

Welsh Government

**A40 Llanddewi Velfrey to Penblewin  
Improvements**

Environmental Statement Chapter 8: Ecology  
and Nature Conservation

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## 8 Ecology and Nature Conservation

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### 8.1 Introduction

- 8.1.1 This chapter of the Environmental Statement (ES) assesses the likely effects of the Scheme on ecological resources within the study area and surrounding vicinity.
- 8.1.2 This chapter documents survey work undertaken in relation to habitats and species, the value of receptors identified and the predicted effects arising from the construction and operation of the Scheme. The chapter also documents measures to mitigate for these effects. Enhancement measures, where deemed necessary in relation to Welsh Government Policies, which go beyond mitigating effects are also identified. The residual effects following the inclusion of these measures are then assessed.
- 8.1.3 The ecological surveys of the study area were undertaken during 2016 with additional surveys in 2017 to inform this chapter.

### 8.2 Legislation, Policy Context and Guidance

#### Legislation

- 8.2.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. This is described in the following sections.

#### **Conservation of Habitats and Species Regulations 2017**

- 8.2.2 The Conservation of Habitats and Species Regulations 2017 (the ‘Habitats Regulations’) transpose the requirements of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) into law within England and Wales. These regulations provide for the designation and protection of sites of European importance known as European or Natura 2000 Sites.

### 8.2.3 European Sites comprise:

- a) Special Areas of Conservation (SACs) designated under the Conservation of Habitats and Species Regulations 2017 (as amended) (known as the Habitats Regulations)<sup>1</sup>;
- b) Special Protection Areas (SPAs) designated under the Wildlife and Countryside Act 1981 (as amended)<sup>2</sup>.

### 8.2.4 The Habitats Regulations require that consideration is given to the implications of plans and projects (developments) on European Sites. Specifically, Regulation 63(1) states:

- a) *"A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which -
  - (i) is likely to have a significant effect on a European site or European marine site (either alone or in combination with other plans or projects), and
  - (ii) is not directly connected with or necessary to the management of that site,*
- b) *must make an appropriate assessment of the implications for that site in view of that site's conservation objectives."*

### 8.2.5 The formal consideration of effects on European Sites is therefore undertaken by the determining authority, such as Welsh Government, under the Highways Act 1980 (also known as the Competent Authority).

### 8.2.6 The Habitats Regulations also convey special protection to a number of species which are listed in Schedule 2 of the Regulations and are referred to as European Protected Species (EPS). Those relevant to the Scheme include:

- a) All UK resident bat species;
- b) Common dormouse (*Muscardinus avellanarius*);
- c) Great crested newt (*Triturus cristatus*);
- d) Otter (*Lutra lutra*);
- e) Marsh fritillary butterfly (*Euphydryas aurinia*).

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<sup>1</sup> The Habitats Regulations transposes the requirements on Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora in to UK law.

<sup>2</sup> The Wildlife and Countryside Act 1981 transposes the requirements of Directive 79/409/EEC on the Conservation of Wilde Birds (Birds Directive) in to UK law. The Birds Directive was updated through Directive 2009/147/EC on the Conservation of Wild Birds.

- 8.2.7 Regulation 43 makes it an offence to:
- a) Deliberately capture, injure or kill any wild animal of a EPS;
  - b) Deliberately disturb wild animals of such a species;
  - c) Deliberately take or destroy the eggs of such a species;
  - d) Damage or destroy a breeding site or resting place of such an animal.
- 8.2.8 Disturbance in the context of the offences above is disturbance which is likely to impair the ability of the animals to survive, to breed or reproduce, to nurture their young, to hibernate, to migrate; or to affect significantly the local distribution and abundance of the species.
- 8.2.9 Licences can be granted by the relevant Statutory Nature Conservation Organisation (SNCO) for developments (sometime referred to as EPS Licences or Derogation Licences) providing the purposes of the licence is for "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".

#### **Ramsar Convention 1971**

- 8.2.10 Wetlands of International Importance (Ramsar Sites) declared under the Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 are considered European Sites as a matter of UK and Local Government Policy.

#### **Eels (England and Wales) Regulations 2009**

- 8.2.11 This implements Council Regulation (EC No. 1100/2007) of 18 September 2007 establishing measures for the recovery of the stock of European Eel (*Anguilla anguilla*). The Regulation requires Member States to implement a number of short and long-term measures to achieve a target of ensuring that at least 40% of the potential production of adult Eels return to the sea to spawn on an annual basis.

#### **Wildlife and Countryside Act 1981 (as amended)**

- 8.2.12 A network of nationally designated sites was established through the designation of Sites of Special Scientific Interest (SSSIs) under the Wildlife and Countryside Act 1981. The protection afforded by the Act means it is an offence to carry out or permit to be carried out any



operation listed within the notification without the consent of the Statutory Nature Conservation Organisation (Natural Resources Wales). The protection afforded to SSSIs is used to underpin the designation of areas at a European Level.

- 8.2.13 The Wildlife and Countryside Act also places obligations on Welsh Ministers and other public bodies with regard to the conserving and enhancing of the features of SSSIs in the exercise of their functions.
- 8.2.14 The Wildlife and Countryside Act 1981 provides protection to both EPSs and other species including wild birds, water voles and reptiles.
- 8.2.15 All wild birds, their nests and eggs are protected, with some rare species afforded extra protection from disturbance during the breeding season (these species are listed in Schedule 1 of the Act). It is illegal to take any wild bird or damage or destroy the nests and eggs of breeding birds. There are certain exceptions to this in respect of wildfowl, game birds and certain species that may cause damage.
- 8.2.16 Water vole (*Arvicola amphibius*) receive protection under the Wildlife and Countryside Act 1981 which prohibits the killing, injuring or taking by any method.
- 8.2.17 All native reptile species in the UK are subject to partial protection from intentional or reckless killing or injury only.
- 8.2.18 The Act also includes provisions for the control of invasive non-native species (INNS). Under these provisions it is an offence to:
- a) release or allow to escape into the wild any animal which is not ordinarily resident or a regular visitor to Great Britain, or is included in Schedule 9 of the Act;
  - b) plant or otherwise cause to grow in the wild any plant which is included in Schedule 9 of the Act.
- 8.2.19 People undertaking works in proximity to invasive non-native plant species should take all reasonable steps and exercise all due diligence to avoid committing an offence.

### **National Park and Access to the Countryside Act 1949 (as amended)**

- 8.2.20 Local Nature Reserves can be given protection against damaging operations through powers within the National Parks and Access to the Countryside Act 1949. However, this protection is usually conveyed through inclusion of protection within local planning policy relating to these sites and other non-statutory sites such as Sites of Importance for Nature Conservation.

### **The Protection of Badgers Act 1992**

- 8.2.21 Badger (*Meles meles*) and their setts are protected under the Protection of Badgers Act 1992 which makes it an offence to kill, injure or take a badger, or interfere with a sett.

### **Hedgerow Regulations 1997**

- 8.2.22 The Hedgerow Regulations 1997 set out a framework for the protection of hedgerows against removal where they are deemed to be important either due to their age, ecological or archaeological features. Approval is required from the local authority prior to the removal of hedgerows. Local authorities can enforce the retention of Important Hedgerows through the issuing of Retention Notices.

### **The Environment (Wales) Act 2016**

- 8.2.23 The Environment (Wales) Act 2016 replaces the duties on public bodies in Wales to conserve and enhance biodiversity in the exercise of their functions. This duty includes consideration of the resilience of ecosystems in terms of their diversity, connectivity, adaptability, scale and condition, The Act also reinforces the duties in relation to the lists of species and habitats of importance and the duties to conserve and enhance those species and habitats. Interim lists were published following the introduction of the Act, which are subject to consultation. Within this chapter these are referred to as Section 7 Habitats and Species unless covered under other legal protections.

### **The Well-being of Future Generations (Wales) Act 2015**

- 8.2.24 The Well-being of Future Generations Act requires public bodies in Wales to consider the long-term impacts of decision on the social, cultural, environmental and economic well-being of both current and future generations.

- 8.2.25 In particular the Act includes a number of goals including to maintain and enhance a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change.

### **Wild Mammals (Protection) Act 1996**

- 8.2.26 This Act operates in parallel with the legislation listed above conferring specific protection on rare or threatened mammal species by protecting all wild mammals from any action intended to cause unnecessary suffering.

### **Policy Context**

- 8.2.27 The Wales Transport Strategy<sup>3</sup> sets out a number of Environmental Outcomes relating to sustainable travel, greenhouse gas emissions, noise and water pollutions, climate change, heritage and biodiversity. The aim of the biodiversity outcome is to “improve the impact of transport on biodiversity”, specifically by ensuring that biodiversity is protected or enhanced through the development of transport measures, and that mitigation and enhancement measures are included where significant negative effects are predicted. The effects of existing roads on biodiversity is also considered through the implementation of the Trunk Road Estate Biodiversity Action Plan<sup>4</sup>.
- 8.2.28 The Scheme is listed within the Pembrokeshire County Council Local Development Plan as being a route that will be safeguarded against any developments that would prejudice their implementation.
- 8.2.29 Planning Policy Wales<sup>5</sup> sets the national policies in relation to development control through the Town and Country Planning Act 1990. This is supported by a series of Technical Advice Notes, of particular relevance is Technical Advice Note 5<sup>6</sup> which sets out the consideration of nature conservation in the determination of planning applications.

### **United Kingdom Biodiversity Action Plan (UK BAP)**

- 8.2.30 In 1992, the UK signed the Convention on Biological Diversity at the Rio Convention, pledging the UK to develop national strategies for the conservation and sustainable use of biological diversity. The UK

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<sup>3</sup> Welsh Government, 2008. The Wales Transport Strategy. Cardiff

<sup>4</sup> Welsh Assembly Government, 2004. Trunk Road Estate Biodiversity Action Plan 2004 – 2014. Cardiff

<sup>5</sup> Welsh Government, 2016. Planning Policy Wales, Edition 9. Cardiff

<sup>6</sup> Welsh Assembly Government, 2009. Technical Advice Note 5: Nature Conservation and Planning. Cardiff

Government subsequently produced ‘Biodiversity: The UK Action Plan’ in 1994 which described the biological resources of the UK as a whole and in turn led to the production of Biodiversity Action Plans for individual habitats and species.

- 8.2.31 Biodiversity policy within the UK was revised through the publication of the UK Post-2010 Biodiversity Framework<sup>7</sup> which covers the period from 2011 to 2020. A total of 65 Priority Habitats and 1150 Priority Species were identified as the most in need of protection. Such species and habitats present in Wales were included in the list of species and habitats under Section 7 of the Environment Wales Act.

#### **Trunk Road Estate Biodiversity Action Plan 2004 - 2014 (TREBAP)**

- 8.2.32 The National Assembly for Wales, as Highway Authority for Wales, has direct responsibility for the maintenance, improvement and development of the trunk road and motorway network for Wales. Under the Environment (Wales) Act 2016, the National Assembly for Wales has a duty to have a regard for the conservation of biodiversity in its work. The WG Transport Directorate is already incorporating biodiversity into its work, and the Trunk Road Estate Biodiversity Action Plan (TREBAP) is to contribute to this ongoing process.
- 8.2.33 There are eleven Habitat Action Plans and seventeen Species Action Plans within the TREBAP. There are also two Generic Action Plans covering Ecological Surveys and Education & Awareness.

#### **Green Corridors on the Welsh Government Trunk Road and Motorway**

- 8.2.34 This initiative in part supersedes the TREBAP and aims for the Trunk Road Network to be managed to provide a range of economic, environmental, social and cultural benefits. The initiative also aims to provide improved journey experiences and local environments through creating and enhancing beautiful, natural landscapes and contributing to a sense of place.

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<sup>7</sup> Joint Nature Conservation Committee and Defra on behalf of the Four Countries' Biodiversity Group, 2012. UK Post-2010 Biodiversity Framework. Peterborough

### **Wales Action Plan for Pollinators (2013)**

- 8.2.35 The ‘Action Plan for Pollinators in Wales’ recognises that: ‘Pollinators are an essential component of our environment. Honey bees and wild pollinators including bumblebees, solitary bees, parasitic wasps, hoverflies, butterflies and moths and some beetles are important pollinators in Wales, for crops such as fruit and oil seed rape, clovers and other nitrogen fixing plants that are important to improving the productivity of pasture systems for livestock grazing, and wild flowers.’
- 8.2.36 The Welsh Government has worked with industry and stakeholders to look in more detail at the evidence and issues around pollinators and their conservation in Wales. Following consultation, an 'Action Plan for Pollinators in Wales' was launched setting the strategic vision, outcomes and areas for action to halt and reverse pollinator decline in Wales. This plan aims to reduce and reverse the decline in wild and managed pollinator populations, which includes bees, some wasps, butterflies, moths and hoverflies, some beetles and flies. A pollinator task force comprising of key stakeholders is now active and a draft implementation plan is in place.

### **Pembrokeshire Local Biodiversity Action Plan**

- 8.2.37 The Pembrokeshire Local Biodiversity Action Plan<sup>8</sup> was published by the Pembrokeshire Biodiversity Partnership. It includes 50 Habitat Action Plans and over 200 Species Action Plans relating to the protection of biodiversity within the county.

### **Relevant Guidance**

- 8.2.38 The main overarching guidance for the assessment of the environmental impacts of road Schemes is contained within Volume 11 of the Design Manual for Road and Bridges (DMRB). Specific guidance in relation to the assessment and reporting of impacts on ecological receptors is provided within Section 3, Part 4<sup>9</sup>. The assessment of the implications of road Schemes on European Designated Sites is set out within Section 4, Part 1<sup>10</sup>.

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<sup>8</sup> Pembrokeshire Biodiversity Partnership, 2011. A Local Biodiversity Action Plan for Pembrokeshire. Haverfordwest

<sup>9</sup> Highways Agency, 1993. Part 4 Ecology and Nature Conservation. In: Design Manual for Roads and Bridges.

<sup>10</sup> Highways Agency, 2009. HD44/09 Assessment of IMplications (of Highways and/or Road Projects) on European Sites (including Appropriate Assessment) . In: *Design Manual for Roads and Bridges*.

