highways england

European Union
European Regional Development Fund

A30 Chiverton to Carland Cross TR010026

6.2 ENVIRONMENTAL STATEMENT CHAPTER 8 ECOLOGY AND NATURE CONSERVATION

Planning Act 2008

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

Volume 6

August 2018

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A30 Chiverton to Carland Cross
Development Consent Order 201[x]

6.2 ENVIRONMENTAL STATEMENT

CHAPTER 8 ECOLOGY AND NATURE CONSERVATION

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010026
Application Document Reference	6.2
Author:	A30 Chiverton to Carland Cross Project Team, Highways England

Version	Date	Status of Version
Rev: C01	22/08/18	Application Issue

Table of Contents

Table of Tables

Table of Figures Volume 6 Document Ref 6.3

Table of Appendices Volume 6 Document Ref 6.4

8 Ecology and Nature Conservation

8.1 Introduction

8.1.1 This chapter of the ES assesses the likely significant effects of the scheme on the ecological resources within the study area and surrounding environments.

8.1.2 This chapter documents survey work undertaken in relation to designated sites, habitats and species to date. The chapter documents measures aimed at mitigating significant effects upon ecological resources. Enhancement measures which go beyond mitigating effects are also identified. Within this chapter the value of receptors is reported and the residual effects arising from the construction and the operation of the scheme are assessed in turn.

8.1.3 The ecological resource of the study area was surveyed in detail over two years (2016 and 2017), with preliminary surveys being conducted in 2015, to ensure a comprehensive baseline for the assessment presented here.

8.1.4 The detailed ecological baseline reports are included within the Technical Appendices (Volume 6 Document Ref 6.4 ES Appendices 8.1 to 8.20). The figures associated with the Technical Appendices have been included for many of the ecological resources for information alongside this chapter.

8.2 Competent expert

8.2.1 The Ecology and nature conservation lead is a Member of the Chartered Institute of Ecology and Environmental Management (CIEEM). They have a First Class BSc (Hons) in Zoology (2002) and a PhD in Ecology (2007) from the University of Southampton. Full details are provided in **Competent expert evidence** (Volume 6 Document Ref 6.4 ES Appendix 1.1.

8.3 Legislative and policy framework

8.3.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. The following relevant legislation exists to protect habitats and species of nature conservation importance:

- The Conservation of Habitats and Species Regulations 2017 (the 'Habitat Regulations 2017') which transposes Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora ('the Habitats Directive') into UK law;
- The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds);
- Wildlife and Countryside Act (WCA) 1981 (as amended);
- Natural Environment and Rural Communities (NERC) Act 2006;
- The Countryside and Rights of Way Act 2000;
- The Hedgerow Regulations 1997;
- Eels (England and Wales) Regulations 2009; and
- Protection of Badgers Act 1992.

8.3.2 These pieces of legislation include a number of offences relating to protected species and requirements for licences to allow construction works to proceed. In

addition, the Habitats Regulations set out the requirement for the consideration of the potential effects of a project on European designated sites.

8.3.3 The legislation and policy relating to specific species are further detailed within the ecological baseline reports (Volume 6 Document Ref 6.4 ES Appendices 8.1 to 8.20), and as such are not repeated here.

National Policy

8.3.4 This chapter has been prepared to conform with the planning policy and strategy documents listed below that are applicable to assessing the impacts to the ecological resources:

- National Networks National Policy Statement (NN NPS): Road and Rail Infrastructure [1];
- UK-Post 2010 Biodiversity Framework (replaced the previous UK Biodiversity Action Plan) [2];
- Biodiversity 2020: A strategy for England's wildlife and ecosystem services (Defra 2011) [3];
- National Planning Policy Framework (2018) [4].

8.3.5 The Government's detailed policy on environmental mitigation for developments is set out in Chapter 5 of the NN NPS:

"Biodiversity is the variety of life in all its forms and encompasses all species of plants and animals and the complex ecosystems of which they are a part. Government policy for the natural environment is set out in the Natural Environment White Paper (NEWP). The NEWP sets out a vision of moving progressively from net biodiversity loss to net gain, by supporting healthy, well-functioning ecosystems and establishing more coherent ecological networks that are more resilient to current and future pressures.

Applicants should include appropriate mitigation measures as an integral part of their proposed development, including identifying where and how these will be secured. In particular, the applicant should demonstrate that:

- *during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works;*
- *during construction and operation, best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised (including as a consequence of transport access arrangements);*
- *habitats will, where practicable, be restored after construction works have finished;*

- *developments will be designed and landscaped to provide green corridors and minimise habitat fragmentation where reasonable;*

- *opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals, for example through techniques such as the 'greening' of existing network crossing points, the use of green bridges and the habitat improvement of the network verge."*

8.3.6 Highways England recognises the national loss of biodiversity and that the road network includes a substantial area of land within the UK. As such, Highways England produced their Delivery Plan 2018 – 2019 [5] and their Road investment strategy (RIS) 2015 – 2020 [6], which commit to protecting biodiversity and aims to reduce the loss of biodiversity by 2020, to deliver no net loss of biodiversity by 2025, and deliver a net gain in biodiversity by 2040.

Local Policy

8.3.7 Consideration has been given to relevant sections and policies relating to biodiversity within the Cornwall Development Plan (notably the Cornwall Local Plan Strategic Policies 2010-2030 [7]) along with the following specific resources:

- Cornwall's Design Guide (2013) [8];
- Cornwall's Biodiversity Volume 1: Audits and Priorities (1996) [9];
- Cornwall's Biodiversity Volume 2: Action Plans (1996) [10];
- Cornwall's Biodiversity Volume 3: Action Plans (2004) [11];
- Biodiversity and Geological Conservation Planning Good Practice Guidance for Cornwall (2007) [12];
- Cornwall and Isles of Scilly Landscape Character Study (2007) [13]; and
- British native trees and shrubs and their status in Cornwall [14].

Guidance

8.3.8 A range of guidance documents are available for biodiversity but the principal assessment sources include:

- Ecological Impact Assessment in the United Kingdom Second Edition (CIEEM 2016) [15] and;
- Highways England standards, including IAN Ecology and Nature Conservation: Criteria for Impact Assessment (IAN 130/10) [16] which supplements the earlier Design Manual for Roads and Bridges (DMRB) chapter in Volume 11, Section 3, Part 4 (dated 1993) [17].

8.3.9 Guidance for specific species, groups and other ecological features is discussed in individual relevant sections or is provided in the ecological baseline reports (Volume 6 Document Ref 6.4 ES Appendices 8.1 to 8.20).

8.4 Study area

8.4.1 The ecology of the scheme and surrounding area was surveyed primarily over three years (2015-2017), in which time the preferred route (Option 7A) was determined and announced in July 2017 (see **Consideration of alternatives** (Volume 6 Document Ref 6.2 ES Chapter 3)). As such, the study areas for some receptors were refined between 2015 and 2017, in response to the route

selection. Furthermore, the study area varied for different species and ecological survey methods to ensure compliance with specific guidance for species, groups and habitats.

8.4.2 Study areas thus varied depending on time of survey and type of survey. Figures of study areas undertaken in support of this chapter are provided within each of the ecological baseline reports (Volume 6 Document Ref 6.4 ES Appendices 8.1 to 8.20). Study areas are summarised in Table 8-1 and described within 8.6 Assessment methodology below.

8.4.3 The maximum extent of the study area was determined by guidance, Zone of Influence (ZOI)[1] and consultation with statutory bodies, and the details of the agreed matters are provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5). Where there were any deviations from guidance these are described and justified within the assessment and ecological baseline reports within Volume 6 Document Ref 6.4 ES Appendices 8.1 to 8.20.

8.4.4 Table 8-1 provides a summary of the study area distances applied for each ecological feature surveyed for the scheme; specific guidance used and justifications for distances are provided in Section 8.6 Assessment Methodology.

Table 8-1 Summary of the study area distances for each ecological feature surveyed.

Survey	Study Area
Statutory and Non-Statutory Sites	At least 2 kilometres, or 30 kilometres for Special Areas of Conservation (SACs) where bats are a qualifying species from scheme. Also within 200 metres of the Affected Road Network (ARN) as list and described in para 8.6.7 and 8.6.160 below.
Phase 1 Habitat Survey	2015 study area – 500 metres (i.e. 250 metres either side of each option) 2017 refined to 200 metres (i.e. 100 metres either side of proposed scheme)
Heathland and Woodland NVC Grassland NVC Hedgerows	200 metres (i.e. 100 metres either side of proposed scheme)
River Habitat Appraisal	500 metres - All watercourses within 100 metres of each option boundary at presented in 2016, with each being surveyed at least 500 metres from the upstream extent
Terrestrial Invertebrates Freshwater Macroinvertebrates Fish Reptiles Breeding Birds Wintering Birds	200 metres (i.e. 100 metres either side of proposed scheme)
Dormice	1 kilometres (i.e. 500 metres either side of proposed scheme) scoping exercise to identify suitable woodlands and 200 metres (i.e. 100 metres either side of proposed scheme) for detailed surveys

1 'The 'zone of influence' for a project is the area over which ecological features may be subject to significant effects as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries... the zone of influence will vary for different ecological features depending on their sensitivity to an environmental change. It may be appropriate to identify different zones of influence for different features.' [16]

Survey	Study Area
Badger	500 metres (i.e. 250 metres either side of proposed scheme)
Otter	Breeding Sites – 1 kilometres (i.e. 500 metres either side of proposed scheme) Resting Sites - 500 metres (i.e. 250 metres either side of proposed scheme)
Nightjar	1 kilometres (i.e. 500 metres either side of proposed scheme) scoping exercise to identify suitable habitat and surveys in relevant locations
Barn Owl	3 kilometres (i.e. 1.5 kilometres either side of proposed scheme)
Bat Activity	500 metres (i.e. up to 250 metres either side of proposed scheme)
Bat Landscape Scale	2 kilometres (i.e. 1 kilometres either side of proposed scheme)
Bat Roosts	200 metres (i.e. 100 metres either side of proposed scheme) – building external and internal daytime surveys and emergence and re-entry surveys 100 metres (i.e. 50 metres either side of proposed scheme) - ground level tree assessments 40 metres (i.e. at least 20 metres either side of proposed scheme) - aerial tree climbing surveys and emergence and re-entry surveys 200 metres (i.e. at least 100 metres either side of proposed scheme) – hibernation roost scoping surveys

8.5 Consultation

8.5.1 Statutory and Non-Statutory Consultations have been undertaken with the following:

- Natural England;
- Cornwall Council;
- Environment Agency – Cornwall;
- Cornwall Wildlife Trust;
- Highways England;
- Scottish Power (with regard to Carland Cross Windfarm)

8.5.2 A detailed consultation exercise was undertaken with Natural England via the Discretionary Advice Service (DAS) to discuss ecology survey methodologies, results and mitigation. Following an initial consultation in June 2016 a number of issues were discussed, resolved, and the details of the agreed matters are provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.5.3 The Natural England SOCG was used to form the foundation of consultation with Cornwall Council and Cornwall Wildlife Trust and their SOCGs.

8.5.4 Bat surveys were of particular interest to Natural England and extensive consultation regarding this was undertaken. Initially, it was proposed not to carry out landscape scale effect transects [18], in addition to the standard walked activity transect methodology [19], however following consultation with Natural England it was agreed to undertake them due to their repeatability as monitoring surveys post-development and their development specifically for linear schemes.

8.5.5 Natural England were also consulted on a deviation from the standard Collins (2016) guidance for the number of emergence/dawn surveys carried out on building and tree roosts. Due to the number of roosts identified by August 2017,

an increase in the number of tree climbing inspections in place of emergence/re-entry surveys of trees was suggested, and for buildings, it was suggested to continue with the standard number of survey visits (two for moderate, three for high) where the building was within the footprint or 20 metres radius of the scheme, to which Natural England agreed.

8.5.6 Further details on general consultation undertaken to date on the scheme are provided in the A30 Chiverton to Carland Cross **Consultation Report** (Volume 5 Document Ref 5.1 and 5.2).

8.6 Assessment methodology

Scoped out surveys

8.6.1 The following species were scoped out of further detailed survey for the reasons detailed below. This approach was agreed through consultation with Natural England, as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

Water vole (*Arvicola amphibius*)

8.6.2 It is considered that this species is absent from Cornwall [20] apart from within localised release sites in the north-east of the County near Bude [21]. Furthermore, no records were identified for water vole within the desk study search areas in either 2015 or 2017. Further details of the 2015 and 2017 desk studies are provided in the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2) and the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3) respectively. As such, water voles are not considered further within this chapter.

Amphibians

8.6.3 Great crested newts (*Triturus cristatus*) are considered absent from Cornwall [22] and no records were returned within the 2015 or 2017 desk study areas. Therefore, great crested newts are not considered further within this chapter.

8.6.4 Twenty records were returned from the desk study for common frog (*Rana temporaria*) and the Section 41 Species of Principal Importance (SPI)[2] listed common toad (*Bufo bufo*) from within two kilometres of the scheme. Common toad have been included within the assessment under 'Other Section 41 Species of Principal Importance' and as such, mitigation has been provided for all common species of amphibians that may be present within the construction footprint.

White clawed crayfish

8.6.5 It is considered that white-clawed crayfish (*Austropotamobius pallipes*) is absent from Cornwall [23]. Indeed, no records were identified for white-clawed crayfish within two kilometres of the scheme within the last ten years. As such, this species is not considered further within this chapter.

2 Section 41 Species of Principal Importance (SPI) as listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006

Table 8-2 Scoped out surveys

Species/Group	Rationale for Scoping Out
Water vole	Geographic range and lack of local records.
Amphibians	Great crested newts absent based on geographic range; SPI amphibians' presence assumed.
White-clawed crayfish	Geographic range and lack of local records.

Desk study

8.6.6 A desk study was undertaken in 2015 to collate and review records from the previous ten years (2006 to 2015 inclusive) of designated sites, and protected and notable species within five kilometres of the existing A30 between Chiverton and Carland Cross. This search area was extended to 10 kilometres for records of bats and to 30 kilometres for SACs where bats are a qualifying species. The desk study was refined in September 2017 to within 100 metres of the scheme for all Section 41 Habitats of Principal Importance (HPIs)[3] (taken from the Priority Habitats Inventory) and within two kilometres of the scheme for all protected species, including SPIs (obtained from the Environmental Record Centre for Cornwall and the Isles of Scilly (ERCCIS) desk study).

8.6.7 In June 2018, a final desk study was undertaken to confirm the presence of statutory and non-statutory designated sites within 2 kilometres of the final scheme design, and statutory sites within 200 metres of the Affected Road Network (ARN) as defined under the DMRB HA207/07 [24] criteria as list in para 8.6.160 below. This approach was agreed through consultation with Natural England, as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5), as well as ensuring the inclusion of any sites designated since the 2015 desk study.

8.6.8 The desk study search for the terrestrial invertebrate survey included post-1989 records of all Red Data Book (RDB)[4] species, and species listed as Nationally Scarce[5] within 2 kilometres of the scheme footprint at the time of writing.

8.6.9 The following organisations and resources were consulted to compile the desk study:

- Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS);
- Multi-Agency Geographic Information for the Countryside (MAGIC);
- Review of 2005 survey [25] reporting on earlier iterations of the scheme.

8.6.10 Road Traffic Collisions (RTC) records were also requested in October 2017 from ERCCIS for the existing A30 between Chiverton and Carland Cross.

Extended Phase 1 Habitat survey

8.6.11 An Extended Phase 1 Habitat Verification Survey was carried out in accordance with the standard Joint Nature Conservation Committee (JNCC) survey methodology [26] and CIEEM guidelines [15] over the course of three days in

3 Section 41 Habitats of Principal Importance (HPI) as listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006
4 Cornwall Red Data Book of rare and scarce wildlife of Cornwall and the Isles of Scilly [108]
5 Species which are found in between 16 and 100 hectads [109]

suitable conditions in August 2015. The Verification Survey was to verify the Phase 1 Habitat survey carried out in 2005 [25].

8.6.12 The 2015 Verification Survey area extended 250 metres on either side of the proposed routes at the time of the survey (Figure 1 in **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2)).

8.6.13 A Phase 1 Habitat Update Survey was undertaken between 21st and 25th August 2017, to ensure the refined study area of the preferred route (Option 7A) was fully surveyed and any existing gaps mapped, again following best practice methodology and guidelines [26] [15]. The survey recorded the habitats present along the length of the scheme and surrounding 100 metres area either side (ES Figure 8.2 (Volume 6, Document Ref 6.3) and Figure 3 in **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3)). The evidence of or potential for any protected or notable habitats and species was recorded. Any incidental records found during this survey were noted.

8.6.14 During the **2017 Phase 1 Habitat update survey** (Volume 6 Document Ref 6.4 ES Appendix 8.3,) consideration was given to the presence of invasive non-native species listed on Schedule 9 of the WCA 1981 (as amended) and the presence of any notable weeds including those covered under the Weed Act 1959[6] (where population is significant enough to be considered injurious).

8.6.15 The surveyors cross-referenced the survey findings with those obtained in 2015 to verify previous results and completed the survey where gaps were found due to lack of access during the 2015 survey.

8.6.16 Where possible, species lists were made and the scientific names for plant species followed those in the New Flora of the British Isles [27]. Species lists were made for each broad habitat type across the scheme rather than for each block of habitat in discrete locations.

8.6.17 The conclusions of the 2015 Phase 1 survey were that further detailed surveys for a number of habitats and species were required. These are detailed below.

River Habitat Appraisal

8.6.18 A river habitat appraisal was conducted to identify aquatic habitats, particularly those used by designated species, within the study area, which included all route options being considered in late 2016. Data obtained during the river habitat appraisal was used to inform the need for further targeted fish, aquatic macroinvertebrate, and pond surveys in the area.

8.6.19 The appraisal was carried out in November and December 2016, focussing on watercourses, still waters, and their tributaries within 100 metres of, or connected to the proposed route options (see Figure 2-1 and Figure 2-2 in the **River habitat appraisal report** (Volume 6 Document Ref 6.4 ES Appendix 8.4)). Of the watercourses and still waters identified, at least 500 metres from the upstream extent was scoped in for the habitat appraisal survey, which resulted in approximately 7.5 kilometres of watercourses surveyed.

6 Act of Parliament. (1959). The Weed Act 1959. London: HMSO

8.6.20 The habitat appraisal approach was tailored towards Annex II species[7], including Atlantic salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), and bullhead (*Cottus gobio*) [28]. These species generally share comparable habitat preferences for spawning which was considered when designing the methodology.

8.6.21 Habitat parcels were determined through recording depth and flow velocity, the predominant substrate type, anthropogenic alterations to the channel, and sources of sediment input in the form of poaching or run-off. Other features that were also recorded when observed include, but are not limited to, pools, woody debris, barriers to fish movement, potential sediment sources, and overhanging riparian vegetation. The features recorded were used to determine suitability for juvenile salmonids.

8.6.22 In addition, still waters were also assessed for submerged and emergent macrophyte cover and potential for supporting fish populations, to inform the need for National Pond Surveys [29].

8.6.23 Further details on the methodology and limitations, including figures, can be found in the **River habitat appraisal report** (Volume 6 Document Ref 6.4 ES Appendix 8.4).

National Vegetation Classification (NVC) survey

8.6.24 NVC surveys were undertaken for grassland in late June/early July 2017, for heathland in late August 2016, and for woodland in early May/late August 2017, following best practice guidelines and standard methodology [30] [31] [32].

8.6.25 Heathland and woodland sites within 100 metres of the proposed options at the time of survey were scoped in for NVC surveys if they had the potential to support protected or notable plant species, were designated for their botanical interest, were listed on the Ancient Woodland Inventory [33] or if they supported or had the potential to support HPIs. The areas surveyed are shown in Figure 2 in the **Heathland and woodland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.5).

8.6.26 Grassland sites within 100 metres of the proposed options at the time of survey were scoped in for NVC surveys if they contained habitats of potential interest (including semi-improved grassland), if they supported or had the potential to support HPIs, or if they had the potential to support significant NVC grassland communities. The areas surveyed are shown in Figure 1 and Figure 2 in Appendix 2 of the **Grassland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.6).

8.6.27 Grasslands within a total of eight sites, woodlands within a total of six sites, and heathland within a total of two sites, considered to support habitat of sufficient quality to be subject to detailed NVC survey were shortlisted and prioritised for further survey, as described within the **Heathland and woodland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.5) and the **Grassland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.6).

8.6.28 Areas of homogenous stands were identified within the selected sites. Five quadrats were then placed in the ‘typical’ and/or representative vegetation in each

7 Listed on Annex 2 of the European Union Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)

stand. Quadrats were evenly spread across the homogenous area, with quadrat size being appropriate to the vegetation being surveyed. Within each quadrat, all plant species were recorded with an estimate of percentage cover/abundance using the Domin scale[8].

8.6.29 Plant species were named in accordance with guidance [27] except for the naming of NVC communities, which is based on some now superseded scientific names for plant species [31].

8.6.30 Data was analysed to provide a 'best' approximation to a published NVC community type, through use of the keys [31] and the computer software MAVIS [34].

8.6.31 Further details on the methodology and limitations, including figures, can be found in the **Heathland and woodland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.5) and the **Grassland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.6).

Hedgerow survey

8.6.32 All hedgerows within 100 metres of the scheme were assessed within the optimal period between June and August 2017. Survey methodology followed that laid out in the Hedgerow Survey Handbook, 2007 [35] and the Hedgerow Regulations 1997[9], and the hedgerow importance was assessed following the criteria provided in Part II of Schedule 1 of the Hedgerows Regulations 1997.

8.6.33 These criteria include, but are not limited to, features such as the presence and/or abundance of woody species, connections with other ecological features, rare tree species, and woodland ground flora species.

8.6.34 The aims of the hedgerow assessment were to:

- Identify hedgerows that are classified as 'important' under the Wildlife and Landscape criteria of the Hedgerow Regulations 1997;
- Identify hedgerows that are classed as Nature Conservation Priority Hedges under The Hedgerow Evaluation and Grading System [18];
- Identify Cornish Hedgerows [19] applying distinguishing features; and
- Identify hedgerows that, although not deemed 'important' under the ecological criteria of the Hedgerow Regulations 1997 have ecological value in terms of species diversity or as potential wildlife corridors.

8.6.35 Further details on the methodology and limitations can be found in the **Hedgerow survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.7).

Terrestrial Invertebrate survey

8.6.36 Terrestrial invertebrate surveys were carried out by an entomological specialist within 100 metres of the scheme. A scoping survey was undertaken at the end of May 2017 to assess all HPIs within the survey area, as well as non-priority habitats such as semi-improved grassland, marshy grassland, and woodland identified as such during the Extended Phase 1 Habitat survey. Eleven sites in total were considered to have the potential to support invertebrate assemblages

8 The Domin scale botanical survey technique is a 10 point non-linear scale used in estimating canopy cover [33].
9 The Hedgerow Regulations 1997. Statutory Instrument 1997 No. 1160 Crown Copyright (comply with the requirements of the "Wildlife and Landscape Criteria").

and species of higher conservation value, and as such were therefore taken forward for further detailed survey (see Figure 1 in the **Terrestrial invertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.8) for scoping sites and survey locations).

8.6.37 Methodology for the more detailed survey followed best practice guidance by Drake et al., 2007 [36], with analysis being undertaken using Natural England's Invertebrate Species-habitat Information System (ISIS (now part of an online resource called 'Pantheon')) [37]. The majority of sites were surveyed on at least three separate occasions between May and August 2017.

8.6.38 To ensure robust analysis, at least four samples were collected per habitat layer per site. Where practical, species were identified in situ and without undue disturbance. The method of sampling varied according to habitat and mainly included sweep-net, vacuum, beating tray, and direct searching. Other methods used occasionally included spot sampling, water traps, flight interception traps, and mercury vapour moth trapping. Specimens not identified on site were identified ex situ using a binocular microscope and appropriate taxonomic keys.

8.6.39 Species data were entered into Pantheon/ISIS, enabling the species lists to be evaluated at three levels. These include a broad biotype landscape-scale level, an individual site habitats level, and a Specific Assemblage Types (SATs) level. Pantheon can be used to list all species of higher conservation status (SPIs, RDB[4], and Nationally Scarce species) within a particular assemblage, in order to assess the conservation value at the three levels (landscape, site, or specific assemblage).

8.6.40 Further details on the methodology and limitations, including figures, can be found in the **Terrestrial invertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.8).

Freshwater Macroinvertebrate survey

8.6.41 Watercourses and still waters that could be impacted by the scheme were identified during the River Habitat Appraisal survey as described above and within the 8.6 Baseline Conditions section below. Through the River Habitat Appraisal, 18 watercourses and six ponds were identified as having the potential to be impacted by the proposed route options at the time of the survey.

8.6.42 Of the four potentially 'directly impacted' watercourses, one site (Site 2.1) was scoped out of further detailed macroinvertebrate survey due to route selection removing the potential impact on this site. Of the 14 potentially 'indirectly impacted' watercourses, land access was denied to Site 5.1 (Site 5.2 acted as a suitable proxy) and it was established that Site 13.2 was connected to a scoped in watercourse (Site 13.1), and as such Site 13.2 was scoped out of further survey.

8.6.43 Of the six ponds identified, Pond 16.1 (the quarry pond) was scoped out of further survey due to steep banks and no safe access to the water's edge posing a health and safety risk.

8.6.44 This resulted in a total of fifteen watercourses and five ponds scoped in for further detailed macroinvertebrate survey. The precise survey site within each watercourse of interest was selected to provide a representative location of the wider watercourse (watercourse survey locations and pond survey locations are shown on Figures 2-1 and 2-2 respectively within the **Freshwater**

macroinvertebrates survey report (Volume 6 Document Ref 6.4 ES Appendix 8.9)). The entirety of each pond was surveyed using standard National Pond Survey methodology [29].

8.6.45 Sampling visits to watercourses and ponds were undertaken in May and October 2017, with an additional visit in summer 2017 to ponds. Macroinvertebrate samples were collected following best practice guidance from the Environment Agency 2002 [38] and 2009 [39], and Pond Action 1998 [29] using standard net sampling procedure and a timed hand search. Samples were preserved on site, and subsequently analysed to Mixed Taxon Level 5 following best practice guidance from the Environment Agency 2009 [40].

8.6.46 Wetland plants within ponds were surveyed by walking and wading the perimeter, and the open areas less than one metre deep, noting the species present, the number of uncommon species, and subsequently calculating the Trophic Rank Score (TRS) [41].

8.6.47 Sampling data from watercourses were analysed to give an indication of overall biological quality of the samples, as well as the comparative conservation value of the communities between sampling locations. The conservation value was determined using a species Conservation Score (CS) (a component of the Community Conservation Index (CCI) [42]).

8.6.48 The Water Framework Directive (WFD) status [43] of watercourses was determined using the Whalley Hawkes Paisley Trigg (WHPT) method [44] to calculate the Average Score per Taxon (ASPT) and the Number of Taxa (NTAXA) within a sample. The ratios between observed and expected (O/E) results were used for the Lotic-invertebrate Index for Flow Evaluation (LIFE) to demonstrate where flow acts as a possible pressure on the ecological community of the site [45], and for the Proportion of Sediment-sensitive Invertebrates (PSI) [46] to indicate potential impacts associated with fine sediment inputs.

8.6.49 Species and sampling data from the ponds were analysed for the presence of macroinvertebrate species with a CS of five (Local conservation status) or above [42]. Water quality parameters and physical characteristics of the pond were recorded and measured on site, and water quality samples were collected for ex situ analysis.

8.6.50 Further details on the methodology and limitations, including figures, can be found in the **Freshwater macroinvertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9).

Fish survey

8.6.51 Through the River Habitat Appraisal survey as described above and within the 8.6 Baseline Conditions section below, 18 watercourses and six ponds were identified as having the potential to be impacted by the scheme.

8.6.52 Of the four potential ‘directly impacted’ watercourses, one site (Site 2.1) was scoped out of further survey due to route selection removing the potential impact on this site. Of the 14 potential ‘indirectly impacted’ watercourses, three were deemed very unlikely to be suitable for fish, and access was denied for Sites 5.1 and 10.1 (Site 5.2 acted as a suitable proxy for Site 5.1, but a precautionary approach to mitigation is recommended for Site 10.1).

8.6.53 Specific surveys for fish were not carried out on any of the ponds, but the methodology and results of the National Pond Surveys are described within the Freshwater Macroinvertebrate survey sections above and below.

8.6.54 A total of 12 watercourse sites were therefore scoped in for targeted fish surveys (Figure 1 in the **Fish survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.10). The targeted survey approach was specifically designed to provide a baseline dataset for freshwater fish, including Atlantic salmon, sea lamprey, brook lamprey, river lamprey and bullhead.

8.6.55 Electrofishing surveys were undertaken in July 2017, following guidance from Carle and Strub 1978 [47], using battery-powered, backpack pulsed-DC current Electrofishing equipment. Stop nets were placed at the upstream and downstream limits of each directly impacted site, to enable a population density to be quantified for each site. Timed runs were performed over set areas in order to provide semi quantitative results for fish at indirectly impacted sites.

8.6.56 All fish captured were identified, counted, and measured (fork length) to the nearest millimetre. After processing, all fish were returned alive to the watercourse from which they were captured.

8.6.57 In addition to a general description of the site, further characteristics were recorded including water quality parameters: conductivity (microsiemens [µs]), pH, oxygen (milligrams per litre and percentage saturation), temperature and salinity (parts per thousand [ppt]).

8.6.58 Lamprey surveys were also undertaken at each of the 12 sites in July 2017, including both optimal and sub-optimal juvenile lamprey habitat where possible. The protocol for surveying lampreys followed Common Standards Monitoring (CSM) guidelines [48], which entailed electric fishing within a less than one metre squared quadrat four times over each 100 metre survey stretch, positioned over the selected optimal lamprey habitat. Individual lamprey were identified, counted, and measured at each site.

8.6.59 Further details on the methodology and limitations, including figures, can be found in the **Fish survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.10).

Reptile survey

8.6.60 Potential reptile habitat areas (including high, medium, low suitability areas) within 100 metres of the scheme were initially identified via aerial photography as well as existing desk study data and information from the **2015 Phase 1 habitat verification survey report** (Volume 6 Document 6.4 ES Appendix 8.2).

8.6.61 Twelve areas were subsequently identified to have moderate or high quality reptile habitat as shown in Figure 1 in of the **Reptile survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.11). Ten of these areas were scoped in and surveyed further. Two moderate quality habitat areas were not surveyed further due to lack of safe access, and isolation of the habitat by the existing road network. Areas of low quality were scoped out and not included in the mapping or surveyed further.

8.6.62 A reptile survey was then carried out in May and June 2017, with the aim of determining the presence or likely absence of reptiles within each of the ten defined areas. Survey methodology followed Froglife (1999) [49], and DMRB [50]

with the placement of the artificial refugia at approximately 20 metre intervals around margins of the survey areas, at an average density of ten per hectare. 365 refugia tiles were used across the ten locations. There were 30 days between the first and last survey visits and a minimum of two days between each visit, of which there were seven.

8.6.63 During each visit, each refuge was lifted carefully to search for reptile species and details of the reptile species were recorded.

8.6.64 Further details on the methodology and limitations, including figures, can be found in the **Reptile survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.11).

Bird survey

Breeding bird survey

8.6.65 Breeding bird surveys were carried out over four visits between April and June 2016 following a combined survey methodological approach of the Common Bird Census and Breeding Bird Methodology [51]. This approach was agreed through consultation with Natural England, as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.6.66 This approach involved walking six pre-determined transects, designed to cover all of the habitats present within the survey area with a focus upon those that were likely to be directly affected by the route options (at the time of survey design).

8.6.67 The six transect routes are shown on Figure 1 in the **Breeding bird survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.12). The transect routes were reversed during each survey in order to reduce the potential for time bias. During each survey, the bird species and behaviour were recorded using the standard British Trust for Ornithology (BTO) codes.

8.6.68 A summary of each transect across the breeding season was carried out, identifying the number of species, those of conservation concern, and the primary habitats that those species appeared to be using. The approximate numbers of breeding pairs of each species were also established.

8.6.69 Further details on the methodology and limitations, including figures, can be found in the **Breeding bird survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.12).

Wintering birds survey

8.6.70 Wintering bird surveys were carried out over six visits from October 2016 to March 2017 following the same six transects as the breeding bird surveys (as described above). As with breeding birds, surveys were conducted following the Common Bird Census and Breeding Bird Survey methodology [51], with species and behaviour being recorded using the standard British Trust for Ornithology (BTO) codes. The six transect routes are displayed on Figure 1 of the **Wintering bird survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.13).

8.6.71 Species that were of conservation importance were mapped to illustrate the ‘hotspots’ within the survey area for wintering species. Again, as with breeding birds, each transect was summarised to provide a species list and relative use of the habitats found within each transect.

8.6.72 During the February transects, weather was inclement and visibility was poor, including fog and rain. Therefore, activity levels may have been decreased due to poor weather conditions, and surveyors may not have detected all species present. However, the surveyors still recorded comparable levels of bird activity to other visits and this was therefore not considered to be a significant limitation.

8.6.73 Further details on the methodology and other limitations can be found in the **Wintering bird survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.13).

Schedule 1 barn owl survey

8.6.74 Barn owl (*Tyto alba*) surveys were carried out in July and August 2017, using adapted methodology[10] and best practice guidance from the Barn Owl Conservation Handbook 2012 [52], Shawyer 1998 [53], and Shawyer 2011 [54].

8.6.75 Features of interest and landscapes broadly suitable to barn owls were identified using desk study data and a barn owl desk-based Stage 1 scoping exercise. Desk study data was requested for up to five kilometres from the existing A30 (which was subsequently refined to up to two kilometres from the scheme), and the Stage 1 scoping exercise was carried out for up to 1.5 kilometres from the scheme, with ground trothing being undertaken during Stages 2 and 3. This process was also used to scope out areas that would not require further survey.

8.6.76 A Stage 2 investigative field survey within 1.5 kilometres of the scheme was carried out, where access was possible. Habitat mapping was classified based upon the apparent condition and likelihood of supporting voles with habitats categorised as Type 1, Type 2, Type 3 or Other habitats. Nest and roost identification followed standard methodology as above, with features recorded identified as a Potential Nest Site (PNS), an Active Roost Site (ARS), or a Temporary Roost Site (TRS) for barn owls.

8.6.77 During the Stage 3 nest verification survey, nest sites identified in Stage 2 as PNS's or ARS's were surveyed to confirm if any could be categorised as Observed Breeding Sites (OBS).

