A303 Sparkford to Ilchester Dualling Scheme TR010036

6.3 Environmental Statement

Appendix 8.5 Barn Owl Technical Report

APFP Regulation 5(2)(a)
Planning Act 2008
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The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A303 Sparkford to Ilchester Dualling Scheme

Development Consent Order 201[X]

6.3 Environmental Statement
Appendix 8.5 Barn Owl Technical Report

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Executive summary

The proposed A303 Sparkford to Ilchester Dualling Scheme (hereafter referred to as 'the Scheme') is to provide a continuous dual-carriageway on the A303 linking the Podimore Bypass and the Sparkford Bypass.

This report investigates the presence of barn owls in the study area (1.5 kilometres either side of the Scheme redline boundary). It then assesses how this species may be using the habitats along route of the Scheme, and identifies and quantifies potential impacts on these birds. Finally, recommendations are outlined for mitigation, habitat creation and enhancement.

Previous records were collated from various sources and a field survey was carried out to assess and map potential roosting, nesting and foraging habitat within the study area.

Two occupied breeding sites and 4 active roost sites were identified during the surveys, indicating that there is a maximum of 4 or 5 breeding pairs in the study area.

Across the study area, 422 hectares of habitat suitable to support foraging barn owls was identified. For this type of mixed arable and pastoral landscape, a pair of barn owls is estimated to require between 17 to 26 hectares of rough grassland. It can be therefore extrapolated that the study area has the potential to support 16 – 25 pairs. This indicates that the area is below its current carrying capacity to support barn owls, and that the current road is having an impact on the barn owl population in the area.

The main impacts of the scheme are considered to be temporary and permanent foraging habitat loss, and loss of potential nesting and roosting locations. These impacts would lead to increased mortality through starvation, loss of habitat and breeding success. One known nesting location would need to be removed as a result of the works and 5 potential nesting locations would also be lost.

During the operational phase, the upgrade of the road to a dual carriageway would increase the impact of the road as a barrier to dispersal. As increase in barn owl and mortality due to traffic collisions is also likely to occur.

The population within the study area consists of two known active barn owl pairs. However, it is likely that the estimate of barn owl pairs using the study area is between 4 and 5 at most. This potentially constitutes around 1% of the Somerset population; therefore, the study area is considered to be of medium conservation value for barn owls.

The magnitude of the impact on the population of barn owls in the study area would be Moderate Adverse during the construction and operation of the road. This results in an overall significance of effect of Moderate Adverse during construction and operation when mitigation measures are not considered.

Mitigation would include a recheck of all known and potential nesting locations within 1 kilometre of the works and replacement of lost foraging habitat (Type 1 and 2 grassland habitat).

In order to deter barn owls from the road to minimise collisions with traffic, a barrier of a minimum of 3 metres high would be provided along the majority of the Scheme. This would be through a combination of screening planting, landscaping bunds and the alignment of the road. Operational impacts would be further mitigated by a 2:1 ratio of habitat replacement for grassland, hedgerows and woodland habitats, and the installation of nest boxes at least 1 kilometre from the Scheme.

There would be a regional impact of the Scheme on the barn owl population. This results in an overall significance of effect of Moderate Adverse during construction and operation when mitigation measures are not considered. Where mitigation measures are implemented the residual impact is considered to be Slight Adverse.

1 Introduction

1.1 Overview of the scheme

Existing corridor

1.1.1 The A303 forms part of Highways England's Strategic Road Network (SRN) and a strategic link between the south west and the rest of the south, south-east and London. The route comprises multiple road standards, including dual carriageway, single carriageway and single carriageway sections with overtaking lanes. Speed limits also vary between 40 miles per hour and 70 miles per hour, depending on the character of the road and its surroundings.

Existing road

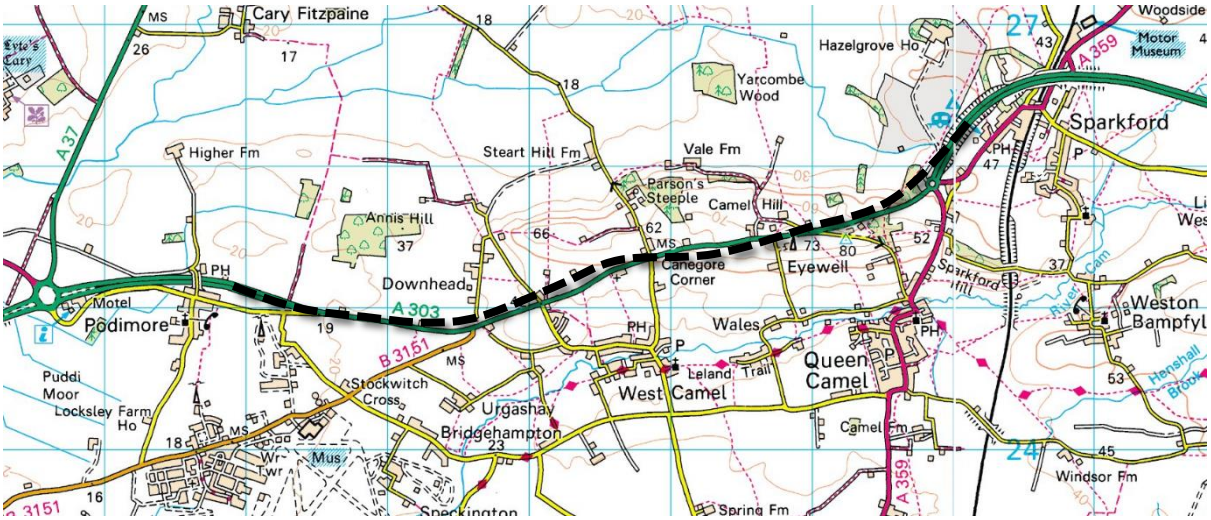
1.1.2 The section of the A303 that is being upgraded as part of this scheme commences at the eastern limits of the existing dual carriageway, the Podimore Bypass. Travelling east, the corridor reaches the junction with the B3151 before bearing north east and rising upwards through Canegore Corner to reach the crest of Camel Hill at Eyewell. This section of the corridor is characterised by a single lane road, with double white lines negating overtaking and subject to a 50 miles per hour speed limit. There are several priority junctions along the route giving access to the settlements of Queen Camel and West Camel to the south and Downhead to the north, as well as several farm accesses and parking laybys.

1.1.3 From the crest of Camel Hill, the corridor descends to meet the roundabout at the western limit of the dual carriageway Sparkford Bypass (Hazlegrove Roundabout). This section comprises 2 lanes in the westbound direction, 1 lane in the eastbound direction and is also subject to a 50 miles per hour speed limit. Hazlegrove Roundabout forms a junction between the A303 and the A359 which runs south through Queen Camel and north-east through Sparkford. The roundabout also provides access to a service station, and to a school at Hazlegrove House.

1.1.4 The section of the A303 that is to be upgraded is almost 3.5 miles, or approximately 5.6 kilometres long.

1.1.5 The extents of the scheme are illustrated in Figure 1.1 below. Figure 2.1 of Volume 6.2 shows the proposed red line boundary for the scheme.

Figure 1.1: Scheme extents



Source: Mott MacDonald Sweco Joint Venture

Scheme proposals

1.1.1 The proposed scheme is to provide a continuous dual-carriageway linking the Podimore Bypass and the Sparkford Bypass. The scheme would involve the removal of at-grade junctions and direct accesses. The Hazlegrove Junction would be constructed to grade-separated standards and Downhead Junction and Camel Cross Junction would be constructed to compact grade-separated standards, as illustrated on Figure 2.3 General Arrangement Plans, contained in Volume 6.2.

