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A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

ENVIRONMENTAL STATEMENT
VOLUME 3C: TECHNICAL APPENDICES

July 2020

Volume 3C

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1 Introduction

1.1.1 Ove Arup and Partners Ltd (Arup) was commissioned by Welsh Government to undertake ecological surveys in relation to the A40 Penblewin to Redstone Cross Improvements. The surveys were required to provide baseline information to inform an ecological impact assessment (EcIA).

1.1.2 At the time of the instruction there were three scheme options, two to the north of the existing A40 (one with a staggered junction north of Redstone Cross and one with a T-Junction), and one option to the south. The alignments of these scheme options are shown on Figure 1.

1.1.3 This report sets out the methodology, results and conclusions of an Extended Phase 1 Habitat survey carried out within 100m of the outer edges of the scheme options.

1.2 Legislation and Policy

1.2.1 A framework of international and national legislation exists to protect and conserve habitats and species in Wales:

a) The Conservation of Habitats and Species Regulations 2017 (as amended) (the Habitat Regulations) 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;

b) The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds) (the Wild Birds Directive);

c) Wildlife and Countryside Act 1981 (as amended) (WCA);

d) Environment (Wales) Act 2016;

e) The Hedgerow Regulations 1997;

f) Protection of Badgers Act 1992;

1.2.2 The following planning policy on nature conservation is also relevant:

a) National Planning Policy Framework (NPPF); and

b) Pembrokeshire Local Biodiversity Action Plan (LBAP) 2011.

1.2.3 These pieces of legislation mentioned above prohibit a number of actions relating to protected habitats and species. The Habitats Regulations set out the requirement for the consideration of the

potential effects of a project on European Sites and European Protected Species (EPS), whilst the WCA and Environment (Wales) Act provide the legal framework for the designation and protection of nationally designated sites, including Sites of Special Scientific Interest (SSSIs), as well as nationally protected and notable species.

1.2.4 Actions which are prohibited by legislation can be made lawful on the approval and granting of a licence from Natural Resources Wales (NRW), subject to conditions.

2 Methodology

2.1 Desk Study

2.1.1 Online searches were carried out using the Multi Agency Geographic Information for the Countryside (MAGIC)[1] and the Joint Nature Conservation Committee (JNCC)[2] websites to gather information on statutory designated sites for nature conservation. All internationally designated statutory sites within 10km and all nationally designated sites within 2km of the scheme options were identified. The search was extended to 30km for any Special Areas of Conservation (SACs) designated for bats.

2.1.2 Information on non-statutory designated sites for nature conservation, Natural Resources Wales (NRW) Priority Habitats and records of protected and notable species were obtained from the West Wales Biodiversity Information Centre (WWBIC). This data search, which was carried out on 11 June 2019, covered the area within 2km of the centrelines of the scheme options. The search was extended to a 5km radius for records of roosting bats.

2.1.3 Protected species included all those protected by European or UK law, and notable species including those identified as being of Principal Importance, as listed in response to Section 7 (S7) of the Environment (Wales) Act 2016.

2.1.4 Publicly available maps and aerial imagery were examined to identify habitats and landscape features that are likely to be important for protected species within the surrounding area such as areas of standing open water for breeding amphibians and areas of woodland or hedgerows suitable to support dormice *Muscardinus avellanarius*.

2.2 Field Survey

2.2.1 The Extended Phase 1 Habitat survey was carried out within a 100m buffer from the outer edges of the scheme options by suitably qualified Arup ecologists.

2.2.2 An initial visit was carried out in July 2017, with further visits to update

[1] http://magic.defra.gov.uk/MagicMap.aspx Accessed 6th September 2019
[2] http://jncc.defra.gov.uk/ Accessed 6th September 2019

these results carried out between June and September 2019. The survey was carried out in accordance with standard JNCC Phase 1 habitat survey methodology[3] and the Institute of Environmental Assessment's Guidelines for Baseline Ecological Assessment[4].

2.2.3 Extended Phase 1 Habitat Survey is a standard technique for rapidly obtaining baseline ecological information over a large area of land. All habitat areas greater than 0.1ha are classified according to a standard set of habitat definitions and are mapped in line with the standard symbology. Any key and/or notable botanical species are noted as target notes (TNs). The habitats are appraised for their potential to support protected or notable species as follows:

Bats

2.2.4 Any buildings/trees within the survey area were appraised for their suitability to support roosting bats using survey methods based on those outlined in the Bat Conservation Trust's (BCT) Good Practice Guidelines[5].

Riparian mammals

2.2.5 Water bodies, if present within the survey area, were assessed for their suitability to support otters *Lutra lutra* and water voles *Arvicola amphibius*. This assessment was based on guidance outlined in Chanin[6] and Strachan, Moorhouse and Gelling[7] respectively.

Dormouse

2.2.6 Woodlands, hedgerows and other dense vegetation within the survey area were appraised for their suitability to support dormouse in accordance with guidance from Bright, Morris and Mitchell-Jones[8].

Badger

2.2.7 Any evidence of badger *Meles meles* setts or other badger activity such as paths, latrines or signs of foraging found during the walk over was target noted and mapped. Standard survey methodology was used, and

[3] Joint Nature Conservation Committee (2010) Handbook for Phase 1 habitat survey – a technique for environmental audit
[4] Guidelines for Baseline Ecological Assessment (Institute of Environmental Assessment, 1995);
[5] J. Collins, (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd Edition. The Bat Conservation Trust, London.
[6] P. Chanin, (2003) Monitoring the Otter, *Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.
[7] R. Strachan, T. Moorhouse and M. Gelling, (2011) Water Vole Conservation Handbook, 3rd Edition, Wildlife Conseravtion Research Unit (WildCRU), Oxford University.
[8] P. Bright, P. Morris and T. Mitchell-Jones, (2006) The Dormouse Conservation Handbook, English Nature, Peterborough.

any setts recorded were classified according to Harris, Creswell and Jefferies[9].

Birds

2.2.8 The survey area was surveyed for habitat suitable to support bird species of conservation significance. Any bird species seen within the survey area were recorded and any further evidence of species such as old nests or owl pellets was noted.

Amphibians

2.2.9 The survey area was appraised for its suitability to support breeding amphibians, both protected species and S7 species.

Reptiles

2.2.10 The survey area was appraised for its suitability to support reptiles. The assessment was based on guidance outlined in the Joint Nature Conservation Committee's published Herpetofauna Workers' Manual[10].

Other Species

2.2.11 The survey area was also appraised for its suitability to support other protected or notable fauna including S7 mammals including hedgehog *Erinaceus europaeus* and brown hare *Lepus europaeus* and significant populations of S7 invertebrates such as ghost moth *Hepialus humuli*, brindled beauty *Lycia hirtaria* and white ermine *Spilosoma lubricipeda*.

2.2.12 Any invasive plant species listed under Schedule 9 of the Wildlife and Countryside Act 1981, such as Japanese knotweed *Fallopia japonica*, Indian balsam *Impatiens glandulifera* and giant hogweed *Heracleum mantegazzianum*, were also target noted if identified.

2.2.13 The extended Phase 1 habitat survey methodology enables an experienced ecologist to obtain a sufficient understanding of the ecology of a site in order to either confirm the conservation importance of the site and assess the potential for impacts on habitats/species likely to represent a material consideration in planning terms, or to ascertain that further surveys will be required before such confirmation can be

[9] S. Harris, P. Creswell and D. Jefferies, (1989) Surveying Badgers, Mammal Society, 1989.
[10] T. Gent and S. Gibson, (2003) Herpetofauna Workers Manual, Joint Nature Conservation Committee, Peterborough.

made.

2.3 Limitations

2.3.1 The findings presented in this report represent those at the time of survey, and data collected from available sources. Ecological surveys are limited by factors which affect the presence of species, such as temporal weather conditions, migration patterns and behaviour, though weather was not considered to be a limitation on this occasion. Every effort has been made to ensure that the findings of this report present as accurate an interpretation as possible of the species and habitats within the study area.

3 Results

3.1 Desk Study

Statutory Sites

3.1.1 The search using MAGIC highlighted four European Sites within 10km, two bat SACs within 10 to 30km, and two national statutory designated sites within 2km of the scheme options. These include six SACs and two SSSIs. No local statutory designated sites were identified within 2km of the scheme options. All statutory designated sites are detailed in Table 1 and shown on Figure 1 and Figure 2.

Table 1 Statutory Designated Sites for Nature Conservation.

Site Name	Features	Distance from Scheme
European Sites within 10km		
Afonydd Cleddau / Cleddau Rivers SAC[11]	• Brook lamprey *Lampetra planeri* • River lamprey *Lampetra fluviatilis* • Bullhead *Cottus gobio* • Otter • Sea lamprey *Petromyzon marinus* • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation • Active raised bogs • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	1.1km west
Pembrokeshire Marine / Sir Benfro Forol SAC[12]	• Estuaries • Large shallow inlets and bays • Reefs • Sandbanks which are slightly covered by sea water all the time • Mudflats and sandflats not covered by sea water at low tide • Coastal lagoons • Atlantic salt meadows *Glauco-Puccinellietalia maritimae* • Submerged or partially submerged sea caves • Grey seal *Halichoerus grypus* • Shore dock *Rumex rupestris* • Sea lamprey • River lamprey • Allis shad *Alosa alosa*	4.5km south west

[11] https://sac.jncc.gov.uk/site/UK0030074 Accessed 06/09/2019
[12] https://sac.jncc.gov.uk/site/UK0013116 Accessed 06/09/2019

Site Name	Features	Distance from Scheme
	• Twaite shad *Alosa fallax* • Otter	
Yerbeston Tops SAC[13]	• *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils *Molinion caeruleae* • Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia*	7.2km south west
Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC[14]	• Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. • Greater horseshoe bat *Rhinolophus ferrumequinum* • Lesser horseshoe bat *Rhinolophus hipposideros* • Otter	7.3km south west
Further SACs for bats between a 10km and 30km radius.		
Limestone Coast of South West Wales / Arfordir Calchfaen De Orllewin Cymru SAC[15]	• Vegetated sea cliffs of the Atlantic and Baltic Coasts • "Fixed coastal dunes with herbaceous vegetation ('grey dunes')" • European dry heaths • Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) • Caves not open to the public • Submerged or partially submerged sea caves • Greater horseshoe bat • Early gentian *Gentianella anglica* • Petalwort *Petalophyllum ralfsii*	17.2km south
North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC[16]	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) • Barbastelle *Barbastella barbastellus*	18.4km north
National sites within 2km		
Afon Cleddau Dwyreiniol / Eastern Cleddau River SSSI	The Eastern Cleddau River SSSI is of special interest primarily for important populations of otter, bullhead, river lamprey, brook lamprey and sea lamprey. It is also of special interest for its range of river habitats including beds of submerged aquatic plants often dominated by water-crowfoot *Ranunculus spp.*, the aquatic plant *Potamogeton berchtoldii x P. polygonifolius* (cf.) as well as a variety of associated riverside habitats.	1.1km west

[13] https://sac.jncc.gov.uk/site/UK0030305 Accessed 06/09/2019
[14] https://sac.jncc.gov.uk/site/UK0014793 Accessed 06/09/2019
[15] https://sac.jncc.gov.uk/site/UK0014787 Accessed 06/09/2019
[16] https://sac.jncc.gov.uk/site/UK0030227 Accessed 06/09/2019

Site Name	Features	Distance from Scheme
Robeston Wathen Quarries SSSI	The limestones seen within the Robeston Wathen Quarries SSSI were deposited beneath a shallow sea which covered the area approximately 440 million years ago and are rich in species of corals, particularly halysitids, and rare brachiopods.	1.8km west

1.1.1 Non-Statutory Sites

3.1.2 No non-statutory designated sites for nature conservation were identified by WWBIC within the 2km search area around either route option.

1.1.2 NRW Priority Habitats

3.1.3 No NRW Priority Habitats were identified by WWBIC within the 2km search area around either route option. Several Restored Ancient Woodland Sites from the Ancient Woodland Inventory were however flagged up in the WWBIC data search within 2km of the scheme. The closest of these sites is immediately adjacent to the scheme on Sodston Farm, northwest of Redstone Cross. The next closest is 125m south of Redstone Cross adjacent to a quarry.

1.1.3 Protected and Notable Species

3.1.4 Records of protected and/or notable species provided by WWBIC within 2km (and within 5km for bats) of the study area are summarised in Table 2 below. Only records from the last 10 years are included unless considered relevant in which case this is noted in the table. Where relevant, the location has been described with approximate distances given, and observations regarding habitats from analysis of publicly available Ordnance Survey (OS) mapping and aerial imagery have been included.

3.1.5 Records include species that are EPS, those protected under the WCA and S7 species.

Table 2 Summary of protected and/or notable species records within 2km (5km for bats) of the scheme options.

Species/ Group	**Summary of records provided by WWBIC** (all records are from 2010 or later, unless otherwise stated)
Bats (within 5km)	The data search returned records of 11 species of bat and one species group within 5km of the scheme options: barbastelle *Barbastella barbastellus*, greater horseshoe bat *Rhinolophus ferrumequinum*, lesser horseshoe bat *Rhinolophus hipposideros*, serotine *Eptesicus serotinus*, Daubenton's bat *Myotis daubentonii*, whiskered bat *Myotis mystacinus*, Natterer's bat *Myotis nattereri*, noctule *Nyctalus noctula*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared bat *Plecotus auritus*, and potentially other species from the *Myotis* species group. There were 193 records of bat roosts within 5km of the scheme options, 83 of these records were from the last 10 years (2009 or later). Four of these roosts were greater horseshoe bat and two of the roosts were lesser horseshoe bat, all over 4.5km away. The remaining roosts were: whiskered bat (1 roost); noctule (1 roost); Natterer's bat (3); common pipistrelle (13); brown long-eared (20); soprano pipistrelle (24); *Myotis* species (1); Plecotus species (2); *Pipistrellus* species (6); and unidentified bat species (6 roosts). The closest roost records to the scheme options were two soprano pipistrelle roosts approximately 500m to the north and a common pipistrelle roost approximately 1.1km to the south in Narberth. During the consultation process a further roost record was provided by NRW of a greater horseshoe bat roost approximately 400m away to the northwest of the scheme near Sodston Manor Farm.
Otter	Ten records were provided in total for the search area, only three of which were from the last ten years. The closest record, which is also the most recent, recorded in 2013, is of a road traffic casualty on the existing A40 approximately 150m east of Redstone Cross junction. The other two records from the last ten years, both from 2009 included spraints found under a bridge 1.3km to the north on a tributary of the Eastern Cleddau River, and found under a bridge on another tributary of the Eastern Cleddau River approximately 1.8km to the south, south of Narberth.
Water vole	There were no records of water vole returned with the data search.
Amphibians	There were no records of amphibians from within the 2km search area from the previous 10 years. However, amphibian records from the years 1970-2008 included four records of common toad *Bufo bufo*, four records of common frog *Rana temporaria*, and four records of palmate newt *Lissotriton helveticus*. A search of publicly available OS mapping and aerial imagery revealed a small number of potential standing waterbodies suitable for breeding amphibians within 250m of the scheme options. Despite suitable habitat, great crested newts are generally considered absent from Pembrokeshire[17]. A positive result for great crested newt eDNA was determined from samples of water taken from a pond 380m northeast of Penblewin roundabout in 2016 as part of the baseline surveys for the A40 Llanddewi Velfrey to Penblewin Improvements. However, the presence of GCN was not confirmed through field surveys the following year. A search using the NBN Gateway showed that the closest record of great crested newt *Triturus critstatus* is located approximately 8.9km north-east of the scheme options in Carmarthenshire[18].
Birds	Records of two Schedule 1 species were returned from within the 2km search area: red kite *Milvus milvus* and barn owl *Tyto alba*, both of which could breed within the area.