- 8.2.39 Species specific guidance, including survey methodology and mitigation measures (Environmental design) are mainly contained within DMRB Volume 10 or through Interim Advice Notes. The species-specific guidance from DMRB and other sources used within this chapter includes:
- a) HD 44/09 Assessment of Implications (of Highways and/or Roads Projects) on European Sites (Including Appropriate Assessment);
  - b) HA 59/92 Mitigating Against Effects on Badgers;
  - c) HA 80/99 Nature Conservation Advice in Relation to Bats;
  - d) HA 81/99 Nature Conservation Advice in Relation to Otters;
  - e) HA 97/01 Nature Conservation Advice in Relation to Dormice;
  - f) HA 98/01 Nature Conservation Advice in Relation to Amphibians;
  - g) HA 116/05 Nature Conservation Advice in Relation to Reptiles and Roads;
  - h) The Bat Conservation Trust Good Practice Survey Guidelines (Collins, 2016).

## 8.3 Study Area

- 8.3.1 The study area for ecological field surveys included all land within 250m of the centre line of the TR111<sup>11</sup> Route as shown on Volume 2 Figure 8.1. Various search buffers were used within the desk study as set out in Section 8.4 below.

## 8.4 Methodology

- 8.4.1 The baseline ecological information for the Scheme was collated through a combination of a desk study, botanical surveys and species-specific surveys. The methodology for establishing baseline conditions is set out in the following sections.
- 8.4.2 Surveys during 2016 were undertaken by Mott MacDonald Limited and were overseen and coordinated by Joanne Bates (MCIEEM, CEnv) who has over 13 years' experience as a professional ecologist. The surveys were undertaken by qualified professional ecologists, considered to be competent in terms of their knowledge and experience to lead surveys for that particular species or habitat group.

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<sup>11</sup> The TR111 route was announced (February 2010) by Welsh Government as their preferred option and is safeguarded in planning policy by Pembrokeshire County Council

- 8.4.3 Surveys during 2017 were undertaken by Ove Arup & Partners Limited (Arup) and their sub-consultants. These surveys were overseen and coordinated by Pete Wells (MCIEEM, CEnv) who has over 17 years' experience as a professional ecologist, who also authored this chapter.
- 8.4.4 Survey work was undertaken by a number of qualified professional ecologists employed by Arup along with employees of various sub-consultancies. Sub-consultants used are set out in the methodology sections below.
- 8.4.5 For the surveys undertaken by Arup and Mott MacDonald Limited, surveyors were assessed as being competent in terms of their knowledge and experience to lead surveys for that particular species or habitat group. In some cases, assistants were used who may not have been classed as competent under the CIEEM competency framework, however on these occasions, the second person was solely present to ensure compliance with Health and Safety procedures and was not undertaking the survey.

### Desk study

- 8.4.6 An ecological desk study for the Scheme was undertaken in 2016. A biodiversity information request was submitted to the West Wales Biological Information Centre (WWBIC). The Multi-Agency Geographic Information for the Countryside (MAGIC) website and the Countryside Council for Wales Protected Sites and Landscapes Map<sup>12</sup> were reviewed for information on internationally and nationally designated sites of nature conservation importance. Information was also sought from the LANDMAP website in terms of the landscape habitats present in 2017.
- 8.4.7 In accordance with the relevant guidance, the ecology desk study area for the Scheme extends 10km for internationally designated sites (except for SACs designated for bat species where a 30km buffer was used in accordance with HD44/09), 2km for nationally designated SSSIs and 1km for locally designated non-statutory sites, such as Sites of Importance for Nature Conservation (SINCs).

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<sup>12</sup> Please note that this information was transposed to the Natural Resources Wales website following the amalgamation of the Countryside Council for Wales, the Environment Agency Wales and Forestry Commission Wales in 2013.

- 8.4.8 For legally protected species the desk study area extends for 5km around the centre line of the Scheme and 1km for other species of conservation concern using the records supplied by WWBIC.

### Extended Phase 1 Habitat Survey

- 8.4.9 An extended Phase 1 Habitat Survey was undertaken broadly in accordance with the guidance set out in Guidelines for Baseline Ecological Assessment<sup>13</sup>, as part of the Preliminary Ecological Appraisal, by Mott MacDonald. This survey was undertaken in February 2016. Although outside of the optimal survey season the information from this survey was updated following observations made during other surveys undertaken during 2016 and 2017. A schedule of survey dates and weather conditions is provided in Volume 3 Appendix 8.1.
- 8.4.10 A Phase 1 habitat survey<sup>14</sup> is a standard technique for rapidly obtaining baseline ecological information over a large area of land. It is primarily a mapping technique and uses a standard set of habitat definitions for classifying areas of land on the basis of the vegetation present. The extended survey also provided an assessment of the potential for those habitats present to support legally protected species and species of principal importance for the conservation of biological diversity (known as Section 7 Species).
- 8.4.11 Incidental records of flora and fauna were also made during the survey, in the form of Target Notes.

### National Vegetation Classification (NVC)

- 8.4.12 A NVC survey was undertaken on 19<sup>th</sup> August 2016 of two grassland and two woodland areas (shown on Volume 2 Figure 8.2 NVC Survey Locations, of Volume 2) identified during the extended Phase 1 survey. The objective of the survey was to map and describe the plant communities within the survey areas in terms of the NVC communities published by the Joint Nature Conservation Committee (JNCC)<sup>15</sup>
- 8.4.13 The survey was undertaken by an experienced botanist, which involved a walk-through method, supplemented by the use of quadrat sampling.

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<sup>13</sup> Institute of Environmental Assessment, 1995. Guidelines for Baseline Ecological Assessment

<sup>14</sup> Joint Nature Conservancy Council, 2010. Handbook for Phase 1 Habitat Survey - a technique for environmental audit. Peterborough

<sup>15</sup> Rodwell, J. S. ed., Various (1991 - 2000). British Plant Communities. Peterborough



A plant species list was compiled for each vegetation type, and the broad characteristics of the habitat described. Each stand of vegetation was then examined in greater detail to describe it in terms of the plant communities present.

### Hedgerows

- 8.4.14 All hedgerows within the study area were assessed to determine their ecological ‘importance’ with respect of Part II of Schedule 1 of the Hedgerow Regulations 1997. Hedgerow surveys were undertaken in May 2016.

### Invasive species

- 8.4.15 As part of the Phase 1 Survey, the locations of invasive plant species included on Part II of Schedule 9 of the Wildlife and Countryside Act 1981 were mapped. During the course of other surveys, additional stands of invasive plants species were noted and recorded.

### Amphibians

- 8.4.16 Ten ponds were identified within the study area during the extended Phase 1 Habitat Survey that were considered suitable to support great crested newts (*Triturus cristatus*). The location of ponds is shown on Volume 2 Figure 8.3.
- 8.4.17 Samples of water were taken from each of the ponds present within the Study Area in 2016 and sent for analysis for the presence of DNA of great crested newts. The testing of water samples for eDNA was shown to be a viable method for establishing the potential presence of great crested newts<sup>16</sup>.
- 8.4.18 Following the positive eDNA test result for Pond 1, a limited presence absence survey was undertaken in May and June 2016, comprising three survey visits due to access restrictions. These surveys involved a combination of bottle trapping, torch surveys and egg searching.
- 8.4.19 The survey undertaken in 2016 recorded probable great crested newt eggs. However as this was not a complete presence/absence survey and did not include enough visits to determine the population size class

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<sup>16</sup> Biggs, J. et al., 2014. *Analytical and methodological development for improved surveillance of the Great Crested Newt*, Oxford: Freshwater Habitats Trust.

(which would be required for any European Protected Species (EPS) Licence application) further surveys were undertaken in 2017. All suitable ponds were subject to presence/absence surveys for amphibians including all species of newts, frog and toad during 2017. These surveys were undertaken following the methodology for great crested newt presence/absence surveys<sup>17</sup> involving a combination of bottle trapping, torch surveys, netting and egg searching.

## Bat Surveys

### Roost Surveys

- 8.4.20 During the extended Phase 1 Habitat Survey undertaken 2016, an initial assessment was made of the potential for trees and buildings within the study area to support bat roosts. This bat assessment was undertaken in accordance with the guidance set out in the Bat Conservation Trust (BCT) Good Practice Guidelines<sup>18</sup>.
- 8.4.21 Trees within the study area were assessed for the presence of natural holes, woodpecker holes, cracks and splits, loose bark and cavities. The presence of such features were considered in determining the potential for bat roosts to be present and assigning trees to four categories of potential: low, moderate, high, and Negligible, as recommended by the BCT Guidelines.
- 8.4.22 Buildings within the study area were also assessed for their potential to support bat roosts based on the presence of potential roost access points. Buildings were also categorised as high, medium or low potential in accordance with the guidelines.
- 8.4.23 Following the initial assessment of trees, an aerial inspection was carried out on trees which had potential roost features identified from the ground. This inspection was undertaken by a licensed bat ecologist and tree climber using a video scope during June and September 2016.
- 8.4.24 Emergence and re-entry surveys were undertaken on buildings within the study area during August and September 2016. As the surveys undertaken in September were outside of the optimum period to identify maternity roosts, further emergence and re-entry surveys were undertaken in July and August 2017 in accordance with the guidelines.

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<sup>17</sup> English Nature, 2001. Great Crested Newt Mitigation Guidelines. Peterborough

<sup>18</sup> Collins, J., ed., 2016. Bat Surveys for Professional Ecologists: Good Practice Guidelines. 3rd ed. London: Bat Conservation Trust.

These 2017 surveys were undertaken by Thomson Ecology and included all buildings and trees within 50m of the Tender Alignment. A schedule of all the emergence and re-entry surveys is included in Volume 3 Appendix 8.1 and the locations are shown on Volume 2 Figure 8.4.

### **Bat Activity Transect Surveys**

- 8.4.25 Walked transect surveys were undertaken to record bat activity and behaviour within the study area. Two surveyors undertook each transect using a Batlogger M bat detector.
- 8.4.26 Transect survey work was undertaken twice per month from April to October 2016 where access permitted, in line with the BCT Guidance. The transect routes are shown on Volume 2 Figure 8.5.
- 8.4.27 Each transect commenced at the time of sunset and continued for at least two hours targeting areas of potential foraging and commuting habitat. Approximately half of the surveys were also repeated at dawn, commencing two hours prior to sunrise.
- 8.4.28 Species identification was undertaken following the transects using AnlookW software to analyse bat calls.
- 8.4.29 Bat registrations from the detectors were plotted with points labelled with the time of the registration. A heat map showing the relative density of bat registrations across all of the transect surveys was produced to identify important foraging areas.

### **Static Bat Activity Monitoring**

- 8.4.30 In addition to the walked transects, static bat detectors were used to record bat activity over a five-night period each month from April to October 2016 where access permitted. The locations used for these surveys were changed to provide a wide coverage of species abundance and diversity within the wider study area.
- 8.4.31 Following the appointment of the contractor team in 2017, further static activity surveys were undertaken to target specific areas along the proposed alignment to identify specific mitigation requirements. These were undertaken each month from June to October 2017. The locations used for the Static Activity Monitoring during 2016 and 2017 are shown on Volume 2 Figure 8.6.

- 8.4.32 During 2016, Anabat Express detectors were used for the surveys. Files recorded by the Anabat detectors were analysed using AnalookW software.
- 8.4.33 In 2017, Arup undertook the surveys using Wildlife Acoustic Song Meter 2 Ultrasonic Bat Detectors (SM2+ BAT) with SMX-U1 microphones for five consecutive nights each month.
- 8.4.34 The microphones used with the detectors during the course of the surveys were regularly checked and calibrated to ensure that they were functioning properly. Microphones which did not show a significant response to the output of the calibration unit were replaced.
- 8.4.35 The files from the Wildlife Acoustics detectors were downloaded and processed using Kaleidoscope Pro Software. The processing also included the automatic identification of bat species based on the classifiers developed by Wildlife Acoustics (Bats of Europe 4.3.0).
- 8.4.36 The files produced by the processing were then reviewed to ensure correct identification of species and to identify where possible the bat species for any calls which could not be recognised by the software. All calls identified as being either common pipistrelle (*Pipistrellus pipistrellus*) or soprano pipistrelle (*P. pygmaeus*) were not reviewed except where high levels of insect noise had been recorded leading to uncertainty over the accuracy of identification. All other calls were checked by Pete Wells, a bat specialist with over 25 years of experience in bat work and holder of significant experience in analysing bat calls for road Schemes and other developments.
- 8.4.37 The number of files (sound clips) recorded by the detectors each night was taken as a proxy value to the number of bat passes. The nightly average of files was used to allow comparison of the levels of activity across different seasons without being influenced by the number of hours of darkness when bats may be active.
- 8.4.38 This was then used to calculate a Bat Activity Index (BAI) for each species at each location during each session. The BAI was calculated on the first five nights recorded each month. In some cases, the detector also recorded data on additional nights. These additional nights were excluded from the BAI as it could not be certain that the detector had recorded data for the entire night. However, where rarer or more notable species were recorded on these additional nights, they were

included to ensure their representation within the data in terms of species diversity.

8.4.39 The BAI levels recorded were compared to the results of previous surveys undertaken by Arup to determine the likely importance of the activity recorded. This was done for common and soprano pipistrelle bats along with all species combined. The thresholds used to determine the different levels of activity are shown in Table 8 1 below and were determined as follows:

- a) Very low – BAI values below the 25th percentile of accumulated data;
- b) Low – between the 25th and 50th percentiles;
- c) Medium – between the 50th and 66th percentiles;
- d) High – between the 66th and 90th percentiles;
- e) Very high – values above the 90th percentile.

8.4.40 Other species have not been recorded on sufficient number of previous occasions to enable statistical analysis and therefore such comparisons cannot be made.

