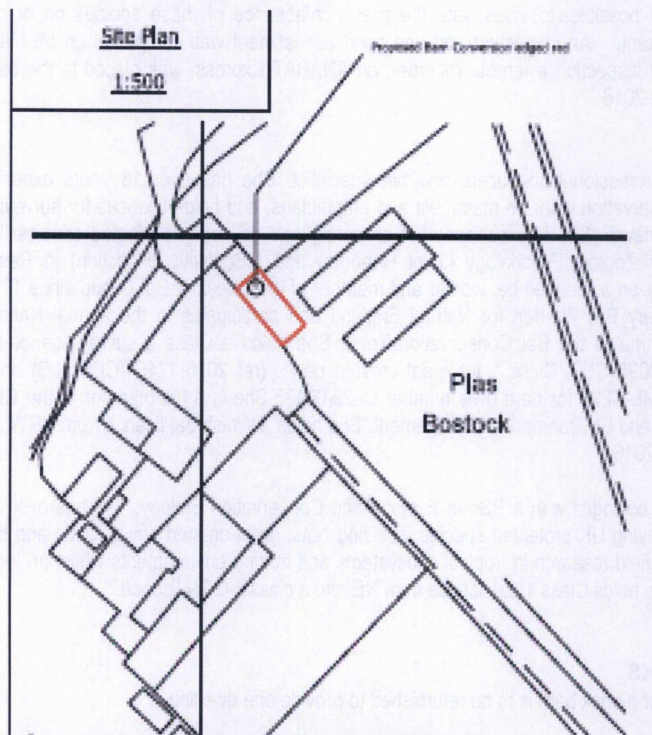


Figure 1: Existing site plan at Red Hall, Plas Bostock

2.2 SITE BUILDING

- 2.2.1 The barn was a single storey section of a barn situated at the NE side of the yard. It had another section at the north end, which was 2-storey. This is not part of the proposal and was not included in the survey.

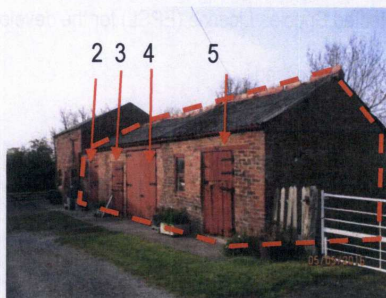


Figure 2: Barn showing section surveyed



Figure 3: south gable

2.2.2 The barn walls were double skin brick with no cavity. The roof was pressed corrugated sheeting on wooden supports, with an open double ridge beam (**Figure 4**). There was no internal lining.

2.2.3 There were 4 compartments. These were numbered 2, 3, 4 and 5 for ease of reference to a previous report (see Section 4.1.4). Two, 3 and 4 were separated internally by partial dividing walls (**Figure 5**). Two, 3 and 5 were empty and 4 was in use as a garage (**Figure 5**).



Figure 4: Internal double ridge



Figure 5: partial internal brick walls



Figure 6: entire wall, Compartment 2



Figure 7: Sealed edges on eaves

2.2.4 The wall between 4 & 5, and 2 and the adjoining two-storey section was complete to the apex (**Figure 6**). The roof edges at the eaves on the east side were sealed with mortar (**Figure 7**).

2.3 GROUND AREA ON SITE

The barn was in a concrete yard. There were several other buildings on the property, including a farmhouse and a residence, which had been converted from a barn to a single dwelling. The entire ground area was hard-standing. There is a grass field to the east and south sides. This abutted the target barn at the south all and part of the east (**Figure 8 & 9**). Some materials were stored against the barn walls at these sides.



Figure 8: wall between end north compartment



Figure 9: Sealed edges on eaves

3 SURVEY METHODOLOGY

3.1 DESK STUDY

Connective lines, large water bodies and woodland areas were identified within 1km of the site. All water bodies within a 100m and 250m radius of the site of the proposed development site were identified. Potential commuting lines, watercourses and connectivity between ponds were identified from OS maps and aerial photographs provided by Google Earth. The connectivity of these water bodies was assessed.

3.2 FIELD SURVEY

3.2.1 Bats

1. Inspection visit on 5th May 2016

An inspection visit was undertaken by Val Cooper and Bobby Smith. The following protocol was used:

- Checking the exterior of the building for signs of bat entry / exit points; such as staining from urine and oils or excessive scratching.
- Checking the building exterior for droppings, especially on ledges and under the potential access/egress points.
- Checking the interior of the buildings for droppings and feeding remains, any staining on beams, cleared patches of cobwebs and for the bats themselves (both hanging and in crevices).
- Noting all potential access points and roosting opportunities for bats and examining them thoroughly. Any inaccessible points are noted and recorded as a constraint of the survey.

Binoculars and ladders are used as an aid in searching for high access points of entry and exit. All small, accessible crevices were examined with a powerful torch and endoscope for evidence of roosting bats.

2. ANABAT remote recording 28th May to 3rd June 2016

A remote recorder, an ANABAT Express, was positioned inside compartment 2 of the single-storey section for the stated period to record any bat activity. Additional checks for bat droppings were made on 28th May and 2nd June 2016.

3.2.2 Great crested newts (GCN)

1. Pond location, habitat and connectivity

The surrounding habitat was examined for suitability and potential for use by great crested newts assessed. Where appropriate, distance and connectivity between proposed sites, ponds and to other ponds outside the 500m radius were assessed by maps and aerial photographs during the desk survey, and during the site visit. Potential dispersal routes were identified.

2. Pond Survey

One pond was assessed for suitability as habitat for great crested newts on the following criteria:

- size
- permanence of pond
- water quality
- percentage shade
- presence of wildfowl
- presence of fish
- pond density
- suitability and availability of terrestrial habitat
- abundance and type of emergent / submerged vegetation

3. Identification of potential refuges, foraging areas on site

The area of the proposed conversion was inspected for potential usage by great crested newts, around and inside any structures on the site. The immediate area around the proposed development site was assessed for their suitability as GCN habitat and potential use of the whole site for commuting, foraging and land refuges.

3.2.3 Other species

The buildings and site were inspected for use and potential for use by breeding birds and badgers.

4 SURVEY RESULTS

4.1 DESK STUDY

- 4.1.1 There is a substantial woodland to the west of the site at approximately 200m. The landscape is generally very exposed low hedgerows and occasional hedgerow trees.
- 4.1.2 Two water bodies (WB) were identified in 250m of the site:
WB1 was 140m to the WSW
WB2 was 169m to the east.
- 4.1.3 Five other water bodies were located in 500m. All were distant and poorly connected. The proposed development is small and on hard-standing. It was assessed that there would be no potential for impacts. Therefore, these were discounted.
- 4.1.4 There has been a previous survey on the site (Bayley, 2008). This identified the presence of night feeding activity by what was identified as brown long-eared bats, in 3 compartments of the target barn (2, 3 and 5). The number and age of bat droppings found was not stated. The photographs indicate small amounts. The 2008 survey included the other buildings on site, some of which have now undergone conversion. Brown long-eared activity was noted in 2 of the other barns, named Barn 1 and 2.
- 4.1.5 Anecdotal evidence from Mr Davies, the site owner, is that the upper storey of the 2-storey section at the north end of the barn was reserved for use by bats and nesting birds. No documented evidence could be located in relation to this. The site has been partly developed and the original survey did state that an EPS licence would be required prior to start of works on the site.
- 4.1.6 In 2008 some great crested newt survey work was done on 3 ponds at 140m, 169m and 455m. A fourth pond was looked at but it is not clear where it was. No signs of GCN were found and ground searches around the site found no GCN or any other amphibians (Bayley, 2008).