1.1.6 A detailed description of the scheme is provided within Chapter 2 The Scheme of Volume 6.1.

1.2 Scope of the report

1.2.1 The objectives of this report are:

- to inform Chapter 8 Biodiversity of the Environmental Statement (Volume 6.1)
- to collate and review existing records for barn owls *Tyto alba* within 3 kilometres of the Scheme
- to identify the locations of suitable roosting, nesting and foraging habitats within 1.5 kilometres of the Scheme
- to assess the potential effects of the Scheme on barn owl
- to provide recommendations for mitigation, habitat creation and enhancement

1.3 Legislation

1.3.1 Barn owls are afforded protection under Schedule 1 of the *Wildlife and Countryside Act 1981* (as amended). This makes it an offence to:

- intentionally kill, injure or take any barn owl
- intentionally take, block, damage or destroy any structure used by barn owls as a nesting site
- intentionally take or destroy their eggs
- possess or control any living or dead part or parts of a barn owl or their eggs
- intentionally or recklessly disturb any barn owl or its young whilst 'building' a nest or whilst occupying the nest

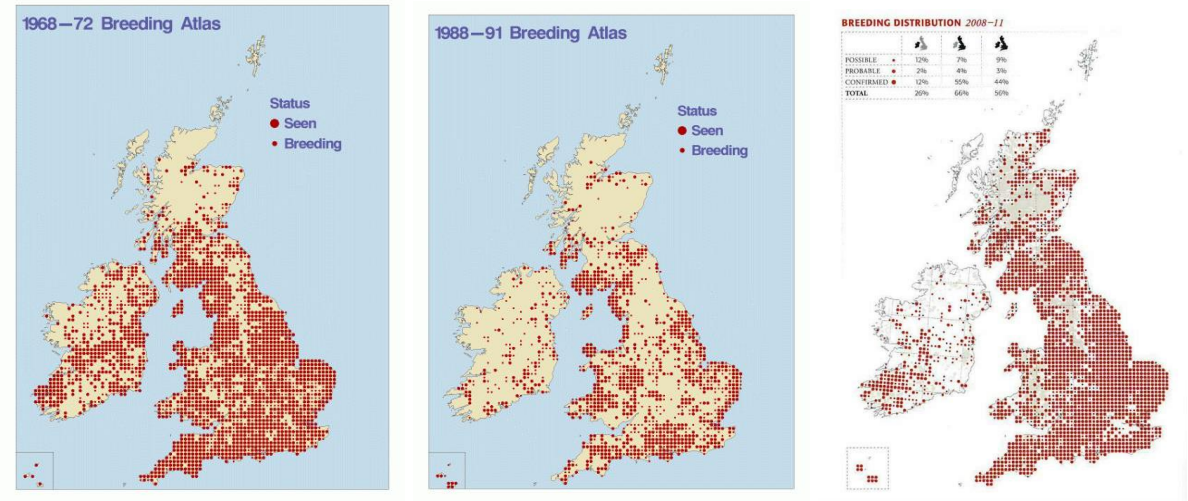
1.4 Status of barn owls at the national level

1.4.1 Whilst barn owl populations in the UK see short-term fluctuations linked to the cyclic availability of the field vole *Microtus agrestis* population, there has been a sustained decline since the mid-1800s[1]. The decline in barn owl abundance and distribution in more recent times can be seen from the British Trust for Ornithology (BTO) breeding bird atlases for 1976 and 1993 (Figure 1.2). However, the 2007-2011 bird atlas indicates that there has been range expansion throughout north-east England and Scotland[2].

1.4.2 The UK population has been estimated to be between 3,000 and 5,000 breeding pairs[3]. A more recent assessment by the Rare Breeding Birds Panel shows the number of pairs has increased by four and a half times between 1996 and 2005[4] and is no longer considered to be a rare breeding bird in the UK. Therefore, barn owl is included the *Green List of Birds of Conservation Concern*[5].

[1] Shawyer, C.R. (1987) *The Barn Owl in The British Isles: It's past present and future*. The Hawk Trust c/o Zoological Society, London.
[2] Balmer, D.E., Gillings, S., Caffrey, B.L., Swann, R.L., Downie, I.S. and Fuller, R.J. (2013) The Bird Atlas 2007-11: the breeding and wintering birds of Britain and Ireland. BTO Books, Thetford.
[3] Toms, M.P., Crick, H.Q.P., & Shawyer, C.R. (2001). *The status of breeding Barn Owls Tyto alba in the United Kingdom 1995-97*. Bird Study 48:23-37.
[4] Holling, M. & Rare Breeding Birds Panel (2008). *Rare breeding birds in the United Kingdom in 2005*. British Birds 101:276-316.
[5] Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D. and Gregory, R. (2015). *Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man*. British Birds 108, 708-746.

Figure 1.2: UK Distribution of barn owls for 1976 (left), 1993 (centre) and 2008-11 (right)



Source: British Trust for Ornithology and Barn Owl Trust (http://blx1.bto.org/atlases/BO-atlas.html and https://www.barnowltrust.org.uk/barn-owl-facts/barn-owl-distribution-uk/)

1.4.3 Reasons for the long-term historic declines and threats to the barn owl are thought to be a combination of various factors including:

- loss of foraging habitat, roosting and nesting locations[6,7]
- an increase in deaths resulting from collisions with road traffic[6,7,8]
- poisoning[6,7]

1.5 Status of barn owls at county level

1.5.1 The barn owl population of Somerset has experienced a decline of 80% in the last century[9]. While there is no current estimation of the barn owl population in Somerset, it is thought that the population has been increasing due to the efforts of the nest box schemes, and the Somerset Levels are now considered one of the most important strongholds for this species in the country[10]. Within Somerset, breeding barn owls were recorded in 169 tetrads (2km^2) of the total 973 tetrads for the period 2007 to 2011[9]. That means that barn owls are present within 17% of the county.

[6] Cramp, S. and Simmons, K. E. L. (eds.) (2004). BWPi: Birds of the Western Palearctic interactive (DVD-ROM). BirdGuides Ltd, Sheffield.
[7] Newton, I., Wyllie, I. and Dale, L. (1997). *Mortality causes in British Barn owls* (*Tyto alba*), based on 1101 carcasses examined during 1963-1996. - In: Duncan, J. R., Johnson, D. H. and Nicholls, T. H. (eds.), *Biology and Conservation of Owls of the Northern Hemisphere, Second International Owl Symposium, February 5-9, 1997*. USDA Forest Service, General Technical Report NC-190, Winnipeg, Manitoba, Canada, pp. 299-306.
[8] Shawyer, C.R. (1987) *The Barn Owl in The British Isles: It's past present and future*. The Hawk Trust c/o Zoological Society, London.
[9] Ballance, D., Grimmond, R., Moss, S., Thomas, J. and Tigwell, E. (2014). *Somerset Atlas of Breeding and Wintering Birds 2007-2012*. Somerset Ornithological Society.
[10] Spearing, C. (2014) Somerset barn owl web cam watched from across the world [online] available at: http://www.bbc.co.uk/news/uk-england-somerset-27139486 (last accessed March 2018).

1.5.2 Although the *UK Biodiversity Action Plan* (BAP) has been superseded, BAPs are still widely used at county level to support *Biodiversity 2020*[11]. Barn owls are not listed as a species on the Somerset BAP

1.6 Barn owl ecology

1.6.1 In Britain the barn owl is typically a bird of lowland farmland where they are primarily active between dusk and dawn. In contrast with continental barn owl populations, the British population is largely sedentary[12] with breeding birds being highly site faithful[13]. Dispersal is usually undertaken within four months of fledging and birds frequently achieve distances of 12 kilometres from natal areas[12].