Table 8.1 Categorisation of Bat Activity Levels

	All Species Combined		Myotis		Common pipistrelle		Soprano pipistrelle		Noctule	
	lower value	upper value	lower value	upper value	lower value	upper value	lower value	upper value	lower value	upper value
Very low	0	10	0	0	0	10	0	1.6	Not used	
Low	10	66.9	0	1	10	47.2	1.6	7.1	0	0.6
Medium	66.9	119	1	2	47.2	77	7.1	20.324	0.6	1.27
High	119.32	347	2	12	76.98	243	20.32	102.32	1.27	7.4
Very high	347.14		11.58		243.4		102.32		7.4	

## Crossing Point Survey

- 8.4.41 Following the identification of calls from greater horseshoe bats (*Rhinolophus ferrumequinum*) on a detector at canopy height alongside the existing A40 in Ffynnon Wood during the July and August 2017 activity surveys and that of a lesser horseshoe (*Rhinolophus hipposideros*) in June 2017, a crossing point survey was undertaken on 18 September 2017. This survey was undertaken to determine if any key points within the section where plantation woodland is present either side of the road, were used by bats to cross the road. Similar surveys were not required at other locations as the location of crossing points could be identified where hedgerows and other linear corridors meet the road corridor.
- 8.4.42 The survey was undertaken using a four-camera infra-red CCTV system for approximately four hours from sunset. The cameras were trained on three places where the tree canopy extends out over the road creating narrower gaps where bats are likely to cross the existing road. Two surveyors were present monitoring bat activity in the area and noting potential activity recorded by the cameras. Following the survey, the footage from the cameras was reviewed to confirm activity.

## Dormice Surveys

- 8.4.43 1450 dormouse nest tubes were erected in areas of suitable habitat within the Study Area as shown on Volume 2 Figure 8.7. These were installed in April and May 2016, where access permitted. The tubes were checked on three occasions in May/June, September and November, although access restrictions prevented some areas from being checked each time.
- 8.4.44 Following comments received from Natural Resources Wales (as documented in Table 8.4), further consideration of dormouse was undertaken in the form of a habitat suitability assessment and nut searching. This assessment was carried out by an experienced ecologist and dormouse survey licence holder and entailed the consideration of habitats present in terms of species composition and connectivity. Searches for characteristically chewed hazel nuts were also undertaken where fruiting hazel was found to be present during the assessment.

## Otter Surveys

- 8.4.45 The water bodies within the Study Area were searched on two occasions during 2016 (as outlined in Volume 3 Appendix 8.1) by experienced ecologists for signs of activity and potential resting places which could potentially be used by otter. The survey was undertaken in accordance with authoritative sources<sup>19,20,21</sup>. The extent of the sections of water bodies surveyed are shown on Volume 2 Figure 8.8.

## Water vole

- 8.4.46 The water bodies within the Study Area were searched on two occasions during 2016 by experienced ecologists for field signs of water voles. These surveys were undertaken in July and September 2016. The survey method for water voles was undertaken in accordance with best practice survey guidelines in the Water Vole Conservation Handbook<sup>22</sup> with the methodology reviewed following the publication of the Water Vole Mitigation Handbook<sup>23</sup>.

## Badger

- 8.4.47 The badger survey was undertaken in April 2016 for the whole of the study area. Surveys included a search for characteristic field signs (faeces, setts, paths, scratching posts, snuffle holes, day nests, hair traces, footprints and latrines). Where setts were identified, these were classified in terms of their type and level of activity in reference to available guidance<sup>24</sup>.
- 8.4.48 A further survey was undertaken in October 2017 to confirm the location and type of setts within the corridor 50m either side of the Scheme design.

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<sup>19</sup> Chanin, P., 2003. *Ecology of the European Otter. Conserving Nature 2000 Rivers, Ecology Series No 10*. s.l.:EN, CCW, EA, SEPA, SNH & SNIFFER.

<sup>20</sup> Crawford, 2003. *Forth Otter Survey of England 2000 - 2002*. Environment Agency.

<sup>21</sup> Strachan, R. & Jefferies, D. J., 1996. *Otter Survey of England 1991-1994: A report on the decline and recovery of otter in England and on its distribution, status and conservation*.

<sup>22</sup> Strachan, M., Moorhouse, T. & Gelling, M., 2011. *Water Vole Conservation Handbook*. 3rd ed. Oxford.

<sup>23</sup> Dean, Strachan, R., Gow, D. & Andrews, 2016. *The Water Vole Mitigation Handbook*. London: Mammal Society.

<sup>24</sup> Harris, S., Cresswell, P. & Jefferies, D., 1989. *Surveying Badgers*.



## Breeding birds

- 8.4.49 The survey methods were derived from current best practice as described in *Bird Census Techniques*<sup>25</sup> and *Bird Monitoring Methods*<sup>26</sup>, and conform to the recommendations of the Royal Society for the Protection of Birds (RSPB), British Trust for Ornithology (BTO) and the Joint Nature Conservation Committee (JNCC). Surveys consist of walking a predefined transect route in all accessible habitat types, as described within the Breeding Bird Survey methodology contained within the above references.
- 8.4.50 All breeding bird surveys were carried out by teams of two surveyors, with at least one experienced in undertaking ornithological survey work. The transect was walked at a slow pace, pausing briefly at intervals to listen for song and to scan for birds flying overhead or taking flight from the surrounding area.
- 8.4.51 All birds seen and heard were mapped in accordance with the BTO standard activity recording codes.
- 8.4.52 The transects were surveyed on three occasions where access permitted between April and June 2016. Additional surveys were undertaken in July where access had prevented surveys in earlier months. The transect route was walked in the morning, between dawn and 10am, when levels of avian activity (particularly singing) are likely to be at their highest. On one of the three visits, the route was walked in the opposite direction to the previous visit, to balance any temporal variation in behaviour levels.
- 8.4.53 Birds were considered to be breeding if any of the following applied:
- a) Birds heard singing within areas of habitat suitable for that species to breed in;
  - b) Birds exhibiting territorial behaviour e.g. displaying or prolonged agitation;
  - c) Birds seen carrying food, nest material or the faecal sacs of young;  
or
  - d) Nests, eggs and/or young found to be present.

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<sup>25</sup> Bibby, C. J., Burgess, N. D., Hill, D. & Mustoe, S., 2000. *Bird Census Techniques*. Second ed. RSPB, BTO, Birdlife International, Ecoscope Applied Ecologists.

<sup>26</sup> Gilbert, G., Gibbons, D. W. & Evans, J., 1998. *Bird Monitoring Methods - a manual of techniques for key UK species*. Sandy: Royal Society the Protection of Birds.

- 8.4.54 Where breeding signs were recorded, it was assumed that a ‘breeding pair’ were present and this term is used from this point forward within this chapter.
- 8.4.55 A barn owl survey was undertaken following the methodology outlined in Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment<sup>27</sup>. The survey encompassed both Stage 1 – Onsite Scoping and Stage 2 – Investigative Field Survey components. The surveys were undertaken by an experienced ornithologist during July 2016.

### Reptile Surveys

- 8.4.56 The methodology used in this survey followed standard guidance for reptile surveys<sup>28</sup>. The methodology involved the placement of artificial refugia within suitable areas of habitat for reptiles. The refugia used during the survey were made from rectangles of roofing felt measuring approximately 1m x 0.5m with a placement density of approximately 5-10 refuges per hectare within areas of suitable habitat. Areas of suitable reptile habitat were targeted for survey and included south facing slopes, areas of short vegetation close to scrub and suitable hibernation habitat including rubble/wood piles and mounds of crushed aggregate where present.
- 8.4.57 1092 reptile refugia were placed in areas of suitable habitat within the Study Area as shown on Volume 2 Figure 8.9. Where access permitted, these refugia were checked at least five occasions during the period from June to September 2016, with areas where reptiles had been recorded being checked up to ten times. Further details of the limitations are provided below.
- 8.4.58 The artificial refugia were checked during early to late morning and/or early afternoon with a starting air temperature of between 13°C until a maximum of 19°C. The weather conditions for each survey visit are provided in Volume 3 Appendix 8.1.
- 8.4.59 In addition, any pre-existing suitable artificial or natural refugia on site were also checked as part of the survey. Each refuge was lifted carefully to search for reptile species and, where feasible, details of the reptile

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<sup>27</sup> Sawyer, 2012. Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. CIEEM, London.

<sup>28</sup> Froglife, 1999. Froglife Advice Sheet 10: Reptile Survey. London

species, sex, age class and condition of the reptiles encountered were recorded. Once the reptiles had been allowed to escape, the refugia were replaced.

- 8.4.60 Additional signs of reptile presence such as sloughed skins were also recorded where evident and any live animals observed away from refugia were also recorded.

### Other Species Groups

- 8.4.61 The Preliminary Ecological Appraisal made various recommendations with regards to other species and species groups. These included the conclusions that no surveys were required for invertebrate species, wintering birds, or mammal species such as hedgehog (*Erinaceus europaeus*) and polecat (*Mustela putorius*). It has therefore been decided to assume that commonly occurring Section 7 mammal species and common assemblages of invertebrates and wintering birds are present within the Study Area.

### Methodology for Assessment of Impacts

- 8.4.62 The assessment of impacts from construction and operation has followed the same methodology which is set out in the Guidelines for Ecological Impact Assessment in the UK and Ireland<sup>29</sup>. This represents the industry standard and provides the information required by the relevant sections of DMRB.

### Zone of impact for ecological features

- 8.4.63 All plant and animal species, habitats and integrated plant and animal communities that occur within the ‘zone of impact’ of the Scheme are defined as potential ‘ecological receptors’. The zone of impact for ecological features varies, depending on the nature and behaviour of the receptors, and also the type of impact that may affect them. In this chapter, the assessment of individual receptors is considered for the whole of the site and in addition, the distances from the site boundary listed in Table 8.2 below.

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<sup>29</sup> Chartered Institute of Ecology and Environmental Management, 2016. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Winchester.

Table 8.2 Maximum Zone of Impact from Scheme Boundary for Ecological Features

Ecological feature	Maximum zone of impact from the site boundary
Internationally designated sites, e.g. Special Areas of Conservation (SACs)	10km (30km for sites designated for bats)
Nationally designated sites, including Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs)	2km
Locally designated sites - Local Nature Reserves (LNRs) and Site of Importance for Nature Conservation (SINCs)	1km
Fauna including amphibians, reptiles, mammals (excluding bats), birds and invertebrates.	2km
Bat species	5km (except where features of European Sites)

- 8.4.64 The maximum zone of impact for international sites was established at 10km due to potential hydrological impacts with the exception of effects on mobile bat populations where a 30km zone was used.
- 8.4.65 The zone of impact for nationally designated sites was considered to be 2km due to their importance and the inclusions of mobile species and hydrological connections which may give rise to affects.
- 8.4.66 For locally designated non-statutory sites, 1km was chosen as a maximum zone of impact given the non-statutory nature of their designation and the fact that these sites are generally designated for their habitat value rather than species which could be impacted upon over a larger area e.g. bats.
- 8.4.67 For fauna, it is largely the behaviour of species, including movement in the landscape combined with the nature of the development, which determines the 2km maximum zone of impact with the exception of bats where 5km was used to reflect the importance of foraging habitats within this distance of roosts.
- 8.4.68 The CIEEM guidelines<sup>30</sup> recommend that the value of ecological receptors or features is determined based on a geographic frame of

<sup>30</sup> Chartered Institute of Ecology and Environmental Management, 2016. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Winchester.

reference. For this assessment, the following geographic frame of reference is used:

- a) International;
- b) National (i.e. UK);
- c) Regional (i.e. West Wales);
- d) County;
- e) Local (i.e. within circa 5km); and
- f) Less than Local (i.e. within the context of the site and immediate vicinity).

### **Valuing habitat and species**

8.4.69 In accordance with the CIEEM guidelines, in assigning a level of value to each habitat or species considered in the assessment, it is necessary to consider its distribution and status, including a consideration of trends based on available historic records. Rarity (including inclusion of lists of species of conservation importance, such as Red Data Lists, Birds of Conservation Concern, Biodiversity Action Plans and Lists of Habitats and Species of Principal Importance for the Conservation of Biodiversity (Section 7 Habitats and Species)) is an important consideration because of its relationship with threat and vulnerability; although since some species are inherently rare, it is necessary to consider rarity in the context of status. A habitat or species that is rare or declining should be assigned a greater level of importance than one that is rare but known to have a stable distribution or population.

8.4.70 Reference is also made to the biodiversity action plans listed in Section 8.2 above. The presence of a habitat or species on these lists reflects the fact that it is in a sub-optimal state; however, it does not necessarily imply any specific level of importance.

### **Predicting and characterising ecological impacts**

8.4.71 In accordance with CIEEM guidelines<sup>31</sup>, when describing impacts, reference is made to the following:

- a) Magnitude - i.e. the size of an impact in quantitative terms where possible;
- b) Extent - i.e. the area over which an impact occurs;
- c) Duration - i.e. the time for which an impact is expected to last;

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<sup>31</sup> CIEEM, 2016. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Winchester: Chartered Institute of Ecology and Environmental Management.

- d) Reversibility - i.e. a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it. A temporary impact is one from which a spontaneous recovery is possible; and
- e) Timing and frequency - i.e. whether impacts occur during critical life stages or seasons and how often impacts occur.

8.4.72 Both direct and indirect impacts were considered: direct ecological impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through impacts on an intermediary ecosystem, process or receptor, e.g. a pollution event reducing the food source for a species such as otter or water vole.

8.4.73 The integrity of a site is defined within the TAN5<sup>32</sup> as: '*...the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*'.

#### **Significance criteria**

8.4.74 In accordance with the CIEEM guidelines, a significant impact, in ecological terms, is defined as 'an impact (whether negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area, including cumulative and in-combination impacts'. It is important to note however that in accordance with the CIEEM guidelines, the actual determination of whether an impact is ecologically significant is made irrespective of the value of the receptor in question. In this respect, the CIEEM methodology differs from some other EIA approaches.

8.4.75 The value of a feature that would be significantly affected is used to determine the geographical scale at which the impact is significant, e.g. an ecologically significant impact on a feature of county importance will be considered to represent a significant impact at a county level. This in turn is used to determine the implications in terms of legislation, policy and /or development management.

8.4.76 Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likelihood of success of

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<sup>32</sup> Welsh Assembly Government, 2009. Technical Advice Note 5: Nature Conservation and Planning. Cardiff

the mitigation, are the factors to be considered against legislation, policy and development management in determining the Scheme.

### **Mitigation and Enhancement**

8.4.77 It is important as part of any environmental impact assessment, wherever possible, to clearly differentiate between mitigation and enhancement. These terms are used in this assessment as follows:

- a) Mitigation is used to refer to measures to avoid, reduce or remedy a specific negative impact in situ; and
- b) Enhancement is used to refer to measures that would result in positive ecological impacts but which do not relate to specific significant negative impacts or where measures are required to ensure legal compliance.