4.2 FIELD SURVEY: BATS

- 4.2.1 No bat droppings were found in any of the compartments on 5th May, 28th May and 2nd June 2016.
- 4.2.2 The wall and floor area in Compartment 2, where evidence of BLE feeding activity had been found in 2008 showed no signs of bat droppings or bats. This was the shared wall with the 2-storey barn, where there is possibly some bats roosting.



Figure 10: floor and wall area in Section 1. Bat droppings were found here in 2008 and it was concluded that a feeding roost may be present.

- 4.2.3 No bat droppings or feeding remains were found in any of the other compartments on any of the inspections.
- 4.2.4 The structure of the barn provided no crevice roosting opportunities for day roosting bats.
- 4.2.5 The interiors of the compartments were very light, giving them poor potential for day-roosting hanging bats.
- 4.2.6 There was no evidence of use by bats of any of the compartments. The floors were clear, but there was no evidence of sweeping between the visits made.
- 4.2.7 Potential access points are limited to the gaps above doors, gaps in the ridge and a small gap at the south gable end.



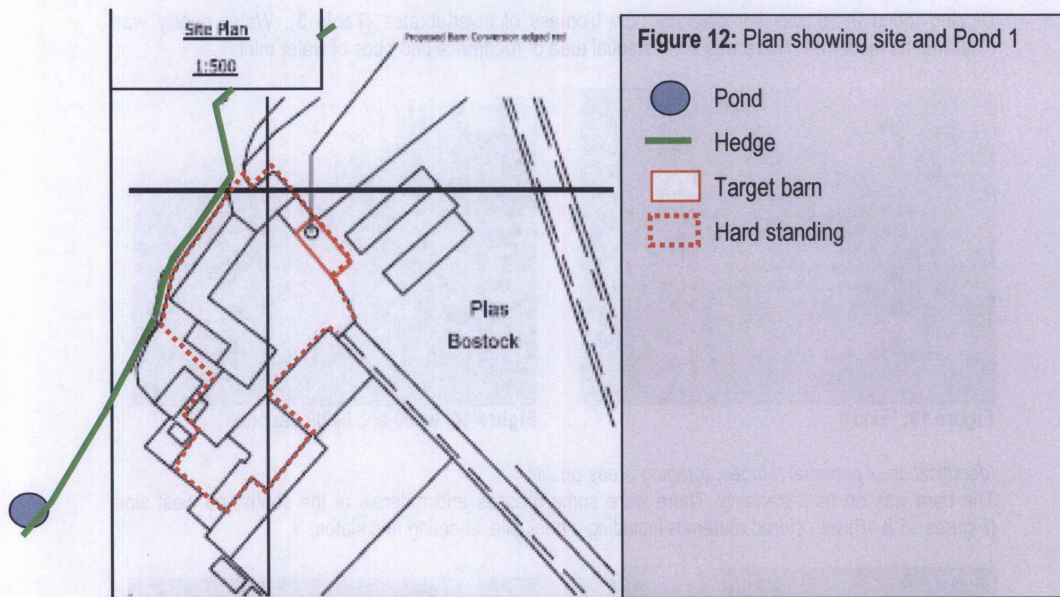
Figure 11: potential access points for bats

- 4.2.8 *ANABAT recordings 28th May to 3rd June 2016*
No bat calls were recorded at all during the 6-night deployment of the ANABAT Express recorder.

4.3 FIELD SURVEY: GREAT CRESTED NEWTS

4.3.1 Pond location, habitat and connectivity

Pond 1 was located along a hedge row 140m to the WSW of the barn (**Figure 12**). The connectivity to the site itself was good, but there were a number of buildings and a large hard-standing area between the target barn and the connecting hedge.



All other ponds within 500m were poorly connected and were not assessed.

4.3.2 Pond Survey

The Habitat Suitability Index (HSI) for GCNs was calculated for one water body. The results are given in **Table 2** below. These were based on the value of the 10 parameters. Water quality is assessed from invertebrate sampling (**Table 3**).

Table 2: HSI score for Pond 1 (Figure 14)

Pond parameter	Pond 1	
	score	Parameter description
SI1 - Location	1	Lowland Cheshire
SI2 - Pond area	0.6	300m ²
SI3 - Pond drying	0.9	permanent
SI4 - Water quality	0.67	moderate
SI4 - Shade	1	50%
SI6 - Fowl	0.67	minor
SI7 - Fish	0.67	possible
SI8 - Ponds	1	14+ponds
SI9 - Terr'l habitat	0.67	moderate
SI10 - Macrophytes	0.8	55%
Index score	0.78	Good

Table 3: dipping results at Ashton House (Pond 1)

Invertebrate/vertebrate	families
Hoglouse	1
Dragonfly larva (one only)	1
Mayfly nymphs	1
Greater water boatman	1
Phantom midge	1
Leech	1
Flatworm	1
Water flea	1

HSI Score Pond Suitability

< 0.5 Poor
 0.5 – 0.59 Below average
 0.6 – 0.69 Average
 0.7 – 0.79 Good
 > 0.8 Excellent

Pond 1 (Figure 13) was a water body approximately 300m² in area. The terrestrial habitat is classified as moderate. There are areas of good habitat immediately around the pond. However, beyond that was an arable field. There was a substantial tract of woodland directly adjacent at the west side.

Dipping found there was fair diversity, low biomass of invertebrates (**Table 3**). Water quality was classified as moderate. There was a substantial area of reedbed and beds of water mint.



Figure 13: Pond 1



Figure 14: wood and field near pond

Identification of potential refuges, foraging areas on site

The barn was on hard-standing. There were some grasses and ruderals at the south and west side (Figures 15 & 16) with stored materials including a brick pile, sheeting and slates.



Figure 15: east side of barn



Figure 16: south edge of barn

The interior of the barn was a concrete flooring. There were a few gaps beneath the doors, but these led into the concrete floor areas. The east edge had some vegetation along the wall edge (**Figure 15**), but no gaps into the wall were identified here. A small gap at the west side (**Figure 18**) was examined. It had very little depth and nothing was found in the crevice.