1.6.2 With the exception of the immediate area around a nest site, barn owl territories are poorly defended, if at all[14,15]. The extent of a home range can vary considerably with the majority of birds found within 1 kilometre of the nest site during the breeding season, although they may range up to 2 kilometres[15]. In winter the foraging range increases up to 4 – 5 kilometres from nest sites[15].

1.6.3 Within a home range, a pair of barn owls may have one nesting site, up to 3 regular roost sites, and up to 5 sites that they only visit occasionally[16]. Roost and nest sites are located in buildings, purpose built nest boxes and tree cavities. In drier, eastern areas, the proportion of roosting and nesting sites in tree cavities can be up to 70% although there is no direct preference and barn owls will use whichever is available to them[13].

1.6.4 Diet consists largely of small mammals, the species of which is dependent on the habitats in which a barn owl forages[17,18.] The species composition can vary seasonally and between years[15]. Common shrew *Sorex araneus* tends to be taken in greater proportion in spring and summer, field vole from late autumn to

[11] DEFRA (2011). *Biodiversity 2020*: *A Strategy for England's Wildlife and Ecosystem Services*. Department for Environment, Food and Rural Affairs, London.
[12] Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R. (eds). (2002) *The Migration Atlas: movements of the birds of Britain and IreRSland*. T. & A.D. Poyser, London.
[13] Barn Owl Trust (2006) Roosting and nesting places [online] available at: http://www.barnowltrust.org.uk/infopage.html?Id=74 (last accessed March 2018).
[14] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B & Thompson, D. (2006). *Raptors: A field guide to survey and monitoring*. The Stationary Office, Edinburgh.
[15] Taylor, I.R. (1994). *Barn Owls: Predator–prey Relationships*. Cambridge University Press, Cambridge.
[16] Barn Owl Trust (2006) Lifestyle [online] available at: http://www.barnowltrust.org.uk/infopage.html?Id=73 (last accessed March 2018).
[17] Cramp, S. and Simmons, K. E. L. (eds.) (2004). BWPi: *Birds of the Western Palearctic interactive* (DVD-ROM). BirdGuides Ltd, Sheffield.
[18] Libois, R.M., Fons, R. & Saint Gibons, M-C. (1983). Le regime alimentaire de la Chouette Effraie, Tyto alba, dans les Pyrenees-Orientales. Etude des variations ecogeographiques. Rev. Ecol. (Terre Vie) 37: 187-217.

early spring[19,20] and the wood mouse *Apodemus sylvaticus* in late summer and autumn[21].

1.6.5 Barn owls are known to be particularly susceptible to road traffic collisions, and are the most frequently encountered raptor or owl as road kill[22]. The combination of their low-level (<5 metres) hunting flight behaviour and the concentration of prey animals in rough grass verges of major roads, brings them into close proximity to moving vehicles. It is estimated that around 3,000 – 5,000 individuals are killed on major roads in the UK each year[23], accounting for at least 50% of known barn owl mortality[24]. In 1986 a study around Norwich estimated that road mortality accounted for 33% of the anticipated annual death rate, although this was thought to be an underestimate[23].

[19] Brown, D.J. (1981). *Seasonal variations in the prey of some Barn Owls in Gwynedd*. Bird Study 28: 139-146.
[20] Love, R.A. (2002). *The Mammal Society: National Owl Pellet Survey* [online] available at: http://www.abdn.ac.uk/~nhi775/owl_pellets.htm (last accessed March 2018).
[21] Montgomery, W.I. (1989). *Population Regulation in the Wood Mouse*, Apodemus sylvaticus. I. Density Dependence in the Annual Cycle of Abundance. Journal of animal Ecology 58: 465-475.
[22] Ramsden, D.J. (2003). *Barn Owls and Major Roads: results and recommendations form a 15-year research project*. The Barn Owl Trust, Ashburton.
[23] Shawyer, C.R. (1987) *The Barn Owl in The British Isles: It's past present and future*. The Hawk Trust c/o Zoological Society, London.
[24] Newton, I., Wyllie, I. and Dale, L. (1997). *Mortality causes in British Barn owls (Tyto alba), based on 1101 carcasses examined during 1963-1996*. - In: Duncan, J. R., Johnson, D. H. and Nicholls, T. H. (eds.), *Biology and Conservation of Owls of the Northern Hemisphere*, Second International Owl Symposium, February 5-9, 1997. USDA Forest Service, General Technical Report NC-190, Winnipeg, Manitoba, Canada, pp. 299-306.

2 Methodology

2.1 Desk study

2.1.1 Barn owl record data was obtained from the Somerset Environmental Records Centre (SERC) within 3 kilometres of the red line boundary of the Scheme in May 2017.

2.1.2 Additionally, the Barn Owl Trust was contacted to obtain species records within 3 kilometres of the Scheme.

2.2 Field survey

2.2.1 The surveys followed Shawyer (2011)[25] and were split into three stages: stage 1 onsite scoping, stage 2 investigative field survey, and stage 3 nest site verification survey. Surveys for stages 1 and 2 were combined into a single walkover survey undertaken in February to April 2017.

2.2.2 During the breeding season, adult barn owls commonly range between 1 and 1.5 kilometres from their breeding sites[26]. Therefore, any breeding barn owls within 1.5 kilometres of the Scheme are considered likely to be impacted by the works. This was therefore defined as the Zone of Influence (ZoI) for the study area (see Figure 2.1) and covers an area of approximately 22km^2.

2.2.3 Studies have suggested that disturbance from human activity can be caused up to 100 metres from the nest site, although the distance at which nesting barn owls become intolerant to the approach of humans and works activities can vary depending on levels of localised day to day activity. The Forestry Commission (2007)[27] sets a safe working distance from barn owls of between 100 metres to 250 metres. As such the ZoI of the works in relation to noise disturbance has been defined as 250 metres within this study.

[25] Shawyer, C. (2011) *Barn Owl Tyta alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Surveying and Reporting*. IEEM, Winchester.
[26] Shawyer, C.R. (1990, revised 1996). *The Barn Owl and its Habitat*. The Hawk and Owl Trust, London.
[27] Forestry Commission (2007) *Forest Operations and Birds in Scottish Forests – the Law and Good Practice*. Guidance Note 32. Forestry Commission, Scotland.

Figure 2.1: Scheme footprint (red line boundary) and the study area (in green)

Stage 1 and stage 2 - onsite scoping survey and investigative field survey

2.2.4 The combined stage 1 and stage 2 surveys involved a walkover of the study area during daylight hours to broadly define those habitat features of potential value (for example, buildings, trees, nest boxes etc.). Unless trees had experienced premature decay, only trees with the following diameter were considered suitable:

- Ash Fraxinus excelsior, sycamore *Acer pseudoplatanus* and crack willow *Salix fragilis*: 0.5 metre diameter or more (>80 years old)
- horse chestnut *Aesculus hippocastanum* and beech *Fagus sylvatica*: 0.75 metre diameter or more (>150 years)
- pedunculate oak *Quercus robur*: 1.5 metre diameter or more (>250 years)

2.2.5 Careful inspection and identification of those built structures, mature trees or other features determined if they offered any of the following features for barn owls:

- potential nest site (PNS)
- occupied breeding site (OBS)
- active roost site (ARS)
- temporary roost site (TRS)

2.2.6 Habitats, particularly grassland, were systematically identified within the study area in terms of their suitability as a feeding resource; these were largely defined by their structural composition:

- Type 1 habitat – Optimum habitat to support field voles, of a permanent, unimproved or semi-natural grassland with varied, tussocky structure. Management is absent or occasional grazing only.
- Type 2 habitat – Sub-optimal to field voles, and offer transient value to barn owls. May be semi-improved or improved grassland characterised as having a more homogenous, even-height sward. Receives some level of farm management such as occasional fertilisation, annual topping or light grazing.
- Type 3 habitat – Very poor habitat for field voles and other small mammals. Improved grasslands with an homogenous sward which is kept short throughout much of the year. High levels of management such as mowing for amenity or closely grazed. These habitats are generally areas of habitat that were not recorded during the surveys due to the large area required to be covered, and their negligible use by barn owls[28]. As such they are not illustrated in appendix A.