[17] https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/european-protected-species/great-crested-newt/?lang=en Accessed 18/12/2019
[18] https://species.nbnatlas.org/species/NHMSYS0000080156 Accessed 09/09/2019

Species/ Group	**Summary of records provided by WWBIC** (all records are from 2010 or later, unless otherwise stated)
	The closest barn owl and red kite records were 1.2km and 1.5km from the scheme options, respectively. Three S7 species were also recorded within the search area: house sparrow *Passer domesticus*, dunnock *Prunella modularis*, and starling *Sturnus vulgaris*.
Reptiles	Records of three common reptile species were returned with the data search for the 2km search area: slow-worm *Anguis fragilis*, grass snake *Natrix helvetica* and common lizard *Zootoca vivipara*. The records comprised a single record of each of each of the above three species from 2006, recorded in the 1km grid square SN1216 in Penblewin, and a 2018 record of slow worm from Narberth town centre.
Badgers	A total of 18 records of badger were returned from within the 2km search area from the last 10 years, 11 of which were road traffic casualties. The closest records were a road casualty found on the existing A40 just west of Penblewin roundabout in 2011 and a road casualty found on the existing A40 just to the west of Redstone Cross also in 2011.
Other notable species	Thirteen records of hedgehog, a S7 species, were provided from the last 10 years. The closest of these was a road traffic casualty 75m east of Penblewin roundabout on the existing A40 recorded in 2014. One record of polecat *Mustela putorius*, also a S7 species, was provided from the last 10 years. This was a road casualty 400m east of Penblewin roundabout on the existing A40 recorded in 2010. Numerous S7 invertebrates and one S7 fungus were also recorded within the search area from the last 10 years, including: hazel gloves *Hypocreopsis rhododendri*, brindled beauty, buff ermine *Spilosoma lutea*, and cinnabar *Tyria jacobaeae.* The closest of these was of a brindled beauty recorded in the public car park to the east of Penblewin roundabout in 2015.
Invasive non-native species	The following invasive non-native species have been recorded within the 2km search area in the last ten years. They are both listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended): Indian balsam *Impatiens glandulifera* and eastern grey squirrel *Sciurus carolinensis.* The closest record is of Indian balsam located approximately 1.4km from the scheme options in 2017.

3.2 Field Survey

Southern option

3.2.1 The study area for the southern option included five blocks of woodland. Two of these blocks of woodland, the westernmost one (to the west of Redstone Cross), and the easternmost one (to the west of Penblewin roundabout), follow the valleys of freshwater streams. Due to the lowland situation of much of the survey area, there were also large areas of waterlogged marshy grassland. Like the northern option, the survey area for the scheme also includes improved or poor semi-improved grassland fields and a well-connected network of mature hedgerows intersecting the fields.

Northern option

3.2.2 The study area for the northern option was predominantly used for cattle or sheep production comprising improved or poor semi-improved grassland fields and a well-connected network of hedgerows intersecting the fields. Small patches of marshy grassland were also present. The study area also included the southern tip of a restored ancient woodland site to the north west of Redstone Cross.

3.2.3 Tables showing the areas of each JNCC phase 1 habitat type within the 100m survey areas for each scheme option are shown in Appendix A.

Habitats

3.2.4 The results of the Extended Phase 1 Habitat Survey are shown on Figure 3, details of Target Notes are provided in Appendix B, and detailed species lists are provided in Appendix C.

3.2.5 There were four large areas of semi-natural broadleaved woodland (A1.1.1) within the survey area of the southern option as well as an area of woodland to the north of the existing A40 west of Redstone Cross (within the survey area of both options). Species most commonly recorded within these semi-natural broadleaved woodlands were hazel *Corylus avellana*, ash *Fraxinus excelsior*, oak *Quercus spp.*, holly *Ilex aquifolium*, hawthorn *Crataegus monogyna*, sycamore *Acer pseudoplatanus*, and bramble *Rubus fruticosus* agg.. Species recorded within the ground flora of these woodland blocks included male fern *Dryopteris filix-mas*, bluebells *Hyacinthoides non-scripta*, primrose

Primula vulgaris, wood avens *Geum urbanum*, creeping buttercup *Ranunculus repens*, and enchanter's nightshade *Circaea lutetiana*.

3.2.6 The woodlands often contained patches of or were bordered by scrub communities (A2.1 / A2.2). The scrub was generally dominated by bramble, although sycamore, hawthorn, beech *Fagus sylvatica.*, gorse *Ulex europaeus*, grey willow *Salix cinerea* and common nettle *Urtica dioica* were also occasionally recorded.

3.2.7 There were occasional scattered broadleaved trees (A3.1) within and along the boundaries of some fields and on Penblewin roundabout. Species included sycamore, ash, hazel, hawthorn, and oak.

3.2.8 Poor semi-improved grassland (B6) was the most abundant grassland type throughout the survey areas of both scheme options. The majority of the fields were grazed by cattle or sheep with resultant poaching being fairly common. Species frequently identified within the poor-semi-improved grassland fields included cock's-foot *Dactylis glomerata*, Yorkshire fog *Holcus lanatus*, perennial ryegrass *Lolium perenne*, creeping bent *Agrostis stolonifera*, bird's-foot trefoil *Lotus corniculatus*, ribwort plantain *Plantago lanceolata*, dock species *Rumex spp.*, common ragwort *Jacobaea vulgaris*, and common knapweed *Centaurea nigra*.

3.2.9 The poor semi-improved grassland road verges were generally more species diverse than the poor semi-improved grassland fields. Species identified along the road verges included Yorkshire fog, creeping bent, timothy-grass *Phleum pratense*, false oat-grass *Arrhenatherum elatius*, creeping cinquefoil *Potentilla reptans*, ribwort plantain, creeping buttercup, cock's-foot, bird's-foot trefoil, dock species, common ragwort, and common knapweed.

3.2.10 Improved grassland (B4) fields were dominated by perennial ryegrass, with some white clover *Trifolium repens*, dock species, common nettle, creeping bent, soft rush *Juncus effusus*, and creeping thistle *Cirsium arvense*. The majority of these fields were grazed by cattle or sheep.

3.2.11 The marshy grassland (B5) was predominantly recorded along the southern option due to its lower, wetter position through the valleys of watercourses. Species identified included jointed rush *Juncus articulatus*, compact rush *Juncus conglomeratus*, soft rush, sedge species *Carex spp.*, ragged robin *Lychnis flos-cuculi*, fen bedstraw

Galium uliginosum, marsh thistle *Cirsium palustre*, wild angelica *Angelica sylvestris*, bird's-foot trefoil, meadowsweet *Filipendula ulmaria*, marsh bedstraw *Galium palustre*, and greater bird's-foot trefoil *Lotus pedunculatus*. As with the rest of the grassland fields, the marshy grassland areas were frequently grazed with resultant poaching.

3.2.12 There are four watercourses within the survey area of the southern option and one small stream (G2) within the survey area of the northern option. The small stream in the north and three of the southern watercourses were heavily shaded by woodland or scrub, thus the potential for growth of aquatic species was limited. The remaining one, which runs through the centre of the field immediately southwest of Penblewin roundabout was not heavily shaded but had a very low flow for much of the 2019 survey season. Water starwort *Callitriche sp.* and water-crowfoot *Ranunculus spp.* were recorded in a ditch (G1) within an area of willow *Salix spp.* scrub to the south east of the survey area (TN1).

3.2.13 The majority of the hedgerows throughout the survey areas of both scheme options were species-rich hedgerows with trees (J2.3.1). Species-rich intact hedges (J2.1.1) were relatively common, recorded towards the eastern and western ends of the survey areas, whilst species-rich defunct hedge (J2.2.1) was only recorded once, towards the centre of the northern option. These species-rich hedgerows (J2.1.1, J2.2.1 and J2.3.1) were generally dominated by a combination of hawthorn, blackthorn *Prunus spinosa*, ash, and oak, with bramble, hazel, rose *Rosa spp.*, holly and gorse also relatively common. Non-woody species within these species-rich hedgerows most commonly comprised red campion *Silene dioica*, common nettle, bracken *Pteridium aquilinum*, hart's-tongue fern *Asplenium scolopendrium*, foxglove *Digitalis purpurea*, herb Robert *Geranium robertianum*, and wood avens. The S7 fungi violet coral *Clavaria zollingeri* was recorded on an earth bank associated with one of the species-rich hedgerows with trees towards the centre of the northern option survey area (TN2) (Photograph 1).

3.2.14 Species-poor intact hedge (J2.1.2) was recorded relatively frequently, scattered across the survey area. Species-poor defunct hedge (J2.2.2) and species-poor hedge with trees (J2.3.2) were less common, located centrally within the northern option survey area, and scattered across both survey areas, respectively. The woody species which generally dominated the species-poor hedgerows (J2.1.2, J2.2.2 and J2.3.2)

included hawthorn, bramble, hazel or ash, with non-woody species frequently comprising hart's-tongue fern, wood avens, common nettle or herb Robert.

3.2.15 Other JNCC field boundary types identified during the survey included fences (J2.4) enclosing some fields, a wall (J2.5) (see TN3 for more information) of stone construction recorded around residential properties in the south west, The survey area also included one dry ditch (J2.6) with steep earth banks within the woodland corridor south of Blackmoor Hill Farm, running perpendicular south of the watercourse. This ditch was heavily shaded by bramble, willow and holly scrub.

3.2.16 Lastly, buildings (J3.6) were scattered throughout the survey area, including farm buildings (TN4-7), residential buildings (TN8), and a residential care home (TN9). Hardstanding (J5) was located across the survey area forming the main A40, side roads and driveways.

Invasive Plant Species

3.2.17 A cotoneaster species *Cotoneaster spp.* was recorded within a species-rich hedgerow with trees along the A40 at the western end of the survey area (TN10), but it was not identified to species level. There are multiple similar cotoneaster species, with several resembling species listed on Schedule 9 of the WCA. Therefore, a precautionary approach has been adopted and it is assumed this could be a Schedule 9 species.

3.2.18 A rhododendron species (likely to be either *Rhododendron ponticum* or *Rhododendron ponticum x Rhododendron maximum*) was recorded within the woodland at the western end of the survey area south of Sodston House Farm (TN11) (Photograph 2).

3.2.19 A patch of montbretia (*Crocosmia x crocosmiiflora*) was recorded adjacent to a house, on the southern road verge at Redstone Cross (TN12).

Species

3.2.20 During the field survey, habitat was assessed for its potential to support protected and/or notable species. Any incidental records or evidence found during this survey were also noted and are further detailed within the species-specific survey reports that accompany the Environmental Statement.

Bats

3.2.21 Evidence of roosting bats was found in an outbuilding of the Blackmoor Hill Farm complex. Several other built structures (TN4-7) including the stone wall (TN3) around the perimeter of the residential care home to the south of Redstone Cross were found to have Potential Roost Features (PRFs). A mature oak tree located centrally within the southern option survey area was also identified as having high bat roosting potential (TN13).

3.2.22 The mosaic of farmland, woodland and scrub along with a well-connected network of hedgerows provides good foraging and commuting habitat for bats.

Riparian mammals

3.2.23 The survey area for the southern option includes four watercourses providing suitable habitat for water vole and otter. Two of these are within corridors of woodland and scrub providing suitable opportunities for breeding/resting otter (TN14-17). A potential otter holt was identified alongside the stream to the west of Redstone Cross (TN18).

3.2.24 The survey area for the northern option includes one very shallow ephemeral stream to the north east which may provide suitable commuting habitat for otter.

Dormouse

3.2.25 Suitable habitat for dormouse was present throughout the survey area in the form of thick hedgerows, scrub and woodland blocks or belts. These habitats are well connected both within the survey area, and to other suitable habitats outside of the survey area.

Amphibians

3.2.26 The field survey did not identify any suitable waterbodies for breeding amphibians. The potential waterbodies identified during the desk study from OS maps were found to be areas of waterlogged ground or otherwise unsuitable features when visited in the field.

Birds

3.2.27 The variety of habitats within the survey area were considered suitable to support a range of breeding birds. Hedgerows, woodland and scrub offered suitable foraging and nesting opportunities. Numerous built

structures including the stone wall (TN3) and various residential and farm buildings (TN4-7) within the survey area provide suitable nesting opportunities for species such as house sparrow and barn owl, with barn swallows *Hirundo rustica* identified nesting within a corrugated metal shed (TN5).

3.2.28 Red kite and buzzard *Buteo buteo* were observed flying over the western end of the survey area during the field survey (TN19).

Badger

3.2.29 The woodlands, scrub, hedgerows, earth banks and grassland habitat across the survey area of both scheme options provides optimal habitat for badger. This habitat mosaic provided key foraging areas and good opportunities for sett building. Numerous signs of badger, including latrines and setts, were recorded during the Extended Phase 1 Habitat survey. However, due to the volume of signs recorded and the sensitivity of records, the locations of these signs have been detailed within the badger-specific survey report, rather than being detailed here or shown on Figure 3.

Reptiles

3.2.30 The mosaic of habitats present is also suitable to support foraging, basking and hibernating reptiles.

Fish

3.2.31 All waterbodies within the survey area were relatively small and were therefore considered unlikely to support significant populations of fish.

Other Species

3.2.32 Habitats suitable to support a number of other notable species including those listed as Species of Principal Importance under S7 of the Environment (Wales) Act 2016) were identified during the survey. The network of woodland, hedgerow and grassland provided suitable habitat for hedgehog, brown hare and polecat. The hedgerows, grassland and woodland provide suitable habitat for white ermine[19], the grassland provides suitable habitat for ghost moth[20] and the woodland provides suitable habitat for brindled beauty[21], records of which were all returned within 500m during the data search.

[19] https://www.naturespot.org.uk/species/white-ermine Accessed 11th November 2019
[20] https://www.naturespot.org.uk/species/ghost-moth Accessed 11th November 2019
[21] https://www.naturespot.org.uk/species/brindled-beauty Accessed 11th November 2019

4 Conclusions

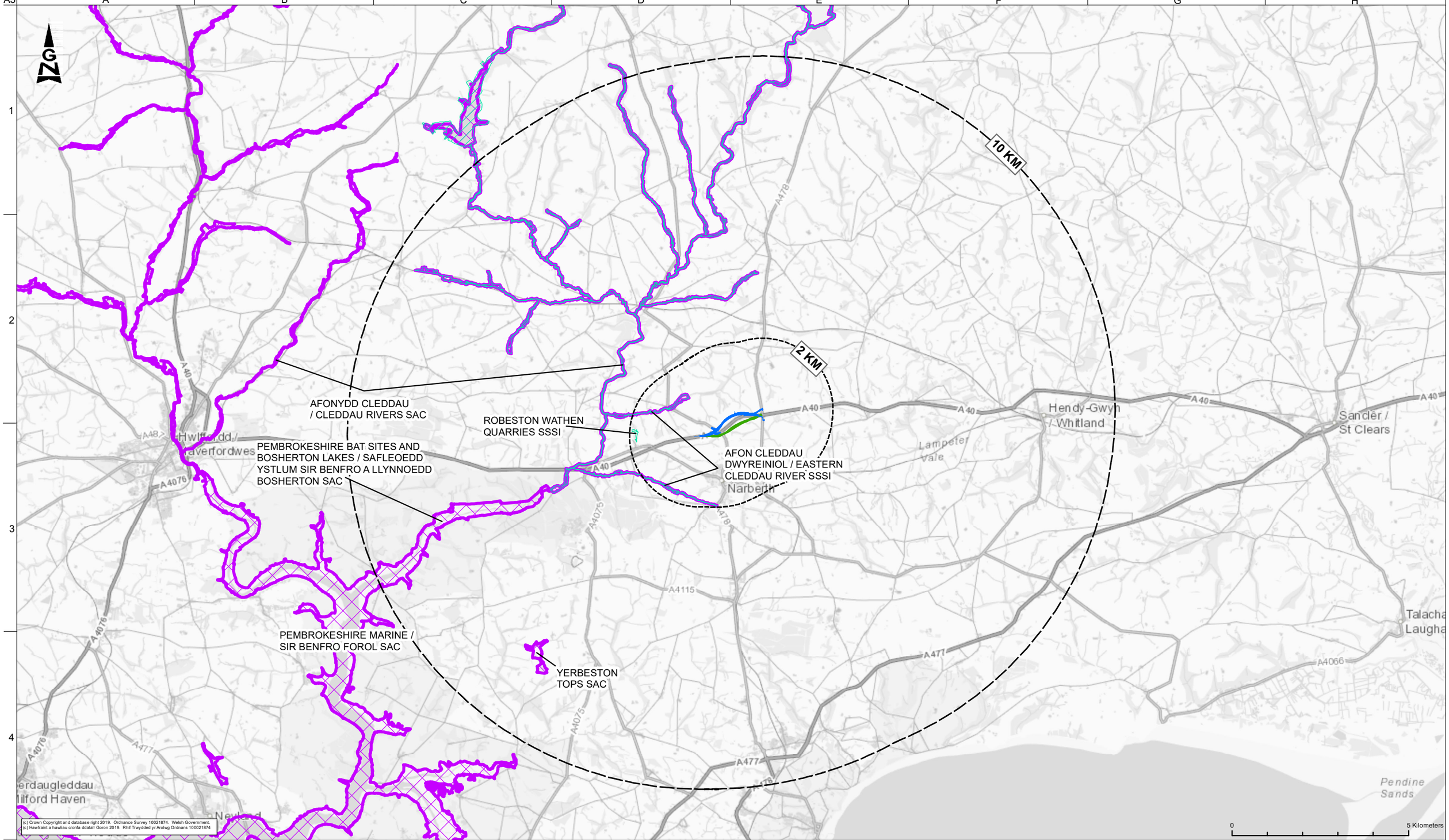
4.1.1 The desk study identified four European Sites within 10km, two bat SACs within 10 to 30km, and two national statutory designated sites within 2km of the study area.