Figure 17: east side of barn

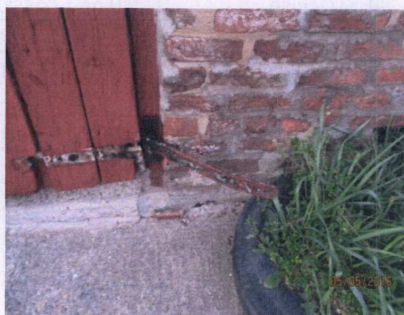


Figure 18: south edge of barn

4.4 FIELD SURVEY: NESTING BIRDS

There was evidence of nesting swallows in 2008. This was not evident in 2016, but there were some remnant nests. No active nests were seen.

5 ASSESSMENT

5.1 CONSTRAINTS OF SURVEY

- 5.1.1 Surveying for bats at a specific season of the year does not provide information of use of the site by bats at other times of the year. Whilst consideration may be given to roosting at other times, there may be no evidence for this outside the survey period.
- 5.1.2 Small roosts and single roosting bats can easily be overlooked. They can be difficult to detect during inspection as they leave few field signs and can be missed entering/leaving buildings during activity surveys. External signs are subject to weather and damp conditions, which may remove them.
- 5.1.3 No emergence surveys were undertaken. Emergence surveys are useful in providing some information on the use of buildings by bats and to determine their presence. Bats are known to change roosts throughout a season and even from night to night. Absence on surveys can indicate the position for a specific point in time. **However, in this instance, when no bat droppings or other evidence was found, it was considered more value to place a remote recorder, as there was no evidence of presence at the time of the inspection survey.**

5.2 CONCLUSIONS

5.2.1 Bats

Conclusions are:

- There is at present no evidence that bat species are using the structures on site to roost or for any other purpose
- The apparent night roosting area may have been transitional, historic or may have been an overspill from the 2-storey section
- The barn had very poor potential for use by roosting bats, with no enclosed crevices such as the ridge or cavity walls
- The interior had no day roosting potential for open-hanging bats due to the high light level in the compartments. There was no evidence of any such roosting in any of the compartments
- The proposed development will not result in the destruction of any roost site or, on present evidence, disturbance of bats
- The historic evidence indicates that the building may have been used by bats, but this use is not recent or ongoing. However, bats can move between sites over different years and activity periods. Therefore, it will be required that best practice measures will be used during the development and measures taken to ensure no potential for short-term and post-development impacts
- The site has been partly developed and anecdotal evidence from the owner, Mr Davies, is that the upper floor of the 2-storey section at the north end of the barn has been reserved for bats and nesting swallows. In the absence of any known documentation it will be recommended in the mitigation section of this report.

5.2.2 Great crested newts

The potential for great crested newts to be using the site is very low to zero. This is concluded because

- Although connectivity to the site is fair, the identified lines of potential dispersal if GCN were present in the pond, are towards the woodland in the west and along the hedge row that crosses the north edge of the site, separated from the target barn by a concrete area
- Much better habitat is readily available to the west and NW of the site
- The proposed site has very limited refuge potential for GCN, with all buildings being set on hard-standing and vegetation areas limited
- The potential for short-term impacts is classified as low. Any possible impacts due to disturbance of individual newts on the site may be avoided by reasonable avoidance measures

- Long-term impacts are classed as zero. There is very small area of potential GCN habitat that would be lost (the small grass area at the side of the barn), no ponds are to be impacted on and the nearest pond is over 100m away
- **Although it is considered very unlikely that great crested newts will be found during work, if any are discovered then all work must stop and a qualified consultant, licensed for great crested newts, must be contacted and their advice followed. Failure to do so may result in an offence under the legislation detailed in Appendix 1.**

5.2.3 Barn owls

Barn owls are not present in the structures and there is no evidence of any use by them of site structures.

5.2.4 Nesting birds

Swallows have not recently used the barn areas. The upper storey barn at the north end was stated as being an area reserved for birds (anec. 2016, Mr Davies).

5.2.5 Other species

No other protected species were identified as using the site.

5.3 PRE AND MID-TERM POTENTIAL IMPACTS

5.3.1 Bats

Bats can move from site to site over the period of a year and from year to year. No recent evidence is present but there was historic evidence of limited use. Therefore, there is a low potential for possible disturbance, if bats return to the site in the near future.

5.3.2 Great crested newts

There is a very small potential impact for disturbance, injury or death through the possibility of amphibians crossing the plot.

The potential for short-term impacts is assessed as very low because:

- It is very unlikely that GCN are crossing the plot. Routes are more likely to be to via the hedge heading west to the woodland, or east past the site
- The refuge potential on the plot is very small, with much more attractive and suitable habitat to the NW and west of the pond and in the hedge to the north side of the site, which is to be retained.
- Although the pond has good suitability for GCN there is a lack of connectivity to other ponds making the potential for dispersal very low
- Even if GCN are present it is considered that the low risk may be addressed by the use of reasonable avoidance measures during the development
- Any potentially sensitive activities, such as the removal of the shrub bed, can be timed to minimise any risk of finding GCN present on the site.

The potential for impact is assessed as small and it will be addressed by mitigation measures. It is concluded that any potential impacts can be mitigated by using best practice, including reasonable avoidance measures (RAMs), during the development work.

5.3.3 Barn owls

There are no impacts foreseen at this time.

5.3.4 Nesting birds

There is potential for the outbuildings to be used by nesting birds, though no active nests were found. There is potential for impact if work begins in the nesting season of March to September.

5.3.5 Other species

No impacts are foreseen at this time.

5.4 LONG-TERM POTENTIAL IMPACTS

5.4.1 Bats

It is assessed that on present evidence the development will not have any long-term impact on bats and will not adversely impact on

- i) the ability of any significant group of animals of that species to survive, breed or rear or nurture their young, or
- ii) the local distribution or abundance of the species.

There is a small potential for increased disturbance post-development due to additional external lighting for the new dwelling. This will be considered in the mitigation section.

It has been established that bats are active on or very close to the site and are likely to be using the trees nearby to feed. Bats are very mobile and change roost areas during transitory periods of the year, taking up short-lived opportunistic roosting places. Roosting potential was identified as poor, but it is advised that best practice is used during roof removal on developments on a site where bats are known to be active.

5.4.2 GCN: Habitat loss

There is no impact identified in respect of habitat loss. The areas of the development have been identified as poor GCN habitat. The potential refuges constitute a very small potential loss and there is to be no denigration of the identified areas such as ponds, the area round any pond, the hedges and other habitat features.

5.4.3 GCN: Habitat modification

Habitat modification is not significant.

5.4.4 GCN: Fragmentation and isolation

The proposed construction will not cause any potential for the fragmentation or isolation of populations or metapopulation of newts. The present connectivity of the habitat is to be maintained and the proposed structures will not present insurmountable obstacles.

5.4.5 Nesting birds

Wild birds have been declining in numbers due to pressures of loss of nesting places, habitat and food sources. Limited nesting has occurred in the building, but loss of nest sites is to be avoided as there can be cumulative impacts that cannot be fully quantified from site-level data.