2.2.7 Other habitats such as arable fields and mature woodland are defined as of negligible value to foraging barn owls due their inability support suitable habitat for field voles for much of the year.

2.2.8 By dividing the total amount of grassland along the route of the Scheme by the estimated area of grassland required, the potential number of territories that can be supported within the study area can be calculated. Although grassland is of high quality to barn owls, they are found in areas that do not contain this habitat[29].

2.2.9 Estimations of the number of territories within the study area are based on the following assumptions:

- nest sites will be at least 250 metres away from each other[30]
- a roosting location or sighting and a known nest site within 1 kilometre of each other will be associated

2.2.10 Traffic accident blackspots (TABs) were also identified from the biological records and a 4-year study undertaken to assess the impact of the existing

[28] Shawyer, C. (2011) *Barn Owl Tyta alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Surveying and Reporting*. IEEM, Winchester.
[29] English Nature (2002). *Barn owls on site – A guide for developers and planners*. English Nature, Peterborough
[30] Shawyer, C.R. (1987) *The Barn Owl in The British Isles: It's past present and future*. The Hawk Trust c/o Zoological Society, London.

A303 on barn owls[31]. These are considered to be locations where there is an increased risk of road mortality though collision with vehicles. These include where prime foraging habitat is bisected by the Scheme and where the road is level or raised above the surrounding landscape[32].

Stage 3 – nest site verification survey

2.2.11 Surveys to confirm which of the PNS identified in stage 2 are actively used by barn owls for breeding or used in the recent past were undertaken by a Schedule 1 (barn owl) licence holder.

2.2.12 Potential nest sites typically include:

- agricultural or old industrial buildings with suitable access and possessing an upper floor, loft, roof void, blocked chimney, wide wall plate, bale stack, empty water tank, ducting or large nest box
- disused or derelict cottages or industrial buildings such as aircraft hangers, which possess an open joist, broken ceiling panel, water tank, disused chimney or large nest box
- mature trees, isolated or in clusters in open fields, hedgerow or on the woodland edge, containing a hole >80 millimetres backed by a large, dark cavity, including those which have rotted-out to ground level but which offer no obvious access to ground predators through an open root structure
- outdoor nest boxes on poles, trees, buildings or owl towers, which offer a dark chamber
- outdoor bale ricks
- cliffs and quarries with caves or fissures
- river, rail or road bridges containing suitable cavities within their structure
- rural churches and the chimneys of intermittently-used holiday homes

2.2.13 This was accomplished by checking for the presence of adult barn owls, their moulted feathers, pellets, eggs, egg shells, chicks or down within tree cavities and within built structures. A ladder was used to access the features. These surveys were conducted in late summer (July and August 2017) to avoid the early phase of breeding when barn owls are prone to nest desertion.

2.2.14 If a PNS was confirmed as an active breeding site, it was then considered to be an OBS.

[31] Shawyer, C. and Dixon, N. (1999) *Impact of Roads on Barn Owl Tyto alba Populations* DPU 9/51/2. Highways Agency.
[32] Barn Owl Trust (2012) *Barn Owl Conservation Handbook*. Pelagic Publishing, Exeter.

2.3 Assessment of Impacts

2.3.1 The assessment methodology follows guidance as outlined within Highways England Interim Advice Note (IAN) 130/10[33] and DMRB Volume 11, Section 3, Part 4[34].

Environmental value (sensitivity)

2.3.2 Table 2.1 details the resource values and their level of importance. The ecological receptors are valued in accordance with IAN 130/10 and the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines (2016)[35].

Table 2.1: Criteria for determining the conservation value of an ecological resource or feature

Conservation value	Criteria	Level of importance	Criteria
Very high	High importance and rarity and limited potential for substitution.	International	Significant populations of species and habitats of international importance, notably qualifying interest features of designated sites. Habitat and species listed in EC Habitats Directive. High importance and rarity and limited potential for substitution.
High	High importance and rarity, or with limited potential for substitution	National	Nationally important habitats of good condition and/or significant species population of national importance. Regionally important habitats and/or species with limited potential for substitution. Significant species population. High importance and rarity, or with limited potential for substitution.
Medium	High or medium importance and rarity, and limited potential for substitution	Regional	Regionally important habitats and/or species with potential for substitution. BAP priority habitats and species other than those of national importance. High or medium importance and rarity, and limited potential for substitution.
Low	Low or medium importance and rarity.	Local	Local species of importance (often listed in BAPs). Low or medium importance and rarity.
Negligible	Very low importance and rarity.	-	Other habitats or species populations with little biodiversity value and earth heritage interest. Very low importance and rarity.

Source: Based on IAN 130/10

[33] Highways England (2010) Interim Advice Note 130/10 *Ecology and nature Conservation: Criteria for Impact Assessment* [online] available at: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian130.pdf (last accessed March 2018).
[34] Highways England (2008) *Volume 11 Environmental Assessment, Section 3, Part 4 Ecology and Nature Conservation* [online] available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/11s3p04.pdf (last accessed February 2018).
[35] Chartered Institute of Ecology and Environmental Management (CIEEM) (2016). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal*. 2nd Edition.

Magnitude of impact

2.3.3 Once the value of each resource was identified using the criteria shown above, the magnitude of impact was assessed as described in Table 2.2.

Table 2.2: Criteria for Determining the Magnitude of Impact

Magnitude of impact	Criteria	
	Adverse	Beneficial
Major	Loss of resources and/or quality and integrity of resources; severe damage to key characteristics, features or elements.	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Moderate	Loss of resources, but not adversely affecting the integrity; partially loss of/damage to key characteristics, features or elements.	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration, to one (maybe more) key characteristics, features or elements.	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements.	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.	

Source: Based on Highways England DMRB Volume 11, Section 3, Part 4

Significance of effect

2.3.4 The significance of effect upon each resource was then ascertained using the criteria set out in Table 2.3. For the purposes of this assessment, effects of Moderate Adverse or Beneficial and above are considered to be significant.

Table 2.3: Overall appraisal category

		Environmental / conservation value (sensitivity)				
		Very High	High	Medium	Low	Negligible
Magnitude of impact	Major	Very Large	Large to Very Large	Moderate to Large	Slight to Moderate	Slight
	Moderate	Large to Very Large	Moderate to Large	Moderate	Slight	Neutral to Slight
	Minor	Moderate to Slight	Slight to Moderate	Slight	Neutral to Slight	Neutral
	Negligible	Slight	Slight	Neutral to Slight	Neutral to Slight	Neutral
	No change	Neutral	Neutral	Neutral	Neutral	Neutral

Source: Based on Highways England DMRB Volume 11, Section 2 Part 5

2.4 Survey constraints

2.4.1 Trees were only assessed from the ground or a ladder therefore, some holes that appeared suitable from vantage points may not actually be of sufficient dimensions; equally some holes may have been missed if they were obscured from view by branches or other obstacles.