4.1.2 The study area for both options was predominantly used for cattle and sheep production and comprised improved or poor semi improved grassland fields with mature hedgerow boundaries. In addition to these habitats, the southern option intersects four large blocks of lowland deciduous broadleaved woodland, and two watercourses.

4.1.3 Suitable habitat to support protected and notable species was identified during the survey. These include bats, otter, dormouse, water vole, breeding birds, reptiles and badger. Additionally, suitable habitat was present for S7 species including hedgehog, polecat, brown hare, and invertebrates.

4.1.4 A complete assessment of the impacts on designated sites, habitats and protected and notable species will be carried out for the scheme as part of an environmental impact assessment, the results of which will be presented in the Environmental Statement together with the mitigation and compensation measures proposed.

5 Figures



LEGEND

- PROPOSED SCHEME (NORTHERN OPTIONS)
- PROPOSED SCHEME (SOUTHERN OPTION)
- 2 KILOMETRE BUFFER
- 10 KILOMETRE BUFFER
- SITES OF SPECIAL SCIENTIFIC INTEREST (SSSI)
- SPECIAL AREAS OF CONSERVATION (SAC)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)
Construction
None
Maintenance / Cleaning
None
Use
None
Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	16/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

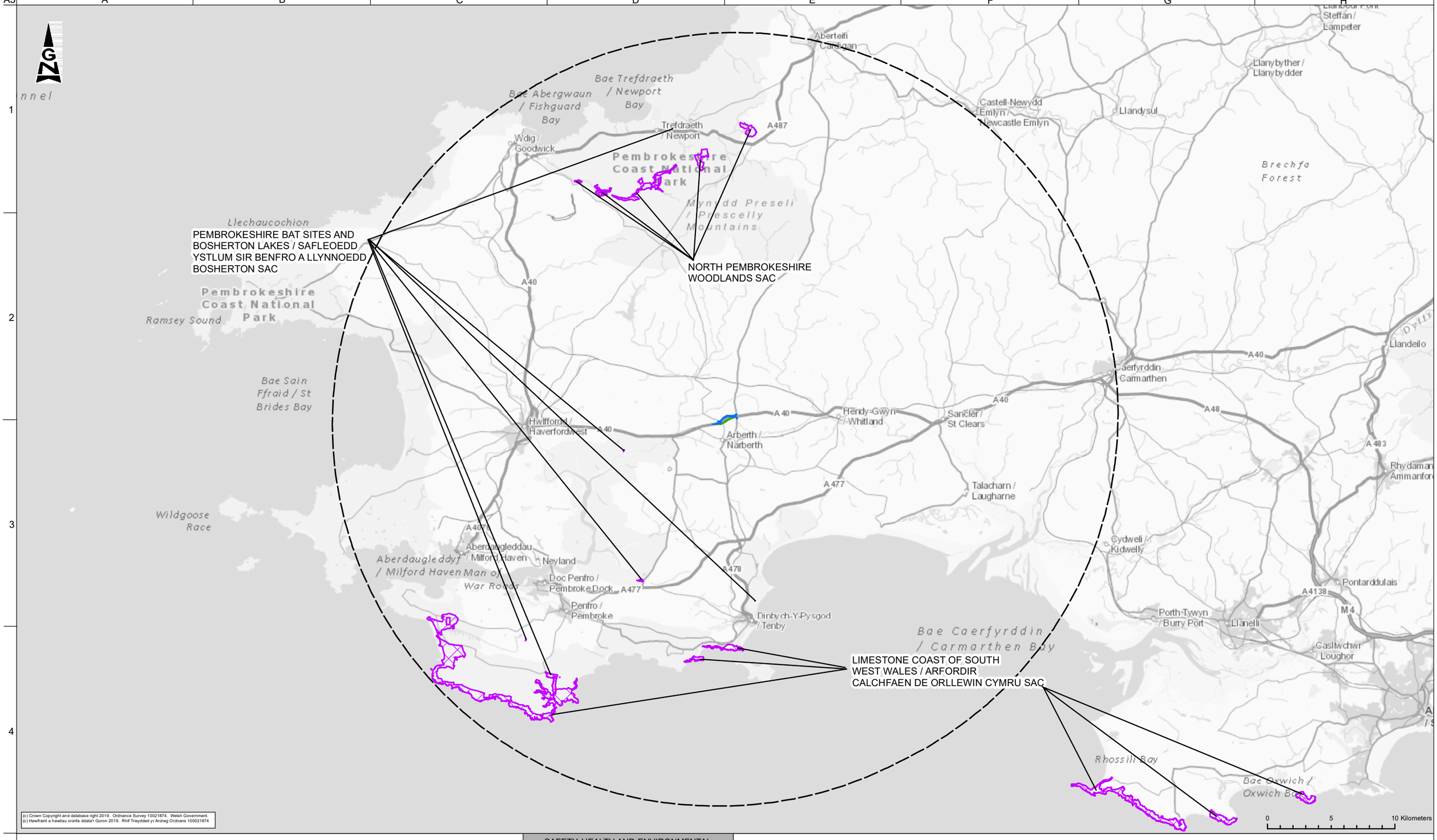
Drawing Title
FIGURE 1
NATIONAL STATUTORY DESIGNATED SITES WITHIN 2 KILOMETRES AND EUROPEAN SITES WITHIN 10 KILOMETRES

Suitability
S3 | FIT FOR REVIEW AND COMMENT

Scale at A3
1:100,000

Rev	By	Chkd	Appd	Auth
P01	EA	CJ	PC	GD
	Date 16/01/20	Date 16/01/20	Date 16/01/20	Date 16/01/20

Name
A40PRC - ARP - EBD - SWI - DR - LE - 0002
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

- PROPOSED SCHEME (NORTHERN OPTIONS)
- PROPOSED SCHEME (SOUTHERN OPTION)
- 30 KILOMETRE BUFFER
- BAT SPECIAL AREAS OF CONSERVATION (SAC)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction	None
Maintenance / Cleaning	None
Use	None
Decommissioning / Demolition	None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	16/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title: A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client: Llywodraeth Cymru / Welsh Government

Delivery Team: ARCADIS; MOTT MACDONALD; ARUP; RICHARDS

Drawing Title: FIGURE 2 BAT SPECIAL AREAS OF CONSERVATION (SACS) WITHIN 30 KILOMETRES

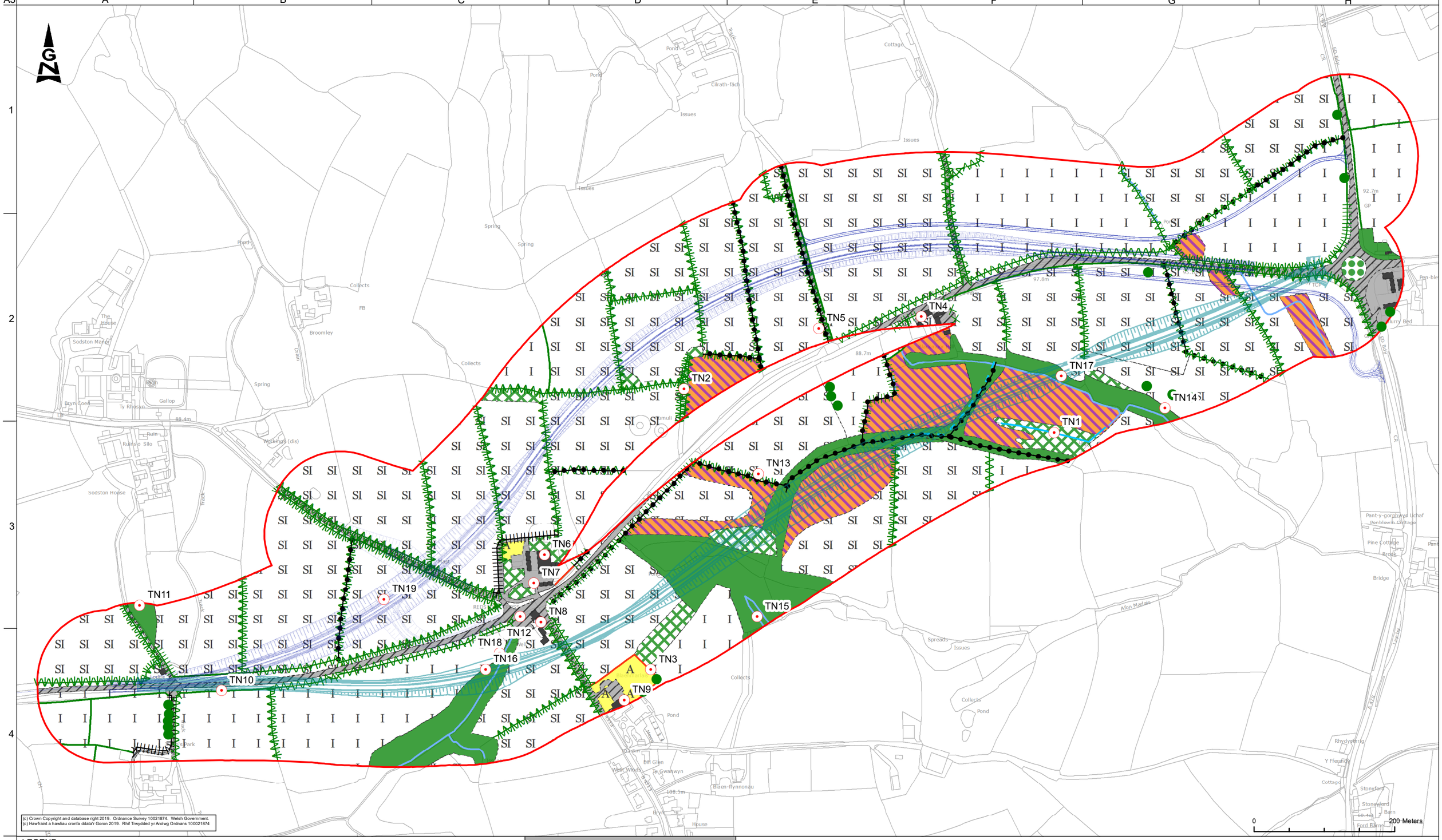
Suitability: S3 | FIT FOR REVIEW AND COMMENT

Scale at A3: 1:275,000

Rev	By	Chkd	Appd	Auth
P01	AC	CJ	PC	GD
	Date 16/01/20	Date 16/01/20	Date 16/01/20	Date 16/01/20

Name: A40PRC - ARP - EBD - SWI - DR - LE - 0003

Project | Originator | Volume | Location | Type | Role | Number



LEGEND

- 100 METRE BUFFER SURVEY AREA
- PROPOSED SCHEME (SOUTHERN OPTION)
- PROPOSED SCHEME (NORTHERN OPTIONS)
- TARGET NOTE
- A3.1 SCATTERED BROADLEAVED TREES
- A2.2 SCATTERED SCRUB
- G1 STANDING WATER
- G2 RUNNING WATER
- J2.1.1 SPECIES-RICH INTACT HEDGE
- J2.1.2 SPECIES-POOR INTACT HEDGE
- J2.2.1 SPECIES-RICH DEFUNCT HEDGE
- J2.2.2 SPECIES-POOR DEFUNCT HEDGE
- J2.3.1 SPECIES-RICH HEDGE WITH TREES
- J2.3.2 SPECIES-POOR HEDGE WITH TREES
- J2.4 FENCE
- J2.5 WALL
- J2.6 DRY DITCH
- J2.8 EARTH BANK
- A1.1.1 SEMI-NATURAL BROADLEAVED WOODLAND
- A2.1 DENSE SCRUB
- A3.1 SCATTERED BROADLEAVED TREES
- B4 IMPROVED GRASSLAND
- B5 MARSHY GRASSLAND
- B6 POOR SEMI-IMPROVED GRASSLAND
- J1.2 AMENITY GRASSLAND
- J3.6 BUILDINGS
- J5 GRAVEL AND CONCRETE
- J5 TARMAC

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction	None
Maintenance / Cleaning	None
Use	None
Decommissioning / Demolition	None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	16/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

Drawing Title
FIGURE 3
EXTENDED PHASE 1 HABITAT SURVEY RESULTS

Suitability
S3 | FIT FOR REVIEW AND COMMENT

Scale at A3
1:5,000

Rev	By	Chkd	Appd	Auth
P01	AC	CJ	PC	GD
	Date 16/01/20	Date 16/01/20	Date 16/01/20	Date 16/01/20

Name
A40PRC - ARP - EBD - SWI - DR - LE - 0004

Project	Originator	Volume	Location	Type	Role	Number

6 Photographs

Photograph 1 Violet coral recorded on an earth bank associated with a species-rich hedge with trees.

Photograph 2 Schedule 9 rhododendron species recorded within woodland to the west of the survey area

7 Appendix A: Habitat areas within 100m of each scheme option

Habitat areas within 100m of scheme options

Table A 1 Habitat areas / lengths within 100m of the southern route option

Phase 1 Code	Phase 1 Habitat Type	Area (ha)	Length (m)
A1.1.1	Semi-natural broadleaved woodland	5.78	-
A2.1	Dense scrub	1.13	-
A3.1	Scattered broadleaved trees	0.10	-
B4	Improved grassland	9.69	-
B5	Marshy grassland	4.98	-
B6	Poor semi-improved grassland	22.3	-
G1	Standing water	-	159
G2	Running water	-	1,116
J1.2	Amenity grassland	0.33	-
J2.1.1	Species-rich intact hedge	-	1,214
J2.1.2	Species-poor intact hedge	-	681
J2.3.1	Species-rich hedge with trees	-	2,278
J2.3.2	Species-poor hedge with trees	-	583
J2.4	Fence	-	162
J2.5	Wall	-	199
J2.6	Dry ditch	-	187
J2.8	Earth bank	-	1,522
J3.6	Buildings	0.17	-
J5	Hardstanding	2.24	-

Table A 2 Habitat areas / lengths within 100m of the northern route option

Phase 1 Code	Phase 1 Habitat Type	Area (ha)	Length (m)
A1.1.1	Semi-natural broadleaved woodland	0.59	-
A2.1	Dense scrub	0.53	-
A2.2	Scattered scrub	-	37
B4	Improved grassland	13.98	-
B5	Marshy grassland	0.90	-
B6	Poor semi-improved grassland	37.79	-
G2	Running water	-	376
J1.2	Amenity grassland	0.06	-
J2.1.1	Species-rich intact hedge	-	2,077
J2.1.2	Species-poor intact hedge	-	1,792
J2.2.1	Species-rich defunct hedge	-	107
J2.2.2	Species-poor defunct hedge	-	12
J2.3.1	Species-rich hedge with trees	-	4,709
J2.3.2	Species-poor hedge with trees	-	182
J2.4	Fence	-	311
J2.5	Wall	-	12
J2.8	Earth bank	-	1,305
J3.6	Buildings	0.22	-
J5	Hardstanding	2.53	-

8 Appendix B: Target Notes

Target Notes

Label	Target Note
TN1	Ditch with water starwort and water-crowfoot, within an area of willow scrub.
TN2	S7 fungi species violet coral recorded
TN3	Stone wall with cracks/gaps. Potential for roosting bats and nesting birds.
TN4	Blackmoor Hill Farm complex – farmhouse, barn and garage. Stone/rendered walls and slate roofs. Some gaps due to slipped tiles or under ridge tiles, in timber above barn garage door, and under facias of house and bargeboards. Bats present in barn.
TN5	Corrugated metal shed used by barn swallows for nesting. Considered to possibly support a bat night roost.
TN6	Farmhouse complex – stone barn with corrugated metal roof, breeze block/metal sheds, and farmhouse with stone rendered walls, slate tiled roof and adjoining rendered barn with metal roof. High bat roosting potential.
TN7	Farmhouse and barn – rendered walls with ceramic roof tiles. New soffits on house with no gaps evident from front. Barn also well sealed.
TN8	Two recently built/renovated houses with rendered walls and new roof. No obvious gaps in roof or walls. New unplasticized Polyvinyl Chloride (uPVC) soffit and barge boards, with a tiny gap beneath soffit/barge board on northern house.
TN9	Residential care home, residential houses and cottages. Most buildings have rendered walls and roofs with slate tiles. Some slipped tiles on roof of old people's home. Low to moderate potential for roosting bats and potential for nesting birds.
TN10	*Cotoneaster* spp. present within this hedgerow
TN11	Schedule 9 rhododendron species recorded (*Rhododendron ponticum* or *Rhododendron ponticum x Rhododendron maximum*)
TN12	Patch of montbretia (*Crocosmia x crocosmiiflora*)
TN13	Mature oak tree with high bat roosting potential – knot-holes, wounds and cankers and lifting bark.
TN14	Larger stream within woodland corridor, approximately 1.5m wide with deep earth banks. Moderate volume of water/flow. Banks vegetated with scrub and woodland ground flora. Bed rocky in places. Potential for commuting/foraging otter with some suitable resting areas.
TN15	1m wide stream with deep sided earth banks, vegetated with bramble, mosses and ferns. Low volume of water at time of survey, slow flowing. Largely very shaded by woodland corridor. Potential for foraging/commuting otter and some suitable resting spots but unlikely to provide foraging opportunities for water vole.
TN16	Potential for commuting/foraging otter along stream with mature trees providing potential resting spots. Earth banks providing potential for water vole although sections are heavily poached.
TN17	Small stream located within woodland corridor, with low water volume, slow flow, and steep sided earth banks well vegetated with ferns, bramble, enchanter's nightshade, hart's-tongue fern and ivy. Potential for otter and water vole.
TN18	40-50cm wide hole under tree stump – potential badger hole or otter holt.
TN19	Red kite and buzzard flying over.