5.4.6 Other species

There are no impacts for other species.

6 IMPLICATIONS AND RECOMMENDATIONS

6.1 FURTHER SURVEY

- 6.1.1 **BATS:** No further surveys are required at this time.
- 6.1.2 **BIRDS:** If work is to commence in the breeding season for wild birds then renovation of barn will be preceded by bird surveys on the building. These will be 2 visits undertaken during the first 2 hours after dawn. There will also be a watching brief operated for ongoing work during the season and any work within 4m of any potential nesting features will be preceded by a check for the presence of breeding birds.
- 6.1.3 **OTHER SPECIES:** No other surveys are recommended.
- 6.1.4 **The conclusions and recommendations in this report in respect to surveys for protected species are based upon results from surveys in spring 2016. These data will only be of use for 1-4 years, depending on the species and circumstances, after which further survey to establish the position and possible changes in status will be necessary to ensure all activities are informed and guided by recent data on site status.**

6.2 REQUIREMENTS FOR LICENSING

6.2.1 Bats/GCN

There is no requirement at this time to apply for a licence from Natural England Wildlife Licensing Unit for the works to proceed. **In the event that bats/GCN are found during in any refurbishing that is being undertaken then all work must stop, workers withdraw from the site and a licensed bat worker or Natural England contacted for advice and to review the licensing position.**

Failure to stop work and take advice in the event of finding bats/GCN may result in a breach of the law under the Wildlife and Countryside Act 1981 (as amended) under Section 9(4)(a), which states that it is an offence to 'intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a bat'. Conversion could also lead to an infringement under the Conservation (Natural Habitats & c) Regulations, which states it as an offence to 'deliberately damage or destroy a breeding site or resting place of a bat/GCN' [Regulation 41(1)(d)].

6.2.2 Other species

There are no licensing requirements at present

6.3 RECOMMENDATIONS

6.3.1 Bats

Bats are highly mobile and move freely between sites, often roosting temporarily in structures. The position of the site is rural and bats are active around the barn and the site. It is advised that work undertaken follows best practice measures to ensure no short-term impacts on bats. Best practice measures are recommended as given below.

They are:

1. **Timing of works**

It is generally recommended that works **begin** in the period September to April. This is outside the main active season for bats. However, potential is poor in this instance and there is no hibernation potential. Therefore, there are no specific time constraints for bats.

2. Deconstruction and other building works

Any roofing works will follow best practice as given below

- Roof removal will be undertaken by hand using a soft protocol method designed to prevent injury to bats
- the removal of sheeting will be done using both hands to lift each section clear, thus avoiding rolling them, which might squash any roosting bats that may be present but undetected
- The exposed roof surface and the underside of each sheet are then inspected for presence of bats.
- Sheets will be removed by lifting off, not sliding down the roof pitch. Bats are often found between the upper surfaces of support structures such as purlins and the roof cover and can be crushed if care is not taken.
- Particular care should be taken in removing the ridge area as these are a favourite area for bats.
- Demolition of any walls, removal of window and door apertures and lintels where a potential cavity is identified, must be done by hand and with care to remove brickwork and expose internal crevices. Bats can fit into any opening >8mm. This will account for a small possibility of bats being present at time of demolition and undetected.

3. Reconstruction/new building

- If construction/refurbishment is being undertaken during the active season for bats between April and October/November, it may offer new roosting opportunities for bats that are active across the site. It is therefore preferable to complete roofing **and** all external work to seal the building prior to starting the installation of internal fixings. If this is not possible then any cavities created by installation of plaster-boarding and so forth are to be covered at night to prevent entry and potential of entombing bats in the works.
- Any replacement/insertion of windows and other fills to apertures that are required should be done by completing the removal and replacement in a day to prevent any crevices being left open overnight. All reveals should be sealed (temporarily if necessary) overnight to avoid bats entering into exposed crevices in walls.
- Further advice on measures to prevent entrapment of bats and methods of preventing entry can be provided on request by a qualified consultant bat specialist.

In buildings where no cavity is present there can still be areas behind lintels and frames that have sufficient depth for a transient bat to use. Pipistrelle bats can fit into spaces with an access aperture of 8mm and as little as 40mm depth. Therefore, caution is advised and these measures will ensure no bats become inadvertently trapped in the construction areas.

If bats or signs of bats are found at any time on the site, then work should stop and advice sought from a qualified bat specialist or representative of Natural Resources Wales. Failure to do so may result in an offence under the protective legislation as detailed in Appendix 1. On no account should bat(s) be handled by anyone other than a licensed bat worker.

4. Reserved bat area

The anecdotal evidence provided indicates that the upper storey of the 2-storey north end of the barn was reserved for bats and birds. **This will be retained to provide an area for bat species using the site. No changes to the area or use or use of it will be made without prior consultation with Natural Resource Wales or a licensed bat consultant.**

5. Lighting

The surrounding habitat and connectivity to wider suitable habitat indicates bats are likely to be flying across and around the site. Therefore, any lighting will be minimised and directed as far as possible away from the potential commuting lines along site boundaries and any potential roosting places. Any additional external security lighting around the site should be designed to point downwards and away from any potential roosting sites such as the trees, use a short duration and a trigger that is not over-sensitive to prevent continuous and false tripping of the activation switch. All lighting will follow the Bat Conservation Trust Lighting Guidelines and given in **Appendix 2.**

6. Site enhancement

The surrounding habitat has some connective features and the hedges and trees provide habitat for bats and many other wildlife species. It is recommended the surrounding habitat is maintained as far as possible to retain the linear features. The following recommendations are made:

- where possible, the mature trees and hedgerows on around and near the site should be retained. These have potential to develop into natural roosting sites.
- **removal of any large mature trees should only be done following an inspection for potential roost holes for bats.**
- Incorporation of insect attracting shrubs into any future planting scheme will encourage the presence of insects and thereby provide suitable foraging sites for local bats which have been observed to use the site for foraging (see **Appendix 3**).

6.3.2 Great crested newts

The development will not result in the loss of any aquatic or significant amount of terrestrial habitat of great crested newts, nor on the basis of present evidence will it result in significant disturbance of the species or interrupt migration between habitats. The redevelopment will not result in the destruction of the hedges and potential habitat areas and all surrounding habitat will remain intact. No trees are to be removed. The long-term and post-activity impacts are assessed as no impact on GCN.

Great crested newts are widespread in North Wales and Cheshire, and while it has been determined that is unlikely that great crested newts are using the site, it is advised that best practice is used during the development to minimise potential disturbance and possible injury. Any potential short-term impacts may be addressed by the following proposals.

- Land clearance are best done during the winter period when GCN are hibernating or in the spring from March to June, when the majority are in ponds. If this is not possible then in this instance as the ground area is easily visible, a sight check can be made for any signs of presence
- The start of development work on the site would normally avoid periods when newts are likely to be commuting (March – April, August – November). In this case the potential for newts to be crossing the area is considered very low. Therefore, it is considered that work may be undertaken **with care** in these periods
- **All material piles in all of the structures will be carefully lifted and inspected beneath for the presence of great crested newts and other amphibians as they are being removed. If any amphibians are found that are not positively identified as NOT being great crested newts, then all work in that areas must stop and advice taken from a licensed ecologist or Natural England**
- Reasonable avoidance measures and best practice, as detailed below, are carried out during building operations on the site.