2.4.2 Even though the stage 1 and 2 surveys were carried out during the winter, when holes should be most conspicuous on deciduous trees, many mature trees seen were partially or completely covered in ivy *Hedera helix*. Therefore, it was not possible to confirm nor deny the presence of suitable holes. A precautionary approach was taken under these circumstances and they were identified as PNS / TRS and investigated further as part of the stage 3 surveys. This is likely to have led to an overestimation of suitable roosting and nesting locations.

2.4.3 The survey area may be used by many barn owls, especially in winter, that do not roost or nest in the area and therefore would not be detected.

2.4.4 The number of barn owls is likely to be under recorded because of the difficultly in locating natural nest and roost sites[36].

[36] Taylor, I.R. (1994). *Barn Owls: Predator–prey Relationships*. Cambridge University Press, Cambridge.

3 Results

3.1 Barn owl records

3.1.1 The Barn Owl Trust returned seven records of barn owl shown in Table 3.1. No records of barn owls were returned from SERC.

Table 3.1: Barn Owl Trust records

Grid reference (TG)	Distance from the Scheme	Description
ST5326	>1.5km	Reported nesting in bell tower of school. Chick fell out of nest but died at West Hatch week commencing 21 October 2002, screeching was subsequently still heard from the nest.
ST558283	>1.5km	Regularly seen using disused building on the airfield, over a period of several weeks.
ST597278	>1.5km	Barn owl regularly seen in their orchard.
ST603281	>1.5km	An individual hunting over a young tree plantation for the last 10 years.
ST6326	>1.5km	3 birds seen dead (2 long dead, 1 fresh) in the fast lane on the A303 between Sparkford and Wincanton.
ST5353624991	1km	Barn owl seen flying once while driving
ST6246526277	>1.5km	Barn owl road casualty seen whilst driving.

3.1.2 TABs were recorded twice in the Barn Owl Trust data within 5 kilometres of the Scheme, however, both were outside the 1.5 kilometres survey area.

3.1.3 Of the collated records, the closest to the Scheme was a single barn owl seen whilst driving, approximately 1 kilometre from the red line boundary of the Scheme.

3.1.4 These records are not within the 1 kilometre study area but it is likely that these birds will frequent the ZoI of the Scheme

3.1.5 Of the 169 records of breeding barn owls detailed in the Somerset Atlas of Breeding and Wintering Birds[37], none were located in the study area.

3.2 Potential nesting sites

3.2.1 A total of 51 potential roosting and nesting locations were found within the study area (Table 3.2).

Table 3.2: Potential roosting and nesting sites

Type of roosting / nesting site	Total number	Density (per km^2)
Mature trees with visible hole(s)	24	3.9
Buildings	22	3.6
Barn owl boxes	5	0.8

[37] Ballance, D., Grimmond, R., Moss, S., Thomas, J. and Tigwell, E. (2014). *Somerset Atlas of Breeding and Wintering Birds 2007-2012*. Somerset Ornithological Society.

Type of roosting / nesting site	Total number	Density (per km^2)
Total:	**51**	**8.3**
Potential nesting sites directly impacted by the road	**26**	**4.3**

3.2.2 These potential nesting locations are shown in the barn owl survey maps (appendix A). These maps show that the density of these features increases eastwards along the route of the Scheme. The density of PNS is considered to be sufficiently high so as not to be a limiting factor in the population levels.

3.3 Occupied breeding sites and active roost sites

3.3.1 Four ARS, 2 of which are adjacent and likely to be part of the same territory and 2 OBS were identified during the stage 3 nest verification surveys. These were at Camel Hill (Grid Ref: ST 58592 25721) and north of Pepper Hill Copse (Grid Ref: ST 59272 26308). Table 3.3 shows the details of the surveys.

Table 3.3: Stage 3 nest verification surveys

Feature	Type	Date of survey and description	Photo
ARS 1	Barn	10 August 2017 – Open sided barn. Barn owl seen leaving site and >20 pellets found within.	
ARS 2	Barn	3 September 2017 – Broken windows allow access. Four relatively fresh pellets (1 less than a month old). Significant 'whitewashing' inside barn and numerous under feathers.	

Feature	Type	Date of survey and description	Photo
ARS 3	Barn	3 August 2017 – Disused barn with around 60 pellets, several adult moulted feathers with 'whitewash' below beam at south end. Feathers appear relatively fresh. Pellets vary in age, none appearing younger than a month. Owner found moribund barn owl in farm yard earlier in the winter. Potentially recently abandoned.	
ARS 4	Barn	3 September 2017 – Six Pellets found in alcove in west wall of derelict barn. Older than a month and recently shed scapula feathers	
OBS 1	Box	3 September 2017 – On south side of oak stump 6m high. Box erected in 2016 / 17 winter. Two barn owls flushed upon inspection. Cache of 3 voles and numerous pellets.	

Feature	Type	Date of survey and description	Photo
OBS 2	Box	3 September 2017 – On oak. Two barn owls flushed upon inspection, 1 of which appeared to be a well grow juvenile. The other may have been an adult female or another juvenile. Numerous pellets, down and droppings. Adult feathers also present. Deep, compact layer or nest materials suggestive of long term use.	

3.4 Potential foraging habitat

3.4.1 The landscape within the study area is predominantly arable with field margins and associated hedgerows. Fields of rough grassland used for grazing are relatively common as well as small parcels of woodland. These habitats range from negligible to high (Type 1 to Type 3 habitat) quality for foraging barn owls.

3.4.2 The habitat most widespread within the study area is categorised as of moderate quality for barn owl foraging (Type 2) habitat. Type 3 which is of negligible or low quality for barn owl foraging was the next most common habitat type (either highly maintained grassland or non-grassland habitats). The highest value habitat type (Type 1) was of limited extents and mostly consisted of narrow strips of habitat along linear features such as roads and hedges (appendix A).

3.4.3 For this type of mixed arable and pastoral landscape a pair of barn owls is estimated to require between 17 to 26 hectares of rough grassland[38].

3.4.4 Table 3.4 shows the results of the potential foraging habitat survey undertaken in 2017. From this, it can be sees that there is approximately 422 hectares of grassland suitable for barn owl foraging within the study area.

3.4.5 Using the figures above an estimate can be derived which suggests that this foraging habitat could support between 16 – 25 pairs of barn owls. It is possible that the actual figure is at the lower end of this scale or lower because the majority of the habitat is of medium quality rather than high quality. Additionally,

[38] Askew, N. (2006). *Where to put nest-boxes? How much habitat?*... British Trust for Ornithology Barn Owl Bulletin 4: 6-7

management of the grassland may involve mowing which will reduce the value of the medium quality grassland for foraging.

Table 3.4: Potential Barn Owl Foraging Habitat

Habitat type	Total amount (ha)	Proportion of all grassland (%)
Type 1 habitat (high quality)	25.8	3.3
Type 2 habitat (moderate quality)	397.1	50
Type 3 habitat (low quality)	370.9	46.7
Total (Type 1 and 2)	**422.9**	**53.3**
Total grassland	**793.8**	**-**

3.4.6 Two pairs were recorded breeding and a further 2 possible territories can be inferred from 3 active roost sites. From this, it can be seen that the current population of barn owls is less than the potential foraging habitat could potentially support, the area is, therefore, below the carrying capacity for barn owls. It is however likely that the actual figure for barn owls using the survey area is between 4 and 5 as a further four active roosting sites indicate 3 additional territories (appendix A).

3.5 Traffic accident blackspots

3.5.1 Two TABs were identified during a study undertaken of the impact of roads on barn owls on the existing A303[39].

3.5.2 No dead barn owls were recorded during the surveys. There are 2 records reporting dead barn owls (section 3.1). These are both outside the study area but are located where the A303 is dual carriageway indicating that the owls in the wider area may be at risk from traffic accidents where the road is dual carriageway.