9 Appendix C: Species Lists

Species Lists

Common Name	Scientific Name
Semi-natural broadleaved woodland (A1.1.1)	
Woody species	
Sycamore	*Acer pseudoplatanus*
Alder	*Alnus glutinosa*
Hazel	*Corylus avellana*
Hawthorn	*Crataegus monogyna*
Ash	*Fraxinus excelsior*
Ivy	*Hedera helix*
Holly	*Ilex aquifolium*
Cherry	*Prunus avium*
Blackthorn	*Prunus spinosa*
Oak	*Quercus spp.*
Rose	*Rosa spp.*
Bramble	*Rubus fruticosus* agg.
Willow	*Salix spp.*
Gorse	*Ulex europaeus*
Non-woody species	
Hart's-tongue fern	*Asplenium scolopendrium*
Enchanter's nightshade	*Circaea lutetiana*
Broad buckler-fern	*Dryopteris dilatata*
Male-fern	*Dryopteris filix-mas*
Wood avens	*Geum urbanum*
Bluebell	*Hyacinthoides non-scripta*
Shield fern	*Polystichum spp.*
Primrose	*Primula vulgaris*
Bracken	*Pteridium aquilinum*
Creeping buttercup	*Ranunculus repens*
Dense (A2.1) / Scattered (A2.2) scrub	
Sycamore	*Acer pseudoplatanus*
Hawthorn	*Crataegus monogyna*
Beech	*Fagus sylvatica*
Bramble	*Rubus fruticosus* agg.
Grey willow	*Salix cinerea*
Gorse	*Ulex europaeus*
Common nettle	*Urtica dioica*
Scattered broadleaved trees (A3.1)	

Common Name	Scientific Name
Sycamore	*Acer pseudoplatanus*
Hazel	*Corylus avellana*
Hawthorn	*Crataegus monogyna*
Ash	*Fraxinus excelsior*
Oak	*Quercus spp.*
Rose	*Rosa spp.*
Improved grassland (B4)	
Creeping thistle	*Cirsium arvense*
Soft rush	*Juncus effusus*
Perennial ryegrass	*Lolium perenne*
Creeping bent	*Ranunculus repens*
Dock species	*Rumex spp.*
White clover	*Trifolium repens*
Common nettle	*Urtica dioica*
Marshy grassland (B5)	
Wild angelica	*Angelica sylvestris*
Sedge species	*Carex spp.*
Marsh thistle	*Cirsium palustre*
Meadowsweet	*Filipendula ulmaria*
Marsh bedstraw	*Galium palustre*
Fen bedstraw	*Galium uliginosum*
Jointed rush	*Juncus articulatus*
Soft rush	*Juncus effusus*
Compact rush	*Juncus conglomeratus*
Greater bird's-foot trefoil	*Lotus pedunculatus*
Bird's-foot trefoil	*Lotus corniculatus*
Ragged robin	*Lychnis flos-cuculi*
Poor semi-improved grassland (B6)	
Creeping bent	*Agrostis stolonifera*
Meadow foxtail	*Alopecurus pratensis*
False oat-grass	*Arrhenatherum elatius*
Oval sedge	*Carex leporina*
Common knapweed	*Centaurea nigra*
Cock's-foot	*Dactylis glomerata*
Meadowsweet	*Filipendula ulmaria*
Marsh bedstraw	*Galium palustre*
Yorkshire fog	*Holcus lanatus*

Common Name	Scientific Name
Common ragwort	*Jacobaea vulgaris*
Compact rush	*Juncus conglomeratus*
Rush species	*Juncus spp.*
Meadow vetchling	*Lathyrus aphaca*
Perennial ryegrass	*Lolium perenne*
Bird's-foot trefoil	*Lotus corniculatus*
Red bartsia	*Odontites vernus*
Timothy-grass	*Phleum pratense*
Ribwort plantain	*Plantago lanceolata*
Rough meadow grass	*Poa trivialis*
Creeping cinquefoil	*Potentilla reptans*
Creeping buttercup	*Ranunculus repens*
Dock species	*Rumex spp.*
White clover	*Trifolium repens*
Common nettle	*Urtica dioica*
Species-rich intact hedge (J2.1.1)	
Woody species	
Sycamore	*Acer pseudoplatanus*
Hazel	*Corylus avellana*
Hawthorn	*Crataegus monogyna*
Ash	*Fraxinus excelsior*
Ivy	*Hedera helix*
Holly	*Ilex aquifolium*
Honeysuckle	*Lonicera periclymenum*
Crab apple	*Malus sylvestris*
Cherry	*Prunus avium*
Blackthorn	*Prunus spinosa*
Oak	*Quercus spp.*
Rose	*Rosa spp.*
Bramble	*Rubus fruticosus* agg.
Willow	*Salix spp.*
Elder	*Sambucus nigra*
Gorse	*Ulex europaeus*
Non-woody species	
Hart's-tongue fern	*Asplenium scolopendrium*
Rosebay willowherb	*Chamaenerion angustifolium*
Foxglove	*Digitalis purpurea*

Common Name	Scientific Name
Male fern	*Dryopteris filix-mas*
Meadowsweet	*Filipendula ulmaria*
Cleavers	*Gallium aparine*
Herb Robert	*Geranium robertianum*
Wood avens	*Geum urbanum*
Ground-ivy	*Glechoma hederacea*
Common hogweed	*Heracleum sphondylium*
Creeping soft grass	*Holcus mollis*
Bluebells	*Hyacinthoides non-scripta*
Common toadflax	*Linaria vulgaris*
Common bird's-foot trefoil	*Lotus corniculatus*
Shield fern species	*Polystichum spp.*
Barren strawberry	*Potentilla sterilis*
Bracken	*Pteridium aquilinum*
Red campion	*Silene dioica*
Bittersweet	*Solanum dulcamara*
Common nettle	*Urtica dioica*
Wood speedwell	*Veronica montana*
Species-poor intact hedge (J2.1.2)	
Woody species	
Sycamore	*Acer pseudoplatanus*
Hawthorn	*Crataegus monogyna*
Ash	*Fraxinus excelsior*
Ivy	*Hedera helix*
Blackthorn	*Prunus spinosa*
Bramble	*Rubus fruticosus* agg.
Elder	*Sambucus nigra*
Gorse	*Ulex europaeus*
Wych elm	*Ulmus glabra*
Non-woody species	
Hart's-tongue fern	*Asplenium scolopendrium*
Rosebay willowherb	*Chamaenerion angustifolium*
Cotoneaster species	*Cotoneaster spp.*
Cleavers	*Gallium aparine*
Herb Robert	*Geranium robertianum*
Wood avens	*Geum urbanum*
Ground-ivy	*Glechoma hederacea*

Common Name	Scientific Name
Common hogwood	*Heracleum sphondylium*
Common toadflax	*Linaria vulgaris*
Bracken	*Pteridium aquilinum*
Rose	*Rosa spp.*
Common nettle	*Urtica dioica*
Wood speedwell	*Veronica montana*
Common dog violet	*Viola riviniana*
Species-rich defunct hedge (J2.2.1)	
Woody species	
Sycamore	*Acer pseudoplatanus*
Hawthorn	*Crataegus monogyna*
Ash	*Fraxinus excelsior*
Blackthorn	*Prunus spinosa*
Oak	*Quercus spp.*
Rose	*Rosa spp.*
Bramble	*Rubus fruticosa*
Gorse	*Ulex europaeus*
Non-woody species	
Red campion	*Silene dioica*
Species-poor defunct hedge (J2.2.2)	
Woody species	
Hazel	*Corylus avellana*
Hawthorn	*Crataegus monogyna*
Holly	*Ilex aquifolium*
Wych elm	*Ulmus glabra*
Species-rich hedge with trees (J2.3.1)	
Woody species	
Sycamore	*Acer pseudoplatanus*
Hazel	*Corylus avellana*
Hawthorn	*Crataegus monogyna*
Ash	*Fraxinus excelsior*
Cleavers	*Gallium aparine*
Ivy	*Hedera helix*
Holly	*Ilex aquifolium*
Honeysuckle	*Lonicera periclymenum*
Crab apple	*Malus sylvestris*
Cherry	*Prunus avium*

Common Name	Scientific Name
Blackthorn	*Prunus spinosa*
Oak	*Quercus spp.*
Rose	*Rosa spp.*
Bramble	*Rubus fruticosus* agg.
Willow species	*Salix spp.*
Elder	*Sambucus nigra*
Gorse	*Ulex europaeus*
Wych elm	*Ulmus glabra*
Non-woody species	
Meadow foxtail	*Alopecurus pratensis*
Silverweed	*Argentina anserina*
False oat-grass	*Arrhenatherum elatius*
Hart's-tongue fern	*Asplenium scolopendrium*
Lady fern	*Athyrium filix-femina*
Rosebay willowherb	*Chamaenerion angustifolium*
Bittersweet	*Circaea lutetiana*
Creeping thistle	*Cirsium arvense*
Foxglove	*Digitalis purpurea*
Broad buckler fern	*Dryopteris dilatata*
Male fern	*Dryopteris filix-mas*
Meadowsweet	*Filipendula ulmari*
Herb Robert	*Geranium robertianum*
Wood avens	*Geum urbanum*
Ground-ivy	*Glechoma hederacea*
Common hogwood	*Heracleum sphondylium*
Creeping soft grass	*Holcus mollis*
Bluebell	*Hyacinthoides non-scripta*
Meadow vetchling	*Lathyrus pratensis*
Garden privet	*Ligustrum ovalifolium*
Ribwort plantain	*Plantago lanceolata*
Shield fern species	*Polystichum spp.*
Barren strawberry	*Potentilla sterilis*
Bracken	*Pteridium aquilinum*
Dock species	*Rumex spp.*
Common figwort	*Scrophularia nodosa*
Red campion	*Silene dioica*
Hedge woundwort	*Stachys sylvatica*

Common Name	Scientific Name
Common nettle	*Urtica dioica*
Wood speedwell	*Veronica montana*
Common dog violet	*Viola riviniana*
Species-poor hedge with trees (J2.3.2)	
Woody species	
Sycamore	*Acer pseudoplatanus*
Hazel	*Corylus avellana*
Hawthorn	*Crataegus monogyna*
Ash	*Fraxinus excelsior*
Ivy	*Hedera helix*
Holly	*Ilex aquifolium*
Honeysuckle	*Lonicera periclymenum*
Blackthorn	*Prunus spinosa*
Bracken	*Pteridium aquilinum*
Rose species	*Rosa spp.*
Bramble	*Rubus fruticosus* agg.
Willow species	*Salix spp.*
Gorse	*Ulex europaeus*
Wych elm	*Ulmus glabra*
Non-woody species	
Hart's-tongue fern	*Asplenium scolopendrium*
Field bindweed	*Convolvulus arvensis*
Black bryony	*Dioscorea communis*
Male fern	*Dryopteris filix-mas*
Cleavers	*Gallium aparine*
Herb Robert	*Geranium robertianum*
Common hogwood	*Heracleum sphondylium*
Primrose	*Primula vulgaris*
Red campion	*Silene dioica*
Common nettle	*Urtica dioica*
Wood speedwell	*Veronica montana*

A40 Penblewin to Redstone Cross Improvements

NVC Vegetation Survey
Revision 3

For Ove Arup & Partners Ltd

August 2019

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Executive Summary

A Phase II survey of the vegetation present within the enclosed field system and associated woodlands described below was undertaken in June/July 2019 by TerrAqua Ecological services.

The survey was undertaken using standard methodologies as described in Rodwell J S (1991 et. seq). British Plant Communities, Volumes 1-5 and analysed using a combination of floristic tables and MAVIS Plot Analyser Version 1.00 Modular Analysis of Vegetation & Interpretation System Software.

The results of the NVC survey show that all of the fields are agriculturally improved and semi improved grassland communities. Most of the fields were assessed as being representative of MG6 and sub community grassland with seven assessed as representing more highly improved MG7 agricultural grasslands. Four fields were assessed as representing rush pasture communities typical of MG10. Open space plant communities including OV23 were also recorded within worn swards around access gates.

Aerial images indicate that none of the grassland communities had been subject to ploughing or re-seeding post 2006. The low levels of floristic diversity are therefore likely to be the result of long and ongoing agricultural management leading to a loss of diversity over time leading to the creation of communities similar to long term grass leys.

None of the grasslands represent plant communities with a high floristic diversity and none represent lowland meadows typical of MG5 species rich neutral grasslands.

Four individual woodlands were assessed as part of the survey. All four woodlands represent W8 Ash woodland types with small areas of woodland D also representative of W10 communities. Narrow strips of W6 Alder woodland were also recorded within woodland C.

Scrub communities typical of W21, W22, W23 and W24 were recorded around the periphery of woodlands notably in areas accessible to livestock or managed to prevent encroachment into the adjacent field system.

All of the vegetation communities recorded are common throughout Britain and are well represented within the county of Pembrokeshire.

No protected or rare plant species were recorded during the data collection.

1 Introduction

1.1 Client Details

The following survey report has been produced by TerrAqua Ecological Services Ltd on behalf of Ove Arup and Partners Ltd.

1.2 Survey Brief

The survey brief includes the requirement for the completion of a Phase II Vegetation survey (NVC) as part of the road scheme A40 Penblewin to Redstone Cross improvements. The survey to be completed within the designated boundary as follows:

- NVC surveys of woodlands and grasslands within a 50m buffer of centreline of proposed Southern option of the Project;
- NVC surveys of woodlands and grasslands within a 50m buffer of centreline of proposed Northern option of the Project;

2 Rational

2.1 Site Description

The site comprises a series of grasslands divided by an extensive hedgerow system that extends north and south of the A40. A total of thirty-eight (38) fields are included within the survey area. All of the fields are currently managed for agricultural purposes and include grasslands used as grazing pasture and those rotated between hay production and seasonal grazing. Almost all of the fields have been the subject of agricultural improvement to varying degrees.

The site also includes a number of woodland blocks, all which are located south of the A40. All represent lowland deciduous woodlands and are currently unmanaged. Almost all of the woodland areas are periodically accessible to livestock.

2.1.2 Designations

No part of the site is covered by a National or International designation for its conservation importance.

2.2 Survey Reasoning

The survey was completed as part of a larger ecological assessment of land north and south of the A40 between the Penblewin roundabout and Redstone Cross, Narberth, Pembrokeshire. The ecological assessments are required as part of the A40 Penblewin to Redstone Cross Improvements. The survey extended to land north and south of the A40 and over a distance of 50m from the central point to allow for a future decision to be made on the most appropriate route of any future road improvements.

3 Methodology

3.1 Survey Dates and Personnel

The survey was undertaken in June/July 2019 this falls within what is normally considered the optimal season for the detailed survey of lowland vegetation types. The survey was undertaken by Carmen Jones MSc MCIEEM Senior Ecological Consultant and Dyfrig Jones BSc Senior Ecological Consultant. Both experienced ecologists with extensive experience in both ecological assessment, Botanical Survey and species-specific issues.

3.2 NVC Field Survey

3.2.1 Survey Extent

The survey included the grassland areas associated with thirty-eight (38) fields and four (4) woodlands. The Identification number and Location of each field and woodland block is shown in appendix I.

The field survey was carried out using the National Vegetation Classification Techniques (Rodwell et al, 1991).

Each field was visually assessed and for each stand of homogenous vegetation five $2m^2$ quadrats were sampled. A quantitative assessment of species abundance was undertaken by eye of each plant above the ground within each quadrat.

A full list of the species present within each quadrat was recorded and the overall abundance of the species indicated using the DOMIN scale.

All information for each quadrat was recorded on a record sheet along with current management practices and this information was analysed at a later date in order to ascertain the vegetation type present within each field area.

The woodlands were assessed using a 50x50m quadrat to for canopy and understory species and a 10x10m for ground and field layers. For narrow or small blocks of woodland the quadrat shape was adjusted to accommodate each distinct community. For some relatively small distinct woodland blocks or scrub communities a single 50x50 and 10x10m quadrat was used to assess the NVC type.