1. Reasonable Avoidance Measures (RAMS)

It is recommended that reasonable avoidance measures (RAMs) are implemented throughout the development period to prevent any harm to great crested newts and other amphibians during the development. The storage of materials on the site (for example) could provide amphibians with potential shelter places. The following RAM's should therefore be implemented:

- Clearance of the grass areas and materials at the east and south side of the barn will be done by hand, with care, preferably outside the active period on land (see above). If done during the active period then a sight check over the ground will be done prior to any mechanical removal of top vegetation and soil layers
- During renovation all rubble and materials generated by the process will be either removed from site as soon as possible or stored on pallets/in skips to prevent the creation of potential refuge areas for amphibians on the site. **Such piles can create new refuge areas and may be used by any amphibians crossing the site.**
- Piles of materials on the site must be removed with care to avoid injury or death to any newts present by removing the bottom layers by hand, lifting clear and inspecting beneath
- All building materials (bricks, tiles, concrete blocks etc) etc should be stored off the ground on pallets or timber baulks

- All loose materials should be delivered to and stored on site in bulk bags, and not be loose tipped on site
- Excavations should, wherever possible, be back-filled at the end of each working day. Where trenches are excavated for services, the trench should be excavated in the morning, the services laid and the trenches back-filled in the afternoon. Where this is not possible, the trenches should be covered over with sheet plywood and the edges sealed with topsoil to prevent amphibians falling into the trenches. All trenches left over night, whether covered or not, must be checked prior to filling.

Although it is considered very unlikely that great crested newts will be found during work, if any are discovered then all work must stop and a qualified consultant, licensed for great crested newts, must be contacted and their advice followed. Failure to do so may result in an offence under the legislation detailed in Appendix 1.

6.3.3 Nesting birds

Nesting birds and potential for nesting birds has been identified at the site.

All bird species and their nests are protected from destruction and disturbance in the breeding season. It is recommended that

- if possible renovation of structures and removal of the shrubbery and other vegetation will take place outside the breeding season of March to September
- if this is not possible it will be preceded by a survey for presence of nesting birds (see **6.1 Further Survey**)
- Where possible any removal of vegetation, especially hedges, close to the hedges and site borders, will be done outside the breeding season of March to September. Wherever possible vegetation will be retained to avoid disturbance.
- Site work to be done within 4m of a hedge line during the breeding season will be preceded by a check to ensure there are no active nests.
- If this cannot be done, then a pre-start check for nesting birds is made on all areas of the site
- **If birds are found to be nesting, then work will be stopped in that area and anywhere in 4m of the nest until the young have fledged**
- All storage of materials and work areas will be situated in such a position to reduce any potential disturbance to nesting birds.

Loss of nesting areas will be mitigated for by the retention of the upper storey of the 2-storey barn as a nesting area for birds. There will be no alterations or use of this section of the building without prior consultation with Natural Resource Wales or a consultant ecologist.

6.3.4 Other species

There are no requirements for other species.

7 APPENDICES

- Appendix 1** Protected species legislation
- Appendix 2** Bat lighting guidelines (BCT)
- Appendix 3:** Habitat enhancement for wildlife

8 REFERENCES

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Appendix 1: Legislation and policy guidance

1.1 BATS

Bats are offered special protection under the following legislation:

- **The Wildlife and Countryside Act 1981 (as amended) Schedule 5, Section 9.** This Act transposes into UK law the **Convention on the Conservation of European Wildlife and Natural Habitats** (commonly referred to as the "Bern Convention". The WCA was recently amended by the **Countryside and Rights of Way [CroW] Act 2000**. This makes it an offence to:
 - intentionally kill, injure or take any species of bat [Section 9(1)]
 - possess or control any live or dead specimens or anything derived from a bat [Section 9(2)]
 - intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a bat [Section 9(4)(a)]
 - intentionally or recklessly disturb a bat while it is occupying a place or structure which it uses for that purpose [Section 9(4)(b)].
- **"The Conservation of Habitats and Species Regulations 2010 (as amended)"** (The Habitats Directive) transposes into UK law Council Directive 92/43/EEC of 21st May 1992 on the **Conservation of Natural Habitats of Wild Fauna and Flora** (2010 revised) (referred to as the Habitats [and Species] Directive). Bats are listed on Annex II and Annex IV of the Directive. Inclusion in Annex II serves to underline their (the bats') conservation significance; inclusion in Annex IV (European Protected Species) means that member states are required to put into place a system of strict protection as outlined in Article 12. This is done through inclusion in Schedule 2 (Annex IV) of the Regulations. Regulation 41 makes it an offence to:
 - deliberately capture or kill a bat [Regulation 41 (1)(a)]
 - deliberately disturb a bat [Regulation 41(1)(b)]
 - deliberately damage or destroy a breeding site or resting place of a bat [Regulation 41(1)(d)].

1.2 GREAT CRESTED NEWTS

Great crested newts, *Triturus cristatus*, are offered special protection under the following legislation:

- **The Wildlife and Countryside Act 1981 (as amended) Schedule 5, Section 9.** This Act transposes into UK law the **Convention on the Conservation of European Wildlife and Natural Habitats** (commonly referred to as the "Bern Convention". The WCA was recently amended by the **Countryside and Rights of Way [CroW] Act 2000**. This makes it an offence to:
 - intentionally kill, injure or take a great-crested newt [Section 9(1)]
 - possess or control any live or dead specimens or anything derived from a great-crested newt [Section 9(2)]
 - intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a great-crested newt [Section 9(4)(a)]
 - intentionally or recklessly disturb a great-crested newt while it is occupying a place or structure which it uses for that purpose [Section 9(4)(b)].
- **"The Conservation of Habitats and Species Regulations 2010 (as amended)"** (The Habitats Directive) transposes into UK law Council Directive 92/43/EEC of 21st May 1992 on the **Conservation of Natural Habitats of Wild Fauna and Flora** (referred to as the Habitats [and Species] Directive). The great-crested newt is listed on Annex II and Annex IV of the Directive. Inclusion in Annex II serves to underline the animal's conservation significance; inclusion in Annex IV (European Protected Species) means that member states are required to put into place a system of strict protection as outlined in Article 12. This is done through inclusion in Schedule 2 of the Regulations. Regulation 41 makes it an offence to:



- deliberately capture or kill a great crested newt [Regulation 41 (1)(a)]
- deliberately disturb a great crested newt [Regulation 41(1)(b)]
- deliberately take or destroy the eggs of a great crested newt [Regulation 41(1)(c)]
- deliberately damage or destroy a breeding site or resting place of a great crested newt [Regulation 41(1)(d)].