8.6.78 Further details on the methodology and limitations can be found in the **Barn owl survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.14).

Nightjar survey

8.6.79 Aerial imagery, along with data obtained during the Phase 1 Verification Survey undertaken in 2015 was used to scope habitats suitable for breeding nightjar (*Caprimulgus europaeus*) within 500 metres of the proposed alignments. This resulted in three areas being scoped in for further field surveys (Figure 1 in the **Nightjar survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.15). Two visits were carried out to each of the three survey areas in the first half of July 2017, with the aim of detecting the presence of churring males.

8.6.80 Following consultation with Natural England both the scoping survey and specific nightjar surveys were repeated in June and July 2018 following Gilbert et al., 1998 [51]. Further details relating to the consultation are presented in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

10 Guidance advises that barn owl surveys are carried out up to three kilometres from the proposed works. However, in this case surveys were only carried out up to 1.5 kilometres from the scheme, with a focus on 500 metres from the scheme.

8.6.81 Surveys in Area 1 and 3 in both 2017 and 2018 were conducted within best practice guidance, with surveys commencing approximately 20 minutes after sunset, and consisted of walking a pre-determined transect designed to reach within 100 metres of all potential breeding areas within the scoped in habitat area. Churring males, calls, and associated flight paths were mapped using standard coding.

8.6.82 Surveys Area 2 in 2017 commenced later than the recommended 20 minutes after sunset, and as such surveys were repeated in 2018 following guidance recommendations.

8.6.83 Further details on the 2017 methodology and limitations, including figures, can be found in the **Nightjar survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.15).

8.6.84 Surveys carried out to date provide sufficient information to inform the assessment. The survey details for the 2018 surveys will be provided as supplementary information within the Examination Period, as the surveys were ongoing during the DCO application submission. The results of these surveys will clarify the outcomes of this assessment and will not materially affect the significance of impacts.

Otter survey

8.6.85 Surveys for otter were carried out in May and July 2017. The aim was to determine presence of otter signs, resting, and breeding sites, categorise valuable habitat, and identify potential locations where otters may cross the new road.

8.6.86 It was assumed that all streams and waterbodies within the study area would be actively used by otters, to a greater or lesser extent, as otters now use all types of watercourses and wetland in southwest England [55].

8.6.87 Combining and adapting methodology and best practice guidance from four sources [56] [57] [58] [59], searches for breeding sites were confined to lakes and ponds within at least 500 metres of scheme and for resting sites were confined to watercourses and ponds within at least 250 metres of the scheme. The small size of watercourses within 500 metres of the scheme suggested that fish are not likely to be numerous, hence the decision to confine the search for breeding sites to lakes and ponds. This methodology was agreed with Natural England as presented in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5). Survey sites are shown in Figures 1 to 5 of the **Otter survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.16).

8.6.88 Breeding sites were categorised for their potential to support breeding using guidance criteria by Liles 2003 [59]. These criteria include, but are not limited to, presence of otter signs, extent of available concealing cover, presence/impact of livestock, level of human disturbance, food availability, and distance to nearest watercourse. These factors were taken into consideration when assigning a subjective score between one and five reflecting the probability of a pond being a breeding site. A score of one indicates a very low probability and five a very high probability. Ponds that were close together (less than 100 metres apart) were aggregated in assigning these scores.

8.6.89 Culverts and locations at which otters may cross the road when moving between catchments were also assessed through mapping, aerial photography and desk study data on RTCs, followed by a site visit to these locations.

8.6.90 Signs of otter including spraints, tracks, feeding remains, slides, holts, couches, and anal jelly were also recorded when identified during the macroinvertebrate surveys, further details of which can be found in the **Freshwater macroinvertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9).

8.6.91 Further details on the otter survey methodology and limitations, including figures, can be found in the **Otter survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.16).

Badger survey

8.6.92 Habitats within 250 metres of the route options at the time of the survey were assessed for their capacity to support badger. Habitats identified included woodlands, farmland and gardens with the potential to support foraging and sett building.

8.6.93 A full badger survey was then carried out within the identified habitats in line with best practice guidelines from DMRB 2001 [60] and Harris et al., 1989 [61] during April, May and August 2017.

8.6.94 Field boundaries within the study area were surveyed for evidence of badger activity including sett entrances, latrines, snuffle holes, and mammal tracks. Setts were mapped and classified as a main, annexe, subsidiary or outlier sett in accordance with the nationally recognised sett classification criteria [61] [62]. The level of badger activity was also assessed and classified as active, partially used, or disused, following Harris et al., 1989 [61].

8.6.95 Further evidence of badgers around sett entrances were also recorded including badger hairs, paw prints, fresh spoil heaps, the presence of bedding nearby, latrines, and well-worn tracks leading to and from the setts.

8.6.96 Further details on the methodology and limitations, including figures, can be found in the **Badger survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.17).

Dormouse survey

8.6.97 Areas of potential dormouse (*Muscardinus avellanarius*) habitat within approximately 500 metres of the scheme were identified using aerial photography and desk study data (Figure 1 in the **Dormouse survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.18)). The connectivity of these habitats to the wider landscape, and large hedgerows within connectivity belts between woodlands were considered.

8.6.98 A nest tube survey was then undertaken in suitable habitat in 2016 and 2017 to determine the presence and extent, or likely absence of dormice. This followed methodology and guidance from the Dormouse Conservation Handbook 2006 [63] and Chanin and Woods 2003 [64]. The nest tube survey in 2016 was undertaken within approximately 100 metres of the scheme, with the survey in 2017 then extending beyond 100 metres of the scheme where suitable habitat was connected to the areas identified in 2016.

8.6.99 A total of 710 nest tubes were set up in eight distinct areas in 2016 and a total of 475 nest tubes were set up in nine distinct areas in 2017, as shown on Figure 2 and Figure 3 in the **Dormouse survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.18). Tubes were deployed in late April in both 2016 and 2017, and subsequently checked within the optimal survey period in each year.

8.6.100 Further details on the methodology and limitations can be found in the **Dormouse survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.18).

Bat surveys

8.6.101 The survey methodologies followed current best practice guidance [19], and relevant sections of the DMRB [65, 66]. The survey methodologies were broadly in line with the new best practice methodology for surveying linear infrastructure [18] , except where deviations were considered appropriate. Consultation was undertaken with Natural England to agree the survey methodology as presented in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

Bat Roost Surveys

Ground Level Tree Assessments

8.6.102 All trees within 50 metres of the 2016 scheme options were subject to ground level tree assessments in April 2016 or April 2017. A further ground level tree assessment of the Merton plantation (between Ch7+600 to Ch8+100) was carried out in May 2018 to ensure all trees within 50m of the final alignment in this area had been assessed. The surveys were undertaken in accordance with best practice guidance [19]. Close focusing binoculars, endoscopes, high-powered torches and ladders were used to search for and categorise potential roosting features (PRFs). PRFs were categorised as negligible, low, moderate or high suitability for roosting bats, or as confirmed roosts. All those categorised as having low potential or above were mapped using GPS devices and described. Any bat droppings found in confirmed roosts were collected and sent for DNA analysis.

8.6.103 Further details on the methodology and limitations, including figures showing the survey locations for the 2016 and 2017 surveys, can be found in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

8.6.104 Surveys carried out to date are documented within this ES. It should be noted that surveys have continued beyond the publication of this ES and submission of the DCO. The results of these surveys are not expected to change the outcome of this assessment and will not materially affect the significance of impacts.

Aerial Tree Climbing Surveys

8.6.105 Following the ground level tree assessments, all trees categorised as having moderate or higher suitability to support roosting bats and which were located within the footprint of the scheme or within 20 metres were subject to aerial tree climbing surveys. The surveys were carried out in accordance with best practice guidance [19] by licenced bat workers using a rope access system, torches and endoscopes. The climbing inspection surveys were undertaken over three occasions in April, August and September 2017.

8.6.106 If during the climbing inspection features were assessed as less or more suitable than they appeared from the ground level assessment, the tree category was downgraded or upgraded respectively. If the overall suitability of the tree was moderate, a total of two climbing inspections were undertaken, if the tree was high suitability, a total of three climbing inspections were undertaken respectively in order to determine likely absence of roosting bats. If evidence of roosting was found, a minimum of three tree climbing surveys were carried out to characterise the roost.

8.6.107 Where it was not possible to thoroughly inspect a PRF using the climbing survey methodology due to the nature of the feature/health and safety reasons (T56, T94, T96, T124), further surveys were carried out as follows:

- Trees considered to have moderate suitability PRFs which could not be exhaustively searched were subject to two further separate survey visits (consisting of a repeat aerial tree climbing inspection plus a dusk emergence /dawn re-entry survey);
- Trees with high suitability PRFs, were subject to three further separate survey visits (consisting of two repeat aerial tree climbing inspections plus at least one dusk emergence /dawn re-entry survey, depending on the PRFs present and the confidence in the aerial tree climbing inspections).

8.6.108 Further details on the methodology and limitations, including figures, can be found in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

Dusk Emergence and Dawn Re-Entry Surveys – Trees

8.6.109 Dusk emergence and/or dawn re-entry surveys were undertaken on a total of four individual trees (T56, T97, T103 and T124) in July and August 2017. Emergence surveys commenced 15 minutes prior to sunset and lasted a minimum of two hours. Re-entry surveys commenced one hour 45 minutes prior to sunrise and lasted up to two hours (a minimum of one hour 45 minutes). The surveys were carried out in suitable weather conditions with temperatures of 10°C of higher.

8.6.110 A combination of full spectrum Echo Meter 3, Echo Meter Touch, and Batlogger M were used in combination with thermal imagers (where necessary as a visual aid). Surveyors were positioned around the tree to ensure that all PRFs were visible. All bats recorded to be emerging and re-entering the features were recorded, along with the flight line and timings. Additionally, notes were made on incidental bat activity recorded during the surveys.

8.6.111 Further details on the methodology and limitations, including figures, can be found in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

Internal and External Built-Structure Assessments

8.6.112 All built-structures within 100 metres of the scheme were subject to an internal and external assessment, where access was possible. The surveys were undertaken by experienced Natural England licensed bat workers throughout 2017, with a small number of surveys undertaken in 2018 as agreed with Natural England as presented in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.6.113 The surveys were carried out in accordance with standard best practice guidelines [19] and involved a detailed search of the interior and exterior of the

built structure using high powered torches and close focusing binoculars to look for bats or evidence of bats. Any bat droppings found were collected and sent for DNA analysis. The suitability of the built structures were categorised as negligible, low, moderate or high suitability for roosting bats, or as confirmed roosts.

8.6.114 Further details on the methodology and limitations, including figures, can be found in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

8.6.115 Surveys carried out to date provide sufficient information to inform the assessment. Further survey activity has been undertaken beyond the submission of this ES. The results of these surveys are not expected to change the outcome of this assessment and will not materially affect the significance of impacts.

Emergence and Re-Entry Surveys - Buildings

8.6.116 Following the internal and external built-structure assessments, dusk emergence and /or dawn re-entry surveys were undertaken of 48 structures within the survey area found to have low, moderate or high suitability for roosting bats or confirmed roosts. All surveys were undertaken in accordance with standard best practice guidelines [19] during the months of May to August in 2016 and 2017. A small number of surveys were also undertaken in 2018 as agreed with Natural England as presented in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.6.117 Emergence surveys commenced 15 minutes prior to sunset and lasted a minimum of two hours. Re-entry surveys commenced one hour 45 minutes prior to sunrise and lasted up to two hours (minimum of one hour 45 minutes). A combination of full spectrum Echo Meter Touch, Batlogger M, and Echo Meter 3 were used in combination with thermal imagers (to complement the survey as a visual aid). Surveyors were positioned around the structure, to ensure that all PRFs were visible. All bats observed emerging and re-entering the structures were recorded, along with timings. Additionally, notes were made on incidental bat activity observed throughout the surveys. All the surveys were carried out in suitable weather conditions with temperatures of 10°C or higher.

8.6.118 Further details on the methodology and limitations, including figures, can be found in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

8.6.119 Surveys carried out to date provide sufficient information to inform the assessment. Further survey activity has been undertaken beyond the submission of this ES. The results of these surveys are unlikely to change the outcome of this assessment and will not materially affect the significance of impacts.

Hibernation Scoping Surveys

8.6.120 Historical and aerial maps were examined to identify potential hibernation sites for bats such as underground cave or mine sites within 100 metres of the scheme. Any potential hibernation sites identified were subject to a walkover survey to assess their suitability for roosting bats on 26 July 2017.

8.6.121 Further details on the methodology and limitations, including figures, can be found in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

Bat Trapping Survey

8.6.122 A trapping survey was carried out on 29 May 2018 at Building 35 – the barn which lies within the footprint of the scheme within the NFH complex. A mist net was installed over the only two entrances to the barn (a door and a window on the western aspect of the building). The surveys were carried out in suitable weather conditions with temperatures of 10°C or higher at sunset.

8.6.123 Further survey details on the methodology and limitations, including figures, will be will be available during the examination. Surveys carried out to date provide sufficient information to inform the assessment. Surveys completed to date are considered appropriate in extent and depth to characterise bat populations/activity and the extent to which the scheme may affect this species. At the time of producing this ES, further surveys are ongoing, the results of which can inform ongoing discussions with Natural England.

Bat Activity Surveys

Bat Activity Transect Surveys

8.6.124 Five bat activity transects were surveyed once a month in appropriate weather conditions between May and September 2016. All transect surveys were dusk surveys with pre-dawn surveys also carried out within the same 24-hour period in July and August. The dusk transects started at sunset and continued for up to 200 minutes after sunset and the pre-dawn surveys commenced approximately 200 minutes before sunrise and finished at sunrise. The surveys were carried out in suitable weather conditions with temperatures of 10°C or higher at sunset. Each of the transects was between 5.5 and six kilometres and incorporated up to ten, five-minute point count locations (Figure 2 in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20)). Each transect was walked once per survey visit, with the direction walked varied throughout the year to reduce any sampling bias associated with change in bat activity patterns throughout the night. The transects were designed to sample a range of habitat types throughout the survey area, focusing on those likely to be the most favourable to bats as well as those areas most likely to be impacted by the scheme.

8.6.125 Surveyors were equipped with Echo-Meter 3 and Echo-Meter Touch full spectrum detectors to identify and record bat activity. The bat activity registered and recorded by the detectors was later analysed using AnalookW v0.4.1.2.

8.6.126 Further details on the methodology and limitations, including figures, can be found in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20).

Automated Detector Survey

8.6.127 Automated static bat detectors were used to supplement the bat activity transect survey data and provide long-term quantitative monitoring data. A total of 15 static detectors, equating to three per transect, were deployed throughout the survey area for five consecutive nights each month between May and October 2016. The automated detector locations (Figure 3 in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20)) were selected to sample the

representative habitats throughout the survey area, focusing on linear features likely to be bisected by the scheme.

8.6.128 A further location, at the quarry pond near Carland Cross was surveyed between April and July 2018, as agreed with Natural England and as presented in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.6.129 Song Meter 2 (SM2) automated detectors were used at each location and were programmed to commence recording 30 minutes before sunset and cease recording 30 minutes after sunrise. Bat activity recorded was later analysed using AnalookW v0.4.1.2. Bat activity was defined as the number of bat passes recorded per hour (pph).

8.6.130 Further details on the methodology and limitations, including figures, can be found in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20).

8.6.131 Surveys carried out to date provide sufficient information to inform the assessment. Further survey activity has been undertaken beyond the submission of this ES. The results of these surveys are not expected to change the outcome of this assessment and will not materially affect the significance of impacts.

Crossing Point Surveys

8.6.132 Crossing Point surveys were undertaken on a total of 12 linear habitat features which crossed the proposed scheme. The surveys were carried out in accordance with best practice guidance and methodology [18].

8.6.133 The selection process that informed these 12 locations involved a study of aerial imagery, desk study records, findings from walked activity transect surveys and static detector surveys as well as the findings from trial dusk/dawn surveys along the linear features in the field. The 12 locations chosen were considered important linear habitat features providing connectivity to areas within the wider landscape expected to be directly severed by the scheme.

8.6.134 A total of six survey visits was undertaken at each crossing point location between June and September during the 2016 and 2017 survey periods; mostly comprising two survey visits in 2016 and four in 2017. All surveys were undertaken in suitable weather conditions with temperatures of 10°C or higher at sunset. The surveys commenced at sunset and continued until two hours after sunset. Two surveyors monitored each crossing point (one surveyor located either side of the proposed route and where possible on opposite sides of the feature).

8.6.135 The surveyors were equipped with full spectrum bat detectors (Echo-Meter 3, Batlogger or Echo-Meter Touch detectors) to aid in the observation of bats and record their calls. All bat passes were recorded, along with the behaviour, distance from feature (at its closest point) flight path and height of flight (where observed). For those bats that altered their flight height during crossing, the lowest flight height was recorded.

8.6.136 Thermal imaging cameras were used at ten of the crossing point locations, where ambient light levels were particularly low due to dense vegetation. The cameras

were used as a visual aid to help determine if bats were crossing 'using the feature'.

8.6.137 Bats were considered to be 'using the feature' if individuals crossed the proposed scheme in a horizontal direction (roughly parallel) to the linear feature and within 5 m of it. Bats were considered to be crossing the proposed Scheme but not using the linear feature when bats were recorded parallel to the feature but further than 5 m from it. Bats were not considered to be crossing the proposed scheme if they were recorded to be flying perpendicular to the linear feature (and not crossing the proposed scheme in between surveyors). Bats were considered to be flying at a safe height if they were flying at 5m or more above ground, and at an 'unsafe height' if flying below 5m high.

8.6.138 Further details on the selection process for each location, methodology and limitations, including figures, can be found in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20)

Landscape Scale Transects

8.6.139 The landscape scale transect surveys were undertaken in accordance with best practice guidance and methodology [18]. They were carried out in July 2017, in appropriate weather conditions with temperatures of 10°C or higher at sunset. Ten different transect routes were chosen approximately perpendicular to the scheme and measuring one kilometres in length. Each transect was situated at least 500 metres apart and large areas of water or human habitation were avoided.

8.6.140 Each transect had a total of 11 spot checks (0, 100, 200, 300, 400, 500, 600, 700, 800, 900 and 1000 metres from the scheme), where surveyors recorded bat activity for exactly ten minutes. The surveyors then walked briskly (approximately six kilometres/hour) onto the next spot check.

8.6.141 Weather variables (temperature and wind speed) and habitat grade were recorded for each spot check. Surveys commenced 30 minutes after sunset and were completed within approximately two hours. Seven of the transects were walked away from the scheme (Transects 1, 4, 5, 6, 7, 8 and 10) and three were walked towards the scheme (Transects 2, 4 and 9). Transect 4 was walked both towards and away from the scheme to make a total of ten transects, as Transect 3 could not be surveyed due to health and safety reasons.

8.6.142 Further details on the methodology and limitations, including figures, can be found in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20)

Data Analysis

8.6.143 Wildlife Acoustic (WAC) recordings from the SM2s, SM4s and Echo Meter 3 used for the bat activity transect, automated static detector, and certain crossing point surveys were converted into ZCA and WAV format using Kaleidoscope 3.1.8 Software. During the conversion, a filter was applied to filter out noise files. The settings used during the filter process and how these are subsequently analysed and will be provided within the ES.

8.6.144 The converted files were analysed using AnalookW v0.4.1.2 Anabat data analysis software. Where the recordings were unclear the corresponding WAV file was analysed using Batsound v 4.2.1[11].

8.6.145 WAV recordings from the batloggers were auto-analysed using the BatClassify software, with a pass threshold of 0.8.

8.6.146 Where possible, bat calls were identified to species level. However, species of the genus Myotis were grouped together in most cases as their calls are similar in structure and have overlapping call parameters, making species identification problematic [67]. Further categories of calls for overlapping call characteristics was also made for Pipistrellus species and noctule (*Nyctalus noctula*), Leisler's bat (*Nyctalus leisleri*) and serotine (*Eptesicus serotinus*), further details of which will be provided within the ES.

Other Section 41 Species of Principal Importance (SPI)

8.6.147 Species specific surveys were not undertaken for the remaining SPIs. However, suitable habitat to support SPIs and the species themselves were looked for during the Phase 1 Habitat surveys and during all other ecological surveys.

8.6.148 This habitat level assessment for SPI is considered sufficient to assess any effects from the scheme. This approach was agreed through consultation with Natural England as presented in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

Assessment methodology and significance criteria

Introduction

8.6.149 This assessment methodology is based on that set out in the Highways Agency's DMRB Interim Advice Note (IAN) 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment [16]. This advice note is supplementary to the advice provided in DMRB Volume 11, Section 3 Part 4 'Ecology and Nature Conservation' [68], which continues to provide the framework for assessment of potential impacts of roads projects on nature conservation resources.

8.6.150 IAN 130/10 sets out a process for the valuation of resources, characterisation of predicted project impacts before and after mitigation and the subsequent assessment of significance of effects.

8.6.151 The assessment methodology for ecological resources is supplemented where appropriate with guidance from the CIEEM Guidelines for Ecological Impact Assessment [15].

8.6.152 The assessment process has also relied on professional judgement by individuals with sufficient relevant expertise, recognising project specific circumstances and decisions have been made through consultation with stakeholders including Natural England.

11 Pettersson Eletronik AB, Uppsala, Sweden, 2002.

Valuation of Resources

8.6.153 The value of nature conservation resources including sites, habitats, species populations and assemblages of species is assessed in accordance with DMRB IAN 130/10, as summarised in Table 8-3.

Table 8-3 Resource Valuation (summarised from Table 1 of DMRB IAN 130/10 'Resource Valuation')

Resource Valuation	Typical Ecological Resources
International or European Value	Internationally designated sites e.g. SPAs, SACs, or areas which meet the criteria but which are not themselves designated. Resident, or regularly occurring, populations of species which may be considered at an International or European level[12] where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
National Value	Nationally designated sites e.g. Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs) or areas which meet the criteria but which are not themselves designated. Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory, and HPIs listed on Section 41 of the Natural Environment and Rural Communities Act (2006). Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
Regional Value	Areas of key/HPIs identified in the Regional BAP (where available); areas of key/HPI identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of HPIs (for example, South West Nature Map); and areas of key/HPI listed within the Highways Agency's (now Highways England) BAP. Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/SPIs listed within the HABAP where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.
County	Sites designated in the county context (or considered worthy of such designation). Areas of key/HPIs identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent). Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species across the County; or • the population forms a critical part of a wider population; or

12 Such species include those listed within Council Directive 79/409/EEC on the conservation of wild birds or animal/plant species listed within Council Directive 92/43/EEC.

Resource Valuation	Typical Ecological Resources
	• the species is at a critical phase of its life cycle.
Local Value	Designated sites including: Local Nature Reserves (LNRs) designated in the local context. Areas of habitat; or populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.

8.6.154 Any receptors that are considered to be of lower than local value have been assigned a less than local value; only receptors valued local or above will be taken forward for detailed assessment.

8.6.155 In circumstances where there are other factors influencing the value of the receptor not covered by the guidance, then professional judgement has overruled the guidance.

Characterisation of Impacts

8.6.156 **The Project** (Volume 6 Document Ref 6.2 ES Chapter 2) describes the proposed development including horizontal and vertical alignment, earthworks, structures, temporary site compounds and lighting. The types of potential impacts anticipated as a result of construction and operation of the scheme on nature conservation receptors in the absence of mitigation include:

Construction

- Permanent and temporary land-take;
- Permanent manipulation of habitats, e.g. landscaping;
- Temporary storage of construction materials within/adjacent to ecological resources with associated land contamination and compaction;
- Habitat fragmentation;
- Direct mortality during site clearance and construction;
- Direct and indirect disturbance from construction activities including visual, noise, vibration and lighting; and
- Pollution caused by use of hazardous materials and incidental release of dust, chemicals, fuels or waste materials.

Operation

- Direct mortality during operational use;
- Displacement, species loss and isolation;
- Increase in barrier effect due to presence of significant area of hard standing;
- Direct disturbance from operational use visual, noise, vibration and lighting; and
- Pollution caused by runoff and air deposition.

8.6.157 Where detailed assessment of specific receptors is considered appropriate, i.e. for those taken forward for detailed assessment, the potential project impacts on these receptors are described and characterised in detail in accordance with DMRB IAN 130/10. The project impacts are characterised firstly in the absence of mitigation and then with the proposed mitigation being taken into account as outlined in Table 2 of the guidance. The following terminology is used for the characterisation of impacts:

- Positive or negative impact;
- Probability of occurring (certain, probable or unlikely);
- Complexity (direct, indirect, cumulative);
- Extent (area measures and percentage of total (e.g. area of habitat/territory lost));
- Size (description of level of severity of influence (e.g. complete loss, number of animals affected);
- Reversibility (reversible or not reversible);
- Duration (permanent, or temporary in ecological terms); and
- Timing and frequency (important seasonal and/or life-cycle constraints and any relationship with frequency considered).

8.6.158 The CIEEM Guidelines for Ecological Impact Assessment [15] are used to guide the characterisation process. For example, in determining the complexity of the impact (whether it is direct or indirect, and the ZOI of that receptor will be considered). ZOI is explained in more detail under Section 8.4 Study Area, however the maximum ZOI applied to the assessment, including the cumulative assessment, for ecological receptors are provided in Table 8-4.

Table 8-4 ZOI from the scheme for ecological features

Ecological Feature	Maximum ZOI from the scheme
Internationally designated sites e.g. SACs and SPAs	Two kilometres
Internationally designated sites for bats e.g. bat SACs	30 kilometres
Nationally designated sites, including SSSIs and NNRS	Two kilometres
Nationally designated sites for bats	Ten kilometres
Locally designated sites e.g. CWSs and CRVI sites	Two kilometres
Species including otter, badger, bat, and reptile	500 metres
Internationally designated sites e.g. SACs and SPAs	200 m of the Affected Road Network
Nationally designated sites, including SSSIs and NNRS	200 m of the Affected Road Network

8.6.159 The maximum ZOI for international sites designated for bats was established at 30 kilometres, and for national sites at ten kilometres due to the potential for bats associated with these sites to use habitats within this radius. For other internationally designated sites as well as nationally and locally designated sites, two kilometres was selected as a maximum ZOI based on potential impacts. Regarding fauna, it is largely the behaviour of these species, including movement in the landscape, which determines the maximum ZOI.

8.6.160 The maximum ZOI for international and national sites relating to potential air quality impacts is established at 200 metres from the Affected Road Network (ARN) within the limits of the Traffic Model. The requirements of DMRB HA207/07 [24] which states that "*Designated Sites within 200 m of roads affected by the project need be considered*", with affected roads being defined as those that meet any of the following criteria:

- road alignment will change by 5 m or more; or
- daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- daily average speed will change by 10 km/hr or more; or

- peak hour speed will change by 20 km/hr or more.

8.6.161 Further details on the methodologies applied for assessing air quality effects of habitats is provided within such effects are further described and assessed within Chapter 5 **Air Quality** (Volume 6, Document Ref 6.2) and the Habitat Regulations Assessment Screening within the **Statement to Inform an Appropriate Assessment** (Volume 6, Document Ref 6.5).

Assessment of Significance of Effects

8.6.162 The significance of effects, both adverse and beneficial, is determined by assessing the value of resources/receptors against any residual impact in accordance with DMRB IAN 130/10 (Neutral, Slight, Moderate, Large, Very Large), see Table 8-5. The assessment relies on professional judgement and guidance as provided within CIEEM Guidelines.

Table 8-5 Summary of Table 3 'Significance of Effects' from DMRB 130/10.

Significance Category	Typical Descriptors of Effect (Nature Conservation)
Very Large	An impact on one or more receptor(s) of International, European, UK or National Value
Large	An impact on one or more receptor(s) of Regional Value
Moderate	An impact on one or more receptor(s) of County or Unitary Authority Area Value
Slight	An impact on one or more receptor(s) of Local Value
Neutral	no significant impacts on key nature conservation receptors

8.7 Baseline conditions

8.7.1 Desk study data for each habitat and protected species has been summarised here within each relevant sub-heading; which is followed by the field survey results. The full habitat and protected species survey reports, including figures, are provided in Volume 6 Document Ref 6.4 ES Appendices 8.2 to 8.20, and are specified within each section.

8.7.2 All measurements of distances of designated sites, habitats and protected species have been made from the nearest edge of the scheme, being the outer fence boundary including all physical works and compounds, or are stated where different.

Designated Sites

Statutory Designations

8.7.3 Internationally important statutory designated sites include SPAs, SACs and Ramsar Sites. Nationally important statutory designations include SSSIs and NNRs, and locally important statutory designations are termed LNRs.

8.7.4 There is one internationally important site within the two kilometres search area. This is Newlyn Downs SAC, which is located approximately 143 metres to the north of the scheme.

8.7.5 There are four nationally designated SSSIs within the two kilometre search area. These are the Newlyn Downs SSSI, Carrick Heaths SSSI, Ventongimps SSSI, and Carnkief Pond SSSI. The closest being Newlyn Downs SSSI which is consistent with the SAC boundary. There are no NNRs or LNRs within the two kilometre search area.

8.7.6 No SACs within 30 kilometres were identified with bats as a qualifying species. A total of one NNR and 22 SSSIs are present within the ten kilometres search area for bats, of which, only Trehane Barton SSSI, located approximately six kilometres south-east of the current A30, is designated in part for the bats it supports. The barns at Trehane Barton support the largest known breeding colony of greater horseshoe (*Rhinolophus ferrumequinum*) bats in Cornwall. It is one of only eleven such main breeding roosts of this rare and endangered species in Britain.

8.7.7 As well as the designated sites identified within the ZOI of the construction and operation of the scheme there are three internationally designated SACs within 200m of the ARN, defined as affected roads under the DMRB HA207/07 [24] criteria as listed in para 8.6.160 above, which goes beyond the two kilometres. These are Newlyn Downs SAC, Breney Common and Goss and Tregoss Moors SAC and The River Camel SAC.

8.7.8 There are four nationally designated sites within 200m of the ARN, these are Newlyn Downs SSSI, Carrick Heaths SSSI, Mid Cornwall Moors SSSI, and River Camel Valley and Tributaries SSSI.

8.7.9 The full results from the statutory designated sites search are summarised in Table 8-6 below. The full details of the statutory designated sites search can be found within the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.2 ES Appendix 8.3). The locations of both statutory and non-statutory designated sites are shown in ES Figure 8.1 (Volume 6 Document Ref 6.3) and Figure 1 of the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.2 ES Appendix 8.3).

Table 8-6 Statutory Designated Sites within a two kilometre search area and within 200m of affected roads

Site	Reasons for designation	Distance from scheme
Newlyn Downs SAC	The site is primarily designated for the presence of the Annex 1[13] habitat Temperate Atlantic wet heaths with Dorset heath (*Erica ciliaris*) and cross-leaved heath (*Erica tetralix*). This is the largest area of Dorset heath in Cornwall and helps to represent the full geographical range of the distribution of this habitat.	143 metres north at the eastern end.
Breney Common and Goss and Tregoss Moors SAC	The site is primarily designated for the presence of Annex 1 habitats Northern Atlantic wet heaths with Dorset heath, European dry heaths, and Transition mires and quaking bogs, as well as the presence of Annex 2 species Marsh fritillary butterfly (*Euphydryas aurinia)*. This site is considered to be one of the best areas in the United Kingdom for these habitats and species.	Intersected by the ARN at multiple points, approximately 8 km from the scheme

13 Annex 1 of the Habitats Directive (as amended by the 2003 Treaty of Accession) comprises a list of 189 habitat types. Member States must consider designation of SACs for each of the features that occur in their European territory.

Site	Reasons for designation	Distance from scheme
The River Camel SAC	The site is primarily designated for the presence of Annex 2 species bullhead and otter. Other Annex 2 species also present include Atlantic salmon. The site also supports a significant presence of Annex 1 habitats including European dry heaths, old sessile oak woods with holly (*Ilex*) and ferns (*Blechnum*) in the British Isles, and alluvial forests with black alder (*Alnus glutinosa*) and European ash (*Fraxinus excelsior*).	41 metres from the ARN, approximately 14.8 km from the scheme
Newlyn Downs SSSI	The site is primarily designated for the presence of Annex 1 habitats Northern Atlantic wet heaths with Dorset heath, European dry heaths, and Transition mires and quaking bogs, as well as the presence of Annex 2 species Marsh fritillary butterfly (*Euphydryas aurinia)*. This site is considered to be one of the best areas in the United Kingdom for these habitats and species.	143 metres north at the eastern end
Carrick Heaths SSSI	The SSSI is comprised of ten components, six of which lie within the two kilometre search area. The sites are characterised by a mosaic of wet and dry heathlands with populations of Dorset Heath. Other important plant species include nationally scarce yellow centaury (*Cicendia filiformis*) and Cornish moneywort (*Sibthorpia europea*). The sites support a range of fauna including the nationally scarce pearl-bordered butterfly (*Boloria euphrosyne*) and the Schedule 1 species, barn owl has been recorded at Penstraze Moor to the south west of the site.	Closest component is located 316 metres south at eastern end of scheme.
Ventongimps SSSI	The site is comprised mainly of wet dwarf shrub heath with areas of bog and willow-alder carr. The heath is important for the presence of Dorset heath and an eyebright species (*Euphrasia virgursii*). The site is also important for supporting 13 species of Odonata including the nationally rare scarce blue-tailed damselfly (*Ischnura pumilio*) and 99 species of Lepidoptera including the narrow-bordered bee hawk-moth (*Hemaris tityus*).	1582 metres to the north
Carnkief Pond SSSI	The site encompasses a range of habitats including swamp vegetation, deciduous woodland, streams, herb-rich meadows, wet heath and bog. Open water areas are also present supporting red data book species balm-leaved figwort (*Scrophularia scorodonia*) and 12 species of dragonfly.	1815 metres to the north
Mid Cornwall Moors SSSI	This site supports a diverse mosaic of semi-natural habitats, including heaths, fens, grasslands, woodlands, scrub and species-rich hedgerows, with ponds and waterways. It is of special interest for multiple other nationally important features that occur within and are supported by the wider habitat mosaic, including an assemblage of nationally rare and nationally scarce flowering plants and ferns, marsh fritillary butterfly, an assemblage of invertebrates chiefly associated with scrub heath and moorland, populations of the water beetle (*Hydrochus nitidicollis*) and the mud snail (*Omphiscola glabra*), and breeding willow tit (*Poecile montanus*).	3 metres from the ARN
River Camel Valley and	The site is particularly important for otters, and is also of great value for fish such as the Atlantic salmon, bullhead, sea trout and sea lamprey. Greater horseshoe and lesser	41 metres from the ARN

Site	Reasons for designation	Distance from scheme
Tributaries SSSI	horseshoe bats (*Rhinolophus hipposideros*), kingfisher (*Alcedo atthis*), dipper (*Cinclus cinclus*), grey wagtail (*Motacilla cinerea*) and water vole (*Arvicola terrestris*) also use the site.	