### **Cumulative Effects**

8.4.78 The cumulative effects of the Scheme with other develops are set out in the Chapters 19 to 21 of this Environmental Statement.

### **Consultation**

8.4.79 Key statutory environmental stakeholders in terms of ecology include:

- a) Natural Resources Wales;
- b) Pembrokeshire County Council; and
- c) South Wales Trunk Road Agent.

8.4.80 Meetings were held with Natural Resources Wales (NRW) during 2016 in relation to the extent of the Study Area. Ecological issues were also discussed within the Environmental Liaison Group meetings.

8.4.81 A Scoping Report for the Environmental Impact Assessment was shared with the Environmental Stakeholders. The comments received relating to ecology are provided in Table 8.3 below.

Table 8.3 Summary of Scoping Consultation Responses Received 21<sup>th</sup> August 2017

Consultee	Comments	Response
Natural Resources Wales	We have no comment to make on the scoping document as we have previously informed the project team of the surveys which are required for the Scheme	The project team welcomes the engagement of NRW.
	We request to again be consulted following completion of surveys prior to the publication of the Environmental Statement (ES). We welcome ongoing discussions throughout the process and note that mitigation and enhancement measures will be discussed through the Environmental Liaison Group	The draft Environmental Statement Chapters will be provided to the stakeholders for comment prior to publication.
	We are satisfied with the level of surveys undertaken to date and note that the potential for effects on European designated sites will also be addressed in the Assessment of the Implications on European Sites (AIES).	Noted
	We would like to see a lichen survey undertaken that maps out what is there along the proposed route, what might be at risk of damage as a result of the Scheme (either through direct damage through felling or by impact from vehicular emissions). Consideration of any sensitive species that may require translocating and how you will mitigate loss.	Further clarification was sought from NRW regarding the need for a lichen survey to inform the EIA. NRW confirmed that the lichen survey was not essential to inform the assessment. Consideration will be given to lichens during the course of any preconstruction surveys.

8.4.82 A meeting was held with the Species Team within NRW in June 2017 to discuss the scope of the 2016 surveys and the additional surveys to be undertaken in 2017. Comments received during and following the meeting are summarised in Table 8.4 below.



Table 8.4 Summary of Comments on 2017 Survey Scope Dated 4<sup>th</sup> August 2017

Species Group	NRW Comment	Response
Otter	We note that the otter surveys undertaken to date were restricted to a search of water courses for field signs. We advise that further work is carried out to enable an informed assessment of use of the terrestrial habitat by otters to include identifying any resting places and in particular to assess the likelihood of natal use of the area.	Consideration of the potential for otters to use terrestrial habitat within the study area will be made during the assessment.
Bats	We welcome the intention to carry out additional emergence and re-entry surveys of relevant buildings and trees during the peak of the activity period.  We welcome the intention to carry out further activity surveys to identify the locations and level of use of existing bat flight routes. At present this is proposed to comprise only static detector surveys. As discussed, we advise that this is supplemented with manual surveys to also provide direct observations by people particularly where automated surveys have identified significant activity.	Noted.
Dormouse	We understand that as dormouse nests were found at either end of the Scheme during the 2016 nest tube surveys you propose to assume dormouse presence in all suitable habitat throughout the Scheme. We consider this approach to be reasonable however we suggest that boxes could be installed within the woodlands on the Scheme and hazelnut surveys carried out if fruiting hazel is present to seek to gain a better understanding of dormouse use of the site to inform any mitigation strategy.	The assessment and mitigation design will be based on assumptions of a high dormouse population within areas of suitable habitat.

## Limitations and Assumptions

8.4.83 The findings presented in this assessment represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors which affect the presence of plants and animals, such as the time of year, migration patterns and behaviour. Nevertheless, these surveys were conducted at the optimal survey periods and using methodologies which are accepted by NRW and other statutory bodies. The results of the ecological survey allow evaluation of nature conservation value, assessment of the significance of potential impacts that may arise from the Scheme and consideration of appropriate mitigation measures. Every effort was made to ensure

that the findings of the study present as accurate an interpretation as possible of the status of flora and fauna located within the study area.

- 8.4.84 During the 2016 surveys access was limited in a number of areas which limited the ability to undertake survey visits for species including the great crested newt surveys, dormouse and reptile surveys.
- 8.4.85 Given the large number of bat passes recorded on the static detectors, Myotis bat calls have not been differentiated. This aggregation approach is not considered to be a limitation within the study given the similar behaviours and habitat requirements of these species with the exception of Bechstein's bat.
- 8.4.86 Due to the subjective nature of bat call analysis, it is possible that other ecologists may differ in opinion on the identification of calls, however current reference works<sup>33,34</sup> were used along with BatExplorer software which also includes species identification functions.
- 8.4.87 There is also the potential that some calls may have been overlooked principally due to the fact that the automatic species identification systems cannot identify multiply species within the same sound clip. However, with the exception of files identified as common or soprano pipistrelle by the software, all the other files were checked; all species recorded within those files included within the results are set out in this report.

## 8.5 Baseline Environment

### Desk Study

- 8.5.1 There are five Special Areas of Conservation (SAC) within 10km of the Scheme and a further two SACs designated for bats within 30km of the site. There is one Special Protection Area within 10km of the site, but no Ramsar Sites are present within this 10km distance. A list of the sites is provided within Table 8.5 and they are shown on Volume 2 Figure 8.10.

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<sup>33</sup> Russ, J., 2012. *British Bat Calls: A Guide to Species Identification*. Exeter: Pelagic Publishing.

<sup>34</sup> Middleton, N., Froud, A. & French, K., 2014. *Social Calls of the Bats of Britain and Ireland*. Exeter: Pelagic Publishing.

Table 8.5 Statutory Designated Sites

Site	Distance	Qualifying Features
Afonydd Cleddau / Cleddau Rivers SAC	2km	Watercourses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batracion</i> vegetation
		Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>
		Active raised bogs
		Brook lamprey ( <i>Lampetra planeri</i> )
		River lamprey ( <i>Lampetra fluviatilis</i> )
		Sea lamprey ( <i>Petromyzon marinus</i> )
		Bullhead ( <i>Cottus gobio</i> )
		European otter ( <i>Lutra lutra</i> )
Yerbeston Tops SAC	8.7km	Molinia meadows on calcareous, peaty or clayey-silt-laden soils ( <i>Molinion caeruleae</i> )
		Marsh fritillary butterfly ( <i>Euphydryas aurinia</i> )
Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC	9.1km	Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.
		Greater horseshoe bat ( <i>Rhinolophus ferrumequinum</i> )
		Lesser horseshoe bat ( <i>Rhinolophus hipposideros</i> )
		European otter
Pembrokeshire Marine / Sir Benfro Forol SAC	9.8km	Estuaries
		Large shallow inlets and bays
		Reefs
		Sandbanks which are slightly covered by sea water all the time
		Mudflats and sandflats not covered by seawater at low tide
		Coastal lagoons
		Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritima</i> )
		Submerged or partially submerged sea caves
		Grey seal ( <i>Halichoerus grypus</i> )
		Shore dock ( <i>Rumex rupestris</i> )
		Sea lamprey
		River lamprey
		Allis shad ( <i>Alosa alosa</i> )
Twaite shad ( <i>Alosa fallax</i> )		

Site	Distance	Qualifying Features
		European otter ( <i>Lutra lutra</i> )
Carmarthen Bays and Estuaries / Twyni Bae Caerfyddin SAC	10km	Sandbanks which are slightly covered by sea water all the time
		Estuaries
		Mudflats and sandflats not covered by sea water at low tide
		Large shallow inlets and bays
		Salicornia and other annuals colonizing mud and sand
		Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritima</i> )
		Twaite shad
		Sea lamprey
		River lamprey
		Allis shad
		European otter
Bae Caerfyrrddin / Carmarthen Bay SPA	10km	Common scoter ( <i>Melanitta nigra</i> )
Limestone Coast of South West Wales / Afordir Calchfaen de Orllewin Cymru SAC	17.8km	Vegetated sea cliffs of the Atlantic and Baltic coasts
		Fixed coastal dunes with herbaceous vegetation (grey dunes)
		European dry heaths
		Semi-natural dry grasslands and scrubland facies on calcareous substrates ( <i>Festuco-Brometalia</i> ) (important orchid sites)
		Caves not open to the public
		Submerged or partially submerged sea caves
		Greater horseshoe bat
		Early gentian ( <i>Gentianella anglica</i> )
Petalwort ( <i>Petalophyllum ralfsii</i> )		
North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC	18.5km	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>
		Old sessile oak woods with Ilex and Blechnum in the British Isles
		Barbastelle ( <i>Barbastella barbastellus</i> )

8.5.2 The Afon Cleddau Dwyreiniol / Eastern Cleddau River SSSI is located approximately 2km from the Scheme. This site is designated for the features of the Afonydd Cleddau SAC which it underpins.

8.5.3 There are no non-statutory designated sites within 1km of the Scheme.

#### **Protected Species Records**

8.5.4 A number of protected and notable species records were provided by the West Wales Biodiversity Information Centre. Records of protected and Section 7 species are summarised in Table 8.6 below.

Table 8.6 Protected and Section 7 Species Records Summary

Species	Number of records	Closest record
<b>Birds</b>		
Hobby ( <i>Falco subbuteo</i> )	1	0.6km
Red kite ( <i>Milvus milvus</i> )	6	1km
Redwing ( <i>Turdus iliacus</i> )	5	1.2km
Fieldfare ( <i>Turdus pilaris</i> )	1	1.2km
Barn owl ( <i>Tyto alba</i> )	1	1.2km
<b>Mammals</b>		
Whiskered bat ( <i>Myotis mystacinus</i> )	1	1.2km
Natterer's bat ( <i>Myotis nattereri</i> )	1	1.2km
Noctule bat ( <i>Nyctalus noctula</i> )	2	0.3km
Common pipistrelle ( <i>Pipistrellus pipistrellus</i> )	3	0.6km
Soprano pipistrelle ( <i>Pipistrellus pygmaeus</i> )	3	0.3km
Brown long-eared bat ( <i>Plecotus auritus</i> )	3	0.9km
Greater horseshoe bat	1	1.2km
Lesser horseshoe bat	1	1.2km
Otter	1	0.9km
Eurasian badger ( <i>Meles meles</i> )	22	0.1km
Polecat	2	0.1km SE (near Penblewin roundabout)
West European hedgehog	7	0.1km
<b>Reptiles and Amphibians</b>		
Slow-worm ( <i>Anguis fragilis</i> )	1	0.2km
Grass snake ( <i>Natrix natrix</i> )	1	0.2km
Common frog ( <i>Rana temporaria</i> )	1	1.4km
Common lizard ( <i>Zootoca vivipara</i> )	1	0.2km
<b>Invertebrates</b>		
Brown hairstreak ( <i>Thecla betulae</i> )	2	1.4km
<b>Flora</b>		
Carolina hornwort ( <i>Phaeoceros carolinianus</i> )	1	1.9km

## Habitat Surveys

- 8.5.5 The habitats present within the study area are shown on Volume 2 Figure 8.11A-C, with further descriptions provided in the Preliminary Ecological Appraisal (Volume 3 Appendix 8.2).
- 8.5.6 The study area is dominated by areas of improved grassland used for cattle grazing. The fields are separated by large hedgerows with trees, with occasional stream corridors with larger areas of broad leaved woodland. The existing A40 corridor is lined with mature hedgerows and areas of mixed plantation woodland, most notably where it passes through Ffynnon Wood.
- 8.5.7 The present woodlands are dominated by ash (*Fraxinus excelsior*) with various mixtures of oak (*Quercus* sp.), silver birch (*Betula pendula*), hazel (*Corylus avellana*), willow (*Salix* sp.), holly (*Ilex aquifolium*), alder (*Alnus glutinosa*). Ground flora species varied with bramble (*Rubus fruticosus*), ground ivy (*Glechoma hederacea*), primrose (*Primula vulgaris*), wild garlic (*Allium ursinum*), bluebells (*Hyacinthoides non-scripta*), wood avens (*Geum urbanum*), hard fern (*Blechnum spicant*), bracken (*Pteridium aquilinum*) and hogweed (*Heracleum sphondylium*). Mixed woodland plantations contain similar species along with larch (*Larix decidua*) and /or Scots pine (*Pinus sylvestris*).
- 8.5.8 The grassland fields within the study area are dominated by perennial rye grass (*Lolium perenne*) with Yorkshire fog (*Holcus lanatus*), soft rush (*Juncus effuses*), thistle (*Cirsium* sp.) buttercup (*Ranunculus* sp.) and ribwort plantain (*Plantago lanceolata*). Marshy grassland areas are also present close to stream corridors where soft rush is the dominant species.
- 8.5.9 Several ponds and lakes were observed. Species associated with open water included long leaved pond weed (*Potamogeton crispus*), watermilfoil (*Myriophyllum aquaticum*), white water lily (*Nymphaea alba*), bulrush (*Typha latifolia*), water starwort (*Callitriche stagnalis*), water dock (*Rumex hydrolapathum*) and water-cress (*Nasturtium officinale*).
- 8.5.10 Field boundaries comprised of species poor hedges with trees that generally comprised of one or two woody species and up to four species

along the hedge. The main species varied and hedges contained the following; hazel, hawthorn, gorse, bramble, holly, oak, willow or ash.

- 8.5.11 The hedgerows within the site comprise of species-poor hedges, with only one qualifying as important under the ecological criteria within the Hedgerows Regulations 1997. The location of the hedgerow is shown on Volume 2 Figure 8.12.
- 8.5.12 Two areas of grassland and two areas of woodland were identified from the Extended Phase 1 Survey for NVC survey and are shown on Volume 2 Figure 8.13.
- 8.5.13 Both grassland samples were strongly characteristic of the MG5 *Cynosurus cristatus* - *Centaurea nigra* plant community. The southern grassland field is a wetter marshy example of this community with the presence of two rush species. Species composition tables are provided in the National Vegetation Classification data table in Volume 3 Appendix 8.3. Whilst these are more notable habitats with great ecological value, there are likely to be extensive areas of habitat within Pembrokeshire.
- 8.5.14 The two woodland areas were considered to be W8 *Fraxinus excelsior* - *Acer campestre* - *Mercurialis perennis* plant community which is a relatively common woodland community within the British Isles. Blaen Pen Troydin woodland is considered to be a restored ancient wet woodland with wet flush habitats. Such woodlands can be considered for selection as SSSIs, however there is likely to be other significant areas of such habitats within Pembrokeshire which are already designated given that there are at least six SSSIs designated for woodland habitats within the county.
- 8.5.15 Japanese knotweed (*Fallopia japonica*) was recorded in one location on the bridleway to the northeast of Llanddewi Velfrey.
- 8.5.16 The habitats present were considered to be of either local value or of value only within the context of the site.