Where possible the vegetation type of each stand was classified according to an NVC type using keys for British plant Communities Volume 3 Grassland and Montane Communities (Rodwell, 1992) and Volume 1 Woodland and Scrub Communities (Rodwell 1991). The vegetation analysis software MAVIS was also used to assist in classification of grasslands. The MAVIS programme mathematically compares the data with diagnostic data of the NVC constancy profiles and assigns the sample an NVC classification with a similar coefficient. Coefficients close to 50 are considered a reasonable match. Due to the vagaries of sampling plant communities will rarely provide an exact match with the NVC.

All woodland and scrub communities were classified using British Plant Communities floristic tables and no MAVIS analysis was undertaken.

3.2.2 Survey Limitations

There were no limitations to the effectiveness of the survey which followed the prescribed recommended NVC methodology as far as possible. Some variation in sampling techniques were used for small woodland blocks and scrub areas. Ground flora of lowland woodlands will

change according to season and surveys in June/July can result in under recording of some early flowering species. In this instance all woodlands were walked in May prior to the full survey commencing in order to get a full understanding of the woodland topography and identify any early species that may become difficult to identify later in the year. No significant differences in the overall ground flora of the woodlands was recorded between the initial walkover and conclusion of the full NVC survey. Access to all areas was possible although in some instances access was delayed due to the presence of cattle, however all fields were accessed by completion of the survey. Overall the results of the survey are considered a true reflection of the vegetation communities within the site.

4 Results

4.1 Vegetation Survey

The results of the survey have been described with reference to the vegetation types within each field and woodland as shown in Appendix I Drawing: **TQ/ARUP:Narb.Field & Woodland ID Plan V1**.

The classification of vegetation type as described above has been based on the field survey results and interpretation through manual assessment of flora using NVC tables and the use of MAVIS software. The MAVIS classification table for fields 1-38 are shown in tables 1-42 with the top three matches for each field/grassland type shown.

Example floristic tables for the common grassland communities recorded, including MG6, MG6a, MG10, MG10a, and MG7 are shown in Appendix IV.

The woodland classification has been based on the use of floristic tables manually assessed. No software analysis was used for the categorisation of woodlands. Woodland classifications are shown in table 43.

4.1.2 NVC Classification MAVIS Output-Grasslands

The full results of the MAVIS Analysis are shown in Appendix II Tables 1-42

4.1.3 NVC Classification Woodlands

Table 43 Classification of Woodland and Scrub Communities

Woodland ID Number	NVC Community
A	W8, W21, W22, W24, W25
B	W8, W21, W22, W24
C	W8, W6, W21, W22, W24
D	W8, W21, W24

4.1.4 General Habitat Descriptions and NVC Classifications

The following tables offer a brief description of each field or woodland and description of the vegetation types and classifications afforded to each. The NVC classification for each field and woodland are also shown in Appendix II Drawing **TQ/ARUP: Narb: Field & Woodland ID & NVC Plan V2.**

Field No	NVC	Comments
1	MG7b	South facing grassland un-grazed with a sward height of some 50-60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. The floristic diversity is low and dominated by agricultural grasses. Vascular plants are poorly represented. The grassland shows a high to moderate degree of agricultural improvement although aerial images would indicate that the sward has remained unploughed for longer than a decade. The NVC classification of MG7b *Lolium perenne-Poa trivialis* community represents a typical improved or floristically poor improved/semi improved grassland type associated with grassland leys. However, in this instance the grassland is likely to have developed as a result of intensive agricultural management rather that re-seeding. This grassland type is common throughout the British agricultural lowlands and has a low conservation value.
2	MG6	South facing un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification MG6 *Lolium perenne-Cynosurus cristatus* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. The grassland has a low conservation value.
3	MG6a	South facing un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC

		classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. The grassland has a low conservation value.
4	MG7	South facing grassland, un-grazed with sward height of 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG7 *Lolium perenne* community presents a typical improved grassland type normally associated with grass leys, however in this case the improvement is likely to be the result of intensive management practises rather than regular re-sowing. The grassland is typical of highly managed grasslands across Britain and has a low conservation value.
5	MG6b	South facing un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG6b *Lolium perenne-Cynosurus cristatus Anthoxanthum oderatum* sub community represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. The grassland has a low conservation value.
6	MG6b	South facing un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG6b *Lolium perenne-Cynosurus cristatus Anthoxanthum oderatum* sub community represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. The grassland has a low conservation value.
7	MG6	South facing cattle grazed grassland with a sward height of some 5cm. The grassland shows signs of regular and heavy grazing. Vascular plants are poorly represented although in patches the sward does improve floristically with higher percentage of clovers, meadow and creeping buttercup, sp, birds foot trefoil, occasional meadow vetchling and a

		single stand of yellow rattle. The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6 *Lolium perenne-Cynosurus cristatus* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. MG6 grasslands can represent diverse and important swards. In this instance the sward while more diverse than many of the surrounding grasslands still remains relatively poor mainly due to the effects of heavy grazing.
8	MG10a	Flat heavily grazed grassland dominated by soft rush. The grassland has been subject to high levels of poaching by cattle. The grassland shows evidence of management through past topping of rush and other tall herbs such as dock and sorrel. Juncus species dominate the grasslands with occasion more grassy areas more typical of MG6 communities at the periphery. The NVC classification of MG10a *Holco-Juncetum effuse typicum* represent a typical grassland community of waterlogged pasture throughout the British lowlands.
9	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular and heavy grazing resulting in poaching. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands and in this instance has a low conservation value.
10	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular and heavy grazing resulting in poaching. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands and in this instance has a low conservation value.
11	MG6a	South facing un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has

		been subject to agricultural improvement and management practices and is common throughout the British lowlands. The grassland has a low conservation value.
12	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular and heavy grazing resulting in poaching. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands and in this instance has a low conservation value. Small patches of soft rush have developed within isolated corners of the sward typical of an MG10 community.
13	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular and heavy grazing resulting in poaching. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands and in this instance has a low conservation value.
14	MG6a	South facing un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG6a re *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* presents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. Towards the northern boundary the vegetation becomes more typical of open woodland with *Holcus Lanatus* and *Pteridium aqualinum* forming a verge of some 1-2m in width between the hay field and adjacent hedgerow representing NVC W25 *Pteridium aqualinum-Rubus fruticosus* under scrub.
15	MG6a	South facing un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC

		classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. Towards the northern and western boundary the vegetation becomes more typical of open woodland with *Holcus Lanatus* and *Pteridium aqualinum* forming a verge of some 1-2m in width between the hay field and adjacent hedgerow representing NVC W25 *Pteridium aqualinum-Rubus fruticosus* under scrub. Heavy trampling/machinery access has resulted in open space vegetation typical of the NVC OV23 *Plantago Major-Trifolium repens* community developing around the main access gate.
16	MG6a	South facing cattle grazed grassland with a sward height of some 5cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate to high degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
17	MG6a	South facing cattle grazed grassland with a sward height of some 5cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented with Ranunculus sp and Trifolium sp being the only frequent vascular species The grassland shows a moderate to high degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
18	MG6a	South facing cattle grazed grassland with a sward height of some 1-2cm. The grassland shows signs of regular and very heavy grazing resulting in severe poaching in places and areas of bare earth beneath hedgerows. Vascular plants are poorly represented with *Ranunculus* and *Trifolium* the only frequent species. A single small patch of *Rhinanthus minor* was recorded towards the centre of the field. The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.

19	MG6a	South facing cattle grazed grassland with a sward height of some 1-2cm. The grassland shows signs of regular and very heavy grazing resulting in severe poaching in places and areas of bare earth beneath hedgerows. Vascular plants are poorly represented with Ranunculus and Trifolium the only frequent species. A single small patch of *Rhinanthus minor* was recorded towards the centre of the field along with a single patch of *Lotus corniculatus*. The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
20	MG6a	Flat un-grazed with a sward height of some 60cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. Heavy trampling/machinery access has resulted in the development of open space vegetation typical of NVC OV23 *Plantago Major-Trifolium repens* community developing around the main access gate.
21	MG7	South facing cattle grazed grassland with a sward height of some 1-2cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement with no evidence of re-seeding with the past decade. The grassland shows a high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG7 *Lolium perenne ley* represents a typical improved grassland type normally associated with grass leys, however in this case the improvement is likely to be the result of intensive management practises rather than regular re-sowing. The grassland is typical of highly managed grasslands across Britain.
22	MG7	South facing grassland, un-grazed with sward height of 10cm. The grassland has been managed for agricultural purposes and at the time of survey contained a short sward of new growth following an earlier cut of hay. Vascular plants are poorly represented. The grassland shows a high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The

		NVC classification of MG7 *Lolium perenne ley* represents a typical improved grassland type normally associated with grass leys, however in this case the improvement is likely to be the result of intensive management practises rather than regular re-sowing. The grassland is typical of highly managed grasslands across Britain and has a low conservation value.
23	MG7	South facing grassland, un-grazed with sward height of 10cm. The grassland has been managed for agricultural purposes and at the time of survey contained a short sward of new growth following an earlier cut of hay. Vascular plants are poorly represented. The grassland shows a high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG7 *Lolium perenne ley* represents a typical improved grassland type normally associated with grass leys, however in this case the improvement is likely to be the result of intensive management practises rather than regular re-sowing. The grassland is typical of highly managed grasslands across Britain and has a low conservation value.
24	MG6a	South facing cattle grazed grassland with a sward height of some 5cm. The grassland shows signs of regular and heavy grazing resulting in scattered dunging areas and poaching. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands and in this instance has a low conservation value. Towards the south western corner and along the southern boundary scrub communities have developed along the hedgerow typical of NVC W25 *Pteridium aqualinum-Rubus fruticosus* under scrub and where inaccessible to livestock occasional small stands of vegetation closely resembling MG1 *Arrhenatherum elatioris* communities.
25	MG6a	Flat un-grazed with a sward height of some 70cm. The grassland has been managed for agricultural purposes and at the time of survey contained a standing hay crop. Vascular plants are poorly represented. The grassland shows a moderate to high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. Scrub communities have developed

		along the boundaries of the grassland, adjacent to mature hedgerows, typical of NVC W25 *Pteridium aqualinum-Rubus fruticosus* under scrub, W24 *Rubus fruticosus-Holcus lanatus* under scrub and occasional small stands of vegetation closely resembling MG1 *Arrhenatherum elatioris* communities.
26	MG6a MG10a	Flat sward with a height of some 50cm. The grassland was un-grazed at the time of survey but evidence of former grazing is apparent. The sward is variable with a mosaic of open grassland communities typical of MG6a communities and large areas of Juncus dominated areas typical of MG10a *Holco-Juncetum effuse typicum*. The MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* community lacks a high proportion of vascular plants with *Ranunculus*, and *Trifolium* species the most frequent. Occasional *Cirsium sp, Galium*, and *convolvulus* are also present along with occasional *Cardamine pratensis.* The Juncus dominated swards are located around the southern, northern and eastern boundaries and become extensive in places encroaching towards the centre of the field. These areas are floristically poor with occasional *Ranunculus* present along with very infrequent *Galium palustre* and *Cardamine pratensis.* The NVC classification of MG6a represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands. The MG10a community is also widespread throughout the British lowlands although is decreasing due to agricultural improvement.
27	MG6a	South facing grazed grassland with a sward height of some 5cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented with *Ranunculus* and *Trifolium* the only frequent species. The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
28	MG7	South facing grazed grassland with sward height of 4cm. The grassland has been managed for agricultural purposes. Vascular plants are poorly represented. The grassland shows a high degree of agricultural improvement through management but based on aerial images has remained unploughed for more than a decade. The NVC classification of MG7 *Lolium perenne ley* represents a typical improved grassland type normally associated with grass leys, however in this case the improvement is likely to be the result of intensive management practises rather than regular re-sowing. The grassland is typical of highly managed grasslands across Britain.

29	MG6a MG10a	Flat sward with a height of some 50cm. The grassland was un-grazed at the time of survey, but evidence of former grazing is apparent. The sward is variable with a mosaic of open grassland communities typical of MG6a communities and large areas of *Juncus* dominated areas typical of MG10a *Holco-Juncetum effuse typicum*. The MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* community lacks a high proportion of vascular plants with *Ranunculus*, and *Trifolium* species the most frequent. Occasional *Cirsium sp*, and *convolvulus* are also present along with *Lotus corniculatus*. The Juncus dominated swards are located around the northern side of the field and become extensive in places encroaching towards the centre of the field. These areas are floristically poor with occasional *Ranunculus* present along with very infrequent *Cardamine pratensis, Lynchis flos-cuculi, Galium palustre and Lotus corniculatus.* The NVC classification of MG6a represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands and in this instance has a low conservation value. The MG10a community is also widespread throughout the British lowlands although is decreasing due to agricultural improvement.
30	MG10 MG6a	Flat heavily grazed mosaic grassland dominated by soft rush. The grassland has been subject to high levels of poaching by cattle. Juncus species dominate the grasslands with occasion more grassy areas more typical of MG6 communities at the periphery. Floristic diversity within the MG10 grassland is relatively poor with occasional *Trifolium, Ranunculus, Cardamine pratensis, Galium pratense, Filipendula ulmaria*, and *Lynchis fos-calculi* present. The MG6a community is also floristically poor with *Trifolium, Ranunculus* the most frequent species and occasional *Lathyrus pratensis*, *Cirsium arvense, Cirsium vulgare* and *Potentilla reptans* also present. The NVC classification of MG10 *Holcus lanatus-Juncus effusus* represent a typical grassland community of waterlogged pasture throughout the British lowlands. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is also common throughout the British lowlands. The field is affected by the encroachment of *Salix caprea* notably along the western boundary.
31	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that

		has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
32	MG10 MG6a	North east facing grazed mosaic grassland dominated by soft rush. The grassland was un-grazed at the time of survey with a sward height of 20cm. *Juncus* species dominate the grasslands with occasional more grassy areas more typical of MG6 communities. Floristic diversity within the MG10 *Holcu lanatus-Juncus effusus* grassland is poor with occasional *Trifolium, Ranunculus, Cardamine pratensis, Galium pratense, Filipendula ulmaria,* and *Lynchis fos-calculi* present. The MG6a *Lolium perenne-Cynosurus cristatus- Lolio-Cynosuretum typicum* community is also floristically poor with *Trifolium, Ranunculus* the most frequent species and occasional *Lathyrus pratensis, Cirsium arvense, Cirsium vulgare* and *Potentilla reptans* also present. The NVC classification of MG10a represent a typical grassland community of waterlogged areas throughout the British lowlands. The NVC classification of MG6a represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is also common throughout the British lowlands. The field is affected by the encroachment of Salix caprea notably along the drain which follows a north west path across part of the field.
33	MG6a	North facing grazed grassland with a sward height of some 5cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
34	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
35	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that

		has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
36	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
37	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands.
38	MG6a	South facing cattle grazed grassland with a sward height of some 2cm. The grassland shows signs of regular grazing. Vascular plants are poorly represented The grassland shows a moderate degree of agricultural improvement with no evidence of re-seeding with the past decade. The NVC classification of MG6a *Lolium perenne-Cynosurus cristatus-Lolio-Cynosuretum typicum* represents a typical lowland grassland that has been subject to agricultural improvement and management practices and is common throughout the British lowlands and in this instance has a low conservation value. A short drain runs through this field with narrow strips of semi aquatic vegetation including *Persicaria sp, Juncus effusus,* and occasional *Mentha aquatica* following the course of the drain.