Non-Statutory Designations

8.7.10 There are 20 non-statutory County Wildlife Sites (CWS) within the two kilometres search area and four Cornwall Roadside Verge Inventory (CRVI) sites along the route. CWS and CRVI sites are designated for the presence of habitats or species of local or regional importance by local authorities. Bats are included in the reason for designations for four of the CWS: Carland Moor, Allet Bog, Polvenna Wood and Benny Mill Valley.

8.7.11 The non-statutory sites are summarised in Table 8-7 below. The full details of the non-statutory designated sites search can be found within the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3).

8.7.12 No other non-statutory sites were identified within the search area.

Table 8-7 Non-Statutory Designated Sites within a two kilometre search area

Site	Reasons for designation	Distance from scheme
CRVI BS316	The site supports lowland heathland vegetation with Dorset heath.	Online at western end
CRVI BS214	The site supports wild parsnip (*Pastinaca sativa*) which is local in Cornwall	Online at western end
CRVI BS315	The site supports Dorset heath.	Online, central near Callestick
CRVI BS22	The site supports Babington's leek (*Allium ampeloprasum babingtonii*), a nationally scarce South West endemic.	On side road centrally near to Shortlanesend
Carland Moor CWS	The majority of this moor is within the Carrick Heaths SSSI. It is comprised largely of willow/gorse scrub and marshy grassland with small areas of purple moor grass (*Molinia caerulea*). The site supports HPI wet woodland and SPIs lesser horseshoe bat, brown long-eared bat (*Plecotus auritus*) and otter.	202 metres south.
Carn Moor CWS	The site is bisected by a disused railway and supports a diversity of habitats and species. The moor is wet and dry heathland with scattered scrub and a man-made pond. HPIs are lowland heathland, purple moor grass and rush pasture, and wet woodland. SPIs include several butterflies such as pearl-bordered fritillary, reptiles such as adder (*Vipera berus*) and grass snake. A number of flora species are present including penny royal (*Metha pulegium*) and pale dog violet (*Viola lactea*).	202 metres south.
Trenerry Wood CWS	The site occupies a sheltered valley along a stream with a variety of woodlands. HPIs include wet woodland, hedgerows, upland mixed woodland and upland oakwood. SPIs include bullfinch (*Pyrrhula pyrrhula*) and eel (*Anguilla anguilla*).	295 metres south

Site	Reasons for designation	Distance from scheme
Bishop's Wood CWS	The main part of the site is comprised of commercial coniferous woodland where the management results in many intermediate habitats. Additionally, some ancient woodland remains such as neglected oak (*Quercus robur*) coppice. The site supports HPIs wet woodland and upland oak wood along with SPIs bastard balm (*Melittis melissophyllum*), slow-worm (*Anguis fragilis*), song thrush (*Turdus philomelos*) and otter.	295 metres south east
Allet Bog CWS	The site lies adjacent to parts of the Carrick Heath SSSI at the head of a valley near to the River Allen. Wet willow woodland dominates with two areas of rough rush-dominated pasture are present. Some remnant heath is present supporting Dorset heath. HPIs are wet woodland, purple moor grass and rush pastures, and hedgerows. SPIs include a number of birds, common toad and common lizard (*Zootoca vivipara*), a number of bats including lesser horsehoe and noctule, and otter.	309 metres south
Polvenna Wood CWS	The site sits on either side of part of the Carrick Heath SSSI. The larger section is dominated by wet willow woodland supporting rich epiphytic growth and particularly rich ground flora. The smaller section includes wet woodland and open marshy areas with a man-made pond. HPI is wet woodland and SPIs include greater horseshoe bat and lesser horseshoe bat.	364 metres north
Goonwinnow CWS	The site is a low lying valley following a stream with well-developed and undisturbed wet willow woodland with abundant bryophytes and lichens. The HPI is wet woodland.	392 metres north
Callestick Vean CWS	The site is a narrow sheltered valley along a stream comprising a range of habitats including broadleaved woodland, wet woodland and oak woodland. Fen is present within the site along with patches of scrub. HPIs are wet woodland, lowland fens and upland oakwoods, SPIs are otter.	441 metres north east
Benny Mill Valley CWS	The site contains a range of undisturbed habitats along a four kilometres stretch of stream. The site is made up of grey willow dominated wet woodland and herb rich meadow. Drier broadleaved woodland occurs in the northern part of the site containing species such as Cornish elm (*Ulmus stricta*) and oak. The HPI is wet woodland and the site supports a number of notable species such as willow warbler (*Phylloscopus trochilus*), whiskered bat (*Myotis mystacinus*) and badger.	444 metres north west
Silverwell Moors CWS	The site lies adjacent to part of the Carrick Heath SSSI and is comprised of two rush dominated pastures which include some moderately rich fen communities. These pastures are enclosed by Cornish hedges which support large stands of grey willow. HPIs include lowland fens and hedgerows.	781 metres north west
Park Hoskyn CWS	The site lies along a steep sided valley with a fast flowing stream. It is comprised of broadleaved woodland, small areas of fen, scrub, a small quarry and disused mineshaft.	1242 metres south west

Site	Reasons for designation	Distance from scheme
	HPI is lowland fen with SPIs including 10 moth species. Badger have also been recorded within the site.	
Lelight CWS & Brickmoor Plantation CWS	The site lies adjacent to part of the Carrick Heath SSSI. Lelight Plantation is dominated by a mosaic of commercial coniferous and broadleaved plantations. Brickmoor Plantation is dominated by silver birch woodland where there is a rich and diverse bryophyte and lichen flora and ferns. HPI is wet woodland, with SPIs of moth being present.	1584 metres north
Carnhot CWS	The site extends along a tributary of the River Carnon, it is fast flowing with grassy margins and several shallow pools. Wetland habitats surround the site and supports a range of wildlife and is considered worthy of conservation for Odonata alone. HPIs are thought to be Lowland fens and SPIs include grass snake (*Natrix natrix*).	1602 metres south
Carnkief Pond CWS	The site is situated near to the Carnkief Pond SSSI and comprises small areas of mixed broadleaved woodland, herb rich grassland and a series of poorly drained fields separated by wide hedgerows. SPIs include common toad, grass snake and hedgehog (*Erinaceus europaeus*).	1725 metres south east
Treworgan Quarry & Lower Tolcarne CWS	The site extends along a tributary of the River Allen with a poorly drained valley bottom, and forms a continuation between the Trenery Woods CWS and Bishops Wood CWS. The HPI wet woodland is dominated by grey willow, with abundant epiphytes and bryophytes throughout. The wet woodlands grade into marsh and wet meadow where soft rush dominates with greater tussock sedge (*Carex paniculata*) and a rich wetland flora. SPIs include linnet (*Cardeulis cannabina*) and otter.	1794 metres north
Boswiddle CWS	The site is situated in a shallow valley of a tributary of the Tresillian River and contains a variety of woodland types with a varied structure and species composition. HPIs include wet woodland and upland mixed ashwoods, and SPIs include lesser horseshoe bat, brown long eared bat, and otter. Other notable species include the Nationally Scarce wavy St John's-wort (*Hypericum undulatum*).	1795 metres east
Metha Wood CWS	The site is a small and partly ancient woodland, adjacent to the Lappa Valley Railway line. HPIs include wet woodland, upland oakwood, and hedgerows. SPIs include dunnock (*Prunella modularis*).	1859 metres north east
Ladock, St Enoder & Trendeal Woods CWS	The site is an extensive woodland extending over moderately sloping hillsides and along the steep valley sides of several streams which flow through the site and ultimately feed into the Tresillian River. HPIs include wet woodland and lowland fens. SPIs include multiple Lepidoptera species including wall (*Lasiommata megera*) and autumnal rustic (*Eugnorisma glareosa*), common toad (*Bufo bufo*), dunnock, marsh tit (*Parus palustris*), and song thrush (*Turdus philomelos*).	1890 metres south
Tredinnick CWS	The site is situated in a valley with gently sloping sides. It is dominated by wet willow woodland with a fringe of oak.	1939 metres north

Site	Reasons for designation	Distance from scheme
	HPIs include wet woodland and purple moor grass and rush pastures. SPIs include marsh fritillary.	
Treworder Woods CWS	The site is located in the Kenwyn River valley and comprises a range of woodland habitats, including some ancient woodland. HPIs include wet woodland and upland oakwood. SPIs include brown trout. The site also supports a rich bryophyte flora, particularly in terms of liverwort species. Amber listed mistle thrush (*Turdus viscivorus*) and badger activity has been noted here.	1981 metres south

Phase 1 Habitat survey

Desk study

HPIs Action Plans

8.7.13 Six HPIs were identified within the study area; these were purple moor grass and rush pasture, deciduous woodland, good quality semi-improved grassland, lowland heathland, lowland fen, and traditional orchards. These are shown in Figure 2 in the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3).

8.7.14 The majority of these areas of HPI were associated with the designated sites.

8.7.15 Of these habitats, deciduous woodland and lowland heathland were located in or within 100 metres of the scheme. Lowland heath was identified at the eastern end of the site opposite Newlyn Downs SAC/SSSI. Deciduous woodland was located throughout the study area and was adjacent to the existing A30 in three locations around Marazanvose.

Field surveys

8.7.16 The scheme passes through largely arable and pastoral farmland areas (predominantly improved grassland), with hedgerows and belts of trees bisecting the fields. A small number of fields were more species-rich, with the scheme passing through an area of semi-improved neutral grassland at both the western and eastern ends of the scheme (ES Figure 8.2 (Volume 6, Document Ref 6.3) and Figure 3 in the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2), and Figure 3 in the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3). The sward in these areas were dominated by common bent-grass (*Agrostis capillaris*), Yorkshire fog (*Holcus lanatus*) and sweet vernal grass (*Anthoxanthum odoratum*). Full species lists, relative abundance and locations are presented in Appendix A of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2).

8.7.17 A total of 29 species-rich hedgerows with infrequent or no standard trees and a total of 40 species-rich hedgerows with two or more trees per 100 metres were recorded across the study area. The number of species within the hedgerow and the trees, included varied selections of the species listed for species-rich intact hedges, with ash (*Fraxinus* spp.) and pedunculate oak (*Quercus robur*) being the dominant standard trees.

8.7.18 A total of 73 species-poor intact hedges (excluding un-vegetated Cornish hedges) and 33 species-poor hedgerows with trees were recorded across the study area, the locations of which are presented in Figure 3 in the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3).

8.7.19 The 126 largely un-vegetated Cornish Hedges are included within the species-poor defunct hedgerows category, due to their low woody species composition and degraded banks largely reducing their stock proofing abilities. A full species list is presented in Appendix A of the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3).

8.7.20 In addition to arable and pastoral land, some areas of woodland are present within the study area, along with heathland, marshy grassland, scrub and wet areas such as streams and ponds.

8.7.21 There are two woodland blocks at the eastern end of the scheme mapped as deciduous woodland HPIs, the Chiverton Estate woodland and a small area of woodland near Nanteague Farm (Figure 2 of the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3)); the latter is being completely lost to the scheme.

8.7.22 The broadleaved woodland within the survey area contained common and widespread deciduous trees, including sycamore (*Acer pseudoplatanus*), oak, goat willow (*Salix caprea*), ash and beech (*Fagus sylvatica*). A full species list is provided in Appendix A of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2). One small semi-natural coniferous woodland block (predominately Monterey pine (*Pinus cf. radiate*)) is also present within the study area, which encompasses the quarry pond west of Carland Cross.

8.7.23 The scheme passes through a small isolated heathland area adjacent to the coniferous woodland as mentioned above and south of the existing A30 west of Carland Cross. This habitat was dominated by bell heather (*Erica cinerea*), common heather (*Calluna vulgaris*), cross-leaved heather, purple moor grass and western gorse (*Ulex galli*). A likely hybrid of Dorset heath with cross-leaved heath was also found in this area during the NVC surveys as detailed below. A full species list is presented in Appendix A of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2). This heathland area is mapped as a HPI, being lowland heathland (Figure 2 of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2).

8.7.24 Standing water was recorded in two locations across the survey area as ponds, one within the heathland area west of Carland Cross, and one to the east of Mount Pleasant.

8.7.25 A number of slow running water systems were present across the survey area. These were largely narrow or ephemeral agricultural drainage ditches or ditches leading to the River Allen and surrounding catchment. Species composition observed was dependent on flow rate and depth of the channel. A full species list is presented for standing and running water in Appendix A of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2).

8.7.26 Japanese knotweed (*Fallopia japonica*) was present in two areas within the survey area to the south of Chiverton Cross and was evidently undergoing weedkiller treatment in situ. This plant infers no ecological value but is a Schedule 9 species on the WCA 1981 (as amended)[26].

8.7.27 Other Schedule 9 species identified included Montbretia (*Montbretia Crocosmia* x *crocosmiiflora*), Japanese Rose (*Rosa rugosa*), Rhododendron (*Rhododendron sp.*), cotoneaster, three-cornered garlic (*Allium triquetrum*) and variegated archangel (*Lamiastrum galeobdolon*), locations of which are presented in Figure 2 of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.2 ES Appendix 8.2).

8.7.28 Minor differences were identified between the 2015 verification report and the 2017 update survey. The majority of these differences were related to fields previously being identified as arable or grassland and changing as part of farming rotations. A number of areas were different due to the inability to fully access these areas in 2015, which resulted in a re-classification of grasslands and in one area, at Carland Cross, was re-classified to semi-natural broadleaved woodland, when it was previously classed as scrub. The full reports for both the 2015 and 2017 surveys are provided in the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2) and the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3), respectively.

River Habitat Appraisal

Desk study

8.7.29 Aquatic desk study records are provided in the para 8.7.82 (Fish survey) below.

Field surveys

8.7.30 Eighteen watercourses and six still waters (ponds) were identified within the survey area as having the potential to be directly or indirectly impacted by the proposed routes, at the time of reporting.

8.7.31 Of the eighteen potentially impacted watercourses (springs and headwater streams) within the study area, five were identified with the potential of being directly affected either by direct intrusion (such as cutting or realignment) or by temporary crossings resulting in reduction in bank stability and/or generation of sediment (see also **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13)). Although the aquatic ecological communities at these four sites was thought to be limited, further fish and macroinvertebrate surveys were recommended.

8.7.32 Of the 14 watercourses that may be indirectly affected, four were deemed completely unsuitable for all fish and macroinvertebrate communities; fish and macroinvertebrate surveys were recommended on the remaining ten.

8.7.33 Of the six still waters (ponds) that were identified with the potential to be affected, three were considered capable of supporting fish and four were considered capable of supporting a well-developed macroinvertebrate community.

8.7.34 The old quarry pond located west of Carland Cross was considered unlikely to support a significant population of fish but with the potential to support a diverse

and well-developed macroinvertebrate population. However, due to very steep banks and no safe access to the water's edge, no further surveys were recommended on health and safety grounds. As such, National Pond Surveys were recommended for the remaining five of these still waters.

8.7.35 Results of the targeted fish, freshwater macroinvertebrate, and National Pond surveys are detailed in the relevant sections below. The full **River Habitat Appraisal report**, including figures, is provided in Volume 6 Document Ref 6.4 ES Appendix 8.4.

National Vegetation Classification (NVC) Survey

Desk study

8.7.36 The desk study returned a large volume of records for plants within the two-kilometre search area. This included seven SPIs and bluebell (*Hyacinthoides non-scripta*) which is listed under Schedule 8 of the WCA 1981 (as amended). These were yellow centaury, lead moss (*Ditrichum plumbicola*), heath lobelia (*Lobelia urens*), the toothed mushroom (*Phellodon confluens*), three lobed crowfoot (*Ranunculus tripartitus*), tongue-leaf copper moss (*Scopelophila cataractae*) and pale dog violet.

8.7.37 The Newlyn Downs SSSI/SAC is designated for the presence of the largest area of Southern Atlantic wet heath with Dorset heath and cross-leaved heath in Cornwall. Previous surveys in 2003 [25] indicated that these species were present in a fragment of heathland near to Carland Cross and may therefore represent a remnant section of this habitat. The Dorset heath was described as being in the south western tip of the heathland fragment.

Field surveys

Grasslands NVC

8.7.38 Of the eight sites selected for grassland NVC surveys, two sites (Sites 6 and 9) were subsequently split into four smaller sites, resulting in a total of ten sites surveyed (Sites 6a, 6b, 7, 9a, 9b, 10, 11, 14, 28, and 29).

8.7.39 One of the drier grassland sites (Site 7) was classifiable as MG5c[14], which is listed within the Lowland Meadow HPI. This site (located alongside the existing A30 near Penglaze, south of Newlyn Downs) is also a designated CRVI (BS214), for supporting wild parsnip, which is local in Cornwall.

8.7.40 Five sites spread through the study area (Sites 9a, 10, 11, 28 and 29) supported drier mesotrophic grassland most strongly classifiable as MG6b[15]. The MG6b classification is not included within the Lowland Meadow HPI classification or any other HPI habitat description; however, the grasslands recorded within stands 9a, 10, 28 and 29, were atypically herb-rich for MG6, with some affinity to MG5 swards. Despite not conforming to Lowland Meadow HPI criteria, these grasslands can be seen as being of some conservation value in supporting herb-rich swards with species characteristic of unintensively and traditionally managed grasslands such as common knapweed, meadow vetchling (*Lathyrus pratensis*),

14 Crested dog's- tail (*Cynosurus cristatus*) - common knapweed (*Centaurea nigra*) grassland, and heath grass (*Danthonia decumbens*) sub-community
15 Perennial ryegrass (*Lolium perenne*) - crested dog's tail grassland, and sweet vernal grass sub-community

common bird's-foot trefoil (*Lotus corniculatus*) and yellow bartsia (*Parentucellia viscosa*).

8.7.41 Of the four remaining sites surveyed, three (Sites 6a, 6b and 14) supported habitat categorised within NVC as being closest to MG10a[16], this habitat is generally widespread and species-poor wet pasture, not included within the Purple Moor-grass and rush pastures HPI. However, the more herb-rich stand 6a showed some affinity with the M23b[17], which is included within the Purple Moor-grass and rush pastures HPI classification. In the strictest sense the habitat does not fit into this classification, however, this stand supported some species more typical of the latter community including marsh bedstraw and great bird's-foot trefoil (*Lotus pedunculatus*).

8.7.42 The wetland habitat recorded at Site 9b showed no particularly strong association to any NVC community, the strongest being the M27c[18]. The habitat supported characteristic wet grassland/rush pasture/swamp species, which complemented the adjacent wet woodland edge and drier, herb-rich grassland habitat of Site 9, but M27 and associated assemblages are not classified within the Purple Moor-grass and rush pastures HPI classification.

8.7.43 No uncommon or otherwise notable species associated with grassland or arable margin habitats were recorded during the survey.

8.7.44 Further detailed results and analysis, including figures, can be found in the **Grassland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.6).

Heathland NVC

8.7.45 The heathland habitats within the two sites surveyed displayed an affinity to the following vegetation communities:

- H4 Western gorse – bristle bent (*Agrostis curtisii*) heath (Site 1);
- H4a Western gorse – bristle bent heath, bristle bent – bell heather sub-community (Sites 1 and 2); and
- H4c Western gorse – bristle bent heath, cross-leaved heath sub-community (Site 1).

8.7.46 Dorset Heath is known to be present within the Newlyn Downs SAC (Site 2 forms part of the SAC). Dorset Heath is not listed as an SPI and is not explicitly afforded legal protection. However, it is a nationally rare RDB species[4] and is listed as an Annex II species on the Habitats Directive[7]. A likely hybrid of this species with cross-leaved heath was also recorded within the western section of Site 1.

8.7.47 Further detailed results and analysis, including figures, can be found in the **Heathland and woodland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.5).

16 Yorkshire fog, common rush (*Juncus effusus*) pasture, and typical sub-community
17 Common rush and sharp flowered rush (*Juncus acutiflorus*), and marsh bedstraw (*Galium palustre*) rush-pasture, with a common rush sub-community
18 Meadowsweet (*Filipendula ulmaria*) and wild angelica (*Angelica sylvestris*) mire, common rush, and Yorkshire fog sub-community

Woodland NVC

8.7.48 A series of fragmented semi-natural and plantation woodlands are located within 100 metres of the scheme. The six woodland sites surveyed showed affinities to the following communities and sub-communities of the NVC:

- W21 common hawthorn (*Crataegus monogyna*) – common ivy (*Hedera helix*) scrub community (Site 1);
- W10c oak – eagle fern (*Pteridium aquilinum*) – blackberry (*Rubus fruticosus*) woodland, common ivy sub-community (Sites 1 and 7);
- W1 grey willow (*Salix cinerea*) - Marsh bedstraw community (Site 3); and
- W14 Beech - blackberry woodland (Sites 6A, 8, and 11).

8.7.49 No uncommon or otherwise notable species associated with woodland habitats were recorded during the survey. Further detailed results and analysis, including figures, can be found in the **Heathland and woodland NVC report** (Volume 6 Document Ref 6.4 ES Appendix 8.5).

Hedgerow survey

Desk study

8.7.50 Results of the plant and habitat desk study are detailed above in Phase 1 Habitat Surveys and NVC Surveys.

Field surveys

8.7.51 The hedgerow survey results may differ from those presented in the Phase 1 Habitat survey results as different parameters are used within the survey methodology.

8.7.52 Within the survey area the hedgerow survey identified 305 native hedgerows, of which 274 can be classified as Cornish Hedges. 179 native hedgerows with woody growth were assessed against the Hedgerow Regulations 1997 and the HEGS guidelines. Of these 179 native woody hedgerows, 45 qualified as 'important' under the Hedgerow Regulations 1997 (44 of which were Cornish Hedges), and 98 were classed as a nature conservation priority under the HEGS guidelines (40 of which were 'important' and 79 of which were Cornish Hedges). Of the 81 hedgerows that were not classified as a nature conservation priority, 69 were Cornish Hedges.

8.7.53 The survey also identified 126 Cornish Hedges with little or no woody species growth. These were therefore not assessed by the HEGS or Hedgerow Regulations 1997 methodology. These included 51 scrub topped Cornish Hedges, 69 grass topped Cornish Hedges, and six bracken topped Cornish Hedges.

8.7.54 Further detailed results and analysis, including figures, can be found in the **Hedgerow survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.7).

Terrestrial Invertebrate survey

Desk study

8.7.55 The desk study returned 853 records for invertebrates within the two kilometre search area from 2006 to 2015 inclusive. This included a Schedule 5 species, the

silver studded blue butterfly (*Plebejus argus*), and 26 SPIs, including but not exclusively, the sallow moth (*Xanthia ictertitia*), cinnabar moth (*Tyria jacobaeae*) and wall butterfly (*Lasiommata megera*). Further details are provided in the **Terrestrial invertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3).

Field survey

8.7.56 The habitats selected for detailed survey included heathland, broadleaved woodland, and grasslands including semi-improved grassland, wetter grassland and rush pasture, as well as more herb-rich examples of drier grassland. Hedgerows and tall ruderal edge were also sampled, as well as sheltered transition zones such as heathland/woodland edge habitats.

8.7.57 In total, 772 species were recorded across the eleven sites throughout the surveys, including 22 species classed as Nationally Scarce in the UK and 15 moth SPIs. In addition, a rare migrant moth, the Scarce Light Plume (*Oxyptilus laetus*) and a rhopalid bug (*Stictopleurus punctatonervosus*), which has recently recolonised much of southern England having formerly been considered 'Extinct' in the UK, were both recorded within Site 9. Site 9 was a deciduous wet woodland and woodland edge habitat located north of Honeycombe Barn (Figure 1 of the **Terrestrial invertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.8)).

8.7.58 On the broad biotope landscape-scale level, most species (381 species) recorded were attributed to the 'Open habitat' category within Pantheon, with both 'Tree-associated' (172 species) and 'wetland' (118 species) assemblages also being well represented.

8.7.59 On the habitat level, most species recorded were attributed to the 'Tall sward and scrub' assemblage, with the wetland habitats including 'Marshland' and 'Running water' supporting assemblages of the highest conservation value. 'Tree-associated' assemblages were of comparatively low conservation value at this level.

8.7.60 The most notable assemblage recorded during the survey was recognised at the SAT level. This being the F003 Open heath and moorland SAT recorded predominantly from the combined heathland Sites 3 and 5, located adjacent to the quarry pond. Through analysis, the combined Sites 3 and 5 achieved a species score more than double that of the Favourable Condition threshold in Pantheon/ISIS. This indicates that these sites support a representative assemblage of high conservation value.

8.7.61 Using the criteria described by Colin Plant Associates [69] the combined Sites 3, 4[19], and 5 can be classed as of at least 'National' significance for invertebrates. Sites 1[20], 6[21], and 9[22] all fulfil criteria for sites of 'County' significance. Sites 10[23]

19 Site 4 was a mixed woodland site surrounding the quarry pond, located in between sites 3 and 5
20 Site 1 was a priority woodland and woodland edge located north east of Carland Cross roundabout
21 Site 6 was a wet grassland, rush pasture, and wet woodland located north of Ennis Farm
22 Site 9 was a priority woodland and woodland edge located adjacent to Honeycombe Barn
23 Site 10 was a semi-improved wet and dry grassland meadow located adjacent to box-heater junction

and 21/22[24] can be classed as, and Site 28/29[25] can be assumed to be, between 'District' and 'County' significance.

8.7.62 Following the classification of Sites 3, 4, and 5 as of at least 'National' significance, Natural England were consulted for advice regarding this heathland area, where they concluded that the heathland area (i.e. Sites 3 and 5) were too small to warrant SSSI designation, as detailed in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.7.63 The heathland area in question had in fact been consulted on previously regarding the possibility that it was functionally linked to Newlyn Downs SAC. Natural England concluded that they did not consider it to be functionally linked, as detailed in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.7.64 During consultation with Natural England it was determined that some of the conservation statuses of species had not been updated in Pantheon; these included six species reducing from Nationally scare to Least Concern and ten species increasing from Notable A and B to Rare and Scarce species, these are listed in Annex A of the **Terrestrial invertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.8).

8.7.65 A check of the output of the revised Pantheon still shows Favourable Condition Status for the F003 assemblage recorded from sites 3, 4 and 5 combined. This would be expected though as output is based on species habitat fidelity and conservation status score is not used in this analysis. Further to this, F001 Scrub edge assemblage was also registered as in Favourable Condition for these sites, which wasn't the case in the original analysis.

8.7.66 Nevertheless, the author concluded that status changes would not significantly alter the key findings, i.e. the importance of the F003 assemblages. This was agreed with Natural England as detailed in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.7.67 Further details on the results and analysis can be found within the **Terrestrial invertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.8).

Freshwater Macroinvertebrate survey

Desk study

8.7.68 No records of freshwater macroinvertebrates were returned by ERCCIS within the study area.

Field surveys

Watercourse macroinvertebrate survey results

8.7.69 With the exception of three sites (Sites 4.1, 12.2 and 13.1), all locations had macroinvertebrate populations consistent with at least Good WFD status [43] (using the WHPT method [44]), with nine locations consistent with High status (Sites 4.2, 5.2, 6.1, 8.1, 10.1, 13.4, 16.2, 17.1 and 18.1). Of the three sites with

24 Site 21/22 was a priority woodland and grassland/tall ruderal edge habitat located adjacent to Chybucca
25 Site 28/29 was a semi-improved grassland pasture and meadow located north of Chiverton Cross roundabout

less than Good status, Sites 13.1 and 4.1 (located northeast of Zelah and northeast of Chiverton Cross respectively) were consistent with a Moderate status, and Site 12.2 (located immediately south of Zelah) was consistent with a Poor status. Analysis using the WHPT method indicated general degradation at Sites 13.1 and 4.1 (please see Figure 2-1 in the **Freshwater macroinvertebrates survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9) for watercourse survey locations).

8.7.70 Sites 4.1, 12.2 and 13.1 and were also the only three sites to achieve a PSI O/E score of less than 0.7, indicating potential fine sediment stress. Furthermore, eight sites located predominantly within the eastern half of the survey area achieved a LIFE O/E score of less than 0.94 in at least one of the two survey visits, indicating potential susceptibility to flow stress.

8.7.71 Only two sites contained species with a CS of seven (Notable) or greater [42], and these species were only recorded once. These include Site 4.2 (located northeast of Chiverton Cross), which contained *Agabus conspersus*, and Site 18.1 (located southeast of Carland Cross), which contained *Octhebius bicolon* and *Pomatinus substriatus*. The three species recorded all have a CS of seven.

8.7.72 Overall, the freshwater macroinvertebrate population was considered relatively diverse albeit with few rare or notable conservation species present. Relative to other locations, Sites 12.2 and 13.1 exhibit invertebrate populations of lower ecological value potentially due to the fine sediment and flow pressures.

National Pond Survey results

Water quality

8.7.73 Water quality analysis established that all ponds generally had a pH of around seven. Pond 5.2 (located south of Callestick) had the lowest pH across the seasons and was consistently below seven, whilst Pond 13.3 (located northeast of Zelah) recorded the highest pH in the autumn, where it rose to 8.5 (please see Figure 2-2 in the **Freshwater macroinvertebrates survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9) for pond survey locations). Baseline water quality was typical of ponds found on this geological typology [70], with relatively high levels of calcium.

8.7.74 The presence of certain plant species and results from visual appraisal suggested that nutrient enrichment was an issue at all ponds. Excessive algal growth was observed throughout the survey visits in all ponds (with the exception of Pond 8.1 online (north of Allet Common)).

8.7.75 There was evidence of cattle entering Ponds 13.3 and 13.4. Pond 5.2 was not open to cattle, but was subject to manure run-off from the surrounding field.

Macrophytes

8.7.76 All ponds supported a moderately species rich macrophyte community [71] throughout the survey visits; however, the ponds were choked with plants, with floating pondweed (*Potamogeton natans*) covering much of the surface area of each pond. This was reflected in the TRS, which was relatively high at all ponds, indicative of a nutrient rich plant community allowing species domination resulting in reduced diversity.

8.7.77 The number of uncommon species present varied across the ponds, though no species were recorded with a rarity status of more than locally scarce [38]. Notably, Pond 13.3 was found to contain the Schedule 9 invasive species[26] New Zealand Pigmyweed (*Crassula helmsii*).

8.7.78 Ponds 13.4.and 13.3 had a plant community with a moderate conservation value, whilst Ponds 8.1 online, 8.1 offline, and 5.2 had a plant community with a high conservation value based on Biggs (2005) [71], and as described within Table 5 and Table 6 of the **Freshwater macroinvertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9).

Macroinvertebrates

8.7.79 All ponds were found to support a moderately species rich [71] macroinvertebrate community, of moderate conservation value. All ponds contained a similar number of species, except for Ponds 8.1 online and 8.1 offline where species richness was reduced.

8.7.80 The number of uncommon species [42] varied across the survey area, with four being collected at Pond 13.4 and Pond 13.3 (including an RDB species and an IUCN (vulnerable) species), two collected at Pond 5.2, and none collected at Ponds 8.1 online and 8.1 offline. The IUCN (vulnerable) species collected at Pond 13.3 was the gravel water beetle (*Hydrochus nitidicollis*) which is also an SPI.

8.7.81 Further details on results and analysis can be found in the **Freshwater macroinvertebrate survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9).

Fish survey

Desk study

8.7.82 The desk study identified two records of fish from 2006 to 2015 inclusive within the two kilometres search area. These were an eel and a bullhead, located at the Ventongimps Nature Reserve and the River Allen respectively.

8.7.83 Previous baseline reports indicate that the water from the existing A30 runs into tributaries of the River Allen, Kenwyn, Tresillian, and Tinney along with a number of smaller streams, which are classed as having good or very good water quality for fish species.

Field surveys

8.7.84 Fish species were absent from seven of the 12 sites surveyed. The five sites at which fish were recorded are all located south of the existing A30 across the length of the scheme, as follows:

- Site 6.1: located within the River Kenwyn just north of Tregavethan;
- Site 8.1: located north of Allet Common;
- Site 12.1: tributary to the River Allen, located south east of Zelah;
- Site 12.3: located within the River Allen, east of Zelah; and
- Site 16.2: located west of Carland Cross, south of Newlyn Downs.

26 Schedule 9 Invasive Non-Native Species (INNS) as listed in the Wildlife and Countryside Act 1981 (as amended by The Wildlife and Countryside Act 1981 (Variation of Schedule 9) (England and Wales) Order 2010).

8.7.85 Across the five sites, the only fish species recorded were bullhead, brown trout (*Salmo trutta*), and lamprey. Brown trout were recorded at all five sites, and were the only species recorded at Sites 8.1 and 16.2. Bullhead were recorded in addition to brown trout at Site 6.1. Only two sites (12.1 and 12.3) were found to support all three species (see Figure 18 in the **Fish survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.10)).

8.7.86 Sites 6.1 and 8.1 recorded very low population densities of fish. A high population density of bullhead was present at Site 12.1, and brown trout were present in relatively high population densities at Sites 12.3 and 16.2.

8.7.87 Overall, the population densities of bullhead, brown trout, and lamprey were poor (or unfavourable) with the exception of sites 12.1 and 12.3 which had fish populations which appeared to be self-sustainable and moderately diverse. It was notable that the aquatic conditions, notably the cleanliness of the substrate at these sites were favourable for fish with minimal upstream pressures arising from cattle encroachment or channel realignment.

8.7.88 The aquatic physico-chemical conditions at each of the fish survey sites was generally good with moderate to high dissolved oxygen concentrations (Figure 19 in the **Fish survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.10)), neutral pH and low conductivity. These conditions are typical of the headwaters of small streams in the southwest of England and provide adequate conditions for most UK fish species.

8.7.89 All of the sites surveyed had evidence of fluctuating flows with some sites thought to cease flowing during dry periods. It is thought that this inconsistent and unpredictable flow is the main contributory factor limiting the fish populations.

8.7.90 Further details on the results and analysis can be found within the **Fish survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.10)).