## Amphibians

- 8.5.17 Of the six ponds where samples were taken for great crested newt eDNA testing in 2016, one returned a positive result. This was the pond



located in the garden of the Caermaenau-Fawr B&B to the north of the existing Penblewin roundabout.

- 8.5.18 The three presence/absence surveys undertaken in 2016 recorded the presence of both adult and juvenile smooth newt (*Lissotriton vulgaris*), along with three eggs which were considered to be probable great crested newt eggs. Amphibian survey results are shown on Volume 2 Figure 8.14.
- 8.5.19 The surveys undertaken in 2017 recorded no great crested newts and it was therefore considered that this species was likely to be absent from the study area. The surveys recorded the presence of palmate newt (*Lissotriton helveticus*) in the ponds at Caermaenau-Fawr B&B, Caermaenau-fach and the Willow Tree School for Dogs. Common frogs were also recorded in a pond at Pencaermanau Farm. No smooth newts were recorded at Caermaenau-Fawr B&B. Full details of the survey results are provided in Volume 3 Appendix 8.4.
- 8.5.20 The County Ecologist also confirmed during an Environmental Liaison Group meeting in August 2017 that great crested newt were considered to be absent from Pembrokeshire.
- 8.5.21 Common toads were recorded using reptile mats as incidental species and were therefore considered to be present throughout the study area.
- 8.5.22 The population of smooth/palmate newts, common frog and common toad within the study area was considered to be of **local** importance.

## Bats

### Roost

- 8.5.23 Thirty-six buildings/properties were surveyed for bats during 2016 by external inspection and emergence/re-entry surveys. Further surveys were undertaken in 2017 to augment the 2016 surveys and confirm the potential presence of maternity roosts. The results of these surveys are summarised in Table 8.7 below and in Volume 3 Appendix 8.5.

Table 8.7 Summary of bat roost surveys of buildings

Reference	Property Name	Building description	2016 results	2017 results
1	Caermaenau-fach	main house	Soprano pipistrelle roost	1 unidentified bat using building
2		Barn	Possible roost	No bats recorded using the building
3		Workshop/Garage	Possible roost	Common pipistrelle – max count of 3
4		building to S of main house	Pipistrelle roost – max count of 8 bats	Soprano pipistrelle – max count of 3 bats Myotis species <sup>35</sup> – max count of 3 bats
5	Trefangor Cottage	Cottage	Soprano pipistrelle roost – single bat	No bats recorded using the building
6	Ffynnon Vestry	Vestry	Soprano pipistrelle roost	Soprano pipistrelle roost – max count 10 bats
7	Maes-y-Ffynnon	House	No bats recorded using the building	No bats recorded using the building
8		outbuilding		Possible soprano pipistrelle roost – single bat
9	Maes-y-Rhos	stone house	Common pipistrelle roost– max count 1 bat	Common pipistrelle roost– max count 2 bats
10		Garage	No bats recorded using the building	No bats recorded using the building
11		Farm house	Soprano pipistrelle	Soprano pipistrelle

<sup>35</sup> Considered likely to be a common species of Myotis bat: Natterer's bat, Daubenton's bat, whiskered or Brandt's bat

Reference	Property Name	Building description	2016 results	2017 results
	Pen-troydin-fach		roost – max count 2 bats Common pipistrelle roost – single bat	roost – max count 4 bats Common pipistrelle roost – 2 bats
12		Farm building 1	No bats recorded using the building	No bats recorded using the building
13		farm building 2	No bats recorded using the building	No bats recorded using the building
14		Farm building 3	No bats recorded using the building	No bats recorded using the building
15		Farm building 4	No bats recorded using the building	No bats recorded using the building
16		Farm building 5	No bats recorded using the building	No bats recorded using the building
17		Farm building 6	No bats recorded using the building	No bats recorded using the building
18		Bethel Cottage	house	No bats recorded using the building
19	outbuilding		No bats recorded using the building	No bats recorded using the building
20	Bethel Vestry	house	Not surveyed	No bats recorded using the building
21	barn behind Bethel Chapel	barn	Not surveyed	No bats recorded using the building
22	Penrhiw	house	Not surveyed	Soprano pipistrelle roost – max count 7 bats
23	Ffynnon Chapel	Chapel	Brown long-eared maternity roost – max count 30 bats	Soprano pipistrelle roost – max county 23 bats.

Reference	Property Name	Building description	2016 results	2017 results
			Soprano pipistrelle roost – max count 2 bats	Assumed maternity roost
24	Ffynnon Bridge	Bridge/culvert	Not surveyed	No bats recorded using the building
25	Henllan Lodge	lodge	Not surveyed	Soprano pipistrelle maternity roost – max count 68 bats
26	Brominau	house	Not surveyed	No bats recorded using the building
27		outbuilding	Not surveyed	No bats recorded using the building
28	Trefangor Farm	farmhouse	Not surveyed	Soprano pipistrelle roost – max count 12 bats
29		Outbuilding 1	Not surveyed	No bats recorded using the building
30		Outbuilding 2	Not surveyed	No bats recorded using the building
31		Outbuilding 3	Not surveyed	No bats recorded using the building
32		Outbuilding 4	Not surveyed	No bats recorded using the building
33		Outbuilding 5	Not surveyed	No bats recorded using the building
34	Bethel Chapel	chapel	Common pipistrelle roost – single bat	Soprano pipistrelle roost – max count 13 bats
35	Penblewin	House	No bats recorded using the building	No bats recorded using the building

Reference	Property Name	Building description	2016 results	2017 results
36		white barns	Common pipistrelle roost – single bat Soprano pipistrelle – single bat	No bats recorded using the building
37		barn 2	No bats recorded using the building	No bats recorded using the building
38		Stone Barn	No bats recorded using the building	Possible soprano pipistrelle roost – single bat

8.5.24 The inspection of 39 trees was undertaken by ground based and aerial climbing methods. Three confirmed roosts of brown long-eared bats were identified from either the presence of bats or droppings which were analysed for DNA identification. These were located in an ash tree in a hedgerow near Grovesner Court (T13), a beech tree within the avenue south of Henllan Lodge (T21), and an ash tree near to Henllan Farm. The locations of trees with potential for bats are shown on Volume 2 Figure 8.16.

8.5.25 No further bat roosts were identified in the trees located within 50m of the Scheme alignment during emergence and re-entry surveys (of trees with moderate or high potential to support bats). Refer to Volume 3 Appendix 8.5.

8.5.26 The roosts of soprano pipistrelle, common pipistrelle, brown long-eared bat and common Myotis species are considered to be of local importance as these are relatively common or widespread species in Wales.

### Walked Activity

8.5.27 The locations of bat registrations are shown on Volume 2 Figures 8.23 – 8.29. Common and soprano pipistrelle bats were the most frequently recorded species during the walked transect surveys recorded using hedgerows and tree lines throughout the study area. Myotis species<sup>36</sup>

<sup>36</sup> Considered likely to be a common species of Myotis bat: Natterer's bat, Daubenton's bat, whiskered or Brandt's bat

and noctule were also frequently recorded although at much lower levels.

8.5.28 Other species such as long-eared species, Leisler's bat, serotine, lesser horseshoe and greater horseshoe bats were also recorded in very low numbers.

8.5.29 Lesser horseshoe bats were recorded in June, July, August and October 2016. In June, these were recorded near to the avenue of trees south of Henllan Lodge, at Pen-ca'rmaenau and between the existing A40 and Grosvenor Court. A single lesser horseshoe was recorded to the north west of the Penblewin roundabout during the July transects. In August, two lesser horseshoe passes were recorded near to Bethel Chapel, one on the edge of the exiting A40 and one to the south. A single lesser horseshoe bat pass was recorded during the October surveys to the north of Pen-troydin-fach Farm.

8.5.30 Greater horseshoe bats were recorded in June, July, August and September 2016. In June, a single recording of a greater horseshoe was recorded to the west of the A478 north of the Penblewin roundabout. Greater horseshoe bats were again recorded to the north-west of Penblewin roundabout during both July and August. During the August surveys, they were also recorded to the south-west of Penblewin and on the access lane to the Willow Tree School for Dogs. A single greater horseshoe bat pass was recorded on the south side of Ffynnon Wood during the September surveys.

8.5.31 It is assumed that the lesser and greater horseshoe bats recorded within the study area are intrinsically linked to the SAC populations of these species.

### **Static Activity Monitoring**

8.5.32 The locations sampled during 2016 are shown on Volume 2 Figures 8.16 – 8.22, with data included in Volume 3 Appendix 8.5. Pipistrelle species were the most commonly recorded bats during the static activity surveys during 2016, although these were not identified to species level. Myotis species<sup>37</sup> were also frequently recorded along with noctule at lower levels.

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<sup>37</sup> Considered likely to be a common species of Myotis bat: Natterer's bat, Daubenton's bat, whiskered or Brandt's bat

- 8.5.33 Other species recorded in low levels of activity included serotine, barbastelle, Nathusius' pipistrelle, long-eared species, lesser horseshoe and greater horseshoe.
- 8.5.34 Greater horseshoe bats were recorded throughout the study area in low numbers with particular areas of activity recorded on hedgerows either side of the A478 north of the Penblewin roundabout, south of Penblewin Farm, north of Pen-troydin-fach Farm and to the west of the footpath near the Willow Tree School for Dogs.
- 8.5.35 Lesser horseshoe bats were recorded on two occasions in July south-west of the Penblewin roundabout and to the south of Trefangor Farm. Barbastelle bat were also only recorded in two locations; to the north-west of the Penblewin roundabout and south of Trefangor Farm, both during the July sampling session.
- 8.5.36 The 2017 static monitoring focused on 15 locations where the proposed alignment intersects linear features likely to be used by bats. Soprano pipistrelle was the most frequently recorded species followed by common pipistrelle and Myotis species. High levels of bat activity were recorded in the eastern sections of the study area as shown on Volume 2 Figures 8.30 – 8.77 Other species were recorded at low or very low levels. Lesser and greater horseshoe bats were also recorded although in very low numbers. The average bat activity indices at the locations are shown in Table 8.9.
- 8.5.37 The data from the transect and static surveys was used to identify 12 key flight routes which are intersected by the Scheme. These are linear features, hedgerows and stream corridors, where significant amounts of bat activity, and or rarer species were recorded. These are shown on Volume 2 Figure 8.78.
- 8.5.38 The times that these three SAC species were recorded on static detectors during 2017 is compared to sunset and sunrise times in Table 8.8 below. The majority of recordings were over one hour after sunset or prior to sunrise. It is therefore considered unlikely that roosts of these species are located within the vicinity of the Scheme.

Table 8.8 Comparison of time of recording for SAC bat species with sunset and sunrise times

Night of recorded	Location	Species	Time of recording	Time post sunset	Time pre-sunrise
23/06/2017	Location 12	Greater horseshoe	01:56	---	03:04
25/06/2017	Location 12	Greater horseshoe	01:54	---	03:07
25/06/2017	Location 7	Lesser horseshoe	04:13	---	00:48
26/06/2017	Location 12	Barbastelle	23:41	01:59	---
18/07/2017	Location 2	Barbastelle	00:23	---	04:59
18/07/2017	Location 6	Greater horseshoe	03:39	---	01:42
18/07/2017	Location 6	Greater horseshoe	01:23	---	03:59
18/07/2017	Location 6	Greater horseshoe	03:37	---	01:44
18/07/2017	Location 6	Greater horseshoe	01:25	---	03:57
18/07/2017	Location 6	Greater horseshoe	01:23	---	03:59
18/07/2017	Location 6	Greater horseshoe	01:21	---	04:01
18/07/2017	Location 6	Greater horseshoe	01:24	---	03:58
18/07/2017	Location 6	Greater horseshoe	01:24	---	03:57
18/07/2017	Location 6	Greater horseshoe	01:22	---	04:00
21/07/2017	Location 14	Greater horseshoe	23:14	01:50	---
21/07/2017	Location 5	Greater horseshoe	01:16	---	04:10
21/07/2017	Location 6	Greater horseshoe	23:46	02:22	---
22/07/2017	Location 6	Greater horseshoe	04:37	---	00:51
23/07/2017	Location 6	Greater horseshoe	02:56	---	02:32
23/07/2017	Location 6	Greater horseshoe	03:00	---	02:28
23/07/2017	Location 6	Greater horseshoe	03:00	---	02:28
23/07/2017	Location 6	Greater horseshoe	03:01	---	02:28
23/07/2017	Location 6	Greater horseshoe	03:00	---	02:29
23/07/2017	Location 6	Greater horseshoe	02:52	---	02:36
23/07/2017	Location 6	Greater horseshoe	03:00	---	02:28
23/07/2017	Location 6	Greater horseshoe	03:01	---	02:28
23/07/2017	Location 6	Greater horseshoe	02:51	---	02:38
23/07/2017	Location 7	Greater horseshoe	02:28	---	03:01
15/08/2017	Location 13	Greater horseshoe	00:16	---	05:48
15/08/2017	Location 14	Greater horseshoe	01:57	---	04:08
15/08/2017	Location 3	Greater horseshoe	22:54	02:11	---
17/08/2017	Location 10	Greater horseshoe	00:45	---	05:23



Night of recorded	Location	Species	Time of recording	Time post sunset	Time pre-sunrise
18/08/2017	Location 12	Greater horseshoe	23:30	02:54	---
18/08/2017	Location 3	Greater horseshoe	04:07	---	02:03
18/08/2017	Location 6	Greater horseshoe	23:32	02:56	---
18/08/2017	Location 6	Greater horseshoe	23:33	02:57	---
18/08/2017	Location 6	Greater horseshoe	22:58	02:22	---
19/08/2017	Location 6	Greater horseshoe	04:51	---	01:20
16/09/2017	Location 4	Greater horseshoe	01:55	---	05:01
21/10/2017	Location 8	Lesser horseshoe	05:43	---	02:12
22/10/2017	Location 6	Lesser horseshoe	22:41	04:30	---

- 8.5.39 The lesser horseshoe and greater horseshoe bats recorded may be foraging from the Slebech Park Roost (9.1km from the Scheme) which forms part of the Pembrokeshire Bat Sites and Bosherton Lakes SAC, although it is noted that the core foraging areas around maternity roosts, for these species is approximately 4km.
- 8.5.40 The barbastelle bats present within the study area are unlikely to be from North Pembrokeshire Woodlands SAC due to the distance of this site from the study area, although they are highly likely to be from roosts which contribute to the SAC populations.
- 8.5.41 Therefore, the populations of these three species recorded within the study area are considered to be of International Importance.
- 8.5.42 The populations of other bat species recorded within the study area are considered to be of local importance.