This legislation applies to all life stages of great crested newts.

1.3 EXCEPTIONS FOR LICENSING

There are several exceptions to the provisions listed above under Regulation 44(2)(e). The Wildlife Licensing Unit of Natural England issues licences for a number of purposes, including *"preserving public health or safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment"*. Licences permit unlawful activities under and in accordance with the terms of a licence granted by the appropriate authority.

Regulations 41 does not apply to anything done (under appropriate licence) for any of the following purposes

- scientific or educational purposes;
- ringing or marking, or examining any ring or mark on, wild animals;
- conserving wild animals or wild plants or introducing them to particular areas;
- protecting any zoological or botanical collection;
- preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment;
- preventing the spread of disease; or
- preventing serious damage to livestock, foodstuffs for livestock, crops, vegetables, fruit, growing timber or any other form of property or to fisheries.

The appropriate authority shall not grant a licence under this regulation unless they are satisfied-

- (a) that there is no satisfactory alternative, and
- (b) that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

1.4 OTHER PROTECTED SPECIES (NOT EPS) AND RELEVANT LEGISLATION

Barn owls

Barn owls, *Tyto alba*, are protected under the **Wildlife and Countryside Act 1981**, in which they are classified as a schedule one species, under this special protection it is an offence to:

- Kill, injure, or take (handle) any wild barn owl.
- Take, damage or destroy any wild barn owl nest whilst in use or being built (Barn owls do not build a nest but make a scrape).
- Take or destroy a wild barn owl egg.
- Have in one's possession a wild barn owl (dead or alive), or egg, unless one can show it was obtained legally.
- Disturb any wild barn owl whilst "building" a nest or whilst in or near a nest containing eggs or young.
- Disturb any dependant young of wild barn owls.

Nesting birds

Wildlife legislation through the *Wildlife & Countryside Act 1981* states it is an offence to

- Intentionally kill, injure or take any wild bird



- Intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built
- Intentionally take or destroy an egg of any wild bird

The *Wildlife & Countryside Act 1981* has several subsequent amendments the most important being the *Countryside and Rights of Way Act 2000* (CROW) which under Schedule 12 of the Act strengthens the legal protection for threatened species. It also makes certain offences 'arrestable' and importantly and significantly creates a new offence of **reckless disturbance**. It also confers greater powers to police and wildlife inspectors for entering premises and obtaining wildlife tissue samples for DNA analysis, and also enables heavier penalties on conviction of wildlife offences.

Schedule 12 amendment state: '...In section 1(5) of the 1981 Act (offence of intentional disturbance of wild birds) after "intentionally" there is inserted "or recklessly".'

EVR ecology

4.1.1.1

- Intentionally take, damage or nest, or use part of any bird and while that nest is in use or being built.
- Intentionally take or destroy an egg of any bird and

The Wildlife Act 1981 has several other provisions that are important when the Court is considering a case of 1981 (1981 Wildlife Act 1981) in the Act of 1981 and local protection for threatened species. These include: (a) the offence of killing and (b) the offence of taking or destroying a bird or its egg. The Act also provides a new offence of reckless disturbance of a bird or its egg and will be relevant for existing premises and obtaining wildlife samples for DNA analysis and other scientific purposes on a number of wildlife offences.

Section 12 (endangered species) in section 12 of the 1981 Act (offence of intentional disturbance of wildlife) also, intentionally, there is (section 12(1)(a) of the 1981 Act).

Bat Conservation Trust



BATS AND LIGHTING IN THE UK

Bats and the Built Environment Series

This document is aimed at lighting engineers, lighting designers, planning officers, developers, bat workers and anyone specifying lighting. It is intended to raise awareness of the impacts of lighting on bats and mitigation is suggested for various scenarios. It also offers an explanation of the facts associated with the lighting industry for the benefit of bat workers.

This is a working document and as such the information contained will be updated in line with advances in our knowledge both into the impact on bats and also to reflect the advances in technology available in the lighting industry.

The information provided here is believed to be correct. However, no responsibility can be accepted by the Bat Conservation Trust, the Institution of Lighting Engineers or any of their partners or officers for any consequences of errors or omissions, nor responsibility for loss occasioned to any person acting or refraining from action as a result of information and no claims for compensation for damage or negligence will be accepted.

ABOUT BATS – FOR THE LIGHTING INDUSTRY

General Ecology

Bats are the only true flying mammals. Like us, they are warm-blooded, give birth and suckle their young. They are also long-lived, intelligent and have a complex social life. In Britain there are 17 species, all of which are small (most weigh less than a £1 coin) and eat insects.

Bats have evolved a number of unusual features, mainly connected with their ability to fly. Their wings are formed from a web of highly elastic skin stretched over greatly elongated finger bones, the legs and tail, though their thumbs remain free to help them cling on when roosting. Bats have also developed a highly sophisticated echolocation system that allows them to avoid obstacles and catch tiny insects, which they seize in flight or pick off water, the ground or foliage, even in complete darkness. When they're flying, bats produce a stream of high-pitched calls and listen to the echoes to produce a sound picture of their surroundings.

Some bats specialise in catching large insects such as beetles or moths but others eat large numbers of very small insects, such as gnats, midges and mosquitoes. Bats gather to feed wherever there are lots of insects, so the best places for them include traditional pasture, woodland, marshes, ponds and slow moving rivers.

During the winter there are relatively few insects available, so bats hibernate. In September and October they put on weight and then, as the weather gets colder, they seek out appropriate sheltered roosts, let their body temperature drop to close to that of their surroundings and slow their heart rate to only a few beats per minute. This greatly reduces their energy requirements so that their food reserves last as long as possible. Bats don't hibernate right through the winter but may wake up and go out to feed on mild evenings when insects are active.

During the spring and summer period female bats gather together into maternity colonies for a few weeks to give birth and rear their young (called pups). Usually only one pup is born each year. This is looked after carefully and suckled for between four and six weeks until it is old enough to fly out and hunt for itself. Bats don't build nests and don't bring food back to the roost to feed their young, so the baby lives only on its mother's milk until it is old enough to fly. Once the baby is independent, the colony breaks up and the bats generally move to other roosts. Bats may gather together from a large area to form these maternity roosts, so any disaster at the summer breeding site can affect the whole colony of bats from a wide surrounding area. Many of these maternity sites are used every summer as bats have a strong tradition of returning to the same site year after year.

Legal Protection of bats

Due to the decline in bat numbers, all species of bat are protected by the Wildlife & Countryside Act (1981) (as amended) and the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). This makes it illegal to: kill, injure, capture or disturb bats, obstruct access to bat roosts or damage/destroy bat roosts. Lighting in the vicinity of a bat roost causing disturbance could constitute an offence, so it is important that Natural England, Countryside Council for Wales, Scottish Natural Heritage or Environment and Heritage Service, Northern Ireland is consulted and allowed time to provide advice on lighting proposals in the vicinity of bats and roosts.