Reptile survey

Desk study

8.7.91 The desk study identified 59 reptile records within five kilometres of the existing A30 from 2006 to 2015 inclusive. Of these, 19 were within two kilometres of the scheme and included all four common species. There were seven records of adder, which were located at Allet Bog, Newlyn Downs, Wheal Busy, Wheal Rose, and Chiverton Nature Reserve. All of these records were more than 700 metres from the scheme. There was one grass snake record at Mithian Downs, over one kilometre from the scheme. Five records of slow-worm were returned from Ventongimps Nature Reserve, Newlyn Downs and Wheal Rose area. There were six records of common lizard within the search area, these were at Wheal Rose, the SSSI near Stanley Farm, Newlyn Downs and near Pollamounter. All of these records were more than 500 metres from the scheme.

Field surveys

8.7.92 Reptiles were present in four out of the ten surveyed areas, and likely absent in five areas. One area (Area 6, east of Zelah) contained moderate potential habitat with no reptiles recorded, however approximately half of the refugia were repeatedly destroyed by cattle, therefore it is considered that a small reptile population could be present.

8.7.93 All four common reptile species were recorded, with results indicating that there are high numbers of breeding common lizard and breeding slow worm present in Area 3 (the isolated heathland area surrounding the quarry pond near Carland Cross), and breeding common lizard in Area 9 (south of the existing A30 near Tresawsen). Area 9 also supports a population of slow-worm. Area 2 (near Carland Cross in habitat connected to Newlyn Downs SAC) supports populations of slow worms, common lizard, and adder. Area 5 (near the existing A30 junction with the B3285 north of Zelah) supports a population of grass snake at a range of ages and common lizard.

8.7.94 Areas are shown on Figure 3 in the **Reptile survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.11). Further details on the results and analysis can be found within the **Reptile survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.11)

Bird survey

Breeding bird survey

Desk study

8.7.95 The desk study results returned over 2,700 records of birds within the study area from 2006 to 2015 inclusive. This included 103 species, of which 84 were considered to be resident or breeding species. The majority of the birds identified within the desk study could be utilising habitats within the scheme.

Field surveys

8.7.96 The field surveys identified 53 species in total. Of these, two were Annex 1[27] species, one of which was also a Schedule 1 species, with both being non-breeders (peregrine (*Falco peregrinus*) and golden plover (*Pluvialis apricaria*)), and eight SPIs (seven of which were at least likely breeders). Seven of the species recorded were on the Red list and eight species were on the Amber list of the Birds of Conservation Concern [72].

8.7.97 The six transects covered habitats including arable farmland, pasture fields, woodland blocks, hedgerows, and residential and farm areas, with a small pocket of heathland located towards the eastern end of the scheme.

8.7.98 Each transect identified between 33 and 40 species, with 9 to 12 of these species being listed as of conservation concern. The preliminary analysis shows that the bird assemblage was typical of the types of habitats within the study area. Habitats of particular importance to breeding birds were as follows:

- Hedgerows throughout the survey area provided important breeding and foraging opportunities for small passerine birds such as dunnock (*Prunella modularis*) and linnet (*Linaria cannabina*);
- Open areas throughout the survey area were of great importance to ground nesting species such as skylark (*Alauda arvensis*) in open pasture fields;
- Farmland and mixed-use areas supported a number of species such as yellowhammer (*Emberiza citrinella*) and linnet; and

27 Species listed as rare or vulnerable on Annex 1 of Directive 2009/147/EC (Birds Directive) on the conservation of wild birds.

- Houses, buildings and associated gardens also offered nesting and foraging opportunities for breeding birds around Chiverton Cross roundabout.

8.7.99 No particularly large aggregations of breeding birds were noted. Dunnock and skylark presence was as expected for the habitat type, with both species having an estimated 69 breeding pairs throughout the survey area. The highest levels of skylark activity were recorded in the fields to the north of four barrows tumuli, within the fields around Hillview Farm, in the fields to the south of Pennycomequick, and the fields to the south and south east of Newlyn Downs.

8.7.100 Linnet, song thrush (*Turdus philomelos*), house sparrow (*Passer domesticus*), yellowhammer, and willow warbler (*Phylloscopus trochilus*) were recorded throughout the survey area within suitable breeding habitat with an estimated 35, 19, 14, 11, and 10 breeding pairs respectively. Starling (*Sturnus vulgaris*) were recorded in the second and fifth transect, with an estimated 19 breeding pairs within the survey area.

8.7.101 Bullfinch (*Pyrrhula pyrrhula*) were recorded as likely breeding along the third and fifth transect, with an estimated three breeding pairs within the survey area. House martin (*Delichon urbicum*) were recorded along the fourth and fifth transect, with one active nest site recorded at Nanteague Farm. Kestrel (*Falco tinnunculus*) were considered to be possibly breeding along the fourth transect and likely breeding along the sixth transect, with evidence of kestrel presence in the form of pellets and/or feathers recorded in a barn to the north of Zelah, and a barn within Trevalso Farm.

8.7.102 Further details on the results, including figures, can be found in the **Breeding bird survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.12).

Wintering bird survey

Desk study

8.7.103 The desk study returned over 2,700 individual records of birds within the study area from 2006 to 2015 inclusive. This included 103 species, of which approximately 78 were considered to be resident or wintering species, the majority of which could regularly occur in the study area. Some species identified in the desk study, which are unlikely to occur within the survey area, include sea birds such as the Northern fulmar (*Fulmarus glacialis)*.

Field surveys

8.7.104 The field survey identified 66 species in total within the study area. Of these were three Annex 1 species, four Schedule 1 species, and ten SPIs. Fourteen of the species recorded were on the Red list, and 13 were on the Amber list of the Birds of Conservation Concern [72].

8.7.105 The six transects covered habitats including arable farmland, pasture fields, woodland blocks, hedgerows, residential and farm areas, and a small pocket of heathland towards the eastern end of the scheme.

8.7.106 A number of areas were identified as supporting higher levels of use by wintering species such as skylark (*Alauda arvensis*), meadow pipit (*Anthus pratensis*), and gulls, and waders such as golden plover and lapwing (*Vanellus vanellus*). These areas include:

- The arable fields surrounding Four Burrows tumuli, on both sides of the existing A30;
- The arable fields south of the Chybucca junction around Four Burrows wind farm;
- The arable fields to the north of Hillview Farm;
- The stubble fields west of Carland Cross adjacent to Newlyn Downs; and
- The pasture fields west of Carland Cross adjacent to the remnant heathland.

8.7.107 No particularly large aggregations of wintering birds were noted. The fields to the south of Chybucca junction around the Four Burrows wind farm provided roosting and foraging grounds for gulls on a number of occasions with a peak of 375 gulls in November 2016. Species present included black-headed (*Chroicocephalus ridibundus*), common (*Larus canus*), herring (*Larus argentatus*), lesser black-backed (*Larus fuscus*) and great black-backed gull (*Larus marinus*).

8.7.108 Small numbers of golden plover were also recorded foraging in arable fields and in flight over the study area, with a maximum flock of 37 birds immediately east of the Chybucca junction in March 2017. During the breeding birds survey, a single golden plover, considered to be a remnant of the wintering population, was recorded to the south east of the four barrows tumuli at the end of April 2016. Small flocks of lapwing were encountered, with peak flock size of 43 birds. Other wading bird records were scarce, with occasional records of dunlin (*Calidris alpina*), snipe (*Gallinago gallinago*) and woodcock (*Scolopax rusticola*).

8.7.109 Occasional records of raptors, including merlin (*Falco columbarius*) and peregrine were made, but these were rare and no regular foraging was observed.

8.7.110 A typical range of farmland passerines were recorded, with flocks of winter thrushes (fieldfare (*Turdus pilaris*) and redwing (*Turdus iliacus*)) linnet, meadow pipit and skylark made from the various transects. Largest flocks were recorded along transect one in the stubble fields to the north of the A30 adjacent to Newlyn Downs, in the fields around Hillview Farm, and around Four Burrows.

8.7.111 Further details on the results, including figures, can be found in the **Wintering bird survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.13).

<u>Schedule 1 barn owl survey</u>

Desk study

8.7.112 The desk study returned 95 records for barn owls from 2006 to 2015 inclusive within five kilometres of the scheme, and contained both roost and nest sites. Not all of the grid references were supplied with the records and therefore were not mapped (those that were supplied were mapped and are shown in Figure 1 of the **Barn owl survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.14).

8.7.113 There are two RTC records of barn owl on the existing A30 between Chiverton and Carland Cross. These records are from 2000 and 2002. The 2000 record is located centrally within the scheme just north-east of Marazanvose, whilst the 2002 record is located towards the eastern end, halfway between Zelah and Carland Cross (Figure 1 of the **Road traffic collision summary report** (Volume 6 Document Ref 6.4 ES Confidential Appendix 8.1)).

Field surveys

8.7.114 The Stage 1 Scoping exercise identified a total of 149 buildings with the potential to support barn owl, which was increased to 153 during the Stage 2 and 3 field surveys. No trees suitable for breeding barn owl were identified.

8.7.115 The habitats within the survey area were predominantly agricultural land, with large areas consisting of arable land and others being grazed pasture. Type 1 habitat was reserved to a few pockets within the survey area, with the remainder being a mosaic of Type 2 and Type 3 habitat. Some woodland areas were identified; however, these were not extensive within the survey area. The habitat mapping is presented in Figure 2 of the **Barn owl survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.14).

8.7.116 Cornish hedges are considered likely to provide foraging grounds for barn owls in the survey area, as they are largely grass banks within this region of the County with tussocks and some bramble rather than dense vegetation.

8.7.117 The field survey covered 124 buildings, of a potential 153 buildings in the survey area. Those not surveyed were due to a lack of access. This equated to a survey coverage of 81% of buildings identified during scoping (Zone A, the area within 500 metres of the scheme, had a coverage of 93%).

8.7.118 Of the 124 buildings surveyed, 35 had evidence to show that they supported barn owls (Figure 3 of the **Barn owl survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.14)). Of these, there was one Observed Breeding Site (OBS), 16 Active Roost Sites (ARSs), 14 Temporary Rest Sites (TRSs) and four Potential Nest Sites (PNSs).

8.7.119 Barn owls were identified being physically present in four buildings (109A, 35, 119, and 120). Building 109A was classified as an OBS which is located approximately 980 metres from the existing A30 and 850 metres from the main carriageway of the scheme.

8.7.120 Buildings 35, 119, and 120 were classified as ARSs, with the nearest ARSs being located approximately 60 metres and 185 metres from the main carriageway of the scheme with others located between 390 metres and 1.68 kilometres from the scheme. The nearest TRSs consisted of two located approximately 180 metres, and a third located approximately 215 metres from the main carriageway of the scheme, with others located between 460 metres and 1.5 kilometres from the scheme. The four PNSs were located approximately 85 metres, 275 metres, 1.4 kilometres, and 1.5 kilometres from the main carriageway of the scheme.

8.7.121 Further details on the results, including figures, can be found in the **Barn owl survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.14).

Nightjar survey

Desk study

8.7.122 No records were returned of nightjar within two kilometres of the scheme from 2006 to 2015 inclusive. Of the 24 historic records identified, 14 records were from 2000-2004. These 14 records showed presence within three areas, around Porthtowan and Mount Hawke approximately three kilometres to the north west, near to Perranporth approximately five kilometres to the north, and around Newlyn East approximately three kilometres to the north.

8.7.123 There were two records returned near Carland Cross in 2002 and 2003, and the Cornwall Bird Watching and Preservation Society (CBWPS) identified a churring male within Newlyn Downs in 2009.

8.7.124 Furthermore, an anecdotal record from the Cornwall Wildlife Trust (CWT) in May 2017 identified the presence of a pair displaying within the southern half, and a churring male within the northern half of Newlyn Downs.

Field surveys

8.7.125 The scoping exercise identified three areas to be surveyed, as follows:

- Area 1 - Newlyn Downs;
- Area 2 - an area near to Trewaters Farm to the south of Carland Cross; and
- Area 3 - Allet Common.

8.7.126 Within Area 1, one pair of nightjar were recorded making contact calls, churring and making territorial flights on both survey visits in the same location. No nightjar were identified within Area 2 or Area 3. However, as discussed in the methodology section above, surveys in Area 2 and Area 3 were not conducted within best practice guidelines [51]. Therefore, as recommended by Natural England (as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5)), a further desk based scoping exercise will be undertaken to scope habitats within 500 metres of the scheme, with further field surveys being undertaken in June and July 2018 as appropriate.

8.7.127 The results, including figures, for the 2017 surveys are detailed further in the **Nightjar survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.15).

8.7.128 Surveys carried out to date provide sufficient information to inform the assessment. Results from the 2018 surveys will be available during the examination. The results of these surveys will clarify the outcomes of this assessment and will not materially affect the significance of impacts.

Otter survey

Desk study

8.7.129 The desk study identified 13 records of otter from 2006 to 2015 inclusive within two kilometres of the scheme. Of these, there were seven RTC records, six of which were on the A30: Two were located near to Chybucca, one at Tresawsen, one at Marazanvose, two were at Zelah Hill, and one was located near to Carland Cross. The remaining records were spraints or field records.

8.7.130 The RTC records requested from ERCCIS in October 2017 returned 14 RTC records of otter on the existing A30 between Chiverton and Carland Cross, the majority of which are located centrally or towards the western end of the scheme (Figure 1 of the **Otter survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.16)). Four of these records were from the previous ten years (2008 to 2017 inclusive).

Field surveys

8.7.131 Limited evidence of otter was recorded during the resting and breeding site surveys; a spraint and footprint recorded at the lake group connected to watercourses at Nanteague Farm and two spraints at a pond near Lower

Ventongimps. Anecdotal evidence from a landowner suggested that a female and two cubs were seen downstream of ponds within this area approximately ten years ago. This evidence is shown in Appendix A of the **Otter survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.16).

8.7.132 All watercourses surveyed were small due to their proximity to the watershed. Many were either dry or not flowing, and were less than one metre wide and less than 50 millimetres deep. The exception was the River Allen, which runs parallel to and just outside the 250 metre buffer for resting sites survey. This was up to two metres wide and 150 millimetres deep.

8.7.133 There are extensive areas of good quality concealing groundcover in which otter could lie up in temporary above-ground couches, but no evidence of underground otter holts was found.

8.7.134 All ponds surveyed for breeding sites were small, even when the areas of neighbouring ponds were aggregated; none reached one hectare of water in area. No site reached a breeding site score of five and only two had scores of three (HR4 – a pond near Creegmeor Farm) or four (HR1 and HR3 - combined ponds near Lower Ventongimps, although these are outside of the 500 metre breeding site survey buffer).

8.7.135 It was established that all other sites were unlikely or very unlikely to be used for breeding.

8.7.136 A RTC otter was noted on the A30 near to Zelah at the Henver Lane junction on 23 August 2017. This incidental sighting provided evidence of use of the area by otter, and it was considered that the otter population move between river catchments across the A30.

8.7.137 During the freshwater macroinvertebrate survey, otter spraint were identified along the River Kenwyn and Zelah Brook. Further details can be found within Appendix 8.9.

8.7.138 Further details of the results, including figures, can be found in the **Otter survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.16).

Badger survey

Desk study

8.7.139 The desk study returned 116 records of badger from 2006 to 2015 inclusive within two kilometres of the scheme, including nine records of badger sightings and four setts.

8.7.140 A previous survey in 2005 [9] identified 26 setts (three main and 23 outliers). The results of the desk study and of the previous survey can be found in Figure 1 of the **Badger survey report CONFIDENTIAL** (Volume 6 Document Ref 6.2 ES Appendix 8.17).

8.7.141 The RTC data requested from ERCCIS in October 2017 returned 100 RTC records of badger scattered throughout the existing A30 between Chiverton and Carland Cross (Figure 1 of the **Road traffic collision summary report** (Volume 6 Document Ref 6.2 ES Appendix 8.1).

Field surveys

8.7.142 The field survey identified 42 setts, and several areas of high badger activity within the survey area. Of the 42 setts recorded, nine were classified as main, three as annexes, four as subsidiaries, and 26 as outliers. One unknown mammal hole was also identified, which was previously classified during the 2005 survey as an outlier sett [25]. However, during the 2017 survey the vegetation was too dense to allow classification, although the mammal tracks leading in were considered to be more consistent with rabbit than badger.

8.7.143 The main setts and the majority of activity were predominantly recorded in the eastern half of the survey area, with limited activity west of Four Burrows tumuli. One area of territorial significance was identified within the centre of the survey area, to the south of Zelah. Significant numbers of latrines were present along the hedgerows and field boundaries, and around the adjacent main, outlier and subsidiary setts. A recorded RTC immediately south of the Four Burrows tumuli group indicates that at least one clan of badgers crosses the current A30 in this location. The results are shown in Figure 2 in the **Badger survey report CONFIDENTIAL** (Volume 6 Document Ref 6.2 ES Appendix 8.17.

8.7.144 Badger paths and footprints were found along field boundaries which will be impacted by the scheme. Eight setts were identified within the fenceline of the scheme (assumed to be worst case construction footprint), including two main setts. A further eight setts were identified within 30 metres of the fenceline, including two main setts.

8.7.145 Results are detailed further in the **Badger survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.17).

Dormouse survey

Desk study

8.7.146 No records of dormice were returned through the desk study from 2006 to 2015 inclusive within the search area.

8.7.147 The 2005 surveys [9] identified suitable habitat for dormice and carried out nest tube and nest box surveys. However, these proved inconclusive with no evidence found.

Field surveys

8.7.148 The 2016 survey identified the presence of wood mouse (*Apodemus sylvaticus*), shrew (*Sorex araneus*), and harvest mouse (*Micromys minutus*) within the survey areas. No definitive results for dormice were found during the field survey. Two tubes were found to contain possible rudimentary dormouse nests, however, these were then considered to be occupied by wood mice during the following survey. These nests were identified as potential dormice nests due to the presence of stripped material such as grass and some green leaves, however these were not conclusive due to the lack of woven structure.

8.7.149 The 2017 survey again identified the presence of wood mouse and harvest mouse within the survey area. No evidence of dormice was found during the field survey, and it is considered that dormice are likely absent from the survey area.

8.7.150 Full results can be found in Appendix A of the **Dormouse survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.18), with detailed descriptions in the **Dormouse survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.18).

Bat surveys

Desk study

8.7.151 A total 711 records of bats were identified from the data search between 2006 to 2015 inclusive within 10 kilometres of the current A30. Species included: barbastelle (*Barbastella barbastellus*), brown long-eared bat, common pipistrelle (*Pipistrellus pipistrellus*), Daubenton's bat (*Myotis daubentonii*), greater horseshoe bat, lesser horseshoe bat, Nathusius' pipistrelle (*Pipistrellus nathusii*), Natterer's bat (*Myotis nattereri*), noctule bat, serotine bat, soprano pipistrelle (*Pipistrellus pygmaeus*) and whiskered bat. Of the 711 records, 124 were roosts. Species recorded roosting were greater horseshoe bat, lesser horseshoe bat, Natterer's bat, brown long-eared bat and common pipistrelle.

8.7.152 A review of MAGIC identified a total of 42 granted Natural England European Protected Species (EPS) licences relating to bats within 10km of the existing A30. Of these, three were located within 2 km, the closest was located at the NFH complex (EPSM2012-5115), Marazanvose (NGR SW 80163 50232). The licence covers destruction of a known breeding site and resting place for species including lesser and greater horseshoe bat, common pipistrelle, soprano pipistrelle, Daubenton's, brown long-eared and Natterer's bat. For further details on the desk study, see the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

8.7.153 There is one RTC record of a brown long-eared bat on the existing A30 between Chiverton and Carland Cross. This record is from 2006 and is located centrally within the scheme near Marazanvose (Figure 1 in the **Road traffic collision summary report** (Volume 6 Document Ref 6.4 ES Appendix 8.1)).

Field surveys

8.7.154 Due to the geographical location of Cornwall and the habitat structure within the survey area every Plecotus bat recorded was assumed to be a brown long-eared bat. Unidentified *Myotis* species were assumed to be either Daubenton's bat, whiskered bat, Brandt's bat or Natterer's bat.

Roost surveys

Tree Roosts

8.7.155 There were no confirmed bat roosts in trees identified within the footprint of the scheme during the combined tree survey methodologies in 2016 and 2017. A total of five tree roosts were identified within 20 metres of the scheme and one tree roost was identified between 20 and 50 metres of the scheme, see Table 8-8.

Table 8-8 Tree roosts identified during the field surveys

Tree roost ID	Approx. nearest chainage	Location	Species	Roost type	Distance from scheme (metres)

T143	3+800	North Plantation	1 x natterer's bat	Day/Transitional (found April only)	2
T25	3+800	North Plantation	1 x brown long-eared bat	Day/Transitional (found April only)	2
T36	3+800	North Plantation	1 x natterer's bat	Day/Transitional (found April only)	6
T27	3+800	North Plantation	1 x natterer's bat	Day/Transitional	12
T99	7+900	Merton Plantation	1 x Myotis sp.	Day/Transitional (found April only)	2
T94	7+900	Merton Plantation	Unidentified (droppings recorded but could not be collected)	Day/Transitional	25

8.7.156 Full results including the ground level tree assessments, tree climbing inspections and dusk and /or dawn surveys of trees can be found in **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

Building Roosts

8.7.157 The field surveys identified one confirmed building within the footprint of the scheme as a confirmed bat roost. This was Building 35 on the northeast side of the access track to NFH. This was found to be a multi-species roost since in 2017 it supported a night roost of lesser horseshoe bat, Myotis species and brown long-eared bat, and a day/transitional/occasional roost for common pipistrelle and brown long-eared bat. During the emergence and trapping survey at this barn in May 2018 no bats were observed emerging. A single non-breeding male common pipistrelle was captured in the mist net during the trapping survey. In addition, at least two attempts were made by lesser horseshoe bats to enter the barn, confirming its use as a night roost for this species.

8.7.158 A total of nine confirmed building roosts were found within 20 metres of the scheme, these are shown in Table 8-9:

Table 8-9 Bat roosts identified in buildings within 20 metres of the scheme.

Building roost ID	Approx. nearest chainage	Location	Species	Roost type	Distance from scheme (metres)
9	0+800	Near Chiverton Cross	Common pipistrelle	Day/Transitional	15
16	6+000	Little Tresawsen	Common pipistrelle, Brown long-eared	Maternity (common pipistrelle), Day/transitional (brown long-eared)	19
42	8+000	Merton Plantation	Common pipistrelle, Brown long-eared	Day/Transitional (both species)	16
Tolgroggan Lodge	8+500	Tolgroggan Lodge, Zelah	Brown long-eared	Maternity roost	11
51	9+600	Trevalso Cottage north of Zelah	Myotis species (likely Natterer's), Common pipistrelle	Maternity roost (Myotis) Day/Transitional (common pipistrelle)	13
53	9+700	Trevalso Farm	Common pipistrelle	Day/transitional	7

Building roost ID	Approx. nearest chainage	Location	Species	Roost type	Distance from scheme (metres)
56A	9+800	Henver Cottage, Henver Lane.	Common pipistrelle, Brown long-eared	Day/transitional (both species)	5
60	10+300	Boxheater Junction	Brown long-eared	Day/transitional	14
64	11+000	Honeycombe Farm	Common pipistrelle, Brown long-eared	Day/transitional (both species)	16

8.7.159 The surveys identified fifteen confirmed building roosts between 20 metres and 50 metres of the scheme, as shown in Table 8-10:

Table 8-10 Bat roosts identified in buildings between 20 metres and 50 metres of the scheme.

Building roost ID	Approx. nearest chainage	Location	Species	Roost type	Distance from scheme (metres)
11A	1+000	Chiverton Cross	Common pipistrelle	Maternity, Day, Transitional	30
13	1+100	Chiverton Cross	Common pipistrelle	Maternity	26
1A	1+700	Chiverton Cross	Brown long-eared	Day/transitional	23
16A	6+000	Little Tresawsen	Common pipistrelle	Maternity (possibly Satellite) of up to 16	29
16B	6+000	Little Tresawsen	Common pipistrelle	Maternity (possibly Satellite) of up to 16	26
16D	6+100	Little Tresawsen	Common pipistrelle	Maternity (possibly Satellite) of up to 16	36
36	7+300	NFH, Marazanvose	Common pipistrelle, brown long eared	Day/transitional (both species)	24
37	7+300	NFH, Marazanvose	Brown long-eared	Day/transitional /night roost	38
40	7+300	NFH, Marazanvose	Common pipistrelle	Maternity	30
44A	8+300	Hill House, Two Barrows	Common pipistrelle, brown long eared	Day/transitional (both species)	21
44G	8+300	Hill House, Two Barrows	Common pipistrelle	Day/transitional	37
54	9+800	Trevalso Farm	Common pipistrelle	Maternity	30
57	9+800	Henver Lane	Common pipistrelle, brown long eared	Day/transitional (both species)	21
57A	9+800	Henver Lane	Brown long-eared	Day/transitional	30
70	13+500	Carland Cross	Common pipistrelle, brown long eared	Maternity (brown long-eared) Day/transitional (common pipistrelle)	47

8.7.160 The surveys identified 6 further confirmed roosts in buildings between 50 metres and 100 metres of the scheme as shown in Table 8-11:

Table 8-11 Bat roosts identified in buildings between 50 metres and 100 metres of the scheme

Building roost ID	Approximate nearest chainage	Location	Species	Roost type	Distance from scheme (metres)
25	6+000	Tresawsen	Brown long-eared	Day/transitional	92
21	6+200	Nanteague Farm, Tresawsen	Brown long-eared	Day/transitional	91
38	7+300	NFH, Marazanvose	Common pipistrelle, brown long eared, *Myotis* species.	Maternity (common pipistrelle and brown long-eared) Day/Transitional (Myotis)	84
45	9+300	Zelah	Common pipistrelle	Day/transitional	68
47A	9+300	Zelah	Common pipistrelle, brown long eared	Maternity brown long-eared) Day/transitional (Common pipistrelle)	59
55A	9+800	East of Zelah	Common pipistrelle	Day/transitional	60

8.7.161 It should be noted that in addition to the species identified roosting in Building 38 during these field surveys, a previous EPS licence for this complex of buildings at NFH (including Buildings 38, 40, 41, 41A, 41B), included lesser horseshoe and greater horseshoe, soprano pipistrelle, Daubenton's and Natterer's bat. Roosts of these species therefore are also likely to be present.

Table 8-12: Roosts in built structures between 100 metres and 150 metres from the scheme.

Building roost ID	Approximate nearest chainage	Location	Species	Roost type	Distance from scheme (metres)
10	0+900	Chiverton	Brown long-eared bat	Unknown (scoped out of further surveys due to distance from scheme)	117
12	1+000	Chiverton	Brown long-eared	Day/transitional	129
74	5+700	Tresawsen	Brown long-eared	Unknown -scoped out of further surveys due to distance from scheme.	122
46	7+800	South of Chyverton Estate	Brown long-eared and common pipistrelle	Scoped out of further surveys due to distance from scheme.	142

Building roost ID	Approximate nearest chainage	Location	Species	Roost type	Distance from scheme (metres)
46A	7+800	South of Chyverton Estate	Brown long-eared and common pipistrelle	Maternity (both species). Scoped out of further surveys due to distance from scheme.	143
19	6+200	Nanteague Farm, Tresawsen	Myotis (likely Natterer's), brown long-eared, common pipistrelle	Maternity roost (Myotis (likely Natterer's) and brown long-eared. Day/ transitional (common pipistrelle)	109

8.7.162 Full results for all built structure surveys including the internal and external inspections, dusk and/or dawn surveys can be found in **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

8.7.163 Surveys carried out to date provide sufficient information to inform the assessment. Further surveys are ongoing post DCO submission. The results of these surveys are expected to confirm the outcome of this assessment and unlikely to materially affect the significance of impacts.

Hibernation Survey

8.7.164 Two disused mine shafts were identified within 100 metres of the scheme options (during scheme options stage), as present at the time of Hibernation Surveys. These were located within Newlyn Downs SAC and to the south of Callestick. Both of these disused mine shafts were fully capped with no obvious access point. As such, no further surveys were considered necessary as they are not considered suitable to support bats.

8.7.165 No further underground sites or features suitable to support larger numbers of hibernating bats have been identified within 100 metres of the proposed scheme.

8.7.166 Figure 2 in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19) displays the locations of the two capped mine shafts, and the full details are provided in the **Bat roost survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.19).

Activity surveys

Bat Activity Transect Survey

8.7.167 A total of nine species and one species group (Myotis species) were recorded during the walked activity transect surveys: common pipistrelle, soprano pipistrelle, serotine, noctule, Leisler's bat, brown long eared bat, lesser horseshoe bat, greater horseshoe bat, barbastelle's bat and Myotis species.

8.7.168 Of those bat calls recorded at point counts, the most commonly recorded species was common pipistrelle, which accounted for 87% of the calls. Myotis sp calls accounted for 6% and the remaining eight species accounted for between 0 and 2% of the remaining 7% of calls recorded during point counts.

8.7.169 The highest levels of bat activity, on average across the season, were recorded at the following four locations out of the total 50:

- Point Count 2 - along a Cornish hedgerow between Trevissome Farm and Silversprings Farm);
- Point Count 17 (at the edge of a woodland with an adjoining hedgerow within the Nanteague Farm complex);
- Point Count 22 (tree lined footpath within NFH); and
- Point Count 33 (tree-lined road within the Trevalso Farm complex).

8.7.170 The locations with the least activity were Point Counts 14, 28, 46, 49, and 50 which were located throughout the scheme within a mixture of habitats including large arable fields, grassland fields, and areas of heathland, where no bats were recorded.

8.7.171 The three Annex II species (greater and lesser horseshoe and barbastelle bat) recorded during the transect surveys were recorded in the following locations during the transect surveys:

- Barbastelle bat was recorded at only one of the 50 locations at Point Count 34 along a hedgerow and a stream connecting to areas of woodland surrounding the River Allen on the eastern side of the A30 near Zelah (with two passes recorded in May 2016);
- Greater horseshoe bat was recorded at three of the 50 locations - with two passes at Point counts 36 and a single pass 37 to the north of Trevalso Farm, and at Point Count 27 where an individual was seen crossing the existing A30 via a footbridge between Zelah and the Tolgroggan Farm complex; and
- Lesser horseshoe bat was recorded at four of the 50 locations at Point Counts 4 and 6 within large arable fields at the Chiverton end of the scheme, and at Point Count 20 and 22 where they were recorded foraging along the lane within the NFH. All records were of single passes apart from Point Count 22 during June with 11 passes recorded.

8.7.172 Myotis species were recorded throughout the scheme but with highest activity recorded at Point Count 33 and 35 along the land at Trevalso Farm. Brown long-eared bat were recorded at Point Count 21 on the lane to Marazanvose Farm and 28 on the edge of the woodland connected to Chyverton Park.

8.7.173 Both noctules and Leisler's bats were generally recorded within the eastern section of the survey area towards Carland Cross where the habitat is more open with Newyln Downs to the north. Peak levels of activity were recorded in June and August.

8.7.174 The detailed survey results are provided in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20). Figure 2 of the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20) provides an overview of the activity transect survey results.

Automated Detector Survey

8.7.175 A total of 10 bat species and one species group (Myotis species) were recorded during the automated detector surveys in 2016: common pipistrelle, soprano pipistrelle, noctule, Leisler's, serotine, Nathusius' pipistrelle, barbastelle bat, lesser horseshoe bat, greater horseshoe bat, brown long-eared bat and Myotis species.

8.7.176 Over 88,000 bat passes[28] were recorded in total during the surveys. As with the transect survey results, the highest level of bat activity was attributed to common pipistrelle, which accounted for approximately 89 % of all bat activity. Myotis species had the second highest level of bat activity, which accounted for 5 % of all bat activity.

8.7.177 Automated detector location 11 (within the Trevalso farm complex) had the highest level of activity, with an average of 69.69 bat pph. Activity levels here were highest during May (188.60 pph), September (83.22 pph) and October (81.01 pph), although activity levels were consistently high in comparison to the other detectors. Eight species and one species group were recorded at this location.

8.7.178 High levels of bat activity were also recorded at automated detector locations 4 and 5 (Marazanvose area), 9 (near Tolgroggan Farm), and 13 (along the road near Honeycombe Farm).

8.7.179 A total of 19 barbastelle bat passes were recorded sporadically throughout the survey area at the following static survey locations:

- SM2 1 (Chiverton Cross) – 2 x passes in August, 1 x pass in May;
- SM2 2 (Callestick Vean) – 1 x pass in June, 5 x passes in July;
- SM2 4 (near Marazanvose Farm) – 1 x pass August;
- SM2 5 (NFH, Marazanvose) - 1 x pass in June;
- SM2 6 (opposite side of A30 to NFH) - 1 x pass in June;
- SM2 7 (Chyverton Lodge) - 1 x pass in June; and
- SM2 13 (near Ennis Farm) – 5 x passes July, 1 x pass September.

8.7.180 Only individual passes were recorded at very low levels, as such, no temporal peak levels of activity were noted.

8.7.181 Lesser horseshoe bat was recorded at all static locations except for location 12 (Honeycombe Farm) and 14 (Carland Cross). A total of 183 passes were recorded throughout the surveys. Lesser horseshoe bats were recorded throughout the season with a peak in activity of 37 bat passes (0.77 pph) being recorded at location 6 in July (along a double tree-lined road in Marazanvoze, north side of A30 which links to Chyverton House). A single building within the NFH is confirmed to be a lesser horseshoe night roost.

8.7.182 Greater horseshoe bat was recorded across the scheme, at all static locations except for locations 3 (Nanteague Farm), 10 (Zelah), and 12 (Honeycombe Farm). In total, 414 greater horseshoe bat passes were recorded throughout the surveys. The highest level of greater horseshoe bat activity (an average of 1.03 pph) was recorded at static 11 located along the access road to the Trevalso Farm complex in May 2016 when 312 bat passes (7.57 pph) were recorded over the 5-day period. This was the only month that greater horseshoe was recorded at this location.

8.7.183 Myotis species were recorded throughout the scheme but with peak activity recorded at location 2 (Callestick Vean) which was attributed to a peak in activity in September with 1526 bat passes (25.83 pph). Brown long-eared were recorded

28 In the field, a ‘bat pass’ was defined as two or more bat calls in a continuous sequence, lasting for no more than 10 seconds. Each sequence or pass is separated by one second or more in which no calls are recorded.

in low number of passes throughout the scheme on seven of the 15 locations, with a peak recorded activity in July at location 9 (near Tolgroggan Farm) with 10 bat passes (0.21 pph) and October at location 11 (near Trevalso Farm complex) with 14 bat passes (0.21 pph).