3.5.3 Three locations have been identified as potential TABs from the surveys. These are areas that barn owls will be most likely to cross the road. This is due to the proximity of a nest to the road with suitable foraging habitat within the pairs territory on the other side of the road. Also, where there is Type 1 habitat close to or adjacent to the road on either side and where a corridor of suitable foraging habitat is present.

3.5.4 The locations of these potential TABs are shown in appendix A.

3.6 Summary

3.6.1 While there is no current estimation of the barn owl population in Somerset, it is thought that the population has been increasing due to the efforts of the nest box Schemes, and the Somerset Levels are now considered one of the most

[39] Shawyer, C. and Dixon, N. (1999) *Impact of Roads on Barn Owl Tyto alba Populations* DPU 9/51/2. Highways Agency.

important strongholds for this species in the country[40]. The population within the study area consists of 2 known active barn owl pairs. It is likely though that the figure of pairs of barn owls using the survey area, is between 4 and 5 at most. This potentially constitutes around 1% of the Somerset population; therefore, is considered to of Medium conservation value.

3.6.2 From the data, it can be inferred that there are at least 2 active barn owl home ranges that are likely to lie, at least in part, within the study area. Of the nesting and roosting locations none are likely to be directly removed as a result of the scheme, however, one is approximately 50 metres from the red line boundary of the scheme.

[40] Spearing, C. (2014) Somerset barn owl web cam watched from across the world [online] available at: http://www.bbc.co.uk/news/uk-england-somerset-27139486 (last accessed March 2018)

4 Potential impacts

4.1 Overview

4.1.1 The assessment methodology follows guidance as outlined within Highways England IAN130/10 and DMRB Volume 11, Section 3, Part 4, and is detailed in section 2.3.

4.2 Construction

4.2.1 The following impacts from the construction of the scheme are considered likely without mitigation:

- permanent and temporary foraging habitat loss
- loss of potential nesting and roosting locations
- barrier to dispersal and fragmentation of habitat
- disturbance effects of artificial lighting
- noise disturbance impacts
- physical disturbance by humans and construction activities
- mortality on site

Permanent and temporary foraging habitat loss

4.2.2 During construction the main impact would be loss of foraging habitat of both Type 1 and 2 high and moderate quality respectively. Barn owls may concentrate their hunting on small patches of high quality, Type 1 long grass and ignore areas of short grass (Type 3 poor quality) in between[41]. The loss of small patches of Type 1 habitat could be significant for the local barn owl population, for instance in the areas of land that would be used temporarily for storage and site compounds.

4.2.3 Temporary loss would be through the requirement for laydown areas, construction compounds and haulage roads. The magnitude of the impact for temporary habitat loss is considered to be Minor Adverse, as the current barn owl population is currently not using the full amount of suitable habitat available to them within the areas they are known to be from the ARS and OBS.

4.2.4 Permanent loss would be through the realignment of the road and land take of the Scheme. The impact for permanent habitat loss is considered to be Moderate Adverse due the proximity of the works to the territory of 1 of the known breeding pairs. This would mean potential decrease in their foraging success without moving their territory.

[41] English Nature (2002). *Barn owls on site – A guide for developers and planners*. English Nature, Peterborough

Loss of known and potential nesting and locations

4.2.5 Only 2 locations have been identified with OBS within the study area. The location of the northern haulage road would pass over OBS 1 therefore losing this nesting location. OBS 2 is located 267 metres from the current red line boundary and therefore, foraging activities may be impacted.

4.2.6 The Forestry Commission (2007)[42] recommend a safe working distance from nesting barn owls of no less than 250 metres for those activities which are likely to cause disturbance. There would be a loss of 5 potential nesting locations within the works boundary and a total of 26 potential roosting locations that would be impacted by the works within 250 metres.

4.2.7 The magnitude of the impact on potential roosting locations is therefore considered to be Moderate Adverse and the impact on currently used nesting locations is Major Adverse without mitigation measures.

Barrier to dispersal and fragmentation of habitat

4.2.8 The upgrade of the A303 along this section from a single carriageway to dual would change the nature of impacts on barn owls moving through the landscape due to the increased width of the road and associated landscaping. Improvements to traffic congestion would also increase the speeds of traffic along this section, therefore increasing the chances of owls to be struck by vehicles[43]. There were no ARS or OBS found to the south of the road despite large areas of suitable foraging habitat which suggests that the road is currently having some impact to the movement of owls within the area and the scheme would increase this barrier and fragmentation.

4.2.9 The magnitude of the impact is there considered to be Moderate Adverse.

Disturbance effects of artificial lighting

4.2.10 Lighting of construction areas and access routes during times when the barn owls are active may cause the owls to avoid areas and further cause a barrier to dispersal. Movement between foraging areas even where lighting is not directed towards nests and roosts would also be impacted.

4.2.11 The magnitude of the impact is considered to be Moderate Adverse.

[42] Forestry Commission (2007) *Forest Operations and Birds in Scottish Forests – the Law and Good Practice. Guidance Note 32*. Forestry Commission, Scotland.
[43] Shawyer, C. and Dixon, N. (1999) *Impact of Roads on Barn Owl Tyto alba Populations* DPU 9/51/2. Highways Agency.

Noise disturbance impacts

4.2.12 A relative increase in noise disturbance to the nest location close to the scheme above that of the current activity levels may cause abandonment of the nesting location. Initial nest location selection, egg laying and incubation are particularly sensitive to nest desertion and breeding failure. Only 2 active nests have been recorded within the study area, 1 of which (OBS 1) is located on the route of the northern haulage route and other areas of permanent land take.

4.2.13 The magnitude of the impact is Major Adverse**,** without mitigation measures.

Physical disturbance

4.2.14 Human and construction activities can cause barn owls to abandon the nest. Prolonged disturbance would prevent the adults from returning to the nest causing breeding failure. Different types of activities can have differing levels of disturbance to barn owls. Heavy construction works such as ground levelling and pile-driving can cause disturbance as far away as 175 metres. Vehicular movement has a much lower disturbance distance at around 40 metres however, this is dependent on the base levels of activity such as normal farm vehicle activity.

4.2.15 The magnitude of the impact is considered likely to vary from Minor Adverse to Moderate Adverse.

Mortality on site

4.2.16 Barns owls can die through drowning on uncovered water butts / troughs and through rodenticide poisoning by eating poisoned rats and mice. This could lead to a Moderate Adverse impact on the barn owl population.

4.3 Operation

4.3.1 The following are potential impacts resulting from the operation of the scheme without mitigation:

- road mortality
- barrier to dispersal and fragmentation of habitat
- disturbance effects of artificial lighting
- noise disturbance impacts

Road mortality

4.3.2 Major roads can result in the complete absence of breeding barn owls within 0.5 kilometre of a road and it is not until 25 kilometres from a major road that its

effect on barn owl population cannot be detected[44]. A study of BTO ringing data found that of juvenile owls dispersing from the natal area, 77% were killed by a major road if they encountered one[44].

4.3.3 The following risk factors are associated with barn owl mortality on major roads in descending order of importance[44] are:

- absence of continuous low flight obstructions
- elevation of the carriageway (sunken, or level)
- presence/absence of rough grass verges
- traffic density
- traffic speed
- vehicle size
- number of traffic lanes

4.3.4 Improvements to traffic congestion on this stretch of the A303 by upgrading from a single carriageway to dual would also increase the speeds of traffic along this section therefore, increasing the chances of owls being struck by vehicles[45]. Therefore, it is considered likely that all owls identified during the surveys are at risk from road mortality and the magnitude of the impact is Moderate Adverse.