Table 8.9 Bat Activity Indices for all bat species recorded in 2017

Location number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
June	226.2	No access	158.4	212	135.8	307.2	27.4	6.2	11.4	3.6	220.8	53.8	556.8	No Data	54.6
July	269	335.8	76	380.8	92	176.8	22.4	10	57.6	12.4	80.8	1.8	815.2	297.6	134.8
August	92.2	291.8	1.4	320.8	No access	104.8	29.6	29.2	8.4	25.2	6.8	4	1519.6	1426	6.2
September	5.2	0.2	10.2	355.8	158.8	2.4	2.4	4.8	97	2.2	15.4	86.4	0	7.8	16.8
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average	148.15	209.3	61.5	317.35	128.87	147.8	20.45	12.55	43.6	10.85	80.95	36.5	722.9	577.13	53.1

Table 8.10 Bat Activity Indices for barbastelle recorded in 2017

Location number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
June	0	No access	0	0	0	0	0	0	0	0	0	0.2	0	No Data	0
July	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	No access	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0.05	0	0	0	0	0	0	0	0	0	0.04	0	0	0

Table 8.11 Bat Activity Indices for greater horseshoe bat recorded in 2017

Location number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
June	0	No access	0	0	0	0	0	0	0	0	0	0.4	0	No Data	0
July	0	0	0	0	0.2	2.2	0.2	0	0	0	0	0	0	0.2	0
August	0	0	0.4	0	No access	0.8	0	0	0	0.2	0	0.2	0.2	0.2	0
September	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0.08	0.04	0.05	0.6	0.04	0	0	0.04	0	0.12	0.04	0.1	0

Table 8.12 Bat Activity Indices for lesser horseshoe bat recorded in 2017

Location number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
June	0	No access	0	0	0	0	0.2	0	0	0	0	0	0	No Data	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	No access	0	0	0	0	0	0	0	0	0	0
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0	0	0
Average	0	0	0	0	0	0.04	0.04	0.04	0	0	0	0	0	0	0

## Dormouse

- 8.5.43 Dormice nests were found within tubes in two locations at either end of the Scheme (Volume 2 Figure 8.80). One was in a hedgerow adjacent to the Caermaenau-Fawr B&B and the other in Castell-Gwyndy Wood to the north of Bethel Chapel.
- 8.5.44 The hedgerows and woodland located within the study area are considered to provide high quality habitat for dormice, and it is considered likely that they were present throughout the study area. The dormouse population within the study area is considered to be of local importance.

## Riparian Mammals

- 8.5.45 Relatively little otter activity was recorded during the surveys, although as the Scheme is located largely on a ridge line, the watercourses are relatively small and do not provide significant foraging areas for otters. Two potential otter holts were recorded, one on a stream in Castell-Gwyndy Wood to the north of Bethel Chapel, and the other within woodland adjacent to the stream to the south of Caermaenau-fach. These locations are shown on Volume 2 Figure 8.81.
- 8.5.46 The otter population present within the study area is considered likely to be part of or contribute to the population designated as part of the Carmarthen Bays and Estuaries and the Cleddau Rivers SACs. Otters within the study area are therefore considered to be of international importance.
- 8.5.47 No signs of water voles were recorded during the surveys and it is therefore considered that this species is likely to be absent from the study area.

## Badgers

- 8.5.48 A total of 49 setts or possible setts were recorded within the study area during the 2016 surveys. A further six setts were recorded during 2017 surveys which were targeted to confirm sett location and type. The survey data from 2017 confirmed that six of the possible setts were not being used by badgers. The locations of setts is shown on Volume 2 Figure 8.82A - C. The 49 setts therefore comprise six main setts, one

annex sett, two subsidiary setts and 39 outliers (further information is supplied in Volume 3 Appendix 8.6).

- 8.5.49 Where possible, the potential arrangement of family groups (clans) were inferred based on the proximity to other setts and associated field signs. Six potential clans (shown as A to F on Volume 2 Figure 8.82A - C) were identified although not all setts could be attributed to a family group.
- 8.5.50 The habitats present within the study area provide optimum habitat for badgers and it is anticipated that population levels will be high with small territory sizes. As badgers are widespread and common throughout West Wales, the population of badgers was considered to be of local importance.

### Breeding Birds

- 8.5.51 The breeding bird surveys recorded a total of 58 species. None of these species were Schedule 1 or Annex 1<sup>38</sup> species. Of the 58 species, it was considered that 48 species were breeding or likely to be breeding in the study area. Non-breeding species included overflying gulls, waterfowl and grey heron (*Ardea cinerea*) along with occasional records of migrant species such as yellow wagtail (*Motacilla flava*).
- 8.5.52 Of the species recorded, nine species are Section 7 priority species, which were bullfinch (*Pyrrhula pyrrhula*), dunnock (*Prunella modularis subsp. occidentalis*), linnet (*Linaria cannabina*), herring gull (*larus argentatus argenteus*), house sparrow (*Passer domesticus*), marsh tit (*Parus palustris subsp. palustris*), willow tit (*Parus montanus subsp. kleinschimdti*), song thrush (*Turdus philomelos*) and yellow wagtail (*Motacilla flava subsp. flavissima*).
- 8.5.53 Furthermore, eight of the likely breeding and confirmed breeding species are Birds of Conservation Concern<sup>39</sup> Red listed species and nine are Amber listed.

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<sup>38</sup> Listed as rare or vulnerable under Annex 1 of Directive 2009/147/EC (Birds Directive) on the conservation of wild birds

<sup>39</sup> Eaton et al. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. British Birds 108;708-746

- 8.5.54 Similarly, seven of these species are included on the Welsh Birds of Conservation Concern<sup>40</sup> Red list and nine on the Amber List. Details are provided in Volume 3 Appendix 8.7.
- 8.5.55 No particularly rare or unusual species were recorded. There was a single record of the declining willow tit (*Poecile montanus*) in July 2016, with small numbers of spotted flycatcher (*Muscicapa striata*) also recorded within the study area.
- 8.5.56 Furthermore, no particularly high concentrations of breeding passerines were noted. There were a number of species such as linnet, willow warbler and song thrush typical of such habitats within the region. Breeding bird survey results are shown on Volume 2 Figures 8.84 – 8.91.
- 8.5.57 Overall the breeding bird assemblage within the site was considered to be of local importance, comprising common species typical of the habitats present within the study area.
- 8.5.58 Twelve features were identified during the barn owl surveys as possible nest sites or roosting sites. These include one former nest site at the Caermaenau-Fawr B&B which was not being used by owls at the time of the survey. Potential nest sites in close proximity (50m) to the Scheme include a log pile adjacent to the access track to Parc-y-Delyn and two farm buildings at Pen-troydin-fach Farm, although none of these were actively being used by barn owls.
- 8.5.59 The majority of the habitats within the study area are of sub-optimal quality for foraging use by barn owls. Small areas of optimal foraging habitat are present at the eastern extent of the Scheme and near to Trefangor Farm. The results of the habitat suitability assessment and the locations of potential nesting and roosting sites are shown on Volume 2 Figure 8.92A.
- 8.5.60 The barn owl population is also considered to be of local importance as this species is relatively common and widespread in Pembrokeshire, although it is noted that this species is included in Schedule 1 of the Wildlife and Countryside Act and therefore subject to greater legal protection.

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<sup>40</sup> Welsh Ornithological Society (2016): Birds in Wales: <https://birdsin.wales/wp-content/uploads/2017/01/Birds-of-Conservation-Concern-Wales-3-2016.pdf>

## Reptiles

- 8.5.61 A population of common lizard (*Zootica vivipara*) were recorded within the western areas of the study area (Volume 2 Figure 8.92B), although in relatively small numbers with a maximum count of three animals including juveniles. Many parts of the study area within the vicinity of the proposed route are considered to be suitable for this species and other species such as slow worms and grass snake. It is considered likely that all three species are present in low numbers throughout the study area. The reptile population within the site was therefore considered to be of local importance.

## Section 7 Species

- 8.5.62 Based on the habitats present within the study area it was assumed that the area supports a range of species included on the list of species of principal importance for the conservation of biodiversity published in response to Section 7 of the Environment (Wales) Act 2016. These were likely to include populations of mammal species such as brown hare (*Lepus europaeus*), polecat (*Mustula putorius*) and hedgehog (*Erinaceus europaeus*). The study area was also likely to support a range of common invertebrate species, mosses and lichens typically found within the habitats present.
- 8.5.63 The populations of Section 7 species were considered to be of local importance.

## 8.6 Impact Assessment

### Construction Impacts

#### Designated Sites

- 8.6.1 An Assessment of the Implications on European Sites (AIES) was prepared for the Scheme to fulfil the requirements of the Habitats Regulations and is provided in the Statement to Inform an Appropriate Assessment (SIAA) which was produced for the Scheme.
- 8.6.2 The majority of the features of the European Sites can be scoped out of the assessment as no pathways, such as linking habitats or movement of species, existed to link the potential impacts from the Scheme to the features of the sites. This scoping exercise is summarised in Table 8.13.

Table 8.13 Scoping of European Sites and features potentially affected the Scheme

Site	Distance	Qualifying Features	Pathway	Scoping for further consideration
Afonydd Cleddau / Cleddau Rivers SAC	2km	Watercourses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batracion</i> vegetation	Potential for pollution to enter designated areas via watercourses	Yes
		Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>	Potential for pollution to enter designated areas via watercourses	Yes
		Active raised bogs	No pathway – feature separated by sufficient distance	No
		Sea lamprey	Potential for pollution to enter designated areas via watercourses	Yes
		Brook lamprey	Potential for pollution to enter designated areas via watercourses	Yes
		River lamprey	Potential for pollution to enter designated areas via watercourses	Yes
		Bullhead	Potential for pollution to enter designated areas via watercourses	Yes
		European otter	Potential for pollution to enter designated areas via watercourses	Yes
Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystum Sir Benfro a Llynnoedd Bosherton SAC	9.1km	Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	No pathway – feature separated by sufficient distance	No
		Greater horseshoe bat	Potential for greater horseshoe bats to cross the Scheme	Yes
		Lesser horseshoe bat	Potential for lesser horseshoe bats to cross the Scheme	Yes



Site	Distance	Qualifying Features	Pathway	Scoping for further consideration
		European otter	No pathway – feature separated by sufficient distance approximately 25km from Bosherton Lakes component, where the otter feature is located.	No
Carmarthen Bays and Estuaries / Twyni Bae Caerfyddin SAC	9.7km	Sandbanks which are slightly covered by sea water all the time	Potential for pollution to enter designated areas via watercourses	Yes
		Estuaries	Potential for pollution to enter designated areas via watercourses	Yes
		Mudflats and sandflats not covered by sea water at low tide	Potential for pollution to enter designated areas via watercourses	Yes
		Large shallow inlets and bays	Potential for pollution to enter designated areas via watercourses	Yes
		Salicornia and other annuals colonizing mud and sand	Potential for pollution to enter designated areas via watercourses	Yes
		Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritimae</i> )	Potential for pollution to enter designated areas via watercourses	Yes
		Twaite shad	Potential for pollution to enter designated areas via watercourses	Yes
		Sea lamprey	Potential for pollution to enter designated areas via watercourses	Yes
		River lamprey	Potential for pollution to enter designated areas via watercourses	Yes
		Allis shad	Potential for pollution to enter designated areas via watercourses	Yes
		European otter	Potential for pollution to enter designated areas via watercourses	Yes

Site	Distance	Qualifying Features	Pathway	Scoping for further consideration
			Potential for otters to cross the Scheme moving between catchments	Yes
Limestone Coast of South West Wales / Afordir Calchfaen De Orllewin Cymru SAC	17.8km	Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathway – feature separated by sufficient distance	No
		Fixed coastal dunes with herbaceous vegetation (grey dunes)	No pathway – feature separated by sufficient distance	No
		European dry heaths	No pathway – feature separated by sufficient distance	No
		Semi-natural dry grasslands and scrubland facies on calcareous substrates ( <i>Festuco-Brometalia</i> ) (important orchid sites)	No pathway – feature separated by sufficient distance	No
		Caves not open to the public	No pathway – feature separated by sufficient distance	No
		Submerged or partially submerged sea caves	No pathway – feature separated by sufficient distance	No
		Greater horseshoe bat	Potential for greater horseshoe bats to cross the Scheme	Yes
		Early gentian	No pathway – feature separated by sufficient distance	No
		Petalwort	No pathway – feature separated by sufficient distance	No
North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC	18.5km	Old sessile oak woods with Ilex and Blechnum in the British Isles	No pathway – feature separated by sufficient distance	No
		Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>	No pathway – feature separated by sufficient distance	No
		Barbastelle	Potential for barbastelle bats to cross the Scheme	Yes

- 8.6.3 There is a hydrological pathway (through the watercourses crossed by the Scheme) which could convey pollution from construction activities (either surface water run-off or spillages from plant and machinery) to areas within Cleddau Rivers and Carmarthen Bays and Estuaries SACs and the SSSI underpinning the Cleddau Rivers SAC. Due to the dilution that could be expected to occur within the river, it is considered that these effects would be of low magnitude and reversible. However, in the absence of mitigation the effects from spillages would be considered to be a significant effect.
- 8.6.4 There is the potential for bats, in particular the two horseshoe species which were recorded crossing the Scheme in a number of locations and are less likely to cross open areas<sup>41</sup>, to be discouraged from crossing the Scheme and therefore be prevented from accessing important foraging areas.
- 8.6.5 While the number of lesser and greater horseshoe bats likely to be crossing the Scheme is relatively low, given the importance of these two species (valued as Internationally important due to being associated with the Pembrokeshire Bat Sites and Bosherton Lakes SAC), the impacts are considered to be significant effects on the lesser and greater horseshoe bats populations taking a precautionary approach.
- 8.6.6 Barbastelle bats have only been recorded very occasionally during the course of the surveys; the bats encountered are less likely to be directly associated with the North Pembrokeshire Woodlands SAC population due to the distance between the SAC and the Scheme. Barbastelle bats are less likely to be deterred from crossing open areas and are therefore were not considered to be significantly affected by the Scheme.