Woodland No	**NVC**	**Comments**
A	W8 W21 W22 W24 W25	Narrow woodland block located on steep bank following small watercourse. The woodland comprises a mosaic of woodland and scrub with the mature broadleaf woodland occupying the mid to lower banks with scrub communities dominating the upper bank and northern field boundary. The woodland has been assessed as representing NVC W8 *Fraxinus excelsior-Acer campestre* community or sub communities of. Along the upper portion of the south facing banks scrub communities occur in patches. The scrub

		community present appears to depend on past and current management such as the accessibility of livestock, regrowth following clearance and management to prevent encroachment into the grassland above. Four scrub communities are present along this northern bank including W21 *Crataegus monogyna-Hedera helix scrub*, W22 *Prunus spinosa-Rubus fruticosus* , W24 *Rubus fruticosus-Holcus lanatus* under scrub is present in more open areas and W25 *Pteridium aqualinum-Rubus fruticosus* under scrub. All vegetation types recorded are common within the British lowlands.
B	W8 W21 W22 W24	Block of broadleaf deciduous woodland. The woodland is located on a relatively flat area of land and contains remnants of old field boundary hedgerows. Ash is the dominant tree species present with oak and sycamore also present as mature trees. The woodland is unmanaged other than a section below power lines that is regularly cleared to preserve the way leave. The mature woodland has been assessed as representing NVC classification W8 *Fraxinus excelsior-Acer campestre* community or sub communities of. The composition of the woodland changes according to the location of the old hedgerows and in places the community merges into that similar to W10 *Quercus robur-Pteridium aqualinum* woodland type. Around the periphery of the woodland and within areas lying adjacent to an old track way scrub communities have developed. These scrub communities occur as a mosaic depending on edaphic factors and previous land use. W21 *Crataegus monogyna-Hedera helix scrub*, and W22 *Prunus spinosa-Rubus fruticosus* are present around the perimeter of the woodland with small areas of W24 *Rubus fruticosus-Holcus lanatus* under scrub. Within the area regularly cleared to preserve the way leave Salix caprea and Salix cinerea are the dominant species present forming a distinct rectangular community dividing the main W8 woodland.
C	W8 W6 W21 W22 W24	Narrow area of broadleaf woodland following course of small watercourse and located on area of steep banks and flat valley floor. The woodland includes remnants of former hedge boundaries. The woodland consists of a mosaic of true woodland and scrub communities and in places is heavily poached due to access by cattle. Alder dominates the banks immediately above the watercourse and forms a narrow strip of W6 *Alnus glutinosa-Urtica dioica* community with Salix species dominating the flat valley bottom and merging with the adjacent MG10 grassland community. Beyond this narrow strip ash becomes the dominant tree species along with scattered oak forming a W8 *Fraxinus excelsior-Acer campestre* community or sub communities of. Towards the upper edges of the northern banks scrub communities dominate. The scrub

		communities form a mosaic according to the degree of grazing and other management used to prevent encroachment into the adjacent fields. Three scrub communities are present along this northern bank including W21 *Crataegus monogyna-Hedera helix scrub*, W22 *Prunus spinosa-Rubus fruticosus* , W24 *Rubus fruticosus-Holcus lanatus* under scrub
D	W8 W21 W24	This narrow strip of broadleaf woodland has formed by the maturing of former hedgerow trees. The majority of mature trees are located on the remnants of an old substantial hedge bank/ditch with substantial outgrowths forming peripheral scrub communities. The woodland is dominated by ash and is representative of W8 *Fraxinus excelsior-Acer campestre* community or sub communities of. In some small sections the community becomes more oak dominated representing close affinity with W10 *Quercus robur-Pteridium aqualinum* woodland type. Outgrowths from the former hedgerow and developing peripheral scrub represent W21 *Crataegus monogyna-Hedera helix scrub*, and W24 *Rubus fruticosus-Holcus lanatus* under scrub communities.

5 General Evaluation

5.1 Grasslands

A total of thirty-eight (38) individual fields were assessed. All of the fields are currently managed for agricultural purposes and include grazed pasture and fields set aside for hay and silage. A number of fields used for hay are subject to grazing for short periods after hay collection. This was observed within number of fields located north of the A40 where following hay collection the fields were immediately grazed by sheep. No arable fields were present within the survey area.

All of the grassland types recorded were representative of agriculturally semi improved grasslands although the degree of improvement varied between fields. Most of the fields assessed were confirmed as communities representative of MG6 *Lolio Cynosuretum cristati* and sub communities. The MG6 grassland is ubiquities throughout the British lowlands and represent common agricultural grasslands. Within the survey area a total of 30 individual fields contain vegetation types typical of MG6 and sub communities and these communities are dominant in twenty-eight of these fields.

Five of the fields assessed also contain MG10 *Holco-Juncetum* communities typical of wet pastures. The MG10 communities are dominant within three fields (8, 30 & 32) interspersed with a mosaic of MG6 grassland types. In fields 26 and 29 MG6 communities dominate but with large areas of MG10 communities present.

Seven of the fields were classified as representing MG7 *Lolium perenne* Leys and sub communities thereof. These vegetation types are associated with re-seeded temporary grasslands with very limited diversity and grown as an agricultural crop. In this instance the grasslands do not appear to have been reseeded for a least a decade and therefore the confidence in these results is low. In most cases the coefficient of similarity between the MG7 and second choice, normally MG6 or sub community, is very small suggesting that the vegetation is a transitional one or that the degree of agricultural improvement has resulted in a decrease of species over time and such that the swards now represent communities similar to older leys.

None of the grasslands represent important conservation grasslands. No stands of floristically rich MG5 communities were recorded. Some MG6 communities can be relatively diverse and represent important conservation grasslands. In this instance none of the grasslands were representative of such communities. Field 7 although heavily grazed was the most floristically diverse and less improved and would in common with fields 9 and 10 benefit from a reduction in grazing which may result in an improved floristic diversity.

The Environment (Wales) Act 2016 list a number Habitats of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales. None of the habitats (Grasslands) recorded during the survey fit the criteria for habitats of principal importance. MG10 rush pasture is considered important if it provides a corridor linking other important habitats or supports a protected or rare species. In this instance the recorded MG10 pastures do not form important links between habitats and therefore are of moderate ecological value.

No protected, rare or locally important species were recorded within the grasslands.

5.2 Woodlands & Scrub

All of the four woodlands are primarily representative of W8 *Fraxinus excelsior-Acer campestre* community or sub community. These communities are common throughout the lowlands of Britain. Scrub communities are also common throughout all of the woodlands are particularly noticeable along woodland edges and areas grazed by livestock or where expansion is controlled.

Woodland D has developed along the length of an old and unmanaged hedgerow allowing the trees to reach maturity. Some sections of this woodland grade into communities more representative of W10 *Quercus robur-Pteridium aqualinum* woodland type.

Woodland C follows the course of a small watercourse allowing the development of a small and narrow strip of W6 *Alnus glutinosa-Urtica dioica community* along the immediate watercourse and narrow valley bottom. The strips of woodland above the watercourse are representative of W8 woodland communities.

The woodland is accessible to livestock with evidence of poaching, heavy and grazing common particularly along the northern side. In more open spaces scrub communities have developed

including W21 *Crataegus monogyna-Hedera helix scrub*, W22 *Prunus spinosa-Rubus fruticosus*, W24 *Rubus fruticosus-Holcus lanatus* under scrub. The presence of these scrub communities is a common feature of all four of the woodlands.

Salix caprea and Salix cinerea (and hybrids) are present along the boundaries of all four woodlands. These pockets of willow occur in patches with other scrub communities. Larger areas of Salix occur along the boundaries of fields 30 and 32 and encroach into the open MG10 grasslands and along the heavily managed way leave strip within WB.

All of the woodlands would be considered lowland mixed deciduous woodlands under the meaning of the Environment (Wales) Act 2016 and are therefore listed as a Habitat of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales.

All of the woodland and scrub communities recorded are common throughout Britain and within the county of Pembrokeshire.

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Appendix I

Map Showing Field and Woodland ID and NVC Classification Per Field and Woodland

TerrAqua Ecological Services Ltd

A40: Narberth
for ARUP

Field & Woodland: ID & NVC Plan

SCALE :	DATE :	N
1 : 2500 @ A1	02/12/2019	
MAP FILENAME : TQ/ARUP: Narb. Field & Woodland: ID & NVC Plan v2		

Legend

Woodland ID	A - D
Woodland NVC	W6; W8....
Field ID	1-38
Field NVC	MG6a; MG7.....

Appendix II

Table 1 MAVIS Output Field 1

NVC Community/ Sub Community Code	Coefficient of Similarity
MG7b	56.27
MG6	54.45
MG6a	53.85

Table 2 MAVIS Output Field 2

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6	55.24
MG6b	54.87
MG6a	54.32

Table 3 MAVIS Output Field 3

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	62.10
MG7d	61.74
MG6	61.22

Table 4 MAVIS Output Field 4

NVC Community/ Sub Community Code	Coefficient of Similarity
MG7	68.23
MG7c	67.34
MG7d	67.04

Table 5 MAVIS Output Field 5

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6b	64.02
MG6d	63.33
MG6	59.63

Table 6 MAVIS Output Field 6

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6b	65.90
MG6d	61.71
MG6	60.47

Table 7 MAVIS Output Field 7

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6	66.44
MG6b	65.84
MG6a	65.10

Table 8 MAVIS Output Field 8

NVC Community/ Sub Community Code	Coefficient of Similarity
MG10a	64.94
MG10	61.40
MG10c	50.70

Table 9 MAVIS Output Field 9

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	64.46
MG6	61.37
MG6b	56.32

Table 10 MAVIS Output Field 10

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	70.42
MG6	66.33
MG7d	64.52

Table 11 MAVIS Output Field 11

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	68.66
MG6	66.33
MG7d	65.11

Table 12 MAVIS Output Field 12

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	53.36
MG6	51.88
MG7d	49.73

Table 13 MAVIS Output Field 13

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	62.98
MG6	62.50
MG7d	60.74

Table 14 MAVIS Output Field 14

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	70.39
MG7	66.39
MG6	63.78

Table 15 MAVIS Output Field 15

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	61.84
MG7d	60.70
MG6b	60.41

Table 16 MAVIS Output Field 16

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	69.20
MG7d	68.41
MG6	67.40

Table 17 MAVIS Output Field 17

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	71.55
MG7d	71.15
MG7	69.89

Table 18 MAVIS Output Field 18

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	74.90
MG6	74.65
MG6b	67.56

Table 19 MAVIS Output Field 19

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	72.45
MG6	70.33
MG6b	66.67

Table 20 MAVIS Output Field 20

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	67.04
MG6	66.51
MG7	65.98

Table 21 MAVIS Output Field 21

NVC Community/ Sub Community Code	Coefficient of Similarity
MG7	72.13
MG7a	66.39
MG6a	66.31

Table 22 MAVIS Output Field 22

NVC Community/ Sub Community Code	Coefficient of Similarity
MG7	64.74
MG7d	66.16
MG6a	61.91

Table 23 MAVIS Output Field 23

NVC Community/ Sub Community Code	Coefficient of Similarity
MG7	63.46
MG6a	61.48
MG6	61.08

Table 24 MAVIS Output Field 24

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	69.13
MG6	69.02
MG7	65.42

Table 25 MAVIS Output Field 25

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	65.42
MG6	63.88
MG6b	62.07

Table 26 MAVIS Output Field 26 Part I

NVC Community/ Sub Community Code	Coefficient of Similarity
MG10a	62.50
MG10	54.44
MG9	51.38

Table 27 MAVIS Output Field 26 Part II

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	70.50
MG6	68.53
MG7c	64.32

Table 28 MAVIS Output Field 27

NVC Community/ Sub Community Code	Coefficient of Similarity
MG7	73.53
MG6a	69.27
MG7d	69.25

Table 29 MAVIS Output Field 28

NVC Community/ Sub Community Code	Coefficient of Similarity
MG7	72.94
MG6a	68.59
MG7d	68.46

Table 30 MAVIS Output Field 29 Part I

NVC Community/ Sub Community Code	Coefficient of Similarity
MG10a	66.51
MG10	59.88
MG9	54.67

Table 31 MAVIS Output Field 29 Part II

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	72.16
MG6	69.33
MG7c	68.87

Table 32 MAVIS Output Field 30 Part I

NVC Community/ Sub Community Code	Coefficient of Similarity
MG10	57.02
MG10a	53.21
MG4c	45.05

Table 33 MAVIS Output Field 30 part II

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	63.95
MG6	61.97
MG7c	59.98

Table 34 MAVIS Output Field 31

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6	61.50
MG7	61.20
MG6a	60.93

Table 35 MAVIS Output Field 32 Part I

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	61.93
MG6	60.97
MG6b	59.82

Table 36 MAVIS Output Field 32 Part II

NVC Community/ Sub Community Code	Coefficient of Similarity
MG10	59.01
MG10a	53.23
MG4c	43.08

Table 37 MAVIS Output Field 33

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	66.96
MG7	66.60
MG6	66.38

Table 38 MAVIS Output Field 34

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	74.26
MG7	73.85
MG6	72.37

Table 39 MAVIS Output Field 35

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	69.21
MG7	65.06
MG6	64.52

Table 40 MAVIS Output Field 36

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	71.05
MG7	69.33
MG6	66.38

Table 41 MAVIS Output Field 37

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	72.70
MG6	68.49
MG7	67.72

Table 42 MAVIS Output Field 38

NVC Community/ Sub Community Code	Coefficient of Similarity
MG6a	68.66
MG6	65.12
MG7	65.06

Appendix III

Plates 1-2 Showing Fields 30 & 32
Mosaic of MG6 & MG10 Communities and encroaching willow scrub

Plate 1 example of MG10 and MG6 mosaic with encroaching willow Field 30

Plate 2 example of MG10 and MG6 mosaic with willow along drain Field 32

Appendix IV

Example Tables for Recorded Vegetation Communities

Table I Example MG6 Community Field F7

Species	Botanical Name	Frequency	DOMIN Score
Perennial Rye	*Lolium Perenne*	V	5-6
Yorkshire Fog	*Holcus lanatus*	V	5-6
Red Clover	*Trifolium pratense*	V	3-4
Meadow Buttercup	*Ranunculus acris*	V	3-4
Crested Dogs Tail	*Cynosurus cristatus*	V	5-6
Sweet Vernal	*Anthoxanthum oderatum*	IV	4-5
Red Fescue	*Festuca rubra*	IV	1-4
Rough Meadow	*Poa trivialis*	IV	3-4
White Clover	*Trifolium repens*	IIII	3-4
Poa Annua	*Poa annua*	IIII	3-4
Ribwort Plantain	*Plantago lanceolata*	III	1-3
Common Mouse Ear	*Cerastium fontanum*	III	1-3
Birds Foot Trefoil	*Lotus corniculatus*	III	3-4
Red Bartsia	*Odontites vernus*	III	1-3
Cocksfoot	*Dactylis glomerata*	III	3-4
Italian Rye	*Lolium Multiflorum*	II	1-3
Timothy	*Phleum Pratensis*	II	1-3
Meadow Foxtail	*Alopecurus pratensis*	II	3-4
Common Bent	*Agrostis capillaris*	II	3-4
Meadow vetchling	*Lathyrus pratensis*	II	2-3
Creeping Buttercup	*Ranunculus repens*	I	2-3
Silverweed	*Potentilla anserina*	I	1-3
Creeping Bent	*Agrostis stolonifera*	I	1-3
Common Sorrel	*Rumex acetosa*	I	1-3
Daisy	*Bellis perennis*	I	1-3
Dandelion	*Taraxacum sp*	I	1-3
Self-Heal	*Prunella vulgaris*	1	1-3

Incidentals (recorded in field but absent from quadrats)

Poa pratensis
Potentilla reptans
Plantago major
Rumex obtusifolius

Table II Example MG6a Comunity Field F10

Species	Botanical Name	Frequency	DOMIN Score
Perennial Rye	*Lolium Perenne*	V	5-6
Yorkshire Fog	*Holcus lanatus*	V	5-6
Meadow Buttercup	*Ranunculus acris*	IV	3-4
Crested Dogs Tail	*Cynosurus cristatus*	IV	5-6
Common Mouse Ear	*Cerastium fontanum*	III	1-3
Red Fescue	*Festuca rubra*	III	1-3
Common Bent	*Agrostis capillaris*	III	3-4
White Clover	*Trifolium repens*	III	3-4
Italian Rye	*Lolium Multiflorum*	II	1-3
Timothy	*Phleum Pratensis*	II	1-3
Red Clover	*Trifolium pratense*	II	3-4
Meadow Foxtail	*Alopecurus pratensis*	II	3-4
Birds Foot Trefoil	*Lotus corniculatus*	II	3-4
Cocksfoot	*Dactylis glomerata*	II	3-4
Sweet Vernal	*Anthoxanthum oderatum*	I	4-5
Field Wood Rush	*Luzula campestris*	I	1-3
Ribwort Plantain	*Plantago lanceolata*	I	1-3
Common Thistle	*Cirsium vulgare*	I	1-3
Rough Meadow	*Poa trivialis*	I	1-3
Creeping Buttercup	*Ranunculus repens*	I	2-3
Red Bartsia	*Odontites vernus*	I	1-3
Creeping Bent	*Agrostis stolonifera*	I	1-3
Common Sorrel	*Rumex acetosa*	I	1-3
Poa Annua	*Poa annua*	I	3-4
Daisy	*Bellis perennis*	I	1-3
Dandelion	*Taraxacum sp*	I	1-3
Meadow Vetchling	*Lathyrus pratensis*	I	1-3

Incidentals (recorded in field but absent from quadrats)

Potentilla reptans
Poa pratensis
Plantago major
Rumex obtusifolius
Prunella vulgaris
Juncus effusus