Barrier to dispersal and fragmentation of habitat

4.3.5 Construction could create a barrier to those areas of good foraging habitat to the south of the road through removal of habitat corridors and linear features. Also, the road is likely to act as a barrier to dispersal of fledged young.

4.3.6 The magnitude of the impact is considered to be Moderate Adverse.

Disturbance of artificial lighting

4.3.7 Lighting during times when the barn owls are active may cause the owls to avoid areas and further cause a barrier to migration and movement between foraging areas.

4.3.8 The magnitude of the impact is Moderate Adverse.

[44] Ramsden, D.J. (2003). *Barn Owls and Major Roads: results and recommendations form a 15-year research project*. The Barn Owl Trust, Ashburton.
[45] Shawyer, C. and Dixon, N. (1999) *Impact of Roads on Barn Owl Tyto alba Populations* DPU 9/51/2. Highways Agency.

Noise disturbance

4.3.9 A relative increase in noise disturbance to the nest location close to the Scheme above that of the current activity levels may cause abandonment of the nesting location.

4.3.10 The magnitude of the impact is considered to be Moderate Adverse.

4.4 Summary

4.4.1 Records have identified barn owls in the wider area and there would be a loss of one active nesting site. Major roads have wide-ranging impacts on barn owl populations and the upgrade of this section of the A303 would increase the existing impacts of the current road. A loss of habitats in addition to an increased impact from the road causing a barrier to dispersal would also have an impact on the population. The magnitude of the overall impact on the population of barn owls in the study area is considered to be Moderate Adverse during the operation and construction of the road.

4.4.2 This results in an overall significance of effect of Moderate Adverse during construction and operation when mitigation measures are not considered.

5 Mitigation and enhancement recommendations

5.1 Further surveys

5.1.1 Prior to the start of the works the 2 recorded OBSs and all previously identified PNS must be rechecked within 1 kilometre of the works to ensure that barn owls have not begun using these locations for breeding and therefore at risk of disturbance. In order to confirm if a barn owl is nesting at a PNS, a Natural England licenced surveyor is required.

5.1.2 If a barn owl nest is found in a tree or building within 175 metres of the road an assessment of the likely levels of disturbance would be required and mitigation measures put in place. If a tree or building used as a nesting location requires removal, this can only be undertaken when the breeding cycle has ended and all dependant young have permanently vacated the site. Approximately 75% of the barn owl nesting cycle in the UK falls between March and August, inclusive, this period would be regarded as the main breeding season for barn owls[46].

5.2 Construction mitigation

5.2.1 Impacts during the construction phase of the Scheme would be mitigated through following best practice measures. These would include:

- closure of OBS 1 would need to take place outside of the breeding season by a licenced ecologist
- no works would take place within 20 metres of an active barn owl nest. If an active nest is identified during the works a suitably qualified ecologist would assess the potential impacts and recommend mitigation. Before work can recommence a licensed person must check that the chicks have fledged and are no longer dependent upon the adults
- minimising light emissions by reducing construction during the hours of darkness and providing lighting that is only directional downward and avoiding light spill onto the surrounding area
- ensure any water storage areas such as water butts are covered to prevent drowning
- control use of rodenticide to prevent secondary deaths of barn owls through eating poisoned rats and mice. The Barn Owl Trust (2009)[47] provides guidance in relation to the safe use of rodenticides with respect to barn owls

[46] Ramsden, D. & Twiggs, M. (2009). *Barn Owls and Rural Planning Applications "What needs to happen" - A Guide for Planners*. Barn Owl Trust, Ashburton.
[47] Barn Owl Trust (2009). Rodent Control [online] available at: https://www.barnowltrust.org.uk/hazards-solutions/rodenticides/background-rat-poison-problem/ (last accessed March 2018)

- replacement planting of temporary and permanent habitat loss. Habitats, such as woodland and grassland, that are lost through temporary and permanent land take would be replaced, particularly reinstating grassland areas of Type 1 and 2 either *in situ* or within areas designated for mitigation. As a minimum, compensation would be implemented of the core habitat loss within 5 kilometres of the known nest sites.

5.2.2 While road mortality is an operational impact, the mitigation for this must be undertaken during the construction phase. As such replacement planting and habitat creation must be in place before the operation phase of the Scheme begins.

5.2.3 Mitigation to reduce the impact of road mortality falls into 2 categories; the creation of obstacles that would force birds to fly higher whilst crossing the carriageway and the reduction of small mammal prey availability on road verges[48,49].

5.2.4 To potentially reduce the number of barn owls killed by vehicles, barn owls would be encouraged to fly over the road at a height of at least 3 metres. This can be achieved by planting continuous hedges or lines of closely spaced trees (>3 metres high) adjacent to the carriageway along both sides of the road as screening. This is especially important where the road is level with or raised above the adjacent terrain[48,49]. Therefore, the design of the road including landscape bunding and whether it is elevated or sunken could have varying degrees of impact for barn owls. Timescale is a real issue, as it is imperative that the mitigation is fully functional (specifically planting is at least 3 metres and continuous) when the road opens and therefore where possible at least some of the planting would be in place in advance of this time.

5.2.5 Barn owls would be encouraged to fly over the road at a height of at least 3 metres for the whole of the route using the mechanisms described above. However, if this is not possible it may be appropriate to target some critical areas. Critical areas are identified as the 2 active nesting locations and potential TABs illustrated in appendix A.

5.2.6 Screen planting would also be designed so that owls are encouraged away from, rather than towards the road. It is possible to create rough grassland areas behind the screening vegetation along the road. This would provide alternative foraging habitat. Planting 2 areas of trees with at least 6 metres of

[48] Baudvin, H. (1997). *Barn Owl (Tyto alba) and Long-eared Owl (Asio otus) Mortality Along Motorways in Bourgogne-Champagne*: Report and Suggestions. - In: Duncan, J. R., Johnson, D. H. and Nicholls, T. H. (eds.), *Biology and Conservation of Owls of the Northern Hemisphere*, Second International Owl Symposium, February 5-9, 1997. USDA Forest Service, General Technical Report NC-190, Winnipeg, Manitoba, Canada, pp. 299-306.

[49] Ramsden, D.J. (2003). *Barn Owls and Major Roads: results and recommendations form a 15-year research project*. The Barn Owl Trust, Ashburton.

rough grassland in between would provide a good foraging corridor for barn owls. It is recommended that screen planting is managed as part of the landscape management plan

5.2.7 Measures are required to deter barn owls from the carriageway in order to minimise potential traffic collisions. Regularly mowing long sections of road verges in order to reduce small mammal abundance is not feasible because of economic, conservation and landscape implications[50]. Planting dense shrubs close to the carriageway has road safety implications and would potentially increase mortality in other bird species. However, in areas where continuous screening is not provided and the loss of verge grassland is acceptable, low-level permanent ground cover such as dense bramble *Rubus fruticosus* agg. or gorse *Ulex europaeus* would be maintained across the entire width of both verges[50].

5.2.8 All temporary areas associated with construction, for example, access tracks, laydown areas and compounds, would be sited to minimise their impact on wildlife. This would be at least 20 metres from the known barn owls nesting locations and in habitats that are not suitable for foraging (specifically not Type 1 and 2). Areas of amenity or heavily grazed grassland or arable would be most suitable. These areas would be fully reinstated post construction.