Impacts on bats

Roosts

Illuminating a bat roost creates disturbance and may cause the bats to desert the roost. Light falling on a roost access point will at least delay bats from emerging and this shortens the amount of time available to them for foraging. As the main peak of nocturnal insect abundance occurs at and soon after dusk, a delay in emergence means this vital time for feeding is missed.

Insects and foraging

In addition to causing disturbance to bats at the roost, artificial lighting can also affect the feeding behaviour of bats. There are two aspects to this. One is the attraction that light from certain types of lamps has to a range of insects; the other is the presence of lit conditions.

Many night flying species of insect 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. As well as moths a range of other insects can be attracted to light such as crane flies, midges and lacewings. Studies have shown that, although noctules, Leisler's, serotine and pipistrelle bats swarm around white mercury street lights (this would also apply to metal halide) feeding on the insects attracted to the light, this behaviour is not true for all bat species. The slower flying broad winged species such as long-eared bats, *Myotis* species (which include Brandt's, whiskered, Daubenton's, Natterer's and Bechstein's), Barbastelle and greater and lesser horseshoe bats generally avoid street lights. In addition it is also thought that insects are attracted to lit areas from further afield. This is thought to result in adjacent habitats supporting reduced numbers of insects. This is a further impact on the ability of the light avoiding bats to be able to feed. It is noticeable that most of Britain's rarest bats are among those species listed as avoiding light. Clearly, effective mitigation where there is potential for impact on bats has importance in the conservation of these species.

Artificial lighting is thought to increase the chances of bats being preyed upon. Many avian predators will hunt bats which may be one reason why bats avoid flying in the day. Observations have been made of kestrels (diurnal raptors) hunting at night under the artificial light along motorways.

Lighting can be particularly harmful if used along river corridors, near woodland edges and near hedgerows used by bats. In mainland Europe, in areas where there are foraging or 'commuting' bats, stretches of road are left unlit or lighting is designed in such a way as to avoid isolation of bat colonies.

Other behaviours

Artificial lighting disrupts the normal 24-hour pattern of light and dark which is likely to affect the natural behaviour of bats. Bright light may reduce social flight activity and cause bats to move away from the light area. Studies have shown that continuous lighting along roads creates barriers which some bat species cannot cross. For example, Daubenton's bats move their flight paths to avoid street lamps. The following images indicate possible scenarios where bats' commuting routes may cross a road. They are linear features such as tree lines, river corridors, hedgerows or where tree canopies form a link over the road.



ABOUT THE LIGHTING – FOR BAT WORKERS

Types of lights in use

A range of lighting equipment is available:

- 1) **Low pressure sodium lamps (SOX)** (typical orange lamps seen along roadsides). Light is emitted at one wavelength, contains no ultraviolet (UV) light and has a low attraction to insects. The lamps tend to be large which makes it more difficult to focus the light from these lamps. These are in the gradual process of being removed or replaced.
- 2) **High pressure sodium lamps (SON)** (brighter pinkish-yellow lamps). Commonly used as road lighting. Light is emitted over a moderate band of long wavelengths including a small UV component. Insects are attracted to the brighter light. The lamp is of medium size and the light can be more easily directed than low pressure sodium. This is the predominant lamp now in use.
- 3) **Mercury lamps (MBF)** (bluish-white lamps). These emit light over a moderate spectrum including a larger component of UV light to which insects are particularly sensitive. Insects are attracted in large numbers along with high densities of bat species. (Rydell & Racey 1993). They are rare now and are not used in new developments.
- 4) **White SON**. This is whiter than High Pressure Sodium and has a larger component of UV light.
- 5) **Metal Halide**. A small lamp and therefore more easy to focus light and make directional. Emits less UV light than mercury but more than high pressure sodium. It comes in three forms a) Quartz arc tube (HQI); b) Ceramic arc tube (CDM-T) and c) Cosmo which is a new ceramic form.

- 6) **Light Emitting Diodes (LEDs)**. Predicted to compete with metal halide and high pressure sodium as a widely used light source within the next few years. The light emitted is more directional. The light is produced in a narrow beam. It is instant light.
- 7) **Tungsten Halogen** (more directional). It is not used in new lighting schemes but may be encountered as security light on a private household.
- 8) **Compact Fluorescent** Mostly in use in residential street lighting. It produces a white light that does include UV light. It can be used at a low wattage and therefore on a low output to achieve low lux.

Legal requirements for lighting

There is no legislation requiring an area or road to be lit.

The Building Regulations specify that 150 W is the maximum for exterior lighting of buildings but this does not apply to private individuals.

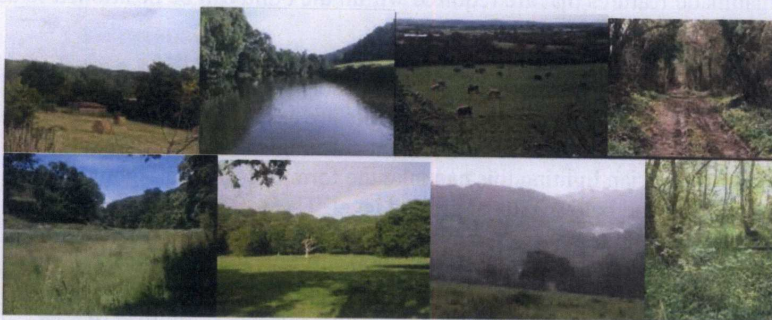
There are a number of British Standards that relate to various components of lighting and there are also guidelines that relate to crime prevention, prevention of vehicular accidents and amenity use.

Many County councils and less often District and Borough councils set out standards in local guidance policy documents. These are sometimes based on the advice given by the Highways Authority 'TA49 – Approval of new and replacement lighting on trunk roads and trunk road motorways'.

In assessing the need for lighting it would be beneficial to ask the local authority for their lighting policy document as this should incorporate all of the above.

The installation of lighting and the planning system

Domestic lighting needs no planning permission and depends on direct advice being given to the householder. Lighting associated with new development or a listed building does require planning permission. Planning officers or developers when dealing with applications for lighting in an area of suitable bat habitat eg. woodland, old pasture, linking hedgerows and water habitats) should seek information on bat roosts in the area.



If assistance is needed they can contact the BCT Bat Helpline 0845 1300 228 who may be able to suggest how best to access information on bat roosts known in the area. If bat roosts are suspected, it may be necessary to conduct a bat survey. A survey may need to

determine the species of bat affected, their population levels, the likely impact of the lighting on the bats and possible mitigation.

The need to install lighting should be questioned. Where lighting is permitted, as may be necessary for public safety, conditions should be imposed to ensure the impact of the lighting on the bats is kept to a minimum. The use of a lighting design computer program that predicts where light will fall should be used to predict the potential impact and to plan mitigation.

The consultation on the addition to PPS23 on Pollution Control of Annex 3 on lighting is on hold at the present time (July 2007) until the outcome of the Baker review is known.