8.7.184 Both noctule and Leisler's bat were recorded in low number throughout the scheme but with peak activity, predominantly noctules, at the eastern end of the scheme toward Carland Cross. With a peak activity being recorded at location 12 (Honeycombe Farm) of 143 bat passes (3.81 pph) in June, location 13 (near Ennis Farm) of 214 bat passes (5.34 pph) in July, and location 14 (Carland Cross) of 109 bat passes (2.71 pph) also in July. A peak of activity was also recorded at location 9 (near Tolgroggan Farm) in September of both noctule (198 bat passes (2.79 pph)) and Leisler's bat (93 bat passes (1.31 pph)).

8.7.185 The detailed survey results are provided in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20). Figure 3 of the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20) gives an overview of the static detector survey results.

8.7.186 The survey details for the 2018 static detector survey at the quarry pond will be available during the examination. Surveys carried out to date provide sufficient information to inform the assessment. The results of these surveys will clarify the outcomes of this assessment and will not materially affect the significance of impacts.

Crossing Point Survey

8.7.187 Bats were recorded using the linear features that were selected for all 12 Crossing Point survey locations.

8.7.188 Relatively high numbers of bats were found to be using the following four linear features: Crossing Point Survey location 3A (Ch 5965) a mature hedgerow near Nanteague Farm, location 6 (Ch 7315) a tree-lined access road to NFH in Marazanvose, location 7 (Ch 8125) a section of road at Two-Barrows which includes the existing A30 underbridge and location 11 (Ch 9720) the tree-lined lane leading to Trevalso Farm. The total number of bats counted 'using the feature' throughout the six surveys at each linear feature is shown in Table 8-13.

8.7.189 It should be noted that as with all bat activity survey methodologies, due to low light levels and other environmental factors, there are limitations in determining actual numbers of bats observed. The crossing point survey methodology records all passes along the feature between surveyors as a pass means high numbers of bats 'using a feature' may be attributable to a small number of individuals foraging up and down it rather than multiple individuals using the feature to disperse/commute along. This is therefore a limitation in determining which features are important for bats dispersing through the landscape and which are important as a foraging resource.

Table 8-13 Bat Crossing Point Survey Results Summary

Crossing point survey location	Chainage	Description and Location	Total bats crossing using feature
1	Ch 1560	Cornish hedgerow dividing two fields to north of Chiverton Cross.	29

Crossing point survey location	Chainage	Description and Location	Total bats crossing using feature
3A	Ch 5965	Hedgerow with trees within a slight depression surrounded by pasture near Nanteague Farm.	218
3B	Ch 6050	Hedgerow with trees within a slight depression surrounded by pasture near Nanteague Farm.	124
4A	Ch 7120	Sheltered road with trees lining both sides leading to Marazanvose Farm.	134
4B	Ch 7150	Line of mature trees which runs parallel with road to Marazanvose Farm.	33
6	Ch 7315	Tree-lined access road to NFH in Marazanvose.	384
7	Ch 8125	Tree-lined road that passes underneath the existing A30 southeast of Chyverton Estate.	589
9	Ch 8595	Double hedgerow-lined access track to Tolgroggan Farm.	118
10	Ch 8900	Hedgerow with trees along a shallow depression with a stream running alongside southeast of Zelah.	162
11	Ch 9720	Double hedgerow-lined access road to Trevalso Farm.	1033
13	Ch 11010	Hedgerow-lined road between Pennycomequick and Honeycombe Farm.	180
12	Ch 12000	Hedgerow perpendicular to existing A30 to west of quarry pond.	112

8.7.190 The results for the four linear features which had the highest numbers of bats 'using the feature' are discussed in more detail below. Bats that were heard but not seen were not included in the summary.

- Crossing Point Survey Location 3A (Ch 5965), a mature hedgerow near Nanteague Farm, had a total of 218 bats crossing using the feature during the six survey visits. Of these 218 bats, 90 were common pipistrelle, 84 were greater horseshoe bat, 36 were lesser horseshoe bat and the remaining eight were a combination of *Myotis* sp., noctule/serotine/Leisler's (NSL) and unidentified bats. Of the 218, 140 were from one visit in July 2017 and may have been attributable to one or two bats foraging continuously along the linear feature during the survey visit. During the six survey visits, six bats (including greater and lesser horseshoe and common pipistrelle) were incidentally seen to cross the existing A30 adjacent to this location.

- Crossing Point Survey Location 6 (Ch 7315), a quiet tree-lined lane leading to NFH had a total 384 bats crossing the proposed scheme using the feature. Of these, 342 were common pipistrelle, 20 *Myotis* sp, four were lesser horseshoe bat and six were unidentified. The majority of these crossings were from one visit in August 2016 (181) and one visit in August 2017 (99). It is likely these peaks are due to individual common pipistrelles and *Myotis* sp foraging up and down the lane. During the six surveys approximately 77 bats were recorded as possibly crossing the existing A30 by the surveyor at the northern end of the feature near to the junction.

- Crossing Point Survey Location 7 (Ch 8125) was a section of the road at Two-Barrows which included the existing A30 underbridge. At this location a total 589 bats were recorded using the feature. Of those seen crossing using the feature, 480 were common pipistrelle, 89 were *Myotis* sp, seven were soprano pipistrelle, two greater horseshoe bats, one lesser horseshoe bat, one serotine and one barbastelle bat. Three bats (noctule and serotine) were recorded flying over the A30 in this location. The majority of the bats were recorded during the fourth visit in June 2017 (peak of 429 passes). It is likely that this peak was due to individual common pipistrelles and *Myotis* sp using the feature to forage underneath.

- Crossing Point Survey Location 11 (Ch 9720) comprised a tree-lined lane leading to Trevalso Farm to the southeast of the existing A30. A total of 1033 bats were recorded crossing the proposed scheme using the feature. Of these 1033 passes the majority were common pipistrelle (889), with *Myotis* sp. (135), noctule (1) and unidentified bats (8) also recorded. There were very few crossings seen in the first two surveys both in 2016 (August and September), but the number of crossings were consistently high in the last four visits which were all in 2017 (June, July and August). During the six surveys a total 28 bats (common pipistrelles and *Myotis* species) were incidentally recorded crossing the existing A30.

8.7.191 Bats were also incidentally recorded crossing the existing A30 during the six crossing point surveys at crossing point 4A (lane leading to Marazanvose Farm; six common pipistrelle), 9 (Tologroggan Farm over bridge; 27 bats including common pipistrelle, *Myotis* species and one lesser horseshoe bat), and 12 (near Ennis Farm; four common pipistrelle). Bats were recorded flying toward or away from the A30 at location 4B (near Marazanvose Farm), and 10 (near Zelah) but none were confirmed to be crossing the existing A30 in these locations.

8.7.192 Detailed survey results are provided in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20). Figure 3 of the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20) gives an overview of the crossing point survey results.

Landscape Scale Transect Survey

8.7.193 A total six species plus two species groups (Myotis species and noctule/serotine/Leisler's species group) (minimum eight species) were recorded during the landscape scale transect surveys:

- common pipistrelle;
- Myotis sp.;
- brown long-eared bat;
- barbastelle;
- soprano pipistrelle;
- lesser horseshoe bat;
- greater horseshoe bat; and
- noctule/serotine/Leisler's species group.

8.7.194 The landscape scale transect with the peak bat activity levels was transect 9, which was along the lane between Pennycomequick and Honeycombe Farm, where a total of 251 bat passes were recorded.

8.7.195 Distance from the scheme had a significant positive effect on the number of bat passes with a predicted increase in bat activity of 83% from 0 and 1000 metres from the scheme. This is likely due to the presence of the existing A30 close to the scheme alignment.

8.7.196 Bat activity was significantly higher in habitat type 2 to 5 (2 - hedges/shrubby verges lining road/path & open fields beyond, 3 - intermittent medium trees/bushes lining road/path & open fields beyond, 4 - intermittent tall trees lining road/path & open fields beyond, and 5 - continuous tall tree cover lining road/path with woodland &/or open fields beyond), than habitat type 1 being fence or wall lining road/path & open fields beyond.

8.7.197 Detailed survey results are provided in the **Bat activity survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.20).

Other Section 41 Species of Principal Importance (SPI)

Desk study

8.7.198 The desk study identified two further species listed as SPIs (other than those previously mentioned above) from 2006 to 2015 inclusive within two kilometres of the scheme. These were hedgehog and harvest mouse. The records identified 32 hedgehog records throughout the search area and one harvest mouse record near Chacewater.

8.7.199 The RTC records requested from ERCCIS in October 2017 returned 20 RTC records of hedgehog on the existing A30 between Chiverton and Carland Cross, of which four were from the ten years prior (2008 – 2017 inclusive). These records are scattered throughout the scheme, with the majority being located centrally near Zelah and Marazanvose or towards the western end near Chiverton Cross (Figure 1 of the **Road traffic collision summary report** (Volume 6 Document Ref 6.2 ES Appendix 8.1)).

8.7.200 No other SPI RTC data was returned from ERCCIS.

Field survey

8.7.201 Species specific surveys were not undertaken for SPIs; however, habitat suitable to support a number of notable species was identified during the Phase 1 Habitat surveys. As mentioned above, this approach was agreed through consultation with Natural England as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.7.202 The Phase 1 Habitat study area covered a variety of habitats (ES Figure 8.2 (Volume 6, Document Ref 6.3), Figure 3 of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2), and Figure 3 of the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3)), including networks of gardens within Zelah and near to Chiverton Cross roundabout. These habitats provide suitable habitat for hedgehog. Whilst no evidence was recorded of this species throughout the ecological surveys, the habitat recorded was extensive enough to support a healthy population.

8.7.203 The network of arable and pastoral fields with good boundaries in the form of Cornish hedges provided suitable habitat for harvest mice and brown hare (*Lepus*

europaeus) throughout the study area. The tussocky grass along the non-woody vegetated Cornish hedges may provide suitable breeding sites for harvest mouse. Harvest mouse were recorded during the dormouse surveys in 2016 and 2017 south of Zelah alongside the existing A30.

8.7.204 The wet areas within the survey area provide suitable habitat for common toad. These areas were located along the length of the study area, with notable areas near to Nanteague Farm, at Marazanvose, within the woodland at Chyverton Park, within the fields associated with Trevalso Farm near to Zelah, and within the fields either side of Pennycomequick. The disused quarry located within the remnant of heathland south of the current A30 also provides habitat for common toad. However, this is an isolated area with the A30 to the north and farmland to the south.

8.7.205 Polecat (*Mustela putorius*) have been recorded in Cornwall in recent years [73], and the first sighting of pine marten (*Martes martes*) in Cornwall for over 50 years has also raised questions whether this species is returning to Cornwall [74] [75]. Polecats set up home in lowland wooded habitats, marshes, along riverbanks or even in farm buildings or dry stone walls [76]; as such suitable polecat habitats are present throughout the study area. Pine marten are more habitat specialists, with preferred habitat being thick woodland or rocky hillsides, with dens frequently made in hollow logs or rock crevices, but also in rabbit burrows or the roofs of old buildings [77]. The lack of well-connected thick woodlands within the study limits the suitability of the habitats for this species.

8.8 Potential impacts

8.8.1 A highway scheme can have potential impacts on ecology and nature conservation in a number of ways during both construction and operation.

8.8.2 The potential impacts to habitats and species may be both permanent and temporary, and direct and indirect. The direct effects are of habitat loss and severance, species mortality through vehicle collisions, habitat damage from changes in air quality, surface run-off and pollution events. Indirect effects are of displaced individuals on the occupancy of alternative habitat, including reduced foraging success, increased competition and predation, genetic isolation and inbreeding, which can lead to local extinctions.

8.8.3 A scheme wide summary of the main potential impacts is provided below.

Habitat loss

8.8.4 Habitats will be lost through the change of land use from countryside (predominantly farmland) to highway. Habitat loss within the highway boundary will be permanent, whereas some larger areas that will be used as compounds and borrow pits during construction will be temporary, with the habitat reinstated or in most cases enhanced post-construction.

8.8.5 In general, habitat loss, including that which supports key species, will be mitigated through creation of replacement habitat, as described in Section 8.10 Design, mitigation, and enhancement measures under Operation Mitigation.

Habitat severance

8.8.6 Given that the proposed A30 scheme largely follows many sections of the existing A30, the habitat severance between habitats and the populations of animals they support north and south of the road are likely to be less than might be the case from a new alignment through open countryside. Nevertheless, the road is likely to sever existing wildlife corridors and foraging areas and as such could still have significant effects on species populations in the area.

8.8.7 Severance can lead to isolation both within and between populations and from specific resources vital for survival. The indirect effects of this could include reduced foraging success, increased competition, genetic isolation and inbreeding, which can lead to local extinctions.

8.8.8 Although, the proposed alignment largely follows that of the existing A30, the wider road, which will have a continuous concrete safety barrier on the central reservation, could prove a more significant obstacle to species movements. As such habitat severance, isolation and movements of species will be mitigated through the provisions of multispecies crossings and fencing to ensure their safe crossing and reduce any isolation effects, as shown on the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) and Table 8-14 below.

8.8.9 Habitat severance will however, still occur during site clearance and construction but these effects can be reduced through the sensitive construction programming. Such severance effects can be further reduced through dead hedging[29] which can provide temporary habitat connectivity within bat hot spots and commuting routes during sensitive bat activity periods.

Habitat damage

8.8.10 Habitats close to the scheme, such as hydrologically connected aquatic habitats, are sensitive to effects from both construction and operation such as pollution events from fuel and chemical spills, from change in vehicle emissions, and from sediment run-off, such effects are further described and assessed within the Habitat Regulations Assessment Screening with in **Statement to Inform an Appropriate Assessment** (Volume 6, Document Ref 6.5).

8.8.11 Whilst best practice construction and operation design techniques for pollution prevention and control will be used, there is always a risk during construction and operation from vehicles and the transporting of potentially polluting goods.

8.8.12 Impacts may also arise on designated sites, in this case the Newlyn Downs SAC, where vegetation may be sensitive to elevated levels of airborne dust from the works and nitrogen deposition during both construction and operation of the road. Best practice control measures will be implemented and are detailed within the

29 When a scheme involves the temporary removal of edge habitat such as woodland edges, hedgerows or tree lines, temporary structures 'dead hedges', can be used to provide connectivity and allow bats to continue along severed flight paths during construction. Such dead hedges may comprise a line of Herras fencing panels or similar with hessian stretched across them to provide a solid structure along which bats can commute. Such structures are only suitable to maintain connectivity for bats over relatively short distances. The structures can be moved during the day to accommodate construction activities, and then put back before dusk so that the mitigation is effective between dusk and dawn every night.

Outline Construction Environmental Management Plan (**CEMP**) (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H).

8.8.13 Elevated Nitrogen oxide (NOx) concentrations are generally considered to be the main threat to vegetation from vehicle emissions. Further details on air quality impacts are set out in Chapter 5 **Air Quality** (Volume 6, Document Ref 6.2), and any associated impacts on vegetation are provided below within the Section 8.11 Assessment of effects and within the Habitat Regulations Assessment Screening with in **Statement to Inform an Appropriate Assessment** (Volume 6, Document Ref 6.5).

Disturbance

8.8.14 Disturbance effects from constructional activities and human presence, as well as noise, vibrations and lighting during both construction and operation of the scheme could lead to significant impacts to sensitive species. This could lead to abandonment of territory or of young, increased predation risk and use of critical energy reserves. These effects would be mitigated through specific construction phase Method Statements that would address potential impacts on species. This would for instance include the removal of vegetation outside of the breeding bird season, sensitive timing of works for bats near roosts, and providing alternative setts for badgers that are close to construction areas. Such mitigation is detailed below in Section 8.10 Design, mitigation and enhancement measures, and within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1) in Table 16-2 and Annex E .

8.8.15 Disturbance to bats from lighting can lead to significant effects. The effect of road lighting is complex, but includes roost disturbance and abandonment, severance and loss of foraging and commuting habitats, and a decline in airborne invertebrate prey. Lighting is only proposed within the scheme for the three Walkers, Cyclists and Horse riders (WCH) underbridges at Chiverton, Church Lane and Newlyn Downs, where the lighting will be motion activated and only activated outside of bat activity periods, as detailed in para 8.10.11.

8.8.16 Construction lighting will also need consideration and implementation of measures to reduce such impacts during construction, as detailed below in Section 8.10 Design, mitigation and enhancement measures, and within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1) in Table 16-2 and Annex E.

Species mortality

8.8.17 Species mortality can occur during construction as well as operation of highways. Less mobile species, or animals that are hibernating or have young, are likely to be most vulnerable to direct mortality during vegetation clearance and construction.

8.8.18 The effects of individual mortality can lead to local extinctions once a population falls below a critical threshold. These effects are often greatest within longer-lived species, with greater parental investment and low annual reproduction, which struggle to recover from loss of family or population members.

8.8.19 Many animals are killed by vehicle collision on UK roads each year and this is likely to be the case for the scheme in the absence of mitigation. Furthermore, the

RTC on the existing stretch of the A30 suggests various species are crossing the road or susceptible to collision in this area.

8.8.20 Animals that are particularly susceptible and are at risk from collision are badger, otter and bats due to the severance of wildlife corridors, and birds, especially barn owl, due to the way in which they hunt.

8.8.21 There are mitigation measures which can reduce the risk of collision such as hedgerow and tree planting along the scheme to discourage species such as barn owl flying into the carriageway, and provisions of multispecies crossings and fencing to ensure their save crossing of species. Such mitigation measures are detailed below in Section 8.10 Design, mitigation and enhancement measures.

8.9 Assessment assumptions and limitations

8.9.1 The findings presented in this chapter represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors that affect the presence of plants and animals, such as the time of year, migration patterns and behaviour.

8.9.2 Nevertheless, these surveys were conducted at the optimal survey periods and using methodologies which are accepted by Natural England and other statutory bodies. Furthermore, the results of the ecological survey allow evaluation of nature conservation value, assessment of the significance of potential impacts that may arise from the proposals and consideration of appropriate mitigation measures. Every effort has been made to ensure that the findings of the study present as accurate an interpretation as possible of the status of flora and fauna within the study area.

8.9.3 With regards to lighting, it is assumed that the scheme will be lit as per the description in **The Project** (Volume 6 Document Ref 6.2 ES Chapter 2).

8.9.4 Any specific survey assumptions and limitations are detailed within the specific flora and fauna ecological reports provided in Volume 6 Document Ref 6.4 ES Appendix 8.2 to 8.20, and any deviation from relevant survey guidance was consulted with and agreed with Natural England as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5)

Limits of deviation

8.9.5 The assessment has been conducted within the limits of deviation outlined in Limits of Deviation within **Approach to EIA** (Volume 6 Document Ref 6.2 ES Chapter 4).

8.9.6 For Ecology and Nature Conservation, the worst case scenario has been considered within the ES (Volume 6 Documents Reference 6.2 Chapter 8), as the assessment takes account of the full footprint of the scheme within the red line boundary. It is considered that the proposed limits of deviation will not give rise to any materially new or materially worse adverse environmental effects from those already reported.

8.10 Design, mitigation and enhancement measures

8.10.1 Where possible, the scheme has been designed to avoid, eliminate, or reduce the magnitude of some of the potential impacts and risks described in 8.7 Potential

Impacts above. Where this has not been possible, mitigation has been developed to avoid or reduce these potential impacts. Mitigation measures will seek to employ best-practice methods for dealing in particular with habitat loss, habitat severance, habitat damage, disturbance and species mortality. Enhancement measures have also been included, going above and beyond what is required to mitigate the adverse effects of the scheme.

8.10.2 It is currently considered that through the engineering design of the scheme, and the proposed mitigation and enhancement measures, as described below, the scheme will be able to deliver a net gain in terms of ecologically rich habitats (see Table 8-15), while also better connecting surrounding habitats and reducing species mortality as compared to the existing A30 (see Table 8-14), in line with requirements laid out in the NN NPS [1].

Engineering design

8.10.3 In terms of ecology, the design of the scheme primarily aims to avoid or reduce the impacts of habitat severance and species mortality. For the purposes of this chapter, engineering design comprises the design of the horizontal and vertical alignment of the scheme, as well as associated junctions and side roads, structures (including multi-species crossings), drainage (including attenuation ponds), fencing, and lighting. As such, the habitat creation and enhancement proposed within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) are not included within this engineering design section, apart from general principles relating to bat mitigation, and are instead discussed within the operation mitigation, construction mitigation, and enhancement sections below.

8.10.4 It should be noted that wildlife populations along the scheme exist within a baseline environment that has a busy road within the local landscape. This has been considered in the design evolution of the scheme which largely follows many sections of the existing A30 to avoid impacts on new populations, as discussed within **Consideration of alternatives** (Volume 6 Document Ref 6.2 ES Chapter 3).

8.10.5 The approach to engineering design has aimed to reduce the overall effect on ecology and nature conservation. For example, the verge widths of side roads have been reduced from the DMRB standard [78], which will allow for a greater retention of surrounding habitats including Cornish hedgerows.

8.10.6 However, two areas in which avoiding important ecological features was not feasible include the woodland HPI at approximately Ch6+500, and the heathland HPI at approximately Ch12+800. Avoiding the woodland HPI to the north or south would have resulted in significant impact on an existing business, cultural heritage features, local farm buildings, including listed buildings, and removal of part of a solar farm.

8.10.7 Avoiding the heathland HPI to the north or south would have resulted in the scheme being significantly closer to, and therefore having a larger impact on Newlyn Downs SAC or having a significant impact on the schedule barrow cemetery (which includes the scheduled Warrens Barrow).

8.10.8 Natural England are in agreement that in these locations, the chosen alignment is preferable to the alternatives as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.10.9 A total of 33 multi-species crossings are proposed within the scheme, including a green bridge at Marazanvose, underbridges, over bridges, dry wildlife tunnels and drainage culverts, see Table 8-14 for details. Further details on how these crossings are suitable for reptiles, badgers and otters, and bats are given in detail below under species headings.

8.10.10 Wildlife fencing for badger and otter (where necessary) has been included in the scheme design throughout the entire length of the scheme, designed to funnel mammals through the crossings. These are discussed in more detail below under species headings.

8.10.11 The majority of these multi-species crossing and scheme structures will not be lit, with the exception of Chiverton underbridge at Ch1+200, Church Lane underbridge at Ch9+265, and Newlyn Downs underbridge at Ch13+000 all of which are to be used by WCHs but not by vehicles. These structures will only be lit in the winter months (outside of the bat activity period) using low lux level lighting which is motion activated by WCHs but not by bats, badgers, or otters. This approach has been agreed with Natural England as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5) and is described in more detail in **The Project** (Volume 6 Document Ref 6.2 ES Chapter 2).

8.10.12 Health and safety concerns did not justify the inclusion of lighting throughout the rest of the scheme. Therefore, there is no risk of light spill from the mainline, junctions, or other side road underbridges on to bat sensitive habitats, such as foraging and commuting routes and roosts.

8.10.13 There are a total of 20 attenuation ponds proposed throughout the scheme for drainage purposes. However, these attenuation ponds when wet will also provide potential foraging opportunities for otters and bats, and habitat for SPIs such as common toad. There will be marginal aquatic, semi-aquatic, and aquatic seeding and planting around each of the 20 ponds. The details of this landscaping, including the planting and seeding mixes, has not yet been designed, nevertheless it is intended that each mix will comprise a diverse range of species which are native, resilient, and beneficial to biodiversity.

8.10.14 Engineering design and drainage has also been designed to ensure no de-watering of existing ponds and watercourses, as well as important habitat which is hydrologically sensitive, such as heathland habitat at Newlyn Downs SAC.

Table 8-14 A compiled list of structures, including multi-species crossings in the form of underbridges, overbridges, tunnels, and culverts, and the ecological value and requirement

Structure location, dimensions, and details**	Species/function crossing suitable for	Baseline results determining the primary requirement for the crossing
Section A – Chiverton to Chybucca		
Ch1+000 DT 900mm (d) x 116m (l)	Otter*; Badger	**Badger baseline –** Three adjacent RTC records[30], mammal tracks surrounding
Ch1+200 Chiverton UB 4m (w) x 4m (h) x 70m (l)	WCH; Bat*	Fencing to exclude badger and otter. Lit with WCH motion activated low lux lighting (may be permanently lit in future due to safety concerns).
Ch1+425 Chiverton West UB 19m (w) x 6m (h) x 34m (l)	Traffic; Bat*	Fencing to exclude badger and otter.
Ch1+560 Chiverton East UB 19m (w) x 6m (h) x 34m (l)	Traffic; Bat*	Fencing to exclude badger and otter.
Ch1+900 DT 900mm (d) x 98m (l)	Otter; Badger	**Otter baseline –** One watercourse to west (suitable for couches) and two to east, one adjacent RTC record. **Badger baseline –** Four adjacent RTC records, mammal tracks surrounding, latrine north east, pawprints south.
Ch2+750 DT 900mm (d) x 65m (l)	Otter*; Badger	**Badger baseline –** Main sett 43 and outlier sett 42 to south, two RTC records, mammal tracks surrounding, pawprints to south
Ch3+750 DT 900mm (d) x 62m (l)	Otter; Badger	**Otter baseline –** Two watercourses to north (one suitable for couches) and one to south (suitable for couches). One adjacent RTC record. **Badger baseline –** Disused subsidiary sett 40 to south, four adjacent RTC records, mammal tracks surrounding, latrines to south and north east
Ch4+545 DT 900mm (d) x 99m (l)	Otter*; Badger	**Badger baseline –** Outlier setts 38 and 39 to north, three adjacent RTC records, mammal tracks surrounding, latrines to north, pawprints to south
Ch4+830 Chybucca OB 14.5m (w) x 34m (l)	Traffic; Bat*	Fencing to exclude badger and otter.
Section B – Chybucca to Zelah		
Ch5+550 DT 900mm (d) x 57m (l)	Otter*; Badger	**Badger baseline –** Two adjacent RTC records, mammal tracks to north and south
Ch5+965 Tresawsen UB 10m (w) x 6m (h) x 35m (l)	Bat; Badger*; Otter*; Traffic; WCH	**Bat baseline*** –** 218 bats commuting and foraging along hedgerow during crossing point surveys. Multiple species recorded at activity level of 2.47 PPH by SM2.
Ch6+050 DC (wet)[31] 1.2m (d) x 94m (l)	Bat*; Otter*; Drainage	**Bat baseline –** 124 bats seen flying along hedgerow and tree line during the crossing point surveys, with an activity level of 2.47pph recorded by an SM2 and of 1.71ppm during the transect surveys.
Ch6+050 DT 1.2m (d) x 89m (l)	Otter; Badger; Reptile; Bat*	**Otter baseline –** Two watercourse to south and two to north. Footprints and spraint identified to the south, and spraints and an anecdotal sight record to north. **Badger baseline –** Outlier sett 37 to south, three adjacent RTC records, latrines to north, mammal tracks surrounding **Reptile baseline –** Peak count of one slow worm and seven common lizards to the west.
Ch6+475 DT 900mm (d) x 87m (l)	Otter*; Badger	**Badger baseline –** Main sett 36 to south east, two adjacent RTC records, latrines to north east and north west, mammal tracks surrounding
Ch7+315 Marazanvose Green OB 12m (w) x 56m (l)	Bat; Otter; Badger; Reptile*; Farm access; WCH	**Bat baseline –** 384 bats seen flying along hedgerow feature during crossing point surveys, multiple species recorded during transect and by SM2. **Otter baseline –** One watercourse to south, one adjacent RTC record **Badger baseline –** Main sett 36 to south west, main sett 32, outlier sett 31, annexe sett 33, and disused outlier sett 35 to south east, eight adjacent RTC records, latrines south and north west, mammal tracks surrounding
Ch8+125 Two Barrows UB (existing – to be retained) 10m (w) x 5.6m (h) x 36m (l)	Bat; Traffic	**Bat baseline –** 589 bats seen using existing underbridge during crossing point surveys. Multiple species recorded by SM2. High levels of Ppips recorded south of structure during transect.
Ch8+125 DT 900mm (d) x 46m (l)	Otter*; Badger	**Badger baseline –** Main sett 32, outlier sett 31, annexe sett 33, and disused outlier sett 35 to south east, main sett 26 to north west, outlier setts 27, 28, and 29, and subsidiary sett 30 to south west, three adjacent RTC records, latrines to south, mammal tracks surrounding
Ch8+595 Tolgroggan OB 5m (w) x 48m (l)	Bat; Otter; Badger; Reptile*; Farm access; WCH	**Bat baseline –** 118 bats seen flying along hedgerow and 26 bats seen crossing existing A30 during crossing point surveys. Multiple species recorded during transect with an overall activity level of 0.43 ppm. **Otter baseline –** One watercourse to east. **Badger baseline –** Main sett 26 to north, outlier setts 27, 28, and 29, and subsidiary sett 30 to south, four adjacent RTC records, mammal tracks surrounding, latrines to south, and pawprints to north and south.

30 Road Traffic Collision records from 2008 – 2017 inclusive on existing A30 between Chiverton and Carland Cross
31 Drainage culverts take existing streams under the road and will therefore be wet all year round.

Structure location, dimensions, and details**	Species/function crossing suitable for	Baseline results determining the primary requirement for the crossing
Ch8+900 Box DC (wet) with two ledges 2.4m (w) x 2.4m (h) x 50m (l)	Bat; Otter; Badger*; Drainage	**Bat baseline –** 162 bats flying along hedgerow and stream during crossing point surveys. **Otter baseline –** One watercourse running through culvert (suitable for couches), one adjacent RTC record
Section C – Zelah to Carland Cross		
Ch9+250 Box DC (wet) with two ledges 2.4m (w) x 2.4m (h) x 75m (l)	Bat*; Otter; Badger*; Drainage	**Otter baseline –** One watercourse running through culvert (suitable for couches), and two to north, one adjacent RTC record.
Ch9+265 Church lane UB 4m (w) x 4m (h) x 38m (l)	Bat*; Otter; Badger; Reptile*; WCH	**Otter baseline –** One watercourse to south (suitable for couches) and two to north, one adjacent RTC record. **Badger baseline –** Main sett 25 to south east, one adjacent RTC record, latrines to north and south, mammal tracks surrounding
Ch9+720 Trevalso UB 8m (w) x 6m (h) x 56m (l)	Bat; Traffic; WCH	**Bat baseline –** 1033 bats seen flying along track and 28 bats seen crossing existing A30 during crossing point surveys. High activity levels recorded (PPM: 0.94) during transect. Multiple species recorded by SM2.
Ch9+720 DT 900mm (d) x 42m (l)	Otter; Badger	**Otter baseline –** Two watercourses to west and two to east, one adjacent RTC record **Badger baseline –** Main sett 25 to south, one adjacent RTC record, latrines and mammal tracks surrounding
Ch10+500 DT 900mm (d) x 49m (l)	Otter; Badger	**Otter baseline –** One watercourse to west **Badger baseline –** Main sett 22, outlier sett 23, and disused outlier 21 to south west, outlier sett 24 to north, mammal tracks surrounding, latrine to south east
Ch11+020 Pennycomequick UB 17m (w) x 6m (h) x 30m (l)	Bat; Traffic; WCH; Otter*; Badger*	**Bat baseline –** 180 bats seen using hedgerow feature during crossing point survey. Multiple species recorded by SM2 in woodland to east.
Ch11+040 DC (wet) 1.2m (d) x 74m (l)	Drainage; Bat*; Otter*	
Ch11+050 DT 900mm (d) x 74m (l)	Otter; Badger	**Otter baseline –** One watercourse running through adjacent culvert (suitable for couches) **Badger baseline –** Main sett 17, outlier setts 16, 19, and 20, and annexe sett 18 immediately adjacent. Outlier sett 15 to south, main sett 22, outlier sett 23, and disused outlier sett 21 to south east, two adjacent RTC records, latrines and mammal tracks surrounding, pawprints to east
Ch12+000 DT Journeys End Culvert (Dry) 2m (w) x 2m (h) x 60m (l)	Bat; Otter; Badger	**Bat baseline** - 112 bats crossing using hedgerow feature including Rfer and Rhip (heard not seen). 32.94 pph recorded by SM2, including Bbar, Rfer, and Rhip. **Otter baseline –** One watercourse to south **Badger baseline –** Main sett 12 to south, three adjacent RTC records, mammal tracks surrounding, pawprints and latrines to south
Ch13+000 Newlyn Downs UB 4.5m (w) x 4.5m (h) x 35m (l)	Bat*; Otter*; Badger; Reptile; WCH	**Bat baseline –** Nnoc recorded (PPM 0.03) to south during transect. **Badger baseline –** Subsidiary sett 11 to west, outlier sett 9 to north east, four adjacent RTC records, mammal tracks surrounding, latrines to north east **Reptile baseline –** Peak counts of three slow worms, one common lizard and one adder in Reptile Survey Area 2 to the north east and of five slow worms and five common lizards in Reptile Survey Area 3 to the south west
Ch13+360 Carland Cross UB north 14.5m (w) x 6m (h) x 14m (l)	Traffic; Bat*	Fencing to exclude badger and otter.
Ch13+360 Carland Cross UB south 14.5m (w) x 6m (h) x 30m (l)	Traffic; Bat*	Fencing to exclude badger and otter.
Ch13+600 DC (wet) 1.2m (d) x 122m (l)	Drainage Bat*; Otter*;	
Ch13+600 DT 900mm (d) x 100m (l)	Otter; Badger	**Otter baseline –** One watercourse to north (suitable for couches), and one to south **Badger baseline –** Main sett 8, subsidiary sett 4, outlier setts 1, 2, and 5, and disused outlier setts 3, 6, and 7 to north east, one adjacent RTC record, mammal tracks surrounding, latrines and pawprints to north and south
Total	33 crossing opportunities	
Total for each species	21 crossings suitable for bat use	22 crossings suitable for badger use
	25 crossings suitable for otter use	5 crossings suitable for reptile use

*Baseline conditions did not indicate that a crossing would be necessary for these species in this location. However, the dimensions and design of this structure is suitable for use by these species, in addition to the species or function (drainage/traffic/WCH) that the structure was originally designed for. Therefore these species have been included in this table for completeness, and to demonstrate further opportunities for them to cross the scheme.
**Ch = chainage; d = diameter; w = width; h = height; l = length; DT = dry tunnel; UB = underbridge; OB = overbridge; and DC = drainage culvert
*** Bat species abbreviations = Rhip (lesser horseshoe bat), Rfer (greater horseshoe bat), Bbar (barbastelle bat), Ppip (common pipistrelle, Nnoc/Nlei (either Leisler's or noctule).