5.2.9 Where a nest needs to be removed (OBS 1) a new nest box cannot be used as a direct replacement for the individual birds that used the removed nest, therefore new nest boxes would be installed. Barn owls would not be encouraged to nest within 1 kilometre of a major road as these individuals are highly likely to be killed[50] and therefore the placement of compensatory boxes would be greater than 1 kilometre from the road.

5.2.10 If there is any indication that barn owls are nesting within the footprint of the Scheme at any time during construction work, all work would stop within a minimum of 30 metres until the ecologist can fully assess the situation and make any necessary recommendations.

5.2.11 A management plan would cover these and other mitigation measures, and all construction staff would receive training and sign up to implementation of the management plan prior to the start of work.

5.3 Operational mitigation

5.3.1 Since barn owls are nocturnal it is essential to minimise light emissions from the road by using lighting such as full cut off high pressure sodium lights that direct downwards to the carriageway. Additionally, night working during maintenance

[50] Ramsden, D.J. (2003). *Barn Owls and Major Roads: results and recommendations form a 15-year research project*. The Barn Owl Trust, Ashburton.

would be minimised. Screening bunds would reduce both light and noise pollution to the surrounding habitats. This may also potentially benefit other species such as badgers and other birds.

5.3.2 It is also essential that regular maintenance is undertaken on mitigation measures, for example, ensuring the continuity of the screening planting and maintenance of the barn owl boxes. Screens would be included as part of the landscape management plan. New barn owl boxes would be entered in the BTO Barn Owl Monitoring Programme (BOMP) and monitored along with the known nesting sites.

5.3.3 Measures are required to deter barn owls from the carriageway in order to minimise potential traffic collisions. Regularly mowing long sections of road verges in order to reduce small mammal abundance is not feasible because of economic, conservation and landscape implications[51]. Planting dense shrubs close to the carriageway has road safety implications and would potentially increase mortality in other bird species. However, in areas where continuous screening is not provided and the loss of verge grassland is acceptable, low-level permanent ground cover such as dense bramble or gorse would be maintained across the entire width of both verges[51].

5.4 Enhancements

5.4.1 Nest Boxes – Additional nest boxes would be provided at least every 1 kilometre, if this can be negotiated with local landowners. It is recommended that these are placed no closer than 1 kilometre, ideally 3 kilometre[51], from the Scheme and in pairs within 500 of each other at a density of about 1 pair per km^2 [52]. Therefore, approximately 13 boxes given that the Scheme is 5.5 kilometres long.

5.4.2 Boxes would be installed where there is suitable roosting and foraging habitat. These boxes would not directly compensate the barn owl population within the ZoI, as these birds are unlikely to migrate away from their existing foraging areas unless the area becomes unsuitable.

5.4.3 Hunting Posts – Wooden posts, approximately 3 metres in height would be provided in any barn owl habitat created as part of the mitigation for the loss of Type 1 or 2 foraging habitat. These posts would be useful in winter for hunting because they reduce the energy costs to the bird. There are no general guidelines with regards to the optimum number, placement and density of posts

[51] Ramsden, D.J. (2003). *Barn Owls and Major Roads: results and recommendations form a 15-year research project*. The Barn Owl Trust, Ashburton.
[52] RSPB/Barn Owl Trust (2007). *Farming for Birds – Barn Owl* [online] available at: http://www.rspb.org.uk/Images/barnowl_tcm9-148724.pdf (last accessed March 2018).

that would be of maximum benefit. It is suggested that posts in suitable foraging habitat would be placed no closer than 100 metres apart.

5.4.4 Monitoring – A key feature of the mitigation is the need to monitor the success of the installation of nest boxes and the installation of screening planting for at least 5 years post construction. This is particularly important where new mitigation techniques are being used or where their success rate is not well understood. Evidence of road kill can be assessed during these monitoring visits. Timing and frequency of the monitoring surveys would follow[53] with annual visits undertaken in July and August.

[53] Shawyer, C. (2011) *Barn Owl Tyta alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Surveying and Reporting*. IEEM, Winchester.

6 Conclusion

6.1.1 Through implementing the above mitigations, the impact of the Scheme on barn owls would be reduced. Using various mechanisms to screen the road would reduce road deaths and could also reduce noise and light pollution. Additionally, woodland and grassland habitats would be created to compensate for the removal of habitats in the footprint of the Scheme.

6.1.2 However, even if the mitigation and compensation package were developed to the best advantage of barn owls there would still be a negative impact of the Scheme on the barn owl population. These impacts would be through unavoidable disturbance during construction, the barrier effect that the road may have on dispersal, some residual mortality on the road as well as noise and light pollution.

6.1.3 The population of barn owls impacted by the works is considered to be of Medium conservation value. The magnitude of the impact on this population would be Moderate Adverse during the operational and construction phases of the works.

6.1.4 There would therefore be a regional impact of the Scheme on the barn owl population, both those owls in the study area and in the wider area. This results in an overall significance of effect of Moderate Adverse during construction and operation when mitigation measures are not considered. Where mitigation measures are implemented the residual effect is considered to be Slight Adverse.

Appendix A: Barn owl survey – territory map

KEY

- PROPOSED RED LINE BOUNDARY
- BARN OWL HABITAT TYPE 1
- BARN OWLHABITAT TYPE 2
- TYPE 1 LINEAR GRASSLAND HABITAT
- TYPE 2 LINEAR GRASSLAND HABITAT
- POTENTIAL TRAFFIC ACCIDENT BLACKSPOTS

BARN OWL SURVEY POINTS

- ACTIVE ROOST
- OCCUPIED BREEDING SITE
- POTENTIAL NESTING SITE
- TEMPORARY REST SITE

SHEET 1
SHEET 2

Scale

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	JULY 2018	DCO SUBMISSION	JI	VC	ER

Project Title: A303 SPARKFORD TO ILCHESTER DUALLING

Drawing Title: BARN OWL SURVEY - TERRITORY MAP SHEET 1

Drawing Status: Published - DEFINITION

Suitability: A3

Scale	Designed	Drawn	Checked	Approved
NTS	JI	ER	VC	ER

Original Size	Date	Date	Date	Date
A1	JULY 2018	JULY 2018	JULY 2018	JULY 2018

Drawing Number: HE PIN | Originator | Volume
HE551507 - MMSJV - EBD
Location 000 | Type DR | Role LB | Number 0049

Project Ref. No.: 389107

Revision: C01

KEY

- PROPOSED RED LINE BOUNDARY
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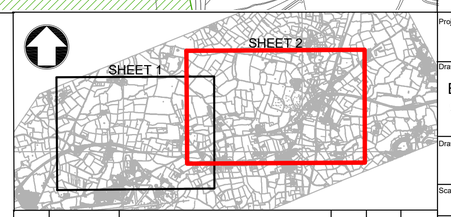
- POTENTIAL TRAFFIC ACCIDENT BLACKSPOTS

BARN OWL SURVEY POINTS

- ACTIVE ROOST
- OCCUPIED BREEDING SITE
- POTENTIAL NESTING SITE
- TEMPORARY REST SITE



REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	JULY 2018	DCO SUBMISSION	JI	VC	ER

Scale

Project Title: A303 SPARKFORD TO ILCHESTER DUALLING

Drawing Title: BARN OWL SURVEY - TERRITORY MAP SHEET 2

Drawing Status: Published - DEFINITION

Suitability: A3

Scale	Designed	Drawn	Checked	Approved
NTS	JI	ER	VC	ER

Original Size	Date	Date	Date	Date
A1	JULY 2018	JULY 2018	JULY 2018	JULY 2018

Drawing Number: HE551507 - MMSJV - EBD - 000 - DR - LB - 0050
(HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No.: 389107

Revision: C01