### **Habitats**

- 8.6.7 The construction of the Scheme would result in the loss of grassland habitat within the study area although the grasslands affected are considered to be of low ecological value due to their improved nature.
- 8.6.8 The woodland areas within the study area would largely be unaffected by the Scheme with the exception of Ffynnon Wood where trees will need to be removed on either side of the existing A40. The majority of

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<sup>41</sup> Catherine Bickmore Associates, 2003. *Review of Work Carried out on the Trunk Road Network in Wales for Bats*, Cardiff: Welsh Government & Countryside Council for Wales.

the areas of woodland affected in Ffynnon Wood are mixed plantation and are therefore of lower value than more semi-natural woodlands. Semi-natural woodland will also be lost to the north of Blaen-Pen-Troydin wood where the woodland extends along the steeper slopes and stream corridors. The loss of woodland in this area is approximately 0.7ha.

8.6.9 Hedgerows are an abundant feature within the landscape. A large number of hedgerows and tree lines would be intersected by the Scheme resulting in sections being removed.

8.6.10 The areas and lengths of habitats to be lost are provided in Table 8.14 below.

Table 8.14 Areas and lengths of habitats removed during construction

Existing Features / Habitat Types	Quantity removed
Broad-leaved woodland	1.49ha
Broad-leaved plantation	0.23ha
Mixed plantation	1.66ha
Coniferous plantation	0.11ha
Scrub	0.67ha
Improved and poor semi-improved grassland	21.71ha
Semi improved neutral grassland	1.28ha
Marshy grassland	2.24ha
Bracken	0.37ha
Standing water	0.01ha
Hedgerows	5,594 linear m
Watercourses	792 linear m

8.6.11 The areas of habitats that would be removed for the construction of the Scheme are relatively small compared to the abundance of equivalent habitats with Pembrokeshire. Although small areas of semi-natural woodland would be affected by the construction activities, the larger blocks of woodland such as Blaen-Pen-Troydin would be largely unaffected.

8.6.12 The grasslands and areas of plantation are of low ecological value being of value within the context of the site. The semi-natural woodland is of local value. Given that the relatively low value of these habitats, the loss of habitats is not considered to be a significant effect.

- 8.6.13 There are a number of small watercourses that would be crossed by the Scheme. There is the potential for surface water run-off during construction to enter the streams crossed by the Scheme and temporarily affect water quality, although it is expected that the dilution that would occur within the river would reduce the scale of any effect.
- 8.6.14 The effects of the Scheme on water quality are assessed within Chapter 7 Road Drainage and the Water Environment. The effects of watercourses as an ecological receptor was considered to be of low magnitude but potentially significant in the absence of mitigation.
- 8.6.15 There are a number of areas of invasive plant of Japanese knotweed, which are likely to be affected by the construction of the Scheme. The release of material contaminated with plant material or seeds could result in adverse effects on other habitats where material is deposited. This is particularly vulnerable in the area around water courses.
- 8.6.16 The potential effect of any spread of these species was considered to be of low magnitude but was considered to be significant as there may be consequential effects on species composition within any habitats in to which material is spread, and would not be significant. However, in light of the legal control of these species, mitigation measures would be included to prevent the potential spreading of these species.

### **Amphibians**

- 8.6.17 The proposed construction work has the potential for killing and injuring of amphibians along with the loss of breeding and terrestrial habitat through vegetation clearance and soil excavations. In addition, there is the risk of introducing biosecurity risks such as pathologies which could affect amphibians and other aquatic species. This would be considered to be a low magnitude impact and would not be significant on amphibian populations in the study area. Even though the effects were not considered to be significant, mitigation measures are included to avoid and reduce the impacts on this receptor and to ensure animal welfare is maintained.

### **Bats**

- 8.6.18 The construction of the Scheme would result in the loss of a roost site within Trefangor Cottage. There are also a further 14 bat roosts located within buildings in close proximity to the proposed constructions areas,

which are likely to experience disturbance through noise or vibration caused by construction vehicles.

- 8.6.19 The loss of a roost site for a single soprano pipistrelle is considered to be low magnitude impact which is unlikely to be significant. The disturbance of other roosts is considered to be a moderate magnitude impact which would be a significant effect at a local scale if maternity roosts were subject to significant disturbance during the period when bats have dependent young. However, it is noted that the buildings containing roosts are located in close proximity to the existing road and therefore subject to noise and vibration from passing traffic.
- 8.6.20 In addition to their geographical valuation discussed in this chapter, as all bat species are protected as European Protected Species there is a legislative requirement to include measures for bats and potentially to obtain a licence for works that may destroy roosts or disturb bats within their roosts.
- 8.6.21 The clearance of vegetation along the Scheme has the potential to lead to the fragmentation of habitats and may prevent certain species - such as horseshoe bats - from crossing the gaps created and accessing foraging areas. The sections of the Scheme to the north of Llanddewi Velfrey provide areas of suitable foraging habitat for bats, which may be lost or disrupted as a result of the vegetation clearance for construction.
- 8.6.22 There is also the potential for construction activities undertaken at night which may require lighting, to give rise to further effects of fragmentation and the displacement of bats from existing flight lines and foraging areas.
- 8.6.23 The effects on horseshoe bat species and barbastelle bats is assessed above. In the absence of mitigation measures, the potential disruption of flight lines and foraging areas is considered to be a large magnitude affect which would be considered significant for all other bat species. As such, mitigation measures will be proposed (Section 8.7).

### **Dormice**

- 8.6.24 The construction of the Scheme would result in the loss of 4.16ha of woodland and scrub, and 5,958m of hedgerow which is considered to be a significant area of dormouse habitat and could result in the death

or injury of dormice from plant or machinery. The cleared corridor of the Scheme is also likely to act as a barrier to the movement and dispersal of dormice leading to fragmentation of the population.

- 8.6.25 In the absence of mitigation measures, the potential effect on the dormouse population is considered to be of sufficient magnitude to be significant on the local population. Additionally, as dormice are legally protected as European Protected Species there is a legislative requirement to include mitigation and compensation measures for dormice and potentially to obtain a licence for works that may destroy habitat or disturb dormice.

### **Otter**

- 8.6.26 Two potential holts were identified during the surveys; however, these are located a sufficient distance away from the construction areas such that it is considered unlikely that otters will be directly affected through the loss of habitats. However, there is the potential for otters to be moving through the area of the Scheme between river catchments, which could result in the death or injury of otters, if in collision with construction vehicles moving at night time or if they become entrapped within excavations.
- 8.6.27 The potential for otters to be killed or injured during construction is considered to be of moderate magnitude on an internationally valued receptor that would be significant. Additionally, as otter are protected as European Protected Species, there is a legislative requirement to include mitigation measures for otter. Mitigation measures are included in Section 8.7 below.

### **Badgers**

- 8.6.28 Nine of the badger setts identified are located within the proposed footprint of the engineering layout for the Scheme. A further 13 setts are located with 30m of the areas required for the construction of the Scheme, including one main sett (as shown in Table 8.15). There is the potential for badgers to be killed or injured by construction activities in the vicinity of setts if the works result in the collapse of tunnels or chambers within the setts. Furthermore, there is the potential for badgers to be displaced from setts if subject to significant disturbance.

Table 8.15 Badger Setts and their proximity to the Scheme

Sett No	Type	Under footprint of Scheme	With 30m of proposed works	Outside zone of influence (30m)
A1	Main	x	✓	x
A2	Subsidiary	✓	x	x
A3	Outlier	✓	x	x
A4	Outlier	x	✓	x
A5	Outlier	x	✓	x
B1	Main	x	✓	x
B2	Subsidiary	x	✓	x
B3	Outlier	x	✓	x
B4	Outlier	✓	x	x
B5	Outlier	x	✓	x
B6	Annex	x	x	✓
B7	Outlier	x	x	✓
B8	Outlier	x	✓	x
B9	Outlier	✓	x	x
B10	Outlier	✓	x	x
C1	Main	x	✓	x
C2	Outlier	x	x	✓
C3	Outlier	✓	x	x
C4	Outlier	x	✓	x
C5	Outlier	✓	x	x
C6	Outlier	x	✓	x
C7	Outlier	x	✓	x
D1	Main	x	x	✓
D2	Outlier	x	x	✓
D3	Outlier	x	x	✓
D4	Outlier	x	x	✓
D5	Outlier	x	✓	x
D6	Outlier	x	x	✓
D7	Outlier	x	x	✓
D8	Outlier	x	x	✓
D9	Outlier	x	x	✓
E1	Main	x	x	✓
E2	Outlier	x	x	✓



Sett No	Type	Under footprint of Scheme	With 30m of proposed works	Outside zone of influence (30m)
E3	Outlier	✗	✗	✓
E4	Outlier	✗	✗	✓
F1	Main	✗	✗	✓
U1	Outlier	✗	✗	✓
U2	Outlier	✗	✗	✓
U3	Outlier	✗	✗	✓
U4	Outlier	✗	✗	✓
U5	Outlier	✓	✗	✗
U6	Outlier	✓	✗	✗
U7	Outlier	✗	✗	✓
U8	Outlier	✗	✗	✓
U9	Outlier	✗	✗	✓
U10	Outlier	✗	✗	✓
U11	Outlier	✗	✗	✓
U12	Outlier	✗	✗	✓

8.6.29 However, there is the potential for badgers to be moving through the area of the Scheme, which could result in the death or injury of badgers by collision with construction vehicles moving at night time or if they become entrapped in excavations.

8.6.30 The potential for badgers to be killed or injured during construction is considered to be a moderate scale effect which would be significant. However, as badgers are a Protected Species, there is a legislative requirement to include mitigation measures for badgers.

### **Breeding Birds**

8.6.31 Overall, the assemblage of breeding birds recorded is typical of the habitats surveyed within the study area. The habitats supported a range of familiar bird species associated with hedgerows, farmland, scrub and woodlands.

8.6.32 The loss of nesting habitat within the footprint of the Scheme and the potential for further displacement of nesting birds from the vicinity of the Scheme, is considered to be a low magnitude impact which would not be significant for local populations of bird species. However, a

number of mitigation measures are discussed later to ensure legally protected active bird nests are not affected by the Scheme.

- 8.6.33 Barn owl survey results suggest no active roost sites are present, but some potentially suitable features occur and could be impacted by the Scheme. Even by taking a precautionary approach and assuming these may be used by barn owls, the potential impact on such birds is considered to be of minor magnitude and would not be significant at a population scale. However due to the legal protection of Schedule 1 species, mitigation measures are set out below.

### **Reptiles**

- 8.6.34 The proposed construction work has the potential for killing and injuring of reptiles along with the loss of breeding and terrestrial habitat through vegetation clearance and soil excavations. As described above, the areas of habitats being lost to the Scheme are relatively low compared to the areas of habitat available within the study area as a whole and with the county of Pembrokeshire. This would be considered to be a low magnitude impact and would not be significant.
- 8.6.35 In order to ensure legislative compliance, mitigation measures will be provided.

### **Section 7 species**

- 8.6.36 The proposed construction work has the potential for killing and injuring of Section 7 mammals along with the loss of habitat through vegetation clearance and soil excavations. There is also the potential loss of habitats that support Section 7 invertebrates.
- 8.6.37 Considering the habitat requirements of Section 7 mammals, such as hedgehog, brown hare and polecat and the availability of similar habitats in the area, it is predicted that the construction phase of the Scheme is unlikely to have significant impacts on the local populations of these species. However, mitigation measures are proposed to fulfil Welsh Government's obligations under the Environment Wales Act.

### **Operational impacts**

- 8.6.38 Once operational, the effects of the Scheme would be limited to the effects of air quality changes, water quality changes from road drainage, fragmentation of habitats where animals are deterred from crossing the

road, the effects of vehicle collisions with animals and the effects of lighting around the roundabout junctions at either end of the Scheme. There is also the potential for amphibians to become trapped within the drainage system or on the road surface.

- 8.6.39 The air quality changes from the Scheme are documented in Chapter 13 Air Quality. The modelling of emissions from the operational Scheme showed a very small change in the amount of emissions although the location of emissions will be further to the north around Llanddewi Velfrey once the village is bypassed.
- 8.6.40 The DMRB only requires effects resulting from air quality emissions on designated sites to be considered within 200m of the Scheme. There are no designated sites within this distance of the Scheme. The effects of the very small-scale changes in emissions will be imperceptible in terms of the habitats and species within the study area.
- 8.6.41 During the operation of the Scheme, there is the potential for surface water run-off that would be contaminated with pollutants and particles from the road surface to enter watercourses. Furthermore, in the event of a traffic accident, spilled fuel or other pollutants could enter watercourses via the drainage network. This is considered to be a significant impact.
- 8.6.42 There is the potential for bats flying along the key flight routes identified by surveys to come into close proximity with road vehicles. Horseshoe bats (both species but especially lesser horseshoe) are particularly vulnerable to collision with vehicles as they will reduce their height to fly at ground level across open areas (Catherine Bickmore Associates, 2003). Given the high level of bat activity and importance of the horseshoe bat populations, the potential magnitude of this impact is considered to be moderate in the absence of mitigation. This is considered to be a significant impact.
- 8.6.43 There is the potential for dormice, badgers, otters and Section 7 mammals species to come in to contact with vehicles while crossing the Scheme, once it is operational. In the absence of mitigation, this is considered to be a low impact that would be not significant given the relatively low traffic volumes at night. The low traffic volumes at night along with the inclusion of oversized culverts with the engineering design mean that it is unlikely to give rise to long term barrier effects and the fragmentation of habitats. However, as badgers are a legally

protected species and given that the potential increased risk of traffic accidents as a result of trying to avoid hitting animals, mitigation measures are proposed below.