Reptiles

8.10.15 There are two identified areas with reptile populations present for which the scheme has the potential to directly effect through habitat loss and indirectly effect through isolation, these are Area 3 and Area 9 as shown in Figure 2 of the **Reptile survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.11). A 1.2 metre diameter dry tunnel at Ch6+050 and Newlyn Downs underbridge at Ch13+000 will serve to link up existing habitats on either side of the scheme to reduce the risk of population isolation. These crossings have been designed to be large enough for the installation of a substrate to allow for reptile movement, such as gravels and/or wood bark.

8.10.16 A further three crossings will also be suitable for use by reptile, including the green bridge at Marazanvose, Tolgroggan overbridge, and Church Lane underbridge, resulting in a total of five crossings available for use by reptiles.

Otter and badger

8.10.17 All watercourses were considered to have the potential to support otters and it was assumed that otters will be active throughout the scheme. Therefore, there are 25 crossings in total suitable for use by otter, with at least one crossing every kilometre. Locations of watercourses, results from the otter survey, and RTC records were considered when determining the locations of crossings for otter (shown on Volume 6 Document Ref 6.3 ES Figure 8.6). These 25 crossings comprise 14 dry tunnels, five drainage culverts, two overbridges, and four underbridges.

8.10.18 Badgers were also found to be highly active throughout the scheme. Therefore, there are a total of 22 crossings suitable for use by badger, with at least one crossing every kilometre. Locations of main badger setts, badger activity, and RTC records were considered when determining the locations of crossings for badger (shown on Volume 6 Document Ref 6.3 ES Figure 8.5). Crossings are provided for badger within 500 metres of each main badger sett and on, or within close proximity of, identified existing pathways and crossings, as per DMRB guidance [79]. These 22 crossings comprise 14 dry tunnels, two drainage culverts, two overbridges, and four underbridges.

8.10.19 The diameters of the 14 dry tunnels are all larger than the minimum specified in DMRB guidance for badger[32]. This is so that all dry tunnels are also suitable for use by otter; DMRB guidance for otter [80] states that where the tunnel is longer than 20 metres, the diameter should be increased to at least 900 millimetres. All dry tunnels within the scheme are 900 millimetres in diameter with the exception of the dry tunnel at Ch6+050 which is 1.2 metres in diameter to allow for the inclusion of a substrate suitable for reptiles (as described above).

8.10.20 Two of the five drainage culverts within the scheme have ledges on either side, again following dimensions specified by DMRB guidance (at least 500mm wide with 600mm headroom [80]), allowing for the dry passage of otters during potential times of flood. It was not feasible to include ledges in the other three drainage culverts, and therefore a dry tunnel of 900 millimetres in diameter has been provided immediately adjacent to each of these drainage culvert for times of

32 DMRB guidance states that dry tunnels for badger should be at least 600 millimetres [81]

flood. When not in flood, these three drainage culverts will be suitable for otter but not badger.

8.10.21 The three underbridges suitable for use by both otter and badger are Church Lane underbridge at Ch9+265, Pennycomequick underbridge at Ch11+020, and Newlyn Downs underbridge at Ch13+000. Church Lane and Newlyn Downs underbridge will both comprise a stone track and will also be used by WCH's but not by vehicles. Pennycomequick underbridge will also be used by WCH's and vehicles, but is predicted to be a very lightly trafficked road, particularly at night (less than two vehicles per hour) when badger and otter are more active. Therefore, conflict with vehicles is unlikely.

8.10.22 The two overbridges that have been designed to be suitable for use by otters and badgers are Marazanvose Green overbridge at Ch7+315 which is described in the bats section above, and Tolgroggan overbridge at Ch8+595 which will consist of a stone track that will also be used by WCHs and for local farm access.

8.10.23 Badger fencing is proposed and designed throughout the scheme to restrict movements on to the main carriageway. Where otter crossings have been designed, and around proposed attenuation ponds, the badger fencing will be replaced by otter fencing (which is still badger proof) up to at least 500 metres on either side of the feature.

Bats

8.10.24 The data from the different bat activity and roost surveys were analysed in combination, and the following eight areas were identified as hot spots for bat activity which will be crossed by the proposed scheme:

- Ch5+965 and Ch6+050 Tresawsen (Nanteague Farm);
- Ch7+120, Ch7+150 and Ch7+315 NFH Marazanvose;
- Ch8+125 Two Barrows;
- Ch8+590 Tolgroggan;
- Ch8+900 Stream east of Zelah;
- Ch9+720 Trevalso Lane;
- Ch10+895 Pennycomequick; and
- Ch12+000 Hedgerow north of Deer Park Wood.

8.10.25 These eight area hot spots or key bat activity areas have been described below along with the engineering design that has been provided for bats in these locations. Where relevant, roost data has also been discussed.

Ch5+965 and Ch6+050 Tresawsen (Nanteague Farm)

8.10.26 Two mature hedgerows with trees which run north-south and would be severed by the proposed scheme formed Crossing Point Survey locations 3A (Ch5+965) and 3B (Ch6+050). Callestick Vean and Polvenna Wood CWS (known to support both lesser and greater horseshoe bats) lie to the north of the scheme in this location and Allet Bog CWS (known to support both lesser and greater horseshoe bats) lies to the south.

8.10.27 A total of 218 bats were seen crossing using the feature at 3A during the six crossing point surveys, a high proportion of these were greater horseshoe bats (Ppip (90), GHS (84), LHS (35), Myotis (5), NSL (2), unidentified (1)). A total of 6 bats (including GHS, LHS, Ppip) were also incidentally seen crossing the existing

A30 in this location confirming it as an existing crossing point for bats. The proposed side road and UB03 Tresawsen Underbridge is in line with hedgerow feature 3A (Ch5+965) so that the existing flight line for bats can be maintained. The new underbridge, measuring 10 metres wide x 6 metres high and 35 metres long, will only carry local traffic and will not be lit. As much of the existing hedgerow as possible will be retained and the landscape planting has been designed to funnel bats towards the underbridge and discourage them from flying over the proposed scheme in this area, as detailed on the Environmental Masterplan (ES Figure 7.6 of Volume 6, Document Ref 6.3 ES Figure 7.6). Crossing point survey location 3B approximately 50m to the northeast had a total of 124 bats recorded using the feature over the six surveys including 1 greater horseshoe bat. One barbastelle pass was also heard in this location although not seen. The landscape planting will also be designed to funnel bats from this flight path towards the underbridge, as detailed on the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3).

8.10.28 Incidentally, two engineering structures DC01 Drainage Culvert (wet) and MC01 Dry tunnel, both 1.2 metres in diameter are proposed in line with this flightpath at Ch6+050. Whilst these structures have not been designed as crossings for bats, at 1.2 metres in diameter, some species may use them to cross underneath the scheme. A literature review suggested that some bat species may use crossings as small as 0.8 metres in height by 0.5 metres in width [81].

Ch7+315 NFH Marazanvose

8.10.29 Marazanvose lies between the woodland of the Chyverton Woodland CWT Reserve to the north of the existing A30 and suitable foraging areas to the south in the form of marshy grassland and organic farmland. The buildings at NFH also contain known roosts for lesser and greater horseshoe bats, common pipistrelle, soprano pipistrelle, Daubenton's, brown long-eared and Natterer's bat. The tree-lined access track to NFH at Ch7+315 was Crossing Point Survey Location 6 where 384 bats were recorded crossing the proposed scheme using the feature over the six surveys (species included common pipistrelle (342), *Myotis* (20), sorano pipistrelle (12), lesser horseshoe (4), as well as greater horseshoe and serotine being heard but not seen). During the six crossing point surveys a total 77 bats were recorded flying from or towards the junction of this track with the existing A30, as such it is believed to be an existing crossing point over the A30 for bats. During the walked transect surveys (Transect Route 3, Point Count 22) a greater horseshoe was recorded as having potentially crossed the A30 in this location. Static location SM2_5 on the access track to NFH recorded all three of the Annex II species.

8.10.30 The proposed Marazanvose Greenbridge is in line with the existing flight path along the access track at Ch7+315 so that bats can continue to use their existing commuting route. The greenbridge will provide a safe route for bats over the proposed scheme and over the existing A30. The vertical alignment of the scheme in this location was lowered into cutting for a combination of environmental and engineering reasons. This is considered to make the structure even more effective as a crossing structure for bats since it will be more level with the natural landscape.

8.10.31 The findings from a literature review of green bridges commissioned by Natural England in 2015 [82] was utilised amongst other sources [83] [84] [85] [86] to inform the design of the green bridge at Marazanvose to maximise its

effectiveness, particularly in ensuring usage by bats. The literature review identified that the width and design of vegetation is more important in ensuring use by bats than the overall width of the bridge. The Marazanvose Greenbridge has been designed to allow a 3m wide strip of vegetation planting along each edge of a 3m wide track in the centre to serve local farm traffic and WCH (a 1m wide trench which will be planted with trees and shrubs and is expected to quickly grow to establish a 3m wide strip of vegetation). The deck of the green bridge will be 12 metres wide and 56m long. The landscape planting has been designed to funnel bats up and over the bridge from all directions, as detailed on the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3).

Ch8+125 Two Barrows

8.10.32 The existing habitat in this location comprises a tree-lined road and an existing underbridge underneath the existing A30. The woodland at Chyverton Woodland CWT Reserve lies to the north and to the south lies suitable habitat in the form of pasture fields and field boundaries. The scheme in this location is in line with the existing A30 with a new alignment for local traffic provided to the north.

8.10.33 An approximate 50 metre stretch of the tree-lined road including the underbridge formed the location of Crossing Point Survey 7 where 589 bats were seen crossing the proposed scheme via this underbridge over the six surveys. Species included common pipistrelle (482), Myotis (89), soprano pipistrelle (7), greater horseshoe (2), lesser horseshoe (1), barbastelle (1) and serotine (1), serotine/noctule/Leisler's (4) and 4 unidentified bats. Static Location 8 was situated to the south of the underbridge and recorded greater and lesser horseshoe bat.

8.10.34 The existing underbridge is being retained, with only minor works proposed to the parapet walls on the top level, so bats will be able to continue using this flight path throughout construction. As much of the existing vegetation along the road as possible will be retained and any that is lost will be replaced within the landscape design as detailed in the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3).

Ch8+590 Tolgroggan

8.10.35 The existing farm access track and single-track overbrige to Tolgroggan Farm from Zelah at Ch8+590 was identified from the field surveys to be a hotspot in terms of bat activity. The track and overbridge, which has high parapet walls, provide a dark corridor over the existing A30, which is in cutting in this location. Crossing Point Survey Location 9 which covered an approximate 50m length of the hedgerow-lined access track east of the bridge recorded a total of 118 bats using the feature over the six surveys. Species included common pipistrelle (95), Myotis (21), noctule (1), with the following species also heard passing but not seen: greater horseshoe (1), lesser horseshoe (28), barbastelle (1). A total 26 bats (*Myotis* sp and common pipistrelle) were incidentally observed crossing the A30 via the overbridge during the surveys.

8.10.36 Point Count 27 of Walked Transect 3 was located in the woodland at the west end of the bridge. During one of the transect surveys a greater horseshoe was observed flying along the access route and over the existing A30 via the bridge confirming this location as an existing crossing point for this species.

8.10.37 The proposed scheme alignment is to the south of the existing A30 in this location. The proposed Tolgroggan Accommodation Overbridge, WCH and Multi-Species Crossing at Ch8+595 will span both the new A30 and existing A30 and will be situated approximately 10 metres northeast of the existing bridge.

8.10.38 The new overbridge will serve Tolgroggan Farm and WCH only and will not be lit. Like the existing bridge it will have parapet walls of 1.8 metres high since it is a bridleway. The parapet walls of the new bridge will be solid in order to shield bats from the glare of headlights from vehicles below. The proposed landscape design will funnel bats towards the new bridge, as detailed on the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3).

Ch8+900 Stream east of Zelah

8.10.39 This stream which runs under the existing A30 to the east of Zelah was the location of Crossing Point Survey Location 10. A total of 162 bats were observed crossing the proposed scheme using the feature in this location. Species included common pipistrelle (115), Serotine (18), brown long eared (10), Myotis (7), lesser horseshoe (2), noctule (1) and noctule/serotine/Leisler's (9). A single greater horseshoe pass and single barbastelle pass were also heard not seen. A total of ten bats including common pipistrelle, serotine, and Myotis species were recorded flying over the hedgerow towards or away from the existing A30 during the surveys.

8.10.40 Relatively high levels of activity were observed at Point Count 26 on Walked Transect 3 with 1.31 passes per hour. The static detector survey in Static location 9 also recorded relativity high levels of activity with 45.22 passes per hour, species included greater and lesser horseshoe bat.

8.10.41 The drainage box culvert (wet) proposed in this location Ch8+900 will be 2.4 metres x 2.4 metres in diameter and will have a length of 89 metres. Whilst this culvert has not specifically been designed for bats, it is considered wide enough to provide most bat species with safe passage underneath the proposed and existing A30.

Ch9+720 Trevalso Lane

8.10.42 The existing Trevalso Lane at Ch9+740 was found to be a hot spot for bat activity. The lane, which leads south to the Trevalso Farm complex off the existing A30 comprises a tree-lined track with a tree canopy which joins overhead.

8.10.43 Crossing Point Survey Location 11 comprised approximately 50m of Trevalso Lane from the A30 junction down to the northern end of this canopy tunnel. A total of 1033 bats were seen flying along this stretch using the feature over the six surveys. Species included common pipistrelle (889), *Myotis* species (135) noctule (1), and unidentified (8). A lot of these passes are likely to be attributable to foraging bats flying up and down the track. A total 28 bats were incidentally confirmed crossing A30 in this location, all common pipistrelle or *Myotis* species.

8.10.44 Point Count 35 of Walked Transect 4 was within the tree canopy tunnel and recorded high levels of bat activity 0.94 passes per minute. Species included common pipistrelle and *Myotis* species only. Static Location 11 was also in this location and recorded greater and lesser horseshoe bats.

The proposed Trevalso Lane Underbridge at Ch9+720 is considered to greatly improve this junction for bats to move safely from one side of the scheme to the

other, compared to the existing situation. The existing junction with the A30 is sparsely vegetated, as are the verges Henver Lane to north. As much of the canopy tunnel feature to the south will be retained as possible. A track will lead from Trevalso Lane to the proposed underbridge approximately 10m south of the existing T-junction. The underbridge itself will be 56m long and go beneath the proposed scheme and existing A30. The track will then join up with Henver Lane which will be re-aligned to be further west than its existing alignment. The landscape planting design will funnel bats towards and into the underbridge from both sides of the scheme, as detailed on the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3).

Ch10+895 Pennycomequick

8.10.45 The existing side road at Ch10+895 which serves the Pennycomequick and Honeycombe Farm properties south of the existing A30 is lined with hedgerows on both sides. It provides a north-south linear feature between Newlyn Downs SSSI & SAC to the north (which is known to support lesser horseshoe) and suitable roosting habitat at Treworgan Quarry & Lower Tolcarne CWS to the south. Crossing Point Survey Location 13 was located along this road where it would be crossed by the proposed scheme. A total 180 bats were recorded crossing the proposed scheme using the feature during the six surveys. The species included common pipistrelle (145), lesser horseshoe bat (19), *Myotis* species (7), greater horseshoe bat (4), soprano pipistrelle (2), brown long-eared bat (2) and Leisler's (1).

8.10.46 The new side road will be positioned between the existing side road and a strip of woodland to the east, to enable noise reduction of the main alignment. The Pennycomequick Underbridge will be positioned at Ch11+020 approximately 45 metres to the east of the existing side road. The surface of the existing road will be maintained and used as access tracks to and from the eastbound and westbound emergency access points of the main alignment. The landscape planting has therefore had to be designed to dissuade bats from flying along their existing flight path (and away from the emergency access points) and along the proposed side road and towards the proposed underbridge, as detailed on the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3).

Ch12+000 Journeys End Culvert

8.10.47 This linear feature comprises a mature hedgerow with trees which runs north-south providing connectivity between Newlyn Downs SSSI & SAC (lesser horseshoe are known to be present) to the north and Deer Park Wood (Trenerry Wood CWS) to the south. The northern section of the hedgerow where it would be severed by the proposed scheme was the location for Crossing Point Survey 12. A total of 112 bats were seen crossing the proposed scheme using the feature in this location. Species included common pipistrelle (104), Myotis species (5), noctule (2) and unidentified (1). Greater and lesser horseshoe bat were also heard flying along this hedgerow but were not seen (9) and (4) respectively. A total of four common pipistrelles were incidentally observed crossing the existing A30 at this location during the surveys.

8.10.48 The static survey in this location recorded relatively high levels of activity with 32.94 passes per hour, species included barbastelle, greater and lesser horseshoe bats.

Other crossing structures – bats

8.10.49 In addition to the structures discussed above in connection with the eight bat hotspot areas, there are a further 13 structures that will provide suitable crossing locations for bats. These structures are identified in Table 8-14, where the bat baseline information for these structures is also summarised.

Operation mitigation

8.10.50 Whilst engineering design predominantly aims to avoid or reduce the potential impacts of habitat severance and species mortality, operation mitigation aims primarily to mitigate for the potential impacts of habitat loss and disturbance.

8.10.51 The loss of important habitats (such as heathland and woodland) and habitats suitable for protected and notable species (including hedgerows) will be mitigated by habitat creation, reinstatement, and enhancement as shown in the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3), and described below.

8.10.52 The **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) will deliver a biodiversity net gain of diverse and ecologically rich habitats suitable to support a number of wildlife populations, as well as providing a linear habitat corridor which also connects habitats into the wider landscape. This is in line with Defra's Biodiversity 2020 [3], the revised National Planning Policy Framework 2018 (NPPF) [87], Cornwall's Development Plan [7], the NN NPS [1], as well as Highway England's Delivery Plan [5], RIS [6], and Biodiversity Plan [88].

8.10.53 Table 8-15 compares the loss of habitat as a result of the construction of the scheme against the habitats to be created and reinstated during and post-construction; indicating the approximate ratio of net gains where appropriate.

Table 8-15 Habitat loss compared to proposed habitat gain (excluding buildings and hardstanding)

Phase 1 Habitat type	Habitat within redline boundary	Habitat to be retained/reinstated*	Habitat to be lost due to scheme*	Environmental Masterplan habitat type	Habitat proposed within Environmental Masterplan	Net habitat gain (and gained : lost ratio)
Semi-natural broadleaved woodland Plantation broadleaved woodland Semi-natural coniferous woodland Semi-natural mixed woodland Total**	8.37 ha 0.02 ha 0.29 ha 0.19 ha 8.87 ha	10.7 ha	7.7 ha	Deciduous woodland Mixed woodland (oak dominant) Mixed woodland (coniferous dominant) Total	23.11 ha 3.42 ha 1.71 ha 28.25 ha	20.54 ha (3.7 : 1)
Broadleaved and Coniferous scattered trees**	981 individual trees	881 individual trees	100 individual trees	Individual deciduous trees Individual coniferous trees Total	536 154 690	590 (6.9 : 1)
Cornish hedgerow***	21,401 m	16,913 m	4,488 m	Cornish hedgerow	12,605 m (including 6,149 m of vegetated Cornish hedgerow)	8,117 m (2.8 : 1)
Hedgerow	30,909 m	23,819 m	7,090 m	Soft hedgerow	8458 m	1,367 m (1.2 : 1)
Acid dry dwarf shrub heath	0.41 ha	0.41 ha (if translocation successful)	0.41 ha (worst case)	Heathland	5.30 ha	4.89 ha (13 : 1)
Semi-improved grassland Poor semi-improved grassland	2.43 ha 13.30 ha	Unknown, although a total of 23.15 ha of undisturbed land reinstated to previous use, some of which is likely to be this habitat type	Unknown but worst case scenario approach gives a total of 15.73 ha	Species rich grassland which includes native bulb planting and pollination strips	64.13 ha (of this 5.07 ha of pollination strips and 0.34 ha of native bulb planting)	48.40 ha (4.1 : 1)
Marshy grassland	1.49 ha	Unknown	1.49 ha	Wet grassland Wetland Marginal aquatic	4.23 ha 1.98 ha 1.48 ha	6.2 ha (4.2 : 1)
Dense scrub, Scattered scrub, Introduced shrub and Tall ruderal	8.56 ha 2.32 ha 0.04 ha 2.96 ha	Unknown	8.56 ha 2.32 ha 0.04 ha 2.96 ha	Scrub buffer	11.07 ha	- 2.82 ha (0.8 : 1)
Continuous bracken Scattered bracken	0.02 ha 0.01 ha	Unknown	0.03 ha	Bracken fern scrub	0.06 ha	0.03 ha (1.9 : 1)
Arable Improved grassland (combined due to possible crop/pasture rotation)	55.18 ha 77.01 ha	11.59 ha disturbed land returned to arable pasture Unknown although a total of 23.15 ha of undisturbed land reinstated to previous use and 11.59 ha disturbed land to be returned to arable pasture, some of which is likely to be these habitat type	Unknown, but worst case scenario approach gives a total of 43.59 ha Unknown, but worst case scenario approach gives a total of 77.01 ha	Disturbed land returned to arable pasture Undisturbed land reinstated to previous use, some of which is likely to be improved grassland and pasture	11.59 ha Unknown	-43.59 (0.2 : 1) Unknown
Amenity grassland	2.17 ha	Unknown	2.17 ha	Amenity grassland	0 ha	-2.17 ha (0 : 2.17)
Ponds	2 ponds	All to be retained	0	Attenuation ponds Aquatic and semi-aquatic	20 ponds 5.29 ha	20 ponds (20 : 0) 5.29 ha (5.29 : 0)

* Where the exact area to be retained/reinstated or lost is unknown, a precautionary approach has been taken where it is assumed that all habitat within the redline boundary will be lost. The **Environmental Masterplan** (**Figure 7.6** of Volume 6, Document Ref 6.3) highlights 28.8 hectares of vegetation to be retained, although it is not specified what this vegetation is, therefore it is likely that this covers some of the habitat types for which the area to be retained is unknown. Exact figures of loss are known for habitats of high ecological value, and the only habitats for which loss is unknown are of lower ecological value, including arable, and semi-improved, poor semi-improved, and improved grassland.
** The figures for the total area of woodland and number of individual trees to be retained and to be lost are taken from the **Arboricultral impact assessment** report (Volume 6 Document Ref 6.4 Appendix 7.6), which is considered to be more accurate in terms of these figures than the **2017 Phase 1 habitat update survey** (Volume 6 Document Ref 6.4 Appendix 8.3). However, the **Arboricultral impact assessment** report (Volume 6 Document Ref 6.4 Appendix 7.6) does not differentiate between broadleaved and coniferous trees/woodland. Therefore, these woodland/tree types have been combined when determining the net habitat gain.
*** All Regulation hedgerows were Cornish hedgerows, with the exception of one, as detailed in para 8.7.52.

8.10.54 Whilst there will be a loss of some habitats, such as pastoral and arable farmland, used by some populations of wildlife, particularly birds, the proposed habitat reinstatement and creation will provide foraging and breeding opportunities for these populations, while the wider area still provides ample agricultural habitats to support these populations. The amount of agricultural loss is considered minimal in terms of ecological benefits for wildlife, and is further assessed within **People and Communities** (Volume 6 Document Ref 6.2 ES Chapter 12).

8.10.55 In particular, woodland planting, Cornish hedge provision, species-rich grassland, wild flower pollination strips and heathland habitat creation will generate habitats and foraging opportunities for various species, including bats, otters, badgers, breeding and wintering birds, reptiles and invertebrates (including bees).

8.10.56 The **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) has been designed to enhance the habitats within the local area, provide natural barriers to deter flying species from the carriageway, including bats and barn owls, and provide habitat corridors leading to the multi-species crossing points while also connecting to the wider landscape. For example, the heathland creation has been designed to link the isolated heathland parcel at the eastern end of the scheme to the designated heathland area to the north within Newlyn Downs SAC.

8.10.57 The Environmental Masterplan has also considered potential disturbance and habitat loss effects to species. For example, suitable areas for alternative bat roosts have been identified where roosts will be disturbed during construction, which is further discussed in the construction mitigation section below.

8.10.58 The Environmental Masterplan will provide green infrastructure which will help to deliver climate change resilience in this part of Cornwall, in terms of both wildlife connectivity and catchment management. This would be in line with Defra's Biodiversity 2020 [3] which establishes principles for the consideration of biodiversity and the effects of climate change, as well as the National Planning Policy Framework (NPPF) [87]. The NPPF requires that the planning system should contribute to the enhancement of the natural environment 'by establishing coherent ecological networks that are more resilient to current and future pressures' (NPPF, Para 170).

8.10.59 Noise mitigation has been incorporated within the scheme at Chiverton Junction in the form of 2,190 meters of 1.8 meter high Cornish hedgerow and at Marazanvose/NFH area in the form of 670 meters of 3 meter high noise fencing, as descried in Operation Mitigation within **Noise and Vibration** (Volume 6 Document Ref 6.2 ES Chapter 11). These barriers will result in reduced noise levels for some roosts including Building 1A north of the Chiverton Junction and Building 36 within the NFH complex).

Construction mitigation

8.10.60 Standard construction best practice techniques and methods will be employed to remove or reduce the risk of potential impacts, in particular disturbance, habitat damage, and species mortality. A general overview of the potential impacts that the final CEMP will be mitigating for, as well as some of the techniques and controls that will be included in the final CEMP are briefly described in the following paragraphs, with further details provided within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1). The mitigation proposed within

the final CEMP and **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1) will be secured through the DCO.

8.10.61 In addition to that which is described below, the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1) and final detailed CEMP will also detail the requirement for pre-construction surveys for protected species (including bats, otters, badgers and barn owls), an Ecological Clerk of Works (ECoW) to, for example, oversee management of ecological issues as they arise, and to educate site personnel in ecological issues where needed.

Habitats

8.10.62 There is a risk that construction activities may inadvertently lead to dust, pollution events, or sediment run-off resulting in damage to those habitats (including designated sites and watercourses) that are within relative close proximity and/or are hydrologically connected to the construction footprint. These risks have been further described and assessed within **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13), and the **Habitat Regulations Assessment Screening** (Volume 6, Document Ref 6.5) in relation to internationally designated sites. These risks will be reduced through following standard best-practice techniques and methods which are summarised within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H) and will be detailed within the final CEMP.

8.10.63 Retained hedgerows and trees may also be at risk of root damage. These risks will be reduced through the implementation of the Arboricultural Method Statement (AMS) and Tree Protection Plan as detailed within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex I).

8.10.64 To mitigate the loss of ecologically valuable mature trees due to the scheme, bat and bird boxes will be provided within mature woodlands/trees within the scheme as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.10.65 Where possible, all in-stream works and works within ponds should be avoided as per best practice construction methodologies. Most of the watercourses within the study area are relatively narrow and shallow (less than one metre wide and less than 50 millimetres deep), as detailed within the **Freshwater macroinvertebrates survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9), therefore avoiding in-stream works is likely to be achievable. Where in-stream works are unavoidable, consultation with the appropriate conservation bodies should be ensured to minimise any impacts. Measures to mitigate for changes in water flow due to cuttings or embankments are detailed within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex E) as well as in **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13).

8.10.66 During the freshwater macroinvertebrate surveys (as detailed within the **Freshwater macroinvertebrates survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.9)), New Zealand pigmyweed (Schedule 9[33] species) was recorded in Pond 13.3. Furthermore, a number of other Schedule 9 species were identified during the 2017 Phase 1 habitat survey (as detailed within the **2017**

[33] Invasive non-native plant listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)

Phase 1 habitat update survey report (Volume 6 Document Ref 6.4 ES Appendix 8.3)). These include Japanese knotweed, montbretia, Japanese rose, rhododendron, cotoneaster, three-cornered garlic and variegated archangel, locations of which are presented in Figure 3 and Table 3.3 in the **2017 Phase 1 habitat update survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.3).

8.10.67 Under the Environmental Protection Act 1990, Schedule 9 species are considered controlled waste and therefore have to be disposed of safely at a licensed landfill if they need to be removed during construction. Further details of this are provided in the within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex D).

8.10.68 Due to the isolated heathland area to be directly affected by the scheme being a HPI and that the terrestrial invertebrate population within the heathland is of national value (as detailed below in para 8.11.38) this heathland will be translocated to a receptor site within the scheme, most likely to be adjacent to the eastern edge of Newlyn Downs SAC, which will then form the heathland connection from the isolated heathland to the SAC, as detailed within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3). Such translocation will mitigate the effects associated with the loss of the HPI and habitat supporting the invertebrate population, as well as reducing the species mortality associated with habitat clearance.

8.10.69 Heathland requires relatively nutrient poor soil to grow [89]. Soil sampling at the receptor site suggests that the current nutrient levels may be above that suitable for heathland growth, with recommended levels for healthy heathland soils of 4.1 milligrams per litre of phosphorous, 23.2 milligrams per litre of magnesium and 23.9 milligrams per litre of potassium [89]. The translocation site was recorded to have between 5 to 7 milligrams per litre of phosphorous, between 39 to 60 milligrams per litre of magnesium and 64 to 87 milligrams per litre of potassium; all of which are over the recommended levels although not grossly so (see **Arup GIR Addendum** (Volume 6 Document Ref 6.4 Appendix 9.3)). However, the sample taken within the heathland area to be lost to scheme and translocated have higher levels of magnesium and potassium than the receptor site being 70 to 73 milligrams per litre of magnesium and 88 to 110 milligrams per litre of potassium; with slightly reduced phosphorous of 4 milligrams per litre. Therefore, the heathland translocation receptor site should not require pre-translocation treatment to ensure successful heathland translocation and growth.

Bats

8.10.70 The bat roosts identified within the footprint, Building 35 within NFH, will be removed under mitigation licence obtained from Natural England. Suitable alternative roosting habitat will be provided close to the existing foraging and commuting route. The exclusion of the roost will take place at an appropriate time of year when the bats are least vulnerable. The nature and location of the replacement roost, timing of the exclusion (where appropriate) and timing of the building demolition will all be in accordance with the licence method statement which will be developed in consultation with Natural England. Draft Protected Species Licences will be reported and submitted separately from the DCO application, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.10.71 Following pre-construction surveys, any confirmed tree roosts required to be felled to accommodate the scheme will need a mitigation licence. Those where the potential for roosting bats cannot be ruled out after survey will be soft felled, see the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex E) for further details.

8.10.72 Any building or tree roosts within 50 metres, depending on type of roost, environmental factors and type of construction activity within the area, may also require a disturbance mitigation licence from Natural England and associated method statements drawn up to minimise potential disturbance impacts, such as noise and lighting on these roosts during construction as detailed within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.10.73 Key commuting routes for bats, as identified within Section 8.10 Design, mitigation, and enhancement measures under Engineering design, will be retained for as long as possible in the works programme. Dead hedges will be used to allow bats to continue using commuting routes, see the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex E) for further details.

8.10.74 Temporary construction lighting required within bat activity periods, will be directional lighting and designed to ensure no light spill over 0.5 Lux on to any identified commuting and foraging areas, as well as roosting habitats. This is detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1) and secured through the DCO.

Otter and badger

8.10.75 A pre-construction survey for otter and badger will be carried out as detailed within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex E) to ensure there are no otter breeding or resting places, or badger setts not previously identified within at least 50 metres of the construction footprint. Badger setts that lie within the construction footprint, or within 30 metres of the construction footprint may need to be temporarily or permanently closed under a Natural England licence. Draft Protected Species Licences will be submitted separately from the DCO application as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.10.76 To determine which badger setts may be lost due to the scheme, a worst case scenario approach has been used. It has been assumed that all badger setts within 30 metres of the fenceline, or within the fenceline itself may be subject to direct intersection by the scheme, or to disturbance during construction and/or operation resulting in the need to close the sett under licence. This is likely to be an over-estimation, but this will be refined on a sett-by-sett basis during the draft licence stage and in discussion with Natural England.

8.10.77 Two main setts, four outlier setts, one annexe sett, one subsidiary sett, and one unknown mammal hole are located within the proposed fenceline of the scheme; assumed at the time of writing to be the construction footprint, and as such could be permanently lost. A further two main setts, four outlier setts, and two disused outlier setts are located within 30 metres of the fenceline, and could be significantly disturbed, therefore requiring temporary exclusion.

8.10.78 Loss of main setts will be mitigated by the creation of artificial setts in suitable locations under licence alongside appropriate closure of the setts as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref

6.4 ES Appendix 16.1). Potential construction disturbances to setts will also be mitigated under licence ensuring no significant disturbances that could result in abandonment of territory or of young.

8.10.79 Night time works could disturb foraging or commuting otters and badgers within approximately 50m of the scheme. Details on work timings to reduce disturbance to otters and badgers will depend on the pre-construction results and mitigation licence requirements; any restrictions will be within the final detailed CEMP.

8.10.80 Any open excavations during construction should be covered at night to reduce the risk of trapping or injuring otters and badgers, and a buffer zone should be maintained around watercourses at night to avoid unnecessary adverse impacts to otter as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

Birds

8.10.81 Vegetation clearance undertaken during the bird breeding season (March to September) [90]) will require sensitive working methods to ensure no active nests are damaged or destroyed in accordance with the WCA 1981 (as amended). An Ecological Clerk of Works (EcoW) will be appointed to carry out a nesting bird check on any vegetation to be cleared, or vegetation directly adjacent to major works, no more than 24 hours prior to works commencing. If an active nest is identified, a suitable buffer shall be implemented around the nest with no works occurring within this buffer until the young are fully fledged, see the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex E) for further details.

8.10.82 A pre-construction survey of barn owl OBSs, PNSs, ARSs, and TRSs up to 50m from the scheme should be undertaken by an ecologist with a barn owl disturbance licence. This will be to determine those that are in use and therefore requiring specific mitigation measures. These measures will be fully detailed within the final CEMP.

Reptiles

8.10.83 Reptiles were confirmed to be present in four out of the ten areas surveyed. Despite being likely absent in the remaining six areas, the survey concluded that common species are likely to be present in small numbers within suitable habitat throughout the study area, and should therefore be considered during construction. Following Natural England's advice, habitat manipulation and creation strategies will be prioritised over exclusion fencing and translocation strategies, as provided in the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.10.84 Within grassland and heathland areas suitable for reptiles, the height of the sward will be reduced in stages within the construction area to encourage animals to move out of the footprint of the scheme (habitat manipulation). The use of this method may vary depending on the time of year and ambient temperatures. Reptile enhancement features such as stone and/or log pile hibernacula will be provided in the habitat adjacent to that being removed. Only if required one-way exclusion fencing will be used to prohibit reptiles returning to the construction area. This approach is detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1)

8.10.85 Reptiles encountered will be carefully moved out of the construction areas to suitable receptor areas outside of the construction footprint.