MITIGATION OF LIGHTING IMPACTS ON BATS

1. BAT ROOSTS

No bat roost (including access points) should be directly illuminated. If it is considered necessary to illuminate a building known to be used by roosting bats, the lights should be positioned to avoid the sensitive areas. Close offset accent lighting causes less light pollution; it is more specific and can be designed to avoid bat sensitive areas, and better highlights the features of the subject of the illumination.

2. FORAGING AND COMMUTING

Type of lamp (light source)

The impact on bats can be minimised by the use of low pressure sodium lamps or high pressure sodium instead of mercury or metal halide lamps where glass glazing is preferred due to its uv filtration characteristics.

Luminaire and light spill accessories

Lighting should be directed to where it is needed and light spillage avoided. This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvres and shields to direct the light to the intended area only. Planting can also be used as a barrier or manmade features that are required within the build can be positioned so as to form a barrier.

Lighting column

The height of lighting columns in general should be as short as is possible as light at a low level reduces the ecological impact. However, there are cases where a taller column will enable light to be directed downwards at a more acute angle and thereby reduce horizontal spill. For pedestrian lighting this can take the form of low level lighting that is as directional as possible and below 3 lux at ground level. The acceptable level of lighting may vary dependent upon the surroundings and on the species of bat affected.

Predicting where the light cone and light spill will occur

There are lighting design computer programs that are widely in use which produce an image of the site in question, showing how the area will be affected by light spill when all the factors of the lighting components listed above are taken into consideration. This should be a useful tool to inform the mitigation process.

Light levels

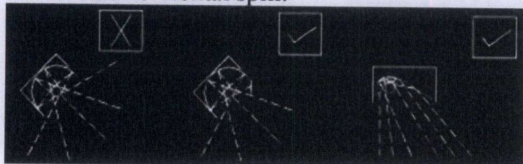
The light should be as low as guidelines permit. If lighting is not needed, don't light.

Timing of lighting

The times during which the lighting is on should be limited to provide some dark periods. Roads or trackways in areas important for foraging bats should contain stretches left unlit to avoid isolation of bat colonies. These unlit stretches should be 10 metres in length either side of commuting route.

3. FLOODLIGHTING OF SPORTS OR EVENTS

The use of asymmetric beam floodlights (as opposed to symmetric) orientated so that the glass is parallel to the ground will ensure that the light is cast in a downward direction and avoids horizontal spill.



See the National Trust guide to 'Events, concerts and bats' at

http://www.nationaltrust.org.uk/main/w-bat05_events.pdf for further advice on ways to reduce the impact of event lighting.

4. SECURITY LIGHTING

Power It is rarely necessary to use a lamp of greater than 2000 lumens (150 W) in security lights. The use of a higher power is not as effective for the intended function and will be more disturbing for bats.

Movement sensors Many security lights are fitted with movement sensors which, if well installed and aimed, will reduce the amount of time a light is on each night. This is more easily achieved in a system where the light unit and the movement sensor are able to be separately aimed.

Timers If the light is fitted with a timer this should be adjusted to the minimum to reduce the amount of 'lit time'.

Aim of light The light should be aimed to illuminate only the immediate area required by using as sharp a downward angle as possible. This lit area must avoid being directed at, or close to, any bats' roost access points or flight paths from the roost. A shield or hood can be used to control or restrict the area to be lit. Avoid illuminating at a wider angle as this will be more disturbing to foraging and commuting bats as well as people and other wildlife.

Alternatives

It may be a better solution for security lighting on domestic properties to use a porch light.

Ongoing areas of research

- The impact of light on commuting corridors used by lesser horseshoe bats. Emma Stone, University of Bristol
- The effects of lighting on prime bat foraging areas within London, concentrating on riparian habitats and open spaces. Alison Fure.
- The effect of light and noise on British bat species. Frank Greenaway.

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Glossary of terms

(used in this article or that may be used by the lighting industry)

Arc tube	A tube normally ceramic or quartz enclosed by the outer glass envelope of a HID lamp that contains the arc stream.
Asymmetric beams	Lamp is off-centre in a reflector more steeply curved at one end.
Candela	The intensity of a light source in a specific direction. Unit of Luminous intensity
Contrast	The relationship between the luminance of an object and its background. The higher the contrast the more likely it is an object

	can be seen.
Cowl	Physical light spill control accessory.
Diffuse	Term describing dispersed light distribution referring to the scattering of light.
Efficacy	A measure of light output against energy consumption measured in lumens per watt.
HID	High Intensity Discharge. Describes mercury vapour, metal halide and high pressure sodium lamps.
High Pressure Sodium Lamp	A HID lamp whose light is produced by radiation from high pressure sodium vapour which usually includes a small amount of UV light.
Hood	Physical light spill control accessory.
Illuminance	Illuminance is the quantity of light, or luminous flux, falling on a unit area of a surface. It is designated by the symbol E. The unit is the lux (lx).
Lamp	Light source.
Light cone	The angle at which the beam falls off to 50% of peak intensity.
Light Pollution	The spillage of light into areas where it is not required. Also known as obtrusive light.
Light spill	The light that falls outside the light cone.
Light Trespass (nuisance)	Light that impacts on a surface outside of the area designed to be lit by a lighting installation. The correct legal term is nuisance.
Louvres	Physical light spill control accessory.
Low Pressure Sodium	A discharge lamp in which light is produced by radiation from low pressure sodium vapour. Emits light at only 589nm ie. monochromatic.
Lumen	The unit of light output from a lamp.
Luminaire	Light fitting or unit designed to distribute light from a lamp or lamps.
Luminance	The physical measure of the stimulus that produces the sensation of brightness measured by the luminous intensity reflected in a given direction. The unit is the candela per square metre (cd/m^2).
Lux (LX)	Illuminance is the quantity of light or luminous flux, falling on a unit area of a

	surface in the environment. It is designated by the symbol E. The unit is lux (lx).
Metal Halide (includes CDM-T)	A type of HID lamp in which most of the light is produced by radiation of metal halide and mercury vapours in the arc tube. Emits UV light. UV poor variants are available. It comes in three forms a) Quartz arc tube (HQI); b) Ceramic arc tube (CDM-T) and c) Cosmo which is a new ceramic form
Mercury	High pressure white light lamp that emits significant UV light.
Optic	The components of a luminaire such as reflectors, refractors, protectors which make up the directional light control section.
Photocell	A unit which senses light to control luminaires.
Reflector	A device used to reflect light in a given direction.
Refractor	A device used to redirect the light output from a lamp when the light passes through it. It is usually made from prismatic glass or plastic.
Shield	Physical light spill control accessory.
Sky glow	The brightening of the night sky caused by artificial lighting.
Symmetric beams	Lamp mounted in the centre of the reflector.
Ultra violet (UV)	Radiation that is shorter in wavelength and higher in frequency than visible violet light.
Voltage	The difference in electrical potential between two points of an electrical circuit.
Watt (W)	The unit for measuring electrical power.