## 8.7 Mitigation

### Design Mitigation

8.7.1 A number of culverts were included within the Scheme design to provide safe crossings for mobile animal species. This includes the oversizing of all stream culverts to 1.8m diameter to allow them to be used by bat species. The locations of culverts and underpasses is shown in Table 8.16 below and on the Environmental Master Plans.

Table 8.16 Culverts and underpasses included within the Scheme design with an ecological mitigation function

Chainage	Description	Provision
0+290	Mainline Cross Drainage Culvert	1.8m diameter pipe culvert approximately 31m in length with associated dry mammal underpass
1+680	NMU Underpass	Shared use bridleway underpass (unlit and suitable to be used bats and other mammals)
2+630	Pen-troydin-fach and Pen-troydin-fawr Farm Underpass	Shared Public Footway and Farm Underpass (Pen-troydin-fach and Pen-troydin-fawr) (unlit and suitable to be used bats and other mammals). This includes a watercourse. 3.2m wide with height of 2.7m above footway level. Approximately 55m in length.
3+000	Ecological Crossing point	1.8m diameter pipe for the crossing of Bats and badgers. 0.4m diameter pipe for the crossing of dormice. Approximately 48m in length
3+100	Watercourse crossing Culvert	1.8m diameter pipe culvert approximately 109m in length
3+115	Ecological Crossing Point	0.9m diameter mammal crossing approximately 85m in length
3+270	Watercourse crossing.	1.8m diameter pipe culvert approximately 108m in length with associated dry mammal underpass.
3+290	Pedestrian Underpass	3.3m wide, minimum 2.6m high public footpath underpass approximately 40m in length (unlit and suitable to be used bats and other mammals).
3+760	Mammal Underpass	0.6m diameter mammal underpass

- 8.7.2 Mammal underpasses for larger terrestrial mammals (otter, badger and Section 7 mammals) are provided through the inclusion of oversized stream culverts and underpasses set out in Table 8.16 above. The majority of these are located on existing stream corridors and hedgerows used by bats and other mammals within the landscape. The sizes of the culverts required for the water courses are considerably smaller than the sizes proposed. The larger sizes have been proposed so that these structures can provide safe passage for bat species beneath the Scheme.
- 8.7.3 In addition, a badger underpass designed in accordance with the advice provided in Volume 10 of the DMRB (specifically HA59/92) will be included at chainage 3+760. Mammal fencing has also been designed in accordance with DMRB to prevent mammals from accessing the carriageway and guide them to the underpasses and culverts. The arrangements of fencing and other associated planting is shown on the Environmental Management Plans. Planting will be used to guide bats and other mammal species to safe crossing points.
- 8.7.4 The proposed dormouse crossings are comprised of a 400mm diameter pipe buried within the embankment, through which branches and hemp ropes would be placed to provide a natural substrate to allow dormice to safely pass from one side to the other. Whilst it is not envisaged that these structures will be used on a regular basis, they are designed to provide a safe crossing for juvenile dormice dispersing from their parental territories. The indicative design of the dormouse crossings is shown in Image 1 below.

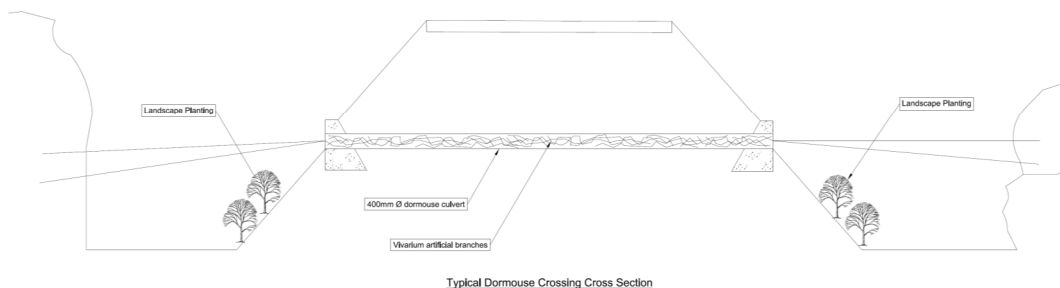


Image 1 Indicative design of dormouse crossings

- 8.7.5 The landscape planting design for the Scheme has aimed to provide replacement habitat for dormice within the Scheme footprint and maintain connectivity. The habitats proposed equate to over twice the area of dormouse habitat that will be lost during the construction of the Scheme as shown in Table 8.17.

Table 8.17 Comparison of dormouse habitat removed and proposed

<b>Dormouse habitat removed</b>	<b>Dormouse habitat proposed</b>
5.84ha	12.56ha
Compensation ratio 2.15:1	

- 8.7.6 Lighting proposals for the Scheme were restricted to the two roundabout junctions at Penblewin and Bethel Chapel, in order to avoid effects on ecological receptors such as bats, badgers and otter. Whilst the Bethel Chapel Junction will extend the area of existing road lighting to the east of Llanddewi Velfrey, the area of lighting at the Penblewin Junction will be reduced from its existing extent. The lighting proposed at the two junctions will include appropriate design features to limit the light spill from luminaires to avoid the lighting of vegetation within proximity to Scheme.
- 8.7.7 Fuel interceptors were included within the drainage network at the two roundabout junctions (where the risk of traffic accidents and therefore spills is greater) to allow pollution incidents to be contained. In addition, penstocks were included within the design of the attenuation ponds to allow pollution incidents to be contained. The inclusion of attenuation ponds will also allow particles from the road surface drainage to drop out of suspension reducing the amount that may be released to watercourses.
- 8.7.8 The landscape proposals for the Scheme (detailed in Chapter 9 Landscape and Visual Effects) were designed to provide replacement habitats both to compensate for the loss of woodland and grassland habitats, and to compensate for species such as dormice. As described above the planting will also encourage species such as the two horseshoe bat species towards underpasses and other safe crossing points. Existing trees will be retained where possible and larger specimens included to provide height to the vegetation on either side of the road and provide safe crossings for bats at each of the identified key crossing points as set out in Table 8.17 below. These safe crossing points are either underpasses or vegetation provisions located on either

side of the Scheme to provide similar crossing points to those being used by bats on the existing A40.

Table 8.18 Key bat flight routes (as shown on Volume 2 Figure 8.79) and mitigation provisions

Bat flight route	Chainage	Mitigation provision
A	0+500	Retained mature trees between existing A40 and Scheme. Inclusion of mature planting to north of the Scheme
B	1+020	Retain mature trees on south side of existing A40. Inclusion of mature planting to north of the Scheme
C	1+220	Retain mature trees on south side of existing A40. Inclusion of mature planting to north of the Scheme
D	1+510 – 1+820	Shared use bridleway underpass (unlit and suitable to be used bats and other mammals) at 1+680. Inclusion of planting to guide bats towards the underpass on both sides. Dimensions as per Table 8.16
E	2+210	Inclusion of planting on either side of the Scheme
F	2+320	Inclusion of planting on either side of the Scheme
G	2+620	Shared Public Footway and Farm Underpass (Pen-troydin-fach and Pen-troydin-fawr) (unlit and suitable to be used bats and other mammals). This includes a watercourse. Approximately 70m in length. Dimensions as per Table 8.16.
H	2+850	Llanfallteg Road Overbridge
I	3+000	1.8m diameter pipe for the crossing of Bats and Dormouse. Approximately 48m in length
J	3+100	1.8m diameter pipe culvert approximately 109m in length
K	3+270	1.8m diameter pipe culvert. Approximately 108m in length.
L	3+460	Inclusion of planting on either side of the Scheme

8.7.9 Lesser horseshoe bats were recorded using culverts as small as 1m in height<sup>42</sup>, while some studies also suggest greater horseshoe will use structures of approximately 2m in diameter<sup>40, 43</sup>. Limpens et al. also report both lesser and greater horseshoe bats using vegetation to cross over road corridors<sup>40</sup>.

<sup>42</sup> Limpens, H. J. G. A., Twisk, P. & Veenbaas, G., 2005. *Bats and Road Construction*. Delft, The Netherlands: Rijkswaterstaat.

<sup>43</sup> Catherine Bickmore Associates, 2003. *Review of Work Carried out on the Trunk Road Network in Wales for Bats*, Cardiff: Welsh Government & Countryside Council for Wales.

## Construction Mitigation

8.7.10 The following mitigation principles and measures will be included within the Scheme during the Construction Phase through detailed design and the adherence to a Construction Environmental Management Plan (CEMP):

- a) Pre-construction surveys will take place to ensure Schedule 1 birds species (notably barn owl) are not present within the construction area. If found, suitable mitigation measures/licences will be undertaken/obtained to allow the works to proceed. Such mitigation measures would include the timing of works to avoid disturbance along with an appropriate buffer around any identified nests
- b) Licences will be required for bats, dormice and badgers (draft method statements are provided in Volume 3 Appendix 8.8);
- c) The badger setts within 30m of the construction activities will be excluded, although where possible the exclusion will only be temporary;
- d) Provision of one artificial badger setts (as shown on the EMPs) as a replacement for the main sett B1 which will require exclusion;
- e) Pre-construction surveys including surveys of trees for bats, otter surveys and badger surveys;
- f) Phased vegetation clearance to allow for the presence of amphibians, reptiles and dormice;
- g) Where possible, vegetation clearance will take place outside of the bird breeding season and will be undertaken under the supervision of an ecologist;
- h) If legally protected species are encountered during the clearance of the construction areas, work in that area will cease and relevant licenses obtained prior to the re-commencement of works;
- i) The exclusion of bats from Trefangor Cottage at an appropriate time of year, under an appropriate licence;
- j) Provision of a mix of bat box types on retained trees within the vicinity of Trefangor Cottage and along the length of the Scheme to compensate for the loss of the roost in Trefangor Cottage and disturbance to other roosts;
- k) Pollution control measures in accordance with industry standards and the Pollution Prevention Guidelines published by the Environment Agency<sup>44</sup>;
- l) Measures to control and contain sediment and material arising from excavations in proximity to water courses, will be included

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<sup>44</sup> It is noted that these Guidelines were withdrawn by the Environment Agency, however they are considered to still be relevant and applicable until such time as new guidance is available.



within the working method statements that will be developed as part of the agreed CEMP;

- m) Implementation of an Invasive Species Management Plan, to be agreed with relevant statutory environmental bodies prior to construction, to ensure that legally controlled plant species are not spread outside of the working areas;
- n) Restrictions on working hours to avoid night working and task lighting, such that no night working is undertaken in the vicinity of watercourses and key bat flight lines, and any task lighting elsewhere is restricted to ensure no light spill into adjacent habitats;
- o) Excavations to be covered or a means of escape provided for animals;
- p) Where possible, hedgerows affected by the construction works will be translocated to suitable receptor sites; and
- q) Supervision by an Ecological Clerk of Works of vegetation clearance and the installation of any ecological mitigation incorporated within the Scheme design.

8.7.11 The proposed landscape planting within the Environmental Masterplans will provide compensation for the loss of dormouse habitat within the Scheme area. The provision of replacement habitat is subject to review however there currently will be no net loss of habitat area.

### **Enhancement Opportunities and Ecosystems Resilience**

8.7.12 The downsizing of the existing A40 corridor between the parking area and Henllan Lodge has the potential to provide an area for the creation of wildflower grassland and other habitat types included within the TREBAP that will provide further habitat enhancement over and above the areas of grassland that will be lost to the Scheme during construction. Enhancement could also contribute to the objectives of the Green Corridors Initiative.

8.7.13 The inclusion of an oversized culvert at chainage 0+290m and ensuring that the pedestrian underpass at chainage 3+290m is unlit will provide additional features which can be used by bats and mammal species to safely cross the Scheme.

8.7.14 This grassland creation works will benefit pollinator populations in the area and thus contribute to the Action Plan for Pollinators<sup>45</sup>. The native woodland, scrub and hedgerow planting will also contribute to the aims

<sup>45</sup> Welsh Government, 2013. *Action Plan for Pollinators*. Cardiff: Welsh Government.

of this Action Plan by mitigating for the loss of and providing additional woodland habitats.

## 8.8 Monitoring Proposals

8.8.1 Monitoring (in addition to the supervision of the works outlined above and the auditing of mitigation measures) will be undertaken during the construction and aftercare periods. Monitoring should also be undertaken for five years post-construction, with any requirement beyond this, subject to agreement with the relevant statutory environmental bodies. The monitoring will include:

- a) Monthly monitoring the effective use of underpasses by bats during the active period;
- b) Quarterly monitoring the effective use of underpasses by badgers and otters;
- c) Monitoring the use of replacement badger setts with motion activated cameras;
- d) Quarterly monitoring of bat boxes;
- e) Monitoring the use of dormouse crossings using motion activated cameras and hair tubes; and
- f) Monitoring the effectiveness of landscape planting as documented in Chapter 9 Landscape and Visual Effects.

8.8.2 The results of the monitoring will be reported to NRW and other relevant statutory environmental bodies (including the local records centre) on an annual basis. In addition, the scope of the monitoring, methods and results will be discussed through further engagement with the Environmental Liaison Group during and post construction.

## 8.9 Residual Effects

8.9.1 The measures outlined above are considered sufficient to reduce the scale of construction impacts from the Scheme to levels which would not be considered significant for all of the receptors identified.

8.9.2 The creation of species rich grassland within Scheme will provide an enhancement in habitats within the local area for a range of species including foraging bats and Section 7 invertebrates. A comparison of the habitats to be lost and those created is shown in Table 8.19 below.

Table 8.19 Comparison of habitats lost and created during the construction of the Scheme

Habitat type	Area lost	Area created
Woodland habitats	3.49ha	6.66ha
Scrub and shrubs	0.67ha	2.83ha
Species rich grasslands	3.52ha	5.20ha
Improved grassland	21.71ha	6.19ha
Standing water	0.01ha	0.22ha
Watercourses and ditches	1.04km	4.95km
Hedgerows	5.59km	4.09km

8.9.3 The design measures outlined above are considered sufficient to reduce the predicted operation impacts to levels that would not be significant.