8.10.86 Reptile habitat to be retained will be appropriately marked and fenced if required. These strategies will be detailed within the final CEMP for each area where reptiles were confirmed to be present.

Other Section 41 Species of Principal Importance (SPI)

8.10.87 Habitat clearance and habitat manipulation techniques will be designed to be sensitive to other SPIs and to deter species away from construction areas. Suitable alternative habitat will be identified and provided for any SPIs found during construction. SPIs will be moved to these areas by an ECoW. Habitat clearance and manipulation techniques, as well as the role of the ECoW will be detailed within the final CEMP and Method Statements, as detailed within Table 16-2 of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

Enhancement

8.10.88 Engineering design, operation mitigation, and construction mitigation have all been developed to avoid, eliminate, or reduce the magnitude of the potential impacts described in 8.7 Potential Impacts above. The enhancement described below aims to enhance biodiversity above and beyond its current condition along the existing A30; thus providing biodiversity net gain in habitats of higher biodiversity value..

8.10.89 Enhancement within the scheme includes the provision of habitats over and above that which is being lost, which will be delivered through the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3). Specifically, 4.89 hectares of heathland, 20.54 hectares of woodland, and 48.40 hectares of species-rich grassland and pollination habitats which are being created; all of which are over 3:1 in ratio (gained to lost, as detailed in Table 8-15 above), with heathland being the highest at 13:1 but all being over and above that required by Natural England as detailed within the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5).

8.10.90 In particular, the 5.07 hectares of pollinating strips and 0.34 hectares of native bulb planting proposed within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) throughout the scheme will provide a significant enhancement for pollinator species, as compared to the existing A30 (see Table 8-15 above). Pollinating strips are provided within areas of species rich grasslands, or adjacent to woodland edges, dense vegetation, or water [91], to further support a variety of pollinators and promote habitat connectivity as shown within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3). These pollinating strips will consist of a wildflower mix, comprising a wide range of flowering plant species that have a long continuous flowering period [92].

8.10.91 A number of pollinator SPIs were identified during the desk study, including, but not exclusively, records of wall butterfly, cinnabar moth, and oil beetle (*Meloe proscarabaeus*), and during the invertebrate survey, including scarce light plume, rosy rustic (*Hydraecia micacea*) and broom moth (*Ceramica pisi*).

8.10.92 Pollinators have varying foraging distances. For example, a bumblebee may travel 400-900 metres to forage, whilst moths generally forage within 250 metres

[92]. Areas of species rich grassland are continuous throughout the scheme and pollinating strips are located every 120 to 500 metres throughout the scheme.

8.10.93 Some of this pollinator habitat will be located within roundabouts of the scheme due to ease of access for management. This means that pollinators may be at a risk of mortality due to traffic collisions; however, research has indicated that this risk is outweighed by the benefits gained from these habitats [91].

8.10.94 This enhancement will contribute to commitments made by Highways England in their 2015 Biodiversity Plan [88] to achieve an estimated 3,500 hectares of restored and enhanced species rich grassland by 2020 [88], in line with Defra's National Pollinator Strategy [93]. The scheme will therefore provide approximately 1.83% of the hectares required to achieve this commitment.

8.11 Assessment of effects

8.11.1 The assessment presented in this chapter takes into account the potential impacts to each ecological receptor and the design and mitigation measures to determine the significance of the effects.

8.11.2 Within this section, the receptors within the study area are valued in accordance to DMRB IAN 130/10 [16] which assigns a geographical value, in line with CIEEM (2016) guidance [15]. This value can then be used to determine the significance of the potential impacts of the scheme with design and mitigation, considered as well as wider opportunities for enhancement.

8.11.3 The effects have been separated into construction and operation effects.

Construction Effects

Designated Sites

Statutory Designations

8.11.4 Newlyn Downs SAC is the only internationally important site within the study area, and is located approximately 143 metres to the north of the scheme. This heathland designated site is of international value.

8.11.5 There are four nationally designated SSSIs within the study area. These are the Newlyn Downs SSSI (143 metres from the scheme), Carrick Heaths SSSI (316 metres from scheme), Carnkief Pond SSSI (1.8 kilometres from scheme) and Ventongimps SSSI (1.6 kilometres from scheme). All are considered to be of national value.

8.11.6 Potential effects from construction activities, such as from dust deposition, pollution events or sediment run-off, to designated sites which are within relatively close proximity and/or are hydrologically connected to the construction footprint will be mitigated through standard best-practice techniques and methods, in line with requirements laid out in the NN NPS [1]. These methods are detailed within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H).

8.11.7 There is one surface water receptor in proximity to the scheme that flows northwards through Newlyn Downs SAC. The watercourse is located at approximate Ch12+900, 220 metres north of scheme alignment and running along the eastern boundary of the European Site for approximately 350m (see ES

Figure 13.1 of Volume 6 Document Ref 6.3). This is the only identified surface water connection between the scheme and a European Site.

8.11.8 The **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H) includes best practice measures for the storage of hazardous substances, the siting of higher risk activities (e.g. vehicle washdown areas) and the maintenance of plant. Following the implementation of these practices, the magnitude of any accidental spillage or temporary physical modification as a consequence of the scheme is likely to be negligible. Therefore, the significance of effect would be neutral.

8.11.9 The relevant mitigation is set out in the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex G and Annex H), which is secured by the DCO.

8.11.10 The cutting at approximately 270 meters to the south of the SAC (Ch11+200 to Ch11+700) has been identified as having the potential to lower ground water levels below those within the SAC[34].

8.11.11 The proposed cutting at this location would reduce the ground level to 112.97 – 119.3 metres above ordnance datum (mOD) (west to east), where the ground water level is located at 117.5 mOD (Ch11+400) and 120.5 mOD (Ch11+500). This could potentially result in drawdown (i.e. lowering of groundwater levels) of between 0.9 and 2.3 meters, as described in **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13).

8.11.12 The formations underlying the scheme and the European Site are separated by a fault zone, highly deformed and fractured complex system, which is known to have a significant impact on the hydrogeological regime. The groundwater flow is likely to be confined to the weathered metamorphic sandstone strata or through fractured layers escaping by flow along the fault zone, located between the scheme and the SAC, or rockhead (e.g. as a spring), or both. The presence of the watershed limits interaction between the scheme and the SAC. Therefore, the potential for hydraulic connectivity between the two formations is considered to be very low. For full details see **Road drainage and the water environment** (Volume 6 Document Ref 6.2 Chapter 13) and the **Statement to Inform an Appropriate Assessment Report** (Volume 6, Document Ref 6.5).

8.11.13 As such, the activities associated with the construction of the scheme would not affect the SAC area and are considered to be of neutral significance.

8.11.14 The potential effects from Nitrogen oxide (NOx) emissions and nitrogen deposition during the construction phase are likely to be negligible as emissions from heavy goods vehicles and site equipment would be minimal and temporary. The effect on nitrogen deposition during the operational phase is discussed below, and are further detailed in **Air Quality** (Volume 6, Document Ref 6.2 Chapter 5), and the **Statement to Inform an Appropriate Assessment Report** (Volume 6, Document Ref 6.5).

8.11.15 On this basis, it is predicted that no significant effects will occur during construction on statutory designated sites. The overall effect is therefore of neutral significance.

[34] All other cuttings that require dewatering will not lower water levels below those within the SAC and therefore will not affect groundwater levels within the SAC.

Non-Statutory Designations

8.11.16 There are 15 non-statutory CWS and four CRVI sites within the study area. CWS and CRVI sites are designated for their presence of habitats or species of local or regional importance by local authorities, as such these sites are considered to be of county value.

8.11.17 None of the CWS are being directly affected by the scheme and with construction mitigation any effects are considered to be of neutral significance.

8.11.18 All four of the CRVIs would potentially be permanently and directly impacted as they fall, in part, within the construction footprint. However, CRVI BS315 and CRVI BS22 were surveyed within the grassland NVC survey (Site 18 and 20, respectively) and were described as 'botanically unremarkable and narrow' and as 'mown perennial ryegrass dominated amenity grassland'. CRVI BS214 was also surveyed for grassland NVC (Site 7) and this was classified as qualifying as HPI Lowland Grassland habitat.

8.11.19 The 58.72 hectares of species-rich grassland, 5.07 hectares of pollination strips, 0.34 hectares of native bulbs and 5.30 hectares of heathland (see Table 8-15) which will be provided through the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) along the entire route and designed to connect into existing habitats and wildlife corridors will mitigate any loss of poor quality CRVIs and provide a net gain to higher biodiversity value habitats within the local area when they are installed. However, during construction before all landscape planting has been realised the effect is considered to be of slight adverse significance. This effect is likely to reduce to neutral significance as planting is started throughout the scheme, and once established could be of slight beneficial significance.

Habitats

8.11.20 The predominant habitats within the study area are improved grassland and arable fields which are of low ecological value and considered to be less than local value. Of the other grasslands recorded and further evaluated through NVC surveying, only one area of grassland (Site 7) was considered to be of HPI character. This site which is located alongside the existing A30 near Penglaze (south of Newlyn Downs) is also a designated CRVI (BS214). This grassland alone is considered to be county value, and is not directly affected by the scheme and has been discussed above. All other species-rich grasslands, including marshy grassland, are considered to be of local value.

8.11.21 A series of fragmented semi-natural and plantation woodlands are located within the study area, and are mostly considered to be of local value as they enrich the habitat resource within the local context. One woodland, which will be permanently and completely lost during construction, and three woodlands, which will be permanently but partly affected during construction are mapped as a HPI under deciduous woodland. These woodlands are valued at county value due to being mapped as HPI but not being of a particular high quality or interesting NVC community.

8.11.22 Two heathland areas are present within the 100 metres Phase 1 Habitat Survey study area, one being Newlyn Downs SAC which is of international value as detailed above, and one small isolated area south of Newlyn Downs and the existing A30. The isolated area is not considered to be contiguous with Newlyn

Downs (as detailed within the Natural England **Statements of Common Ground** (Volume 7 Document Ref 7.5)), it is however mapped as a HPI lowland heathland and is likely to be a remnant area of habitat which once would have linked to Newlyn Downs. As such this small isolated heathland area is considered of county value.

8.11.23 All other habitats within the study area, such as tall ruderal, scrub and hardstanding, would be considered less than local value.

8.11.24 Hedgerows are considered separately below under Hedgerows, and watercourses and ponds in River Habitats.

8.11.25 Areas of habitat loss have been calculated using a combination of the mapping within the **2017 Phase 1 habitat update survey** (Volume 6 Document Ref 6.4 Appendix 8.3) and the **Arboricultural impact assessment** (Volume 6 Document Ref 6.4 Appendix 7.6) (used for woodlands and trees). Improved grassland has the highest area of habitat loss of approximately 77.01 hectares, followed by arable with a loss of approximately 55.18 hectares and hard standing (predominantly roads and buildings as defined on Figure 1 of the **2015 Phase 1 habitat verification survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.2)) with a loss of approximately 38 hectares.

8.11.26 The loss of poor semi-improved grassland is estimated at approximately 13.3 hectares, and all other habitat losses were 10 hectares or less.

8.11.27 Habitat losses within areas of potential interest and of higher value ecologically are approximately 7.7 hectares of broad-leaved, coniferous, and mixed woodland, 2.43 hectares of semi-improved grassland, 1.49 hectares of marshy grassland, and 0.41 hectares of acid dry dwarf shrub heath (from the small isolated heathland area).

8.11.28 Other habitats being lost included amenity grassland, scrub and tall ruderal, as identified within Table 8-15.

8.11.29 As mentioned above in Section 8.10 Design, mitigation and enhacement measures, the habitats being created and enhanced exceeds those being lost, as described in Table 8-15 above, with habitats of potential interest being enhanced and created to at least a ratio of 3:1, with heathland being the highest at a ratio of 13:1 (gain to loss), in line with requirements laid out in the NN NPS [1].

8.11.30 Some of these created habitats will become available before the end of the construction period, but mostly will be incomplete or in very early stages. As such, the construction effects on the loss of these higher quality habitats would be considered to be of moderate adverse significance, reducing to neutral as planting throughout the scheme starts to establish.

8.11.31 Heathland will be translocated to a receptor site within the scheme, most likely to be adjacent to the eastern edge of Newlyn Downs SAC, which will then form the heathland connection from the isolated heathland to the SAC. This will help to mitigate the effects associated with the loss of HPI heathland and is likely to reduce the significance of effect for heathland to neutral if successful.

8.11.32 Other impacts on habitats such as root damage to retained trees and hedgerows, pollution events, dust and sediment run-off will all be mitigated through techniques and methods detailed within the **Outline CEMP** (Volume 6 Document

Ref 6.4 ES Appendix 16.1 Annex H and Annex I). As such, these effects are considered to be of neutral significance due to available mitigation methods.

Hedgerows

8.11.33 The field boundaries in the study area west of Tresawsen are dominated by Cornish hedges, mostly being un-vegetated topped with grass, bracken and scrub. East of Tresawsen the field boundaries are dominated by hedgerows with several being Important Hedgerows under the Hedgerow Regulations.

8.11.34 Important Hedgerows, priority Hedgerows and Cornish Hedges within the study area are considered to be of county value; all others of local value.

8.11.35 The approximate length of hedgerow loss was calculated using the hedgerow mapping within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3), which identifies hedgerows to be removed and hedgerows to be retained.

8.11.36 Approximately 4,488 metres of Cornish Hedgerow and 7,090 metres of other native soft hedgerows will be lost during construction, as shown within Table 8-15. Although some of the 12,605 metres of new Cornish hedgerow and 8458 metres of native species-rich hedgerow will become available before the end of construction, as identified within Table 8-15, much will be in early stage of growth and as such the effect of hedgerow loss during construction is considered to be of a moderate adverse significance; reducing to neutral as planting throughout the scheme starts to establish.

8.11.37 Potential impacts on hedgerows being retained such as damage through root damage, pollution events, dust, and sediment run-off will all be mitigated through techniques and methods detailed within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H and Annex I) , in line with requirements laid out in the NN NPS [1]. As such, these effects are considered to be of neutral significance.

Terrestrial Invertebrates

8.11.38 Based on the invertebrate assemblages identified, their conservation value, and the habitats they were found within, it is concluded that the invertebrate populations supported by the combined heathland sites 3, 4, and 5 are of national value, sites 1, 6, and 9 are of county value, and sites 10, 21/22, and 28/29 are of regional value. All others are considered of local or less than local value.

8.11.39 Potential impacts on terrestrial invertebrates as a consequence of the scheme include; habitat loss, habitat severance, and direct mortality (during vegetation clearance).

8.11.40 The construction of the scheme (based on the fence line) will result in the loss of 1.1 hectares of the combined heathland sites 3, 4, and 5 (amounting to 30% of the area surveyed), 0.3 hectares of site 1 (14% of area surveyed), 1.7 hectares of site 9 (65% of area surveyed), 0.1 hectares of site 10 (1% of area surveyed), and 1.3 hectares of sites 28/29 (100% lost).

8.11.41 To mitigate for the loss of these habitats, 5.3 hectares of heathland is proposed within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3), which will replace that lost within sites 3, 4, and 5, by a ratio of 1:12 (loss

to gain), as identified within Table 8-15, and in line with requirements laid out in the NN NPS [1].

8.11.42 Furthermore, the heathland will be translocated to a receptor site within the scheme, most likely to be adjacent to the eastern edge of Newlyn Downs SAC, which will then form the heathland connection from the isolated heathland to the SAC. This will mitigate the effects associated with the loss of HPI habitat supporting the invertebrate population, as well as reducing the direct mortality to non-mobile invertebrate stages associated with vegetation clearance.

8.11.43 39.32 hectares of woodland and woodland edge (scrub) habitat are proposed, which will replace that lost within sites 1 and 9 by a ratio of 1.8:1. 64.13 hectares of species-rich grassland are proposed which will replace that lost within sites 10 and 28/29 by a ratio of 4.1:1, as identified within Table 8-15. The planting proposed within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) will provide greater connectivity between habitats, thus mitigating for the impact of habitat severance.

8.11.44 Although, the majority of these habitats, with the exception of translocated heathland, will not become fully available until post-construction, the amount of loss is considered minimal in the context of available and supporting habitats within the wider area. It is considered that the effect of habitat loss to invertebrate populations during construction is to be of a slight adverse significance (at most); increasing to slight to moderate beneficial as planting throughout the scheme starts to establish.

Water Habitats, including fish and freshwater macroinvertebrates

8.11.45 Based on the relative diversity and conservation value of the freshwater macroinvertebrate populations within the study area, it is concluded that all watercourses and still waters, and the freshwater macroinvertebrate populations they support, are of local value with the exception of sites 12.2 and 13.1 which are of less than local value. The fish populations supported by these watercourses were found to be relatively limited, and it is therefore concluded that these populations are of less than local value, with the exception of sites 12.1 and 12.3 which are of local value.

8.11.46 The watercourses that will be crossed by the scheme may be subject to temporary habitat loss, alterations in water flow or species mortality during construction. The majority of the scheme runs between the headwaters of catchments on either side of the road, the temporary loss of riparian habitat during construction is considered minimal, although instream work will be required in a number of watercourses (see **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13)), including those with fish populations present. Where instream work is required, fish relocation should take place in watercourses where fish where recorded in order to move fish from impacted reaches to suitable habitat elsewhere. This would only be done under licence from the Environment Agency. Measures to mitigate for changes in water flow due to cuttings or embankments are laid out in **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13).

8.11.47 The fish populations identified are thought to be fragile communities that would be extremely sensitive to changes in water quality conditions, including those due to pollution run-off or sedimentation, as described within the **Fish survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.10). Measures to mitigate for

changes in water quality are laid out in **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13). These mitigation measures will be implemented at all watercourses, and not just those were fish species were found to be present, due to the possibility of colonisation into these watercourses in the future.

8.11.48 As such, considering mitigation methods provided and reducing species mortality through movement of fish as above, the construction effects on water habitats including fish and macroinvertebrates are considered to be of neutral significance.

Reptiles

8.11.49 Relatively high numbers of breeding common lizard and breeding slow worm were present in the isolated heathland area surrounding the Quarry pond near Carland Cross, and relatively high numbers of breeding common lizard were also recorded in suitable habitat south of the existing A30 near Tresawsen. Small populations of grass snake and adder were also recorded within the study area.

8.11.50 Likely reptile absence was however recorded in five of the ten survey areas, suggesting that the reptile populations within the study are relatively moderate and potential isolated in some areas. The common species recorded within the study area are common and widespread throughout Cornwall and as such, the populations of reptiles within the study area are considered to be of local value.

8.11.51 Vegetation clearance, ground works and site traffic in suitable reptile habitat have the potential to impact reptiles directly, through removal of habitat or accidental killing of individuals. The killing or injuring of individual reptiles could also represent an offence under the WCA 1981 (as amended) and mitigation is therefore proposed.

8.11.52 Displacement, exclusion and translocation strategies have been detailed above and within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex E). No population will be completely isolated within the final design, although some populations may have to be displaced into surrounding suitable habitats during construction; this will be achieved through habitat manipulation techniques as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1). Reptile habitat to be retained will also be appropriately marked and fenced if required.

8.11.53 Although many of the habitats being created within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) will be suitable for reptiles, most will not be completely available until later stages of construction. Nevertheless, considering the populations recorded and the loss of habitats predicted during construction, is not considered that an overall significant effect at a population level will occur, considering the extent and condition of the remaining connected habitats within the study area.

8.11.54 As such, considering mitigation methods provided, the construction effects on reptiles are considered to be of neutral significance.

Birds

Breeding Birds

8.11.55 Based on the individual species, numbers of breeding pairs recorded on transects and breeding bird assemblage present, the study area is assessed to be of local

value (at most) for breeding bird populations, typical of such areas of farmland in Cornwall.

8.11.56 During the construction phase, breeding birds are likely to be affected by disturbance/displacement associated with construction activities and habitat loss, primarily of arable land and hedgerows. Nest destruction could also occur in the absence of mitigation measures.

8.11.57 The final CEMP will include details on working times. Pollution control measures and timing of vegetation clearance to avoid impacts on nesting birds are detailed within Table 16-2, Annex E, and Annex H of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1) , in line with requirements laid out in the NN NPS [1].

8.11.58 With these measures in place, and considering abundance of similar habitats locally, it is predicted that no significant impacts will occur on the populations of breeding birds within the study area and legal compliance with regard to avoiding destruction of active nests can be achieved. As such, effects are assessed to be of neutral significance on breeding birds.

8.11.59 Embedded design mitigation will provide habitats that will be of use to breeding birds as described above which are likely to become available towards the end of the construction as reinstatement works progress. The provision of these will not change the overall significance of effect on breeding birds which remains as neutral.

Wintering birds

8.11.60 Based on the individual species, flock numbers and wintering bird assemblage present, the study area is assessed to be of local value for wintering bird populations, typical of such areas of farmland in Cornwall.

8.11.61 During the construction phase, wintering birds are likely to be affected by disturbance/displacement associated with construction activities and habitat loss, primarily of arable land and hedgerows.

8.11.62 As no particularly large or significant aggregations of birds were recorded, and considering the partial habituation to disturbance in the area from existing highways along with the abundance of similar habitats available for foraging, no significant impacts on this feature of local value are predicted and effects are therefore assessed as of neutral significance on wintering birds.

8.11.63 As with breeding birds, embedded design mitigation will provide habitats that will be of use to wintering birds as described above which are likely to become available towards the end of the construction as reinstatement works progress. The provision of these will not change the overall significance of effect on wintering birds, which remains as neutral.

Barn Owl

8.11.64 Baseline survey works confirmed barn owl activity along the length of the scheme and whilst only one OBS was recorded, a number of ARS were recorded throughout the survey area. Based on these results, it is concluded that the barn owl population in the study area is of local value.

8.11.65 Potential impacts on barn owls as a consequence of the scheme include; habitat loss (including nesting sites), disturbance, habitat severance, and direct mortality (vehicle collisions).

8.11.66 The construction of the scheme is likely to result in the loss of around 12 hectares of Type 1 habitat and 74 hectares of Type 2 habitats and based on an over-estimated calculation using the scheme fence line to determine loss.

8.11.67 Habitat suitable for use by foraging barn owls has been created as part of the scheme and as detailed within Section 8.10 Design, mitigation, and enhancement measures above. These include 64.13 hectares of species-rich grassland and 5.30 hectares of heathland habitats, as well as 11.59 hectares of disturbed land returned to arable pasture, and 23.15 hectares of undisturbed land returned to previous use (some of which will be suitable barn owl foraging habitat) as detailed within the EMP (ES Figure 7.6 of Volume 6, Document Ref 6.3) and within Table 8-15 above. The habitat creation within the Environmental Masterplan will ensure that there is no net loss of semi-natural habitats that are of value to barn owls.

8.11.68 None of the identified roost features (OBS, TRS, ARS, PNS) will be lost. The new scheme will still be located around 850 metres from the OBS. The realignment of the highway will move closer to some ARS/TRS/PNS but further away from others, with the nearest being an ARS approximately 60 metres from the scheme.

8.11.69 A temporary increase in general disturbance would occur as a result of construction, which could adversely affect any breeding barn owls or their dependent young. In advance of construction, repeat surveys of active and potential nest sites would be re-surveyed by an ecologist with a barn owl disturbance licence in order to determine those that are in use and therefore if specific mitigation measures are required. This would be undertaken during May and August in the year prior to the commencement of any construction activities, including clearance works detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.11.70 If present, such specific mitigation measures may include avoiding works in areas, use of temporary screening and control of noise/light spill which will be detailed within the final CEMP.

8.11.71 Habitat severance is not considered to be a significant issue for the scheme, given the presence of the existing A30 in the landscape and the fact that the scheme is not predicted to sever significant areas of Type 1 habitat.

8.11.72 Direct mortality due to collision with moving traffic during both the construction and the operational phase is possible and could have a permanent impact on the conservation status of this species as it is considered particularly vulnerable due to its foraging method. It should be noted that the population of barn owls in the local areas is likely to habituated to the presence of the existing A30, but direct mortality remains a valid consideration for this species.

8.11.73 During construction, site speed limits will be in place and work timings specified in the final CEMP, which will to reduce risks of collisions. To help further prevent direct mortality of barn owls during construction, construction timing and habitat manipulation techniques will be used to reduce this risk and deter barn owls from flying or foraging near the construction area.

8.11.74 The Environmental Masterplan also includes planting of woodlands, trees and hedgerows along the road verge in order to deter barn owls from foraging near to the road.

8.11.75 With the inclusion of these measures, it is predicted no significant impacts will occur on the barn owl population and as such an effect of neutral significance is predicted.

Nightjar

8.11.76 Given the scarcity of nightjar as a breeding species in the UK (around 4,600 pairs [94]), and its rarity in Cornwall (present in only 12 tetrads [95] and a Cornwall BAP species), the breeding single pair located on Newlyn Downs SAC/SSSI is considered to be of county value.

8.11.77 Newlyn Downs SAC/SSSI will not be directly affected by the scheme and baseline surveys indicated that the closest nightjar activity to the proposed work areas was approximately 440 metres away from proposed work areas. Studies [96] [97] indicate that disturbance distances associated with construction work for this species when breeding range between 150 metres and 200 metres.

8.11.78 As described under the habitats section above, no degradation of breeding habitat is predicted and embedded construction phase mitigation, including control of pollution events, dust and sediment run-off will all be controlled through techniques and methods detailed in the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H).

8.11.79 With the provision of these measures, no significant impact on this species is predicted; as such, effects are assessed to be of neutral significance on nightjar.

Otter

8.11.80 The South West is one of only two ‘regions’ in England that are believed to have reached carrying capacity for otters and otters now use all types of watercourses and wetland in the region [55].

8.11.81 Nevertheless, no resting or breeding places were found during the survey, with only limited activity recorded. Based on these survey results in context with the ‘healthy’ otter population in Cornwall, it is concluded that the otter population in the study area is of no more than local value.

8.11.82 A pre-construction survey will also be carried out to determine the level of activity at potential breeding and resting sites as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1); the assessment however is based on current baseline.

8.11.83 There are five watercourses that cross the scheme or are within the construction footprint. However, as the majority of the scheme runs between the headwaters of catchments on either side of the road (see **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13)), the temporary loss of riparian habitat during construction is considered minimal and no areas identified as suitable for breeding were identified within these areas. The only site identified in the **Otter survey report** (Volume 6 Document Ref 6.4 ES Appendix 8.16) requiring further observations was a pond within a substantial area of woodland west of Creegmeor Farm which was assessed as having a moderate

potential to be used as a breeding site. However, this is at least 300 metres north of the scheme fence line.

8.11.84 The habitat associated with the recorded otter signs at Nanteague Farm and north of Tresawsen will not be directly affected during construction.

8.11.85 Nevertheless, severance during site clearance and construction can lead to the isolation of otter populations, which in worst-case scenarios could result in breeding and local extinctions, a reduction in territory or foraging habitat size, and/or a complete isolation from vital resources such as foraging habitat. The severance of the current landscape by the existing A30 suggests that otters may be habituated to this impact. However, the number of RTC records on the existing A30 between Carland and Chiverton Cross indicates that otters still readily move within this landscape north and south of the road (Figure 1 of the **Road traffic collision summary report** (Volume 6 Document Ref 6.4 ES Appendix 8.1)).

8.11.86 The negative effects of habitat severance and isolation will be mitigated by careful construction programming, the maintenance of safe crossing places for otters, and the installation of temporary and/or permanent fencing to funnel otters towards these crossings which will be detailed within the final CEMP.

8.11.87 There is the potential for riparian habitat to be damaged due to pollution run-off, dust, or sedimentation during operation of vehicles or during the transportation of potentially polluting materials or substances. This pollution could negatively impact prey species, such as pollution intolerant salmonid fish, thus indirectly affecting otters by reducing foraging opportunities. This will be mitigated by the implementation of best practice construction techniques for pollution prevention and control, as detailed within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H).

8.11.88 Construction activities can cause temporary disturbance to otter, which are known to be highly susceptible to human disturbance, which subsequently can lead to effects such as abandonment of territory or of young. As mentioned above potential resting and breeding areas will not be directly affected and are at reasonable distances as not to cause significant disturbance. Nonetheless, mitigation measures such as avoiding works in certain areas at certain times, and control of noise or light spill may be implemented and will be detailed within the final CEMP.

8.11.89 Otters may potentially become injured or trapped in excavations during construction. Any open excavations will therefore be covered at night or means of escape provided, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.11.90 Direct species injury or mortality may occur during construction of the scheme, due to vehicle collisions or inadvertent damage to a holt (if present). Speed limits and work timings, which will be outlined in the final CEMP, will be implemented to reduce the risk of collisions with construction vehicles.

8.11.91 With the inclusion of these mitigation measures, it is predicted that no significant impacts will occur on the otter population during construction. Therefore, an effect of neutral significance is predicted.

Badger

8.11.92 Survey works confirmed high to moderate levels of badger activity throughout the scheme, with a total of nine main setts, three annexes, four subsidiaries and 26 outliers. Desk study data including road causalities also indicated presence along the length of the existing A30 (Figure 1 of the **Badger survey report CONFIDENTIAL** (Volume 6 Document Ref 6.4 ES Appendix 8.17) and Figure 1 of the **Road traffic collision summary report** (Volume 6 Document Ref 6.4 ES Appendix 8.1)). Nevertheless, badgers are likely to be numerous in this part of Cornwall with abundant habitat for both setts and foraging and reasonable habitat connectivity in the form of hedgerows (including Cornish hedges). As such, the badger population in the study area is considered to be of local value.

8.11.93 A pre-construction survey will also be carried out to determine the presence of setts within at least 50 metres of the construction footprint, not previously identified during the badger survey or any change to existing setts, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.11.94 Potential impacts on badgers as a consequence of construction of the scheme include permanent or temporary habitat loss or damage (including setts and foraging habitat), habitat severance, habitat damage due to pollution and sediment run-off, temporary disturbance (including from noise and vibration), and direct injury, trapping or mortality.

8.11.95 As described above within construction mitigation in Section 8.10 Design, mitigation and enhancement measures a total of four main setts, eight outlier setts, two disused outlier setts, one annexe sett, one subsidiary sett, and one unknown mammal hole may require temporary or permanent closure due to the scheme; either through being directly affected or being within at least 30 metres of the scheme.

8.11.96 Construction activities which cause noise and vibration can result in temporary disturbance to badger which subsequently can lead to effects such as abandonment of territory or of young; 30 metres is general taken as distance of disturbance but this does depend on the type of construction activity and the level of vibration and noise caused.

8.11.97 All setts to be lost or predicted to be affected through construction activities will be mitigated under licence by the creation of artificial setts, where appropriate, in suitable locations under licence alongside appropriate closure of the setts. Draft Protected Species Licences will be reported and submitted separately from the DCO application. This approach is detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.11.98 Habitat loss and severance during site clearance and construction could lead to the isolation of badger populations both within and between clans, which in a worst-case scenario could result in local extinctions. Severance may also cause an increase in conflict and competition between clans due to a reduction in territory and foraging habitat size, or completely isolated clans from vital resources such as foraging habitat. Habitat loss and severance will be mitigated by careful construction programming, the maintenance of safe crossing places for badgers where possible, and the installation of temporary and/or permanent fencing to funnel badgers towards these crossings, which will be detailed within the final CEMP. The creation and enhancement of habitats will further mitigate

these losses, although these will only start to become available towards the end of construction.

8.11.99 There is the potential for badger habitat to be damaged due to pollution and sediment run-off during construction, which could indirectly affect badgers by reducing foraging opportunities. This will be mitigated by the implementation of best practice construction techniques for pollution prevention and control as outlined within the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1 Annex H).

8.11.100 Like otters, badgers may potentially become injured or trapped in excavations during construction. Any open excavations will therefore be covered at night or means of escape provided, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1).

8.11.101 Direct species mortality may occur during construction of the scheme, due to vegetation clearance or vehicle collisions. Speed limits and work timings, which will be outlined in the final CEMP, will be implemented to reduce the risk of badger collisions with construction vehicles.

8.11.102 With the inclusion of these mitigation measures, it is predicted that no significant impacts will occur on the badger population during construction. Therefore, an effect of neutral significance is predicted.

Dormice

8.11.103 Due to the lack of dormouse records and the negative result during field surveys carried out, dormice are presumed absent from the study area, and thus any effects on dormice can be considered of neutral significance.

Bats

8.11.104 The barns at Trehane Barton SSSI were designated due to the greater horseshoe bat breeding colony they support, once the largest known in Cornwall. This species is restricted to the southwest of England and Wales, and this roost is therefore of national value, although anecdotal evidence suggests that this is no longer in use, (personnel communication with Sam Smith, Cornwall Bat Group). Nevertheless, the scheme will have no significant impact on this maternity colony during construction as it is six kilometres[35] away to the southeast with no shortage of alternative foraging and commuting habitat nearer the barns themselves, resulting in a neutral significance of effect.

8.11.105 Construction will result in the loss of the multi-species roost at NFH (Building 35), which comprises a night roost for lesser horseshoe, Myotis species (likely natterer's) and brown long-eared as well as a well-used day/transitional roost for common pipistrelle and brown long-eared all of which are considered to be of local value. A replacement multi-species roost will be provided under a mitigation licence from Natural England, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1). Construction will also result in temporary disturbance of the assemblage of bats at the NFH complex through the loss and fragmentation of the commuting and foraging habitat provided by the farm access track and woodland along the existing A30 as

35 Four kilometres has been suggested for greater horseshoe when considering important habitats surrounding and supporting roosts [114] [115] [116] [117] [118]

well as movement of vehicles and machinery. Following construction stage mitigation including the replacement roost and given the abundance of other suitable commuting and foraging habitat to the south of the scheme, the effects on this locally important assemblage are considered to be of slight adverse significance.

8.11.106 The maternity roost of common pipistrelle at Little Tresawsen (Building 16 Ch6+000), the maternity roost of brown long-eared at Tolgroggan Lodge, Zelah (Ch8+500) and the maternity roost of Myotis (likely natterer's) at Trevalso Cottage (Building 51 Ch9+600) lie within 20 metres of the scheme and will therefore be subject to some disturbance effects including noise, vibration, movement of plant and personnel. Following construction mitigation which will be undertaken under a mitigation licence drawn up in consultation with Natural England, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1), the disturbance effects on these local value receptors are considered to be of slight adverse significance.

8.11.107 All other building roosts identified within 20 metres of the scheme (Buildings 9, 42, 53, 56A, 60 and 64), and all tree roosts identified within 20 metres of the scheme (T143, T25, T36 and T27 and T99), are day/transitional roosts used by single or small numbers of individuals and as such have been valued at less than local value. It is expected that given the nature of the rural environment that these bats would be able to find alternative roosting opportunities during times of particularly disturbing construction activities. Following consideration of construction mitigation (which may or may not be undertaken under a mitigation licence, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1)), the temporary construction disturbance effects on these roosts is considered to be of neutral significance.