Table III Example MG7 Community Field F21

Species	Botanical Name	Frequency	DOMIN Score
Perennial Rye	*Lolium Perenne*	V	5-6
Yorkshire Fog	*Holcus lanatus*	V	5-6
Common Bent	*Agrostis capillaris*	III	4-5
Crested Dogs Tail	*Cynosurus cristatus*	III	3-4
Italian Rye	*Lolium Multiflorum*	II	1-4
Timothy	*Phleum Pratensis*	II	1-3
Red Fescue	*Festuca rubra*	II	4-5
Red Clover	*Trifolium pratense*	II	3-4
Meadow Foxtail	*Alopecurus pratensis*	II	3-4
Rough Meadow	*Poa trivialis*	II	4-5
White Clover	*Trifolium repens*	II	3-4
Cocksfoot	*Dactylis glomerata*	II	1-3
Sweet Vernal	*Anthoxanthum oderatum*	I	1-3
Ribwort Plantain	*Plantago lanceolata*	I	1-3
Meadow Buttercup	*Ranunculus acris*	I	3-4
Creeping Buttercup	*Ranunculus repens*	I	2-3
Creeping Bent	*Agrostis stolonifera*	I	3-4
Common Sorrel	*Rumex acetosa*	I	1-3
Common Sorrel	*Rumex acetosa*	I	2-3
Poa Annua	*Poa annua*	I	1-3
Daisy	*Bellis perennis*	I	1-3
Dandelion	*Taraxacum sp*	I	1-3
Self-Heal	*Prunella vulgaris*	1	1-3

Incidentals (recorded in field but absent from quadrats)

Vicia Cracca
Cerastium fontanum
Poa pratensis
Plantago major

Table IV Example MG10 Community Field F30

Species	Botanical Name	Frequency	DOMIN Score
Soft Rush	*Juncus effusus*	V	5-6
Yorkshire Fog	*Holcus lanatus*	V	5-6
Creeping Bent	*Agrostis stolonifera*	III	4-5
Sweet Vernal	*Anthoxanthum oderatum*	III	1-3
Cuckoo Flower	*Cardamine pratensis*	III	1-3
Ragged Robin	*Lychnis flos-cuculi*	III	1-3
Crested Dogs Tail	*Cynosurus cristatus*	III	3-4
Creeping Buttercup	*Ranunculus repens*	III	1-3
Acute Rush	*Juncus acutus*	II	3-4
Perennial Rye	*Lolium perenne*	II	1-3
Marsh Bedstraw	*Galium palustre*	II	1-3
Field Wood Rush	*Luzula campestris*	II	1-3
Silverweed	*Potentilla anserina*	II	1-3
Creeping Cinquefoil	*Potentilla reptans*	II	1-3
Common Bent	*Agrostis capillaris*	II	3-4
Common Sorrel	*Rumex acetosa*	II	1-3
Hard Rush	*Juncus inflexus*	I	1-3
Rough Meadow Grass	*Poa trivialis*	I	1-3
Jointed Rush	*Juncus articulatus*	I	1-3
Timothy	*Phleum Pratensis*	I	1-3
Hairy Sedge	*Carex hirta*	I	1-3
Meadow Foxtail	*Alopecurus pratensis*	I	1-3
Meadow Buttercup	*Ranunculus acris*	I	1-3
White Clover	*Trifolium repens*	I	1-3
Red Clover	*Trifolium pratense*	I	1-3
Creeping Bent	*Agrostis stolonifera*	I	1-3
Meadow Vetchling	*Lathyrus pratensis*	I	1-3
Common Thistle	*Cirsium vulgare*	I	1-3
Meadowsweet	*Filipendula ulmaria*	I	1-3
Common Fleabane	*Pulicaria dysentrica*	I	1-3
Cocksfoot	*Dactylis glomerata*	I	1-3
Common Cleavers	*Galium aparine*	1	1-3

Incidentals (recorded in field but absent from quadrats)

Vicia Cracca
Lolium perenne
Prunella vulgaris
Cerastium fontanum
Poa pratensis
Urtica dioica
Plantago lanceolata
Festuca rubra

Table V Example MG10a Community Field F29

Species	Botanical Name	Frequency	DOMIN Score
Soft Rush	*Juncus effusus*	V	5-6
Yorkshire Fog	*Holcus lanatus*	V	5-6
Sweet Vernal	*Anthoxanthum oderatum*	III	1-3
Cocksfoot	*Dactylis glomerata*	III	1-3
Creeping Buttercup	*Ranunculus repens*	III	3-4
Meadow Foxtail	*Alopecurus pratensis*	II	1-3
Cuckoo Flower	*Cardamine pratensis*	II	1-3
Common Bent	*Agrostis capillaris*	II	3-4
White Clover	*Trifolium repens*	II	3-4
Creeping Bent	*Agrostis stolonifera*	II	3-4
Common Sorrel	*Rumex acetosa*	II	2-3
Timothy	*Phleum Pratensis*	I	1-3
Marsh Bedstraw	*Galium palustre*	I	1-3
Hairy Sedge	*Carex hirta*	I	1-3
Silverweed	*Potentilla anserina*	I	1-3
Meadow fescue	*Festuca pratensis*	I	1-3
Meadow Buttercup	*Ranunculus acris*	I	3-4
Ragged Robin	*Lychnis flos-cuculi*	I	1-3
Birds Foot Trefoil	*Lotus corniculatus*	I	1-3
Common Dock	*Rumex obtusifolius*	I	1-3
Poa Annua	*Poa annua*	I	1-3
Crested Dogs Tail	*Cynosurus cristatus*	I	1-3
Cuckoo flower	*Cardamine pratensis*	I	1-3
Red Fescue	*Festuca rubra*	I	1-3
Plantain	*Plantago Major*	I	1-3
Common Cleavers	*Galium aparine*	1	1-3

Incidentals (recorded in field but absent from quadrats)

Vicia Cracca
Lolium perenne
Prunella vulgaris
Cerastium fontanum
Poa pratensis
Pulicaria dysentrica

HEDGEROW REGULATIONS 1997
SURVEY REPORT
OF
Land at Redstone Cross
Narberth
Haverfordwest
Pembrokeshire
Revision 1

On Behalf of Ove Arup & Partners Ltd

July 2019

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Contents Page

1 Introduction

1.1 Survey Brief

TerrAqua Ecological Services Ltd were commissioned by Ove Arup and Partners Ltd to undertake an assessment of all hedgerows, within a defined boundary, on a parcel of land adjacent to the A40 at Redstone Cross, Narberth, Haverfordwest, Pembrokeshire in order to ascertain their importance under the Hedgerow Regulations 1997.

The survey brief included the requirement for the completion of the Hedgerow Regulations Survey as part of the road improvement project A40 Penblewyn to Redstone Cross, project No **266173-24.** The survey to be completed within the designated boundary as follows:

- Hedgerows within a 50m buffer of centreline of proposed Southern option of the Project;
- Hedgerows within a 50m buffer of centreline of proposed Northern option of the Project;

The Hedgerow survey was undertaken during June/July 2019.

1.2 Client Details

The survey was undertaken on behalf of Ove Arup & Partners Ltd.

1.3 Background

The survey was commissioned by the client as part of the suite of ecological assessments being undertaken during the selection of an appropriate strategy for the improvement of the A40 between Redstone Cross and the Penblewyn roundabouts near Narberth Pembrokeshire.

The survey area comprises a series of improved and semi improved fields separated by a significant hedgerow system including land north and south of the A40. A total of sixty six hedgerows were assessed.

Hedgerows are recognised as being important wildlife habitats in their own right providing suitable habitats for over 47 species of conservation concern within the UK. Hedgerows are particularly recognised as being of importance to birds, butterflies, moths, bats, dormouse and both amphibian and reptile species. Hedgerows also form important wildlife corridors allowing species to disperse and move throughout the countryside to other favourable habitats.

In order to protect the hedgerow system and in acknowledgement of the importance of hedgerows to both wildlife and the general landscape the retention or removal of hedgerows is a material consideration during the planning process.

Hedgerows are classed as Priority Habitats within the UK Biodiversity Action Plan and listed in the Environment (Wales) Act 2016 Section 7 as a Habitat of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales. The Act places a duty on both government departments and local authorities to have regard for the conservation of hedgerow habitats.

The Hedgerows Regulations 1997 are designed to protect 'important' hedgerows by controlling the removal of such hedgerows through a system of notification to the local planning authority.

1.4 Survey Objectives

The objectives of the survey were to ascertain which, if any, of the hedgerows within the survey area would:

- Qualify as important hedgerows under the Ecological criteria for the Hedgerow Regulations 1997

2 Methodologies

2.1 Desk Study

The results of this Hedgerow Survey is based entirely on their importance under the Wildlife and Landscape Criteria of the Part of the Hedgerow Regulations 1997 and no account has been made of their value under the Archaeology or History criteria.

2.2 Data Search

A desk top data search was undertaken for any records of species and/or habitats within the survey boundary by the client as part of the initial Phase I Habitat Survey.

2.3 Field Survey

2.3.1 General

The definition of a hedgerow was taken as that described in the Hedgerow Survey handbook, 2nd Edition (DEFRA, 2007).

The survey included the assessment of sixty six (66) hedgerows. In order to satisfy the requirements of the Hedgerow Regulations any hedgerow was considered to end at a point where it formed a junction with another hedgerow.

Each of the sixty six hedgerows surveyed was over 20m in length and were considered true hedgerows under the 1997 Hedgerow Regulations criteria.

The location and identification number of each hedgerow is as shown in Drawing No **TQ/ARUP: Narb Hedgerow Assess ID Plan V1** (Appendix I).

The survey was undertaken in June/July 2019 by Carmen Jones MSc MCIEEM and Dyfrig Jones BSc both highly experienced ecologists.

The survey was carried out according to the Hedgerow Survey handbook, 2nd Edition (DEFRA, 2007) with some amendments to include information required to ascertain the importance of the hedgerows under the Hedgerow Regulations.

2.3.2 Hedgerow Assessment Methodology

The hedgerows were surveyed to determine if they are considered important under the Hedgerow Regulations 1997.

Each of the hedgerows was walked and notes taken as to the presence of associated features such as banks, ditches, banks, walls and the proximity to associated habitats including adjacent hedgerows, woodlands and ponds.

For each 100m of each hedgerow a count was made over a 30m length of woody species present within the hedgerow. Ground flora species as listed in Schedule 3 of the Hedgerow Regulations were also noted. Note was also taken of the number of standard trees present within the total length of each hedgerow and the accumulative total length of canopy gaps within each hedge.

The methodology and qualifying criteria was that as detailed within Schedule I and Schedule II of the Hedgerow Regulations 1997 (Appendix II).

2.4 Survey Limitations

All hedgerows were fully accessible although some limitations were experienced due to the presence of livestock delaying the survey access for several weeks. However all hedgerows were surveyed within appropriate timelines and in line with the Hedgerow Regulations guidance. The survey results are considered an accurate assessment of all hedgerows within the survey area.

3 Results

3.1 History and Archaeology

This report has been produced based on Part II Landscape and Wildlife criteria, and does not include assessments based on the History and Archaeology criteria of the Hedgerow Regulations 1997.

3.2 Landscape and Wildlife

No data was available at the time of survey relating to the presence or otherwise of protected species. A dormouse survey of the site was underway during the assessment and the results of this survey would need to be considered before final evaluation of all hedgerows can be made. The presence of dormouse within a hedgerow would result in that hedgerow being considered "Important" under the Hedgerow Regulations regardless of the presence or absence of other qualifying features.

All hedgerows with the exception of H18, a wire fence, were considered true hedgerows under the Hedgerow Regulations.

Twenty three (23) of the hedgerows form boundaries with the A40. Some of these hedgerows appear to have been replanted following previous highway improvement works and are not representative of the hedgerows within the surrounding field system. These boundary hedges also show evidence of management on the road side of the hedge by mechanical means.

A further seven (7) hedgerows form boundaries with highways including the A487 and B4313. These hedgerows also show evidence of management by mechanical means but most appear to have been in situ for a long period and are similar to the surrounding hedgerow system.

Six (6) hedgerows form boundaries within minor lanes and farm access tracks.

Almost all of the interior field hedgerows show some evidence of historic management through laying but now generally remain unmanaged and have become tall and straggly with many showing the effects of heavy grazing pressure resulting in relatively poor ground and field layers.

Few of the hedgerows remain entirely stock proof at ground level and in the majority of hedgerows some fencing has been installed to reinforce the hedgerow as a stock proof barrier. All of the hedgerows have less than 10% gaps in the continuity of the hedge canopy.

Remnants of hedge banks are common throughout the hedgerow system except those bordering the A40 that had been subjected to road improvement schemes. Ditches were not common within the system.

Forty three (43) of the hedgerows are considered species rich and contain 5 or more native woody species, on average, within a 30m length.

Hawthorn, blackthorn, hazel, ash and oak were the dominant woody species recorded, with rose, elder, holly and gorse all relatively common.

Standard trees were recorded within 67% of the hedgerows assessed.

The total number of native woody species recorded per hedgerow and the species composition of each is shown in Table 1.

The ground flora of the hedgerow system is generally sparse due to the combined effects of grazing and cutting for hay. Despite these impacts a number of species associated with woodland habitats were recorded within 1m of the hedgerows. These included species forming part of Schedule 2 of the Hedgerow Regulations qualifying criteria.

The woodland species recorded for each hedgerow are shown in Table 2.

Table 1 Woody Species Present per 30m length as per Schedule 3 Hedgerow Regulations 1997

HEDGEROW ID	**H1a**	**H1b**	**H2**	**H3**	**H4**	**H5**	**H6 Sec 1**	**H6 Sec 2**	**H7 Sec 1**	**H7 Sec 2**	**H8 Sec 1**	**H8 Sec 2**	**H9 Sec 1**	**H9 Sec 2**	**H9 Sec 3**
Woody Species (as recorded on site)															
Hawthorn – *Crataegus monogyna*	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓
Oak- *Quercus rober*	✓				✓	✓						✓	✓	✓	✓
Ash- *Fraxinus excelsior*	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
Crab Apple- *Malus sylvestris*															
Buckthorn *Frangula alnus*															
Guelderose-*Viburnum opulus*															
Dogwood *Cornus sanguinea*									✓						
Hazel-*Corylus avellana*	✓	✓			✓				✓	✓		✓	✓		✓
Holly *Ilex aquifolium*					✓									✓	
Elder- *Sambucus nigra*				✓			✓	✓						✓	
Elm-*Ulmus procera*									✓					✓	
Blackthorn-*Prunus spinosa*	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	
Gorse *Ulex* Europaeus			✓		✓			✓							
Rose sp			✓				✓	✓	✓	✓	✓	✓	✓	✓	✓
Rowan *Sorbus aucuparia*															
Willow *Salix sp*															
Beech *Fagus sylvatica*	✓			✓									✓		
Field Maple *Acer campestre*															
Silver Birch *Betula pendula*															
Downy Birch *Betula pubescens*															
Bird Cherry *Prunus padus*															
Total Woody Species per 30m	**6**	**4**	**4**	**3**	**6**	**4**	**5**	**4**	**6**	**4**	**4**	**6**	**7**	**8**	**5**

HEDGEROW ID	**H10 Sec 1**	**H10 Sec 2**	**H11 Sec 1**	**H11 Sec 2**	**H12 Sec 1**	**H12 Sec 2**	**H12 Sec 3**	**H13 Sec 1**	**H13 Sec 2**	**H13 Sec 3**	**H14 Sec 1**	**H14 Sec 2**	**H14 Sec 3**	**H14A Sec 1**	**H14A Sec 3**
Woody Species (as recorded on site)															
Hawthorn – *Crataegus monogyna*	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oak- *Quercus rober*	✓	✓	✓				✓					✓	✓		
Ash- *Fraxinus excelsior*			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Crab Apple- *Malus sylvestris*															
Buckthorn *Frangula alnus*															
Guelderose *Viburnum opulus*															
Dogwood *Cornus sanguinea*						✓		✓							
Hazel-*Corylus avellana*			✓		✓	✓	✓	✓	✓						
Holly *Ilex aquafolium*				✓											
Elder- *Sambucus nigra*			✓	✓				✓						✓	✓
Blackthorn-*Prunus spinosa*			✓	✓	✓	✓	✓					✓			
Elm *Ulmus procera*									✓						
Gorse *Ulex Europaeus*		✓			✓	✓	✓				✓	✓			
Rose sp		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rowan *Sorbus aucuparia*															
Willow *Salix sp*											✓		✓		
Beech *Fagus sylvatica*															
Field Maple *Acer campestre*								✓	✓						
Silver Birch (*Betula pendula*															
Downy Birch *Betula pubescens*								✓							
Bird Cherry *Prunus padus*									✓						
Total Woody Species per 30m	**2**	**4**	**7**	**6**	**5**	**7**	**7**	**8**	**7**	**3**	**5**	**6**	**5**	**4**	**4**

HEDGEROW ID	**H15**	**H15A**	**H16 Sec 1**	**H16 Sec 2**	**H16 Sec 3**	**H17 Sec 1**	**H17 Sec 2**	**H17 Sec 3**	**H18 Fence N/A**	**H19 Sec 1**	**H19 Sec 2**	**H19A**	**H20**	**H21**	**H22 Sec 1**
Woody Species (as recorded on site)															
Hawthorn – *Crataegus monogyna*	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Oak- *Quercus rober*	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓		
Ash- *Fraxinus excelsior*	✓	✓				✓							✓	✓	
Crab Apple- *Malus sylvestris*															
Buckthorn (*Frangula alnus*)															✓
Guelderose *Viburnum opulus*															
Dogwood *Cornus sanguinea*															
Hazel-*Corylus avellana*	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓
Holly *Ilex aquafolium*	✓					✓		✓		✓	✓	✓			
Elder- *Sambucus nigra*															
Blackthorn-*Prunus spinosa*	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		
Elm *Ulmus procera*															
Gorse *Ulex* Europaeus														✓	
Rose sp	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Rowan *Sorbus aucuparia*															
Willow *Salix sp*															
Beech *Fagus sylvatica*															
Field Maple *Acer campestre*															
Silver Birch *Betula pendula*															
Downy Birch *Betula pubescens*															
Bird Cherry *Prunus padus*															
Total Woody Species per 30m	**7**	**6**	**5**	**4**	**4**	**7**	**4**	**6**	**N/A**	**6**	**6**	**6**	**6**	**4**	**4**

HEDGEROW ID	**H22b**	**H23 Sec 1**	**H23 Sec 2**	**H24 Sec 1**	**H24 Sec 2**	**H25 Sec 1**	**H25 Sec 2**	**H26**	**H27**	**H28 Sec 1**	**H28 Sec 2**	**H29**	**H30 Sec 1**	**H30 Sec 2**	**H30 Sec 3**
Woody Species (as recorded on site)															
Hawthorn – *Crataegus monogyna*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oak- *Quercus rober*						✓	✓	✓	✓	✓	✓	✓			✓
Ash- *Fraxinus excelsior*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Crab Apple- *Malus sylvestris*		✓													
Buckthorn (*Frangula alnus*)															
Guelderose *Viburnum opulus*															
Dogwood *Cornus sanguinea*															
Hazel-*Corylus avellana*	✓	✓	✓	✓	✓					✓	✓		✓	✓	✓
Holly *Ilex aquafolium*		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓
Elder- *Sambucus nigra*							✓	✓	✓			✓			
Blackthorn-*Prunus spinosa*				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Elm *Ulmus procera*															
Gorse *Ulex* Europaeus				✓	✓									✓	
Rose sp	✓	✓	✓												
Rowan *Sorbus aucuparia*															
Willow *Salix sp*						✓		✓	✓			✓			
Beech *Fagus sylvatica*															
Field Maple *Acer campestre*															
Silver Birch *Betula pendula*															
Downy Birch *Betula pubescens*															
Bird Cherry *Prunus padus*															
Total Woody Species per 30m	**3**	**6**	**5**	**6**	**6**	**6**	**6**	**7**	**7**	**5**	**5**	**7**	**4**	**5**	**6**

HEDGEROW ID	**H31 Sec 1**	**H31 Sec 2**	**H31 Sec 3**	**H32 Sec 1**	**H32 Sec 2**	**H33 Sec 1**	**H33 Sec 2**	**H34 Sec 1**	**H34 Sec 2**	**H34 Sec 3**	**H35 Sec 1**	**H35 Sec 2**	**H36 Sec 1**	**H36 Sec 2**
Woody Species (as recorded on site)											✓	✓	✓	✓
Hawthorn – *Crataegus monogyna*	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
Oak- *Quercus rober*	✓						✓	✓	✓	✓			✓	✓
Ash- *Fraxinus excelsior*	✓	✓	✓					✓	✓	✓	✓			
Crab Apple- *Malus sylvestris*														
Buckthorn -*Frangula Alnus*														
Guelderose *Viburnum opulus*														
Dogwood *Cornus sanguinea*														
Hazel-*Corylus avellana*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Holly *Ilex aquafolium*													✓	
Elder- *Sambucus nigra*		✓	✓					✓	✓	✓		✓	✓	✓
Blackthorn-*Prunus spinosa*						✓	✓							
Elm *Ulmus procera*														
Gorse *Ulex* Europaeus				✓	✓	✓	✓				✓			
Rose sp		✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Rowan *Sorbus aucuparia*														
Willow *Salix sp*														
Beech *Fagus sylvatica*								✓	✓	✓	✓		✓	✓
Field Maple *Acer campestre*														
Silver Birch (*Betula pendula*														
Downy Birch *pubescens*														
Bird Cherry *Prunus padus*														
Total Woody Species per 30m	**4**	**5**	**5**	**4**	**4**	**4**	**6**	**6**	**6**	**6**	**6**	**5**	**8**	**7**

HEDGEROW ID	**H36 Sec 3**	**H37 Sec 1**	**H37 Sec 2**	**H38 Sec 1**	**H38 Sec 2**	**H39 Sec 1**	**H39 Sec 2**	**H40 Sec 1**	**H40 Sec 2**	**H41 Sec 1**	**H41 Sec 2**	**H41 Sec 3**	**H42**	**H43**	**H44 Sec 1**
Woody Species (as recorded on site)															
Hawthorn – *Crataegus monogyna*	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓
Oak- *Quercus rober*	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓
Ash- *Fraxinus excelsior*	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Crab Apple- *Malus sylvestris*								✓							
Buckthorn-*Frangula alnus*															
Guelderose *Viburnum opulus*												✓			
Dogwood *Cornus sanguinea*															
Hazel-*Corylus avellana*	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	
Holly *Ilex aquafolium*						✓								✓	✓
Elder- *Sambucus nigra*	✓		✓	✓	✓	✓							✓		
Blackthorn-*Prunus spinosa*				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Elm *Ulmus procera*														✓	
Gorse *Ulex Europaeus*													✓		
Rose sp	✓	✓							✓	✓	✓		✓	✓	
Rowan *Sorbus aucuparia*															
Willow *Salix sp*									✓	✓					✓
Beech *Fagus sylvatica*	✓	✓	✓												
Field Maple *Acer campestre*															
Silver Birch *Betula pendula*															
Downy Birch *pubescens*															
Bird Cherry *Prunus padus*															
Total Woody Species per 30m	**7**	**6**	**6**	**6**	**6**	**4**	**5**	**6**	**6**	**7**	**6**	**4**	**7**	**7**	**6**

HEDGEROW ID	**H44 Sec 2**	**H44 Sec 3**	**H45 Sec 1**	**H45 Sec 2**	**H45 Sec 3**	**H46**	**H47 Sec 1**	**H47 Sec 2**	**H48**	**H49 Sec 1**	**H49 Sec 2**	**H50**	**H51 Sec 1**	**H51 Sec 2**
Woody Species (as recorded on site)														
Hawthorn – *Crataegus monogyna*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Oak- *Quercus rober*		✓	✓		✓									
Ash- *Fraxinus excelsior*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Crab Apple- *Malus sylvestris*							✓	✓						
Buckthorn-*Frangula alnus*														
Guelderose *Viburnum opulus*														
Dogwood *Cornus sanguinea*														
Hazel-*Corylus avellana*							✓			✓		✓	✓	✓
Holly *Ilex aquafolium*		✓	✓		✓				✓					
Elder- *Sambucus nigra*							✓		✓					
Blackthorn-*Prunus spinosa*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
Elm *Ulmus procera*							✓							
Gorse *Ulex* Europaeus								✓	✓					
Rose sp								✓	✓		✓			
Rowan *Sorbus aucuparia*														
Willow *Salix sp*	✓	✓	✓	✓	✓	✓				✓	✓			
Beech *Fagus sylvatica*														
Field Maple *Acer campestre*														
Silver Birch *Betula pendula*														
Downy Birch *pubescens*														
Bird Cherry *Prunus padus*									✓					
Total Woody Species per 30m	**4**	**6**	**6**	**4**	**6**	**4**	**7**	**6**	**8**	**5**	**4**	**3**	**3**	**1**

HEDGEROW ID	**H52**	**H53**	**H54 Sec 1**	**H54 Sec 2**	**H55 Sec 1**	**H55 Sec 2**	**H56 Sec 1**	**H56 Sec 2**	**H56 Sec 3**	**H57 Sec 1**	**H57 Sec 2**	**H57 Sec 3**	**H58 Sec 1**	**H58 Sec 2**	**H59**	**H60**	**H61 Sec 1**	**H61 Sec 2**
Woody Species (as recorded on site)																		
Hawthorn – *Crataegus monogyna*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oak- *Quercus rober*									✓							✓		
Ash- *Fraxinus excelsior*			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Crab Apple- *Malus sylvestris*																		
Buckthorn-*Frangula alnus*																		
Guelderose *Viburnum opulus*																		
Dogwood *Cornus sanguinea*																		
Hazel-*Corylus avellana*		✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Holly *Ilex aquafolium*							✓			✓								
Elder- *Sambucus nigra*											✓	✓						
Blackthorn-*Prunus spinosa*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓
Elm *Ulmus procera*																		
Gorse *Ulex* Europaeus						✓	✓	✓	✓			✓						
Rose sp		✓	✓		✓	✓	✓			✓		✓			✓	✓		
Rowan *Sorbus aucuparia*																		
Willow *Salix sp*		✓		✓												✓		
Beech *Fagus sylvatica*																		
Field Maple *Acer campestre*																		
Silver Birch *Betula pendula*																		
Downy Birch *pubescens*																		
Bird Cherry *Prunus padus*																		
Total Woody Species per 30m	**1**	**5**	**5**	**5**	**4**	**5**	**7**	**5**	**5**	**5**	**5**	**7**	**3**	**3**	**4**	**6**	**4**	**4**

HEDGEROW ID	**H61 Sec 3**	**H62**	**H63**	**H64**	**H65**	**H66**								
Woody Species (as recorded on site)														
Hawthorn – *Crataegus monogyna*	✓		✓	✓	✓	✓								
Oak- *Quercus rober*		✓			✓	✓								
Ash- *Fraxinus excelsior*	✓		✓	✓	✓	✓								
Crab Apple- *Malus sylvestris*		✓												
Buckthorn-*Frangula alnus*														
Guelderose *Viburnum opulus*														
Dogwood *Cornus sanguinea*														
Hazel-*Corylus avellana*	✓		✓	✓	✓	✓								
Holly *Ilex aquafolium*		✓				✓								
Elder- *Sambucus nigra*														
Blackthorn-*Prunus spinosa*		✓		✓	✓	✓								
Elm *Ulmus procera*														
Gorse *Ulex Europaeus*														
Rose sp	✓													
Rowan *Sorbus aucuparia*														
Willow *Salix sp*					✓	✓								
Beech *Fagus sylvatica*														
Field Maple *Acer campestre*														
Silver Birch *Betula pendula*														
Downy Birch *Betula pubescens*														
Bird Cherry *Prunus padus*														
Total Woody Species per 30m	**4**	4	**3**	**4**	**6**	**7**								

Table 2 Woodland Species Present per 30m length, within 1m of hedgerow as per Schedule 2 Hedgerow Regulations 1997

Hedgerow ID	**H1a**	**H1b**	**H2**	**H3**	**H4**	**H5**	**H6 Sec 1**	**H6 Sec 2**	**H7 Sec 1**	**H7 Sec 2**	**H8 Sec 1**	**H8 Sec 2**	**H9 Sec 1**	**H9 Sec 2**	**H9 Sec 3**	**H10 Sec 1**	**H10 Sec 2**	**H11 Sec 1**
Woodland Species (as recorded on site)																		
Barren Strawberry *Potentilla sterilis*																		
Bluebell *Hyacinthoides non scipta*																		
Broad Buckler Fern *Dryopterisdilatata*					✓													
Bugle *Ajuga reptans*			✓	✓														✓
Common polypody *Polypodium vulgare*				✓		✓			✓	✓	✓	✓						
Common Dog Violet *Viola riviniana*	✓	✓			✓				✓	✓	✓	✓						
Early Dog Violet *Viola reichenbachiana*																		
Dog's Mercury *Mercurialis perennis*																		
Goldilocks Buttercup *Ranunculus auricomus*										✓								
Enchanters Nightshade *Circaea mascula*																✓	✓	
Hard Fern *Blechnum spicant*			✓															
Hartstongue Fern *Asplenium scolopendrium*					✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Herb Bennet/Wood Avens *Geum urbanum*				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Heath Bedstraw *Galium saxatile*						✓												
Herb Robert *Geranium robertianum*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lady Fern *Athyrium filix-femina*				✓														
Lords and Ladies *Arum maculatum*																		
Male Fern *Dryopteris filix mas*																		
Pignut *Conopodium majus*														✓				✓
Primrose *Primula vulgaris*					✓													
Ransoms *Allium ursinum*											✓	✓						
Sanicle *Sanicula europaea*																		
Sweet Violet *Viola odorata*																		
Tormantil *Potentilla erecta*							✓											
Wild Strawberry *Fragaria vesca*															✓			
Wood Anemone *nemerosa*																		
Wood Melick *Melica uniflora*																		
Wood Sedge *Carex sylvatica*																		
Wood Sorrel *Oxalis acetosella*																		
Wood Speedwell *Veronica montana*							✓	✓										
Pignut (*Conopodium majus)*																		
Total Woodland Species	2	2	3	5	6	4	5	4	4	5	6	6	3	4	4	4	4	5

Hedgerow ID	**H11 Sec 2**	**H12 Sec 1**	**H12 Sec 2**	**H12 Sec 3**	**H13 Sec 1**	**H13 Sec 2**	**H13 Sec 3**	**H14 Sec 1**	**H14 Sec 2**	**H14 Sec 3**	**H14A Sec 1**	**H14B Sec 2**	**H15**	**H15A**	**H16 Sec 1**	**H16 Sec 2**	**H16 Sec 3**	**H17 Sec 1**
Woodland Species (as recorded on site)																		
Barren Strawberry *Potentilla sterilis*		✓																
Bluebell *Hyacinthoides non scipta*																		
Broad Buckler Fern *Dryopterisdilatata*																		
Bugle *Ajuga reptans*																		
Common polypody *Polypodium vulgare*		✓	✓	✓														
Common Dog Violet *Viola riviniana*	✓	✓	✓	✓						✓	✓	✓			✓	✓	✓	
Early Dog Violet *Viola reichenbachiana*									✓				✓	✓				
Dog's Mercury *Mercurialis perennis*													✓	✓				
Goldilocks Buttercup *Ranunculus auricomus*																		
Enchanters Nightshade *Circaea mascula*																		
Hard Fern *Blechnum spicant*																		
Hartstongue Fern *Asplenium scolopendrium*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Herb Bennet/Wood Avens *Geum urbanum*	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Heath Bedstraw *Galium saxatile*																		
Herb Robert *Geranium robertianum*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
Lady Fern *Athyrium filix-femina*																		
Lords and Ladies *Arum maculatum*																		
Male Fern *Dryopteris filix mas*																		
Pignut *Conopodium majus*																		
Primrose *Primula vulgaris*	✓	✓		✓					✓	✓					✓	✓	✓	
Ransoms *Allium ursinum*																		
Sanicle *Sanicula europaea*																		
Sweet Violet *Viola odorata*				✓														
Tormantil *Potentilla erecta*																		
Wild Strawberry *Fragaria vesca*													✓	✓				
Wood Anemone *Anemone nemerosa*																		
Wood Melick *Melica uniflora*			✓	✓			✓								✓			
Wood Sedge *Carex sylvatica*																		
Wood Sorrel *Oxalis acetosella*																		
Wood Speedwell *Veronica montana*																		
Pignut (*Conopodium majus)*																		
Total Woodland Species	**5**	**7**	**6**	**8**	**3**	**3**	**4**	**3**	**4**	**4**	**3**	**3**	**6**	**6**	**5**	**4**	**4**	2

Hedgerow ID	**H17 Sec 2**	**H17 Sec 3**	**H18 Fence N/A**	**H19 Sec 1**	**H19 Sec 2**	**H19A**	**H20**	**H21**	**H22 Sec 1**	**H22 Sec 2**	**H23 Sec 1**	**H23 Sec 2**	**H24 Sec 1**	**H24 Sec 2**	**H25 Sec 1**	**H25 Sec 2**	**H26**	**H27**
Woodland Species (as recorded on site)				✓														
Barren Strawberry *Potentilla sterilis*							✓											
Bluebell *Hyacinthoides non scipta*																		
Broad Buckler Fern *Dryopterisdilatata*									✓									
Bugle *Ajuga reptans*																		
Common polypody *Polypodium vulgare*																		
Common Dog Violet *Viola riviniana*							✓	✓			✓	✓	✓	✓			✓	✓
Early Dog Violet *Viola reichenbachiana*		✓														✓	✓	✓
Dog's Mercury *Mercurialis perennis*																		
Goldilocks Buttercup