8.11.108 All maternity roosts between 20 metres and 50 metres of the scheme are of common pipistrelle or brown long eared species (Buildings 11A, 13, 16A, 16B, 16D, 40, 54 and 70) and have been assessed as local value. As these roosts are in close proximity to the scheme, a method statement will be drawn up to minimise potential disturbance impacts such as noise and lighting on these roosts during construction and they may be included in a bat mitigation licence application as appropriate (to be determined in consultation with Natural England), as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1). Construction disturbance effects on these roosts are therefore considered to be of slight adverse significance.

8.11.109 All other roosts between 20 and 50 metres of the scheme (Buildings 1A, 36, 37, 44A, 44G, 57, 57A), are all day/transitional roosts of common pipistrelle or brown long eared bat have been assessed as less than local value. As these roosts are in close proximity to the scheme, a method statement will be drawn up to minimise potential disturbance impacts such as noise and lighting on these roosts during construction and they may be included in a bat mitigation licence application as appropriate, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1). Nevertheless construction disturbance effects on these roosts are considered to be of neutral significance.

8.11.110 Construction will result in the severance and fragmentation of foraging and commuting habitat notably the eight areas identified as hotspots for bats activity:

the two mature hedgerows at Tresawsen, linear features in Marazanvose near NFH, the tree-lined road and underbridge at Two Barrows, the double hedgerow-lined farm track to Tolgroggan Farm, the stream to the east of Zelah, tree-lined Trevalso Lane, the existing side road to Pennycomequick and the hedgerow north of Deer Park.

8.11.111 The assemblages of bats which use these habitats all include Annex II species and are assessed as county value assemblages. Following construction mitigation (timing of works i.e. retention of vegetation along known commuting routes for as long as possible and the use of dead hedges to minimise loss of connectivity, as detailed within Table 16-2 and Annex E of the **Outline CEMP** (Volume 6 Document Ref 6.4 ES Appendix 16.1)), effects will include the requirement for some bats to seek alternative foraging resources, travel greater distances and thus expend more energy duration construction. However, due to nature of the rural landscape either side of the A30, the quality and abundance of suitable foraging and commuting habitat for bats (i.e. hedgerows, treelines, woodlands and water courses), the temporary effects on the county assemblages is considered to be of moderate adverse significance.

Other Section 41 Species of Principal Importance (SPI)

8.11.112 Habitat suitable for SPI (other than those discussed above), especially hedgehog, harvest mouse, brown hare, polecat and common toad, are present within the study area. However, the study area does not provide significant amount of suitable habitat to support populations of these species, greater than that considered to be of local value.

8.11.113 During construction potential impact could occur through permanent and temporary habitat loss, severance and disturbance, as well as individual mortality. However, embedded mitigation and best practise techniques, such as habitat clearance designed and timed to be sensitive to these species alongside using habitat manipulation clearance techniques to deter species away from areas, will remove or minimise these risks. This approach will be detailed within the final CEMP.

8.11.114. Habitat creation, some of which will be realised before the end of construction, will also provide alternative habitats for these species. Provisions will be identified and provided as for where any animals found during construction are moved to by the ECoWs. For example, the mitigation areas specifically for common toad will be provided adjacent to wet areas and ponds to be affected.

8.11.115 With the inclusion of these mitigation measures, it is predicted that no significant impacts will occur on these SPI population during construction. Therefore, an effect of neutral significance is predicted.

Operation Effects

Designated Sites

Statutory Designations

8.11.116 As described above in the construction effects assessment, it is concluded that the Newlyn Downs SAC is of international value, whilst Newlyn Downs SSSI, Carnkief Heath SSSI, Carnkief Pond SSSI and Ventongimps SSSI are considered to be of national value.

8.11.117 Similarly, Breney Common and Goss and Tregoss Moors SAC and The River Camel SAC which are 200m of the ARN are of international value, whilst Mid Cornwall Moors SSSI, and River Camel Valley and Tributaries SSSI are of national value.

8.11.118 Biodiversity 2020 [3] identifies air pollution as a direct threat to biodiversity in England. Many habitats of nature conservation importance in the UK are adapted to low nutrient conditions and/or are vulnerable to acidification and are sensitive to additional airborne Nitrogen oxide (NOx), sulphur dioxide (SO2), and ammonia (NH3), as well as to nitrogen and acid deposition. Pollutants come from a range of different sources, but transport is known to be the single largest source of NOx emissions [98]. There is potential for NOx deposition on surrounding habitats to the scheme, and this is of particular concern for sensitive habitats which are vulnerable, such as protected heathlands.

8.11.119 Carnkief Heath SSSI, Carnkief Pond SSSI, and Ventongimps SSSI are all over the distance for which effects from nitrogen deposition are considered significant, being over 200 metres from the scheme [99],and as such are not considered further within this Chapter. For further details on the air quality assessment of these sites, see **Air Quality** (Volume 6 Document Ref 6.2 ES Chapter 5).

8.11.120 Newlyn Downs SAC and SSSI, Breney Common and Goss and Tregoss Moors SAC, and River Camel SAC are all within 200 metres of the scheme and/or the ARN, and support 'European dry heaths'. Newlyn Downs SAC also supports ' Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix', whilst Breney Common and Goss and Tregoss Moors SAC also supports 'Northern Atlantic wet heaths with *Erica tetralix'* and 'Transitional mires and quaking bogs' [100] [101].

8.11.121 The Mid Cornwall Moors SSSI supports a diverse mosaic of semi-natural habitats, including heaths, fens, grasslands, woodlands, scrub and species-rich hedgerows, with ponds and waterways. River Camel Valley and Tributaries SSSI is particularly important for otters, and is also of great value for fish such as the Atlantic salmon, bullhead, sea trout and sea lamprey.

8.11.122 In accordance with HA207/07 [24], where a Designated Site has been identified as being within 200 meters of an affected road, NOx concentrations should be calculated within the site. NOx concentrations were predicted using modelling software Advanced Dispersion Modelling System (ADMS Roads), as further detailed within **Air Quality** (Volume 6 Document Ref 6.2 ES Chapter 5), and the **Statement to Inform an Appropriate Assessment Report** (Volume 6, Document Ref 6.5).

8.11.123 Current UK air quality regulations and the EU Directive on ambient air quality set objectives and Limit Values covering a range of pollutants. These are presented in Table 1.1 of IAN 174/13 [102]. For NOx, the objective (also referred to as the critical level) is set at 30µg/m^3 as an annual mean. IAN 174/13 states that where predicted NOx concentrations are predicted to be below their objective then significant effects are not anticipated. Where the objective is exceeded, consideration is given to the magnitude of change in pollutant concentrations between the Do-Minimum and the Do-something scenarios. IAN 174/13 [102] and the IAQM position statement [103] support the definition of an 'imperceptible impact' as being less than or equal to 1% of the objective. In the case of NOx this equates to an increase of just 0.3 µg/m³ (see **Air Quality** (Volume 6, Document

Ref 6.2 ES Chapter 5), and the **Statement to Inform an Appropriate Assessment Report** (Volume 6, Document Ref 6.5).

8.11.124 For the Breney Common and Goss and Tregoss Moors SAC, exceedances of both the vegetation criterion (30 µg/m3) and the 1% threshold (0.3µg/m3) were predicted to occur between 0-10 meters from the highway boundary. Therefore, a significant effect could not be excluded and further assessment is required.

8.11.125 It is calculated that the area of the SAC located within the 0-10 metres of the ARN equates to just 0.2% of the total area of the SAC. A full assessment and mapping exercise using NVC data from Natural England, historic mapping and aerial imagery was conducted to determine any effects on qualifying habitats. This is fully detailed within **Habitat within 10m of the A30 at Breney Common SAC** (Volume 6, Document Ref 6.5 Appendix 6).

8.11.126 Of the habitats mapped, only one: 'H4c *Ulex gallii Agrostis curtisii* heath*, Erica tetralix* sub-community' features on the list of NVC communities that make up the qualifying Annex 1 habitats for the site. Therefore, of the area of the SAC located within the 0-10 meters of the ARN, only a small fraction was identified as containing Annex 1 Habitat for which the SAC was designated. This habitat area accounts for only 0.05% of the total recorded habitat type within the SAC.

8.11.127 However, it is very likely that the area of Annex 1 Habitat for which the SAC was designated and that is likely to be affected by the scheme is less than 0.05%, based on the following factors:

- More recent aerial imagery shows that this area comprises grassland with gorse *Ulex* spp. stands on the cutting created for the A30 Bodmin to Indian Queens scheme, and as such is unlikely to still be classed as Annex 1Habitat.
- Increases in nitrogen deposition are small (0.12-0.13 kg N ha-1 yr-1) and have decreased to less than the 1% of the critical load before reaching 10 meters from the roadside. Therefore, in reality the area of Annex 1 habitat that is likely to be exposed to deposition levels that exceed 1% of the critical load is likely to cover an area that is less than 0-10 meters from the roadside.
- The habitat identified is in cutting is constantly exposed to emissions from traffic that already exceed the critical load, and is therefore already exhibiting a degree of tolerance to nitrogen deposition.

8.11.128 Therefore, taking into account the very small area of habitat affected, the probability that much of this area is no longer likely to compromise Annex 1 habitat, and that the habitat is present within a cutting and is already exposed to exceedances of the critical load for nitrogen deposition, a significant effect on the Designated Site can be excluded, as detailed within the **Statement to Inform an Appropriate Assessment Report** (Volume 6, Document Ref 6.5). As such, an effect of neutral significance is predicted relating to air quality effects on international valued sites.

8.11.129 Although not assessed to the same level, the same justifications as above would apply to the habitats relating to Mid Cornwall SSSI which is also mapped within 10 meters of the ARN; particularly in that habitats within 0-10 meters of the road already exceed the critical load, and is therefore already exhibiting a degree of tolerance to nitrogen deposition. As such, an effect of neutral significance is predicted relating to air quality effects on national valued sites.

Non-Statutory Designations

8.11.130 As described above in the construction effects assessment, it is concluded that the CWSs and CRVIs in the study area are of county value.

8.11.131 All CWS's are over 200 metres [54] from the scheme and as such are not considered to be affected by air quality impacts. Some of these however will be hydrologically connected and as such have the potential to be impacted during operation through pollution events. However, through effective drainage and attenuation pond design in addressing potential pollution events, effects on these sites during operation is considered to be of neutral significance.

8.11.132 As mentioned above, the 64.13 hectares of species-rich grassland (including 5.07 hectares of pollination strips), and 5.30 hectares of heathland which will provided along the entire route will mitigate any loss of poor quality CRVIs and provide a net gain to higher biodiversity value habitats, in line with requirements laid out in the NN NPS [1]. As such, the effects are considered to be of neutral but potentially increasing to slight beneficial significance subject to habitat development.

Habitats

8.11.133 As described above in the construction effects assessment, designated and important habitats such as HPI woodland and heathland; important, Priority and Cornish hedgerows and CRVIs are county value all other habitats are local or less than local value.

8.11.134 As mentioned above in Section 8.10 Design, mitigation and enhancement measures, the habitats being created and enhanced exceeds those being lost with 28.25 hectares of woodland (23.11 hectares being deciduous woodland), 64.13 hectares being species-rich grassland (including 5.07 hectares of pollination strips and 0.34 hectares of native bulb planting), 4.9 hectares of heathland, 1.48 hectares of marginal aquatic, 1.98 hectares of wetland, and 2.74 hectares of wet grassland providing a net gain to higher biodiversity value habitats; as detailed within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3), and in line with requirements laid out in the NN NPS [1]. As such, the effects are considered to be of moderate beneficial significance, subject to habitat development.

Hedgerows

8.11.135 As described above in the construction effects assessment, it is concluded that the Important Hedgerows, priority Hedgerows and Cornish Hedges within the study area are of county value, whilst all others are of local value.

8.11.136 Also as described above 12,605 metres of Cornish hedgerows and 8458 metres of soft hedgerows, some of which being double hedges to increase ecological value, particularly for bats, have been designed throughout the scheme to maintain and provide green corridors while enhancing the ecological connectivity into the wider landscape, in line with requirements laid out in the NN NPS [1].

8.11.137 Based on the calculation of the proposed hedgerow planting providing an 2.8:1 gain of Cornish hedgerow and a 1.2:1 gain of soft hedgerow (see Table 8-15) the hedgerow planting is considered to provide a neutral significance, increasing to slight beneficial significance, subject to habitat development.

Terrestrial Invertebrates

8.11.138 As described above in the construction effects assessment, it is concluded that the invertebrate populations supported by the combined heathland sites 3, 4, and 5 are of national value, sites 1, 6, and 9 are of county value, and sites 10, 21/22, and 28/29 are between county and regional value.

8.11.139 Habitat planting described within the construction effects section above will be fully available during operation of the scheme, and will provide greater areas of more diverse habitats suitable for diverse and significant assemblages of invertebrates, as well as greater connectivity between habitats, in line with requirements laid out in the NN NPS [1].

8.11.140 Therefore, with the inclusion of these mitigation measures, it is considered that any operational effects are of neutral significance, increasing to slight beneficial significance, subject to habitat development.

Water Habitats, including fish and freshwater macroinvertebrates

8.11.141 As described above in the construction effects assessment, it is concluded that all watercourses and still waters, and the freshwater macroinvertebrate populations they support, are of local value and less than local value.

8.11.142 Drainage culverts will be provided to maintain hydro-connectivity (see Table 8-14 for details), vegetated attenuation ponds will be provided to capture and treat surface run-off from the road and will act as holding tanks in the event of severe flooding or a major spillage from a collision. These measures and others designed to mitigate for potential impacts on the water environment are detailed in **Road Drainage and the Water Environment** (Volume 6 Document Ref 6.2 ES Chapter 13).

8.11.143 With the inclusion of these mitigation measures, it is considered that any operational effects are of neutral significance.

Reptiles

8.11.144 As described above in the construction effects assessment, it is concluded that the reptile populations in the study area are of local value.

8.11.145 Habitats suitable for reptile populations, such as Cornish hedgerows, species-rich grasslands, and heathland, have been provided within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) which will increase and enhance optimal habitats for reptiles. Planting to enhance habitat connectivity throughout the scheme has also been designed, including heathland planting near Carland Cross, in line with requirements laid out in the NN NPS [1]. As well as planting to increase connectivity, two multi-species crossings suitable for reptiles will also be provided.

8.11.146 With the inclusion of crossings suitable for reptiles, and in time when the habitat planting is maturing, it is considered that any operational effects are of neutral significance for reptile populations throughout the scheme.

Birds

Breeding Birds

8.11.147 As described above in the construction effects assessment, it is concluded that the breeding bird population in the study area is of local value.

8.11.148 Once the scheme has been built and opened the only effects expected to be encountered by breeding birds are disturbance/displacement and species mortality through collisions. However, considering the partial habituation to the existing A30 and with the abundance of similar habitats available for foraging no significant impacts on this feature of local value are predicted.

8.11.149 As the habitats being created within the scheme mature these will be of increasing value to breeding birds. Overall and in time this is considered to be a positive effect to those species associated with these habitats, however, the overall effect will remain at neutral significance.

Wintering birds

8.11.150 As described above in the construction effects assessment, it is concluded that the wintering bird population in the study area is of local value.

8.11.151 Once the scheme has been built and opened the only effects expected to be encountered by wintering birds are disturbance/displacement and species mortality through collisions. However, considering the partial habituation to the existing road and associated disturbance along with the abundance of similar habitats available for foraging no significant impacts on this feature of local value are predicted.

8.11.152 As for breeding birds, as habitat creation provided during the construction period matures, habitats such as hedgerows and heathland will be of increasing use to wintering birds. This is considered to be a positive effect to those species associated with these habitats, however, the overall effect of the scheme will remain at neutral significance.

Barn Owl

8.11.153 As described above in the construction effects assessment, it is concluded that the barn owl population in the study area is of local value.

8.11.154 As identified above, once operational the scheme could result in direct mortality due to collision with moving traffic. The characteristics of a barn owl's flight make them vulnerable to landscape changes and in particular, impacts can arise from built infrastructure. Road traffic mortality is significant in population densities near to major roads, and can be seen to reduce populations within 1.5 kilometres of a busy road [24]. As described in the barn owl desk study in Section 8.7 Potential impacts, there were two RTC records of barn owl on the existing A30 between Chiverton and Carland Cross (Figure 1 of the **Road traffic collision summary report** (Volume 6 Document Ref 6.2 ES Appendix 8.1)).

8.11.155 The **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3) shows habitats that will be created away from the carriageway, and within significant tree planting between, that will provide suitable habitat for foraging barn owls. The woodland, tree and hedgerow planting along the scheme has been designed to deter barn owls crossing the road or foraging close to the road,

to help prevent direct mortality through vehicle collisions. In areas where this is not possible a grass sward considered to be unattractive to foraging barn owls would be maintained on the verges directly adjacent to the highway.

8.11.156 With the inclusion of these measures, it is predicted no significant impacts will occur on the barn owl population and as such, an effect of neutral significance is predicted.

Nightjar

8.11.157 As described above in the construction effects assessment, it is concluded that the nightjar population in the study area is of county value.

8.11.158 No disturbance or displacement effects are anticipated on the nightjar population during operation, based on the separation distances from the scheme. It should be noted that the main carriageway of the scheme will not be closer than the existing A30, which this population will be habituated to in the landscape. Therefore, no significant impact on this species is predicted; as such, effects are assessed to be of neutral significance on nightjar.

8.11.159 As heathland habitat creation provided during the construction period matures, it is possible that it could be used by this species, though the proximity to the A30 may preclude nightjar from nesting. Whilst foraging may be more likely, at this stage it is predicted the proposed heathland will not have significant positive impact, so overall effects on nightjar remain at neutral significance.

Otter

8.11.160 As described above in the construction effects assessment, it is concluded that the otter population in the study area is of local value.

8.11.161 All watercourses will have culverts designed to maintain safe crossing for otters, as detailed in Table 8-14.

8.11.162 Permanent severance of terrestrial habitat due to the operation of the scheme may lead to the same impacts as described above in the construction effects assessment. These impacts will be mitigated by the provision of dry multi-species crossings, allowing otters to move freely about the landscape. A total of 25 crossings suitable for otter are located throughout the scheme each being less than one kilometres apart as detailed in Table 8-14.

8.11.163 A combination of badger and otter fencing will also be installed to funnel otters towards these crossings, as well as around attenuation ponds, to allow otter access to these whilst still preventing them from crossing the road.

8.11.164 To mitigate any potential impacts to otters associated with disturbance from road noise, the scheme will have planting on either side of the road including woodland, scattered trees, and Cornish hedges, which will help screen potential disturbances to otters from vehicle movements, noise and light. Planting is detailed in **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3), and more details on noise impacts are set out in Noise and Vibration (Volume 6 Document Ref 6.2 ES Chapter 11). There is no lighting within the scheme apart from three WCH underbridges which will have motion sensory lighting, not sensitive to otters.

8.11.165 With the inclusion of these mitigation measures, it is predicted that no significant impacts will occur on the otter population during operation. The exclusion of otters to cross the road and the provision of 25 crossing locations is considered to be of neutral significance to otters.

Badger

8.11.166 As described above in the construction effects assessment, it is concluded that the badger population in the study area is of local value.

8.11.167 The number of RTC records on the existing A30 between Chiverton and Carland Cross indicates that badgers are still frequently crossing the road or are susceptible to collision in this area (Figure 1 of the **Road traffic collision summary report** (Volume 6 Document Ref 6.2 Appendix 8.1)).

8.11.168 A total of 22 crossings suitable for badger use, located between 50 to 1000 metres apart, have been provided at suitable locations throughout the scheme where badgers paths and crossing points of the existing A30 were located, and ensuring at least one crossing in each identified territory. Badger fencing will also be installed throughout both sides of the scheme to funnel badgers towards these crossings.

8.11.169 The majority of the scheme will have planting in the form of woodland, scattered trees, or Cornish hedges on either side of the road, which will help screen the noise and light, and reduce disturbance to badgers and other surrounding wildlife. This planting is detailed in **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3), and more details on noise impacts are set out in Chapter 11 (Noise and Vibration). As described above, there is no lighting within the scheme apart from three WCH underbridges which will have motion sensory lighting, not sensitive to badgers.

8.11.170 With the inclusion of these mitigation measures, it is predicted that no significant impacts will occur on the badger population during operation. The exclusion of badgers to cross the road and the provision of 22 crossing locations is considered to be of neutral significance to badgers.

Dormice

8.11.171 As described above, dormouse are considered likely absent from the study area, and as such, the operational effect on dormice is of neutral significance.

Bats

8.11.172 A number of roosts will be subject to higher noise levels as a result of the scheme in operation. In turn, a number of roosts will see a reduction in noise levels as a result of the scheme in operation. The roosts which will be subject to the highest noise level increases as a result of the scheme in operation are Buildings 19 and 21 (both within the complex of buildings at Nanteague Farm) and Building 51 (Trevalso Cottage). Building 19 is a maternity roost of *Myotis* (likely Natterer's) and brown long-eared bat as well as a day roost for common pipistrelle which has been assessed as local value. Building 21 is a day roost of brown long-eared bat of less than local value. Building 51 is a maternity roost of *Myotis* species (likely Natterer's) as well as a day roost of common pipistrelle assessed as local value.

8.11.173 The complex of buildings at Nanteague Farm (including roosts Building 19 and 21) already receive a noise level of 46.8dBL during the daytime; the scheme will

result in a day time noise level of 52.3 dBL (an increase of 5.5 dBL). Building 51 (Trevalso Cottage) already receives a noise level of 56.1dBL during the daytime; the scheme will result in a level of 61.2 dBL (an increase of 5.1 dBL).

8.11.174 Whilst these increases in noise level may be deemed an adverse effect in EIA terms for humans, see **Noise and Vibration** (Volume 6 Document Ref 6.4 ES Chapter 11), there is little evidence to show what constitutes a significant adverse effect for bats. In their paper on the effects of anthropogenic noise on foraging bats, Schaub, et al (2008) [104] identify that whilst traffic noise and other sources of intense broadband noise are shown to degrade the suitability of foraging areas, there are many examples of bats roosting in extremely noisy situations (bell towers of churches or under motorway bridges). The effect of noise during operation on roosting bats has therefore been assessed as being of neutral significance.

8.11.175 Following construction of the multi-species crossings and the establishing of landscape planting designed to provide habitat connectivity and enhanced foraging opportunities for bats; no significant impacts on the commuting and foraging activity of bats is expected. The effects of the scheme during operation on the bat assemblage which includes Annex II species has therefore been assessed as of neutral significance.

Other Section 41 Species of Principal Importance (SPI)

8.11.176 As described above in the construction effects assessment, it is concluded that the SPI populations in the study area are of local value.

8.11.177 Potential effects on SPI during operation of the scheme disturbance and direct morality through vehicle collision.

8.11.178 As mentioned above in Section 8.10 Design, mitigation, and enhancement measures, the habitats being created and enhanced exceeds those being lost within the scheme, with the exception of lower valued habitats such as arable and improved grasslands. The habitats being created throughout the scheme will provide suitable habitat for SPI, including hedgehog, harvest mouse, brown hare, polecat and common toad. These habitats have been designed to enhance habitats within the local area and provide habitat connectivity within the wider landscape.

8.11.179 A total of 33 multi-species are located throughout the scheme at least every kilometre that could be used by these SPI's.

8.11.180 Due to the creation and enhancement of habitats, and the provision of multi-species crossings, the effects of scheme operation on SPI populations is considered to be of neutral significance.

8.12 Monitoring

8.12.1 Moderate to slight adverse effects have been identified during construction relating to the temporary severance of Annex II bat species foraging and commuting habitats and those associated general habitat loss of high quality habitats such as woodlands, hedgerows and heathland. This temporary loss of vegetation is difficult to mitigate during construction, although heathland translocation help reduce the impacts, they are not avoidable.

8.12.2 Habitats planted throughout the scheme which will provide a moderate to slight beneficial effect, will require detailed monitoring and management plans. Outline information is provided within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6 Document Ref 6.3), and full details will be provided at the detailed design stage and within the Handover Environmental Management Plan (HEMP).

8.12.3 Beyond the first two year contractor aftercare period, management responsibilities would fall to the relevant highways authority. Highways England would be responsible for highways land associated with the A30 trunk road and Cornwall Council would look after the soft estate associated with the non-trunk road sections of the scheme. Management of the soft estate in either case up until year 15 (2038) would be necessary in accordance with normal highway soft estate management practices, to ensure that the planting does establish. Ongoing management activities and inspections during the first five years in particular would provide the opportunity to identify any further work or measures required to deliver the required level of mitigation.

8.12.4 Man-made hedgerows (dead hedging) can be used to reduce temporary habitat severance for bats, and as such, monitoring may be required to determine whether the bats are using such structures or alternative linear features.

8.12.5 Slight adverse effects have been identified during construction for the loss of CRVIs (albeit being poor quality), terrestrial invertebrate habitat specifically within the heathland, loss of a bat roost and disturbance to others within the NFH complex and disturbance to maternity roosts.

8.12.6 Monitoring will be required under licence applications for bats and badgers, to ensure these species are correctly and fully excluded before demolition of currently used roosts and setts, and to determine whether roosts and artificial setts are being utilised. Monitoring will also be required during and post construction at identified crossing points for bats and along landscape scale transect for comparative analysis [18].

8.12.7 Reptile mitigation strategies, such as fencing if required, will also require monitoring throughout construction and post-construction. Monitoring may also be required for otter presence during construction, particularly in locations where they are likely to cross the construction of the road.

8.12.8 Monitoring will be required for habitat clearance to ensure no animals are harmed during the clearance and to ensure all retained vegetation are not damaged during the works.

8.12.9 Once the scheme is in operation there are no adverse effects predicted, however monitoring of mitigation and enhancement strategies will be required, such as mammal fencing and multispecies crossing to ensure these are functioning correctly. Details of the monitoring and management of such assets are outlined within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6 Document Ref 6.3), and full details will be provided at the detailed design stage and within the HEMP.

8.13 Summary

8.13.1 The ecology and nature conservation chapter describes the methodology used for each ecological survey, and the existing baseline conditions of ecological receptor within the study area. A value has then been assigned to each of these receptors

(including designated sites, habitats, species populations, and assemblages of species) in accordance with DMRB IAN 130/10 [68], followed by an assessment of the potential impacts on these ecological receptors.

8.13.2 The majority of ecological receptors within the study area have been assessed as being of county, local, or less than local value, the exceptions being mainly associated with designated sites and terrestrial invertebrates. Newlyn Downs SAC is of international value. The SSSIs and the invertebrate populations supported by the combined heathland sites 3, 4, and 5 are of national value.

8.13.3 A slight adverse effect has been identified during construction relating to the disturbance of the locally valuable maternity bat roosts between 20 meters and 50 meters, and the loss of the locally valuable bat roost at NFH (Building 35), and the temporary fragmentation of habitat at NFH. A moderate to slight adverse effect has been identified during construction relating to the temporary severance of linear features used by bat assemblages including Annex II species.

8.13.4 Slight adverse, and moderate to slight adverse effects have also been identified during construction relating to general habitat loss and fragmentation, including HPI woodlands and hedgerows because the majority of habitats being created and enhanced will not be fully available until the operational phase. A moderate to slight adverse effect has been identified relating to the loss of heathland habitat, however, if heathland translocation is successful this effect will reduce to neutral.

8.13.5 The habitats as provided within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6 Document Ref 6.3) when fully planted and maturing will provide a moderate to slight beneficial effect during operation. The landscape planting has been designed to provide a net gain for higher biodiversity value habitats and connectivity into the wider landscape. Numerous multi-species crossings with fencing throughout the scheme will also provide safe connectivity for mobile species. No adverse effects have been predicted during operation.

8.13.6 Full details of habitat creation and enhancements are detailed within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6, Document Ref 6.3). Outline information regarding management and monitoring is provided within the **Environmental Masterplan** (ES Figure 7.6 of Volume 6 Document Ref 6.3), and full details will be provided at the detailed design stage.

8.13.7 Excluding those where the potential impacts were assessed as neutral, Table 8-16 and

8.13.8 Table 8-17 summarise the significance of the potential impacts during construction and operation, respectively.

Table 8-16 Summary of assessment of construction effects

Ecological receptor	Description of potential impact	Embedded design, mitigation, and enhancement measures	Value of receptor	Significance of potential impact during construction
Designated sites				
CRVI	Loss and/or damage of four CRVI sites (two of which are poor quality, and one of which is of HPI character)	Planting of replacement habitats, including heathland and species rich grassland, will mitigate the loss of the CRVI's, but this habitat will not be fully available during construction (see Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3)).	County value	Slight adverse, reducing to neutral as planting throughout the scheme starts to establish
Habitats				
HPI woodlands	Habitat loss of four deciduous woodland HPI sites (not being of a particular high quality or interesting NVC community)	Proposed woodland planting is detailed in Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3) and will mitigate the loss of this woodland, but this habitat will not be fully available during construction.	County value	Moderate adverse, reducing to neutral as planting throughout the scheme starts to establish.
Heathland	Habitat loss of one heathland area	Proposed heathland planting is detailed in Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), and will mitigate the loss of this heathland, but this habitat will not be fully available during construction. Heathland will be translocated to a receptor site within the scheme, most likely to be adjacent to the eastern edge of Newlyn Downs SAC, which will then form the heathland connection from the isolated heathland to the SAC. This will help to mitigate the effects associated with the loss of HPI heathland and is likely to reduce the significance of effect for heathland to neutral if successful.	County value	Neutral if heathland translocation is successful, or moderate adverse, reducing to neutral as planting throughout the scheme starts to establish.
Hedgerows				
Important hedgerows, priority hedgerows, and Cornish hedges	Habitat loss	Proposed hedgerow planting, including Cornish hedgerows, is detailed in Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3) and will mitigate the loss of these hedgerows, but this habitat will not be fully available during construction.	County value	Moderate adverse; reducing to neutral as planting throughout the scheme starts to establish.
All other hedgerows	Habitat loss	Proposed hedgerow planting is detailed in Table 8-15and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), and will mitigate the loss of these hedgerows, but this habitat will not be fully available during construction.	Local value	Moderate; reducing to neutral as planting throughout the scheme starts to establish.
Terrestrial invertebrates				
Terrestrial invertebrate assemblages	Habitat loss, habitat severance, and direct mortality (during vegetation clearance).	Proposed replacement habitat planting, including species heathland, is detailed in Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), to mitigate for habitat loss, but will not be fully available during construction. The proposed planting will provide greater connectivity between habitats, thus mitigating for the impact of habitat severance. Furthermore, the heathland from combined sites 3, 4, and 5, will be translocated which will mitigate the effects associated with the loss of HPI heathland supporting the invertebrate population, as well as reducing the direct mortality to non-mobile invertebrate stages associated with vegetation clearance.	National (Areas 3,4,5), (and lower valuations as described for other defined areas)	Slight adverse, increasing to slight to moderate beneficial as planting throughout the scheme starts to establish.
Bats				
Bats roost at NFH (building 35)	Loss of roost	A replacement multi-species roost will be provided under a mitigation licence from Natural England.	Local value	Slight adverse
Common pipistrelle maternity roost (Building 16), brown long-eared bat maternity roost (Tolgroggan Lodge), and Myotis maternity roost (Building 51)	Disturbance effects including noise, vibration, movement of plant and personnel.	Construction mitigation undertaken under a mitigation licence drawn up in consultation with Natural England.	Local value	Slight adverse

Ecological receptor	Description of potential impact	Embedded design, mitigation, and enhancement measures	Value of receptor	Significance of potential impact during construction
Maternity roosts between 20 metres and 50 metres of the scheme of common pipistrelle or brown long eared species (Buildings 11A, 13, 16A, 16B, 16D, 40, 54 and 70)	Disturbance effects such as noise and lighting on these roosts during construction	Method statement to minimise potential disturbance impacts, and possible inclusion in a bat mitigation licence application as appropriate (to be determined in consultation with Natural England).	Local value	Slight adverse.
Assemblages of bats which include Annex II species	Temporary severance and fragmentation of foraging and commuting features	Construction mitigation (timing of works i.e. retention of vegetation along known commuting routes for as long as possible and the use of dead hedges to minimise loss of connectivity).	County value	Moderate adverse

Table 8-17 Summary of assessment of operation effects

Ecological receptor	Description of potential impact	Embedded design, mitigation, and enhancement measures	Value of receptor	Significance of potential impact during operation
Designated sites				
CRVI	Loss of three poor quality CRVI sites	Planting of replacement habitats, including heathland and species rich grassland, will mitigate the loss of the CRVI's, providing a net gain of this habitat during operation (see Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3)).	County value	Moderate beneficial significance, subject to habitat development.
Habitats				
HPI woodlands	Habitat loss of four deciduous woodland HPI sites (not being of a particular high quality or interesting NVC community)	Proposed woodland planting is detailed in Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), to mitigate for the loss of woodland and provide a net gain of this habitat during operation.	County value	Moderate beneficial significance, subject to habitat development.
Heathland	Habitat loss of one heathland area	Proposed heathland planting is detailed in Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), to mitigate for the loss of heathland, and provide a net gain of this habitat during operation.	County value	Moderate beneficial significance, subject to habitat development.
Hedgerows				
Important hedgerows, priority hedgerows, and Cornish hedges	Habitat loss	Proposed hedgerow planting is detailed in Table 8-15and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), to mitigate for the loss of hedgerows, and provide a net gain of this habitat during operation.	County value	Neutral, increasing to slight beneficial, subject to habitat development.
All other hedgerows	Habitat loss	Proposed hedgerow planting is detailed in Table 8-15and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), to mitigate for the loss of hedgerows, and provide a net gain of this habitat during operation.	Local value	Neutral, increasing to slight beneficial, subject to habitat development.
Terrestrial invertebrates				
Terrestrial invertebrate assemblages	Habitat loss, habitat severance, and direct mortality (during vegetation clearance).	Proposed replacement habitat planting is detailed in Table 8-15 and the **Environmental Masterplan** (Figure 7.6 of Volume 6, Document Ref 6.3), to mitigate for habitat loss and provide, providing a net gain of this habitat during operation. The proposed planting will provide greater connectivity between habitats, thus mitigating for the impact of habitat severance.	National (Areas 3,4,5), (and lower valuations as described for other defined areas)	Neutral, increasing to slight beneficial, subject to habitat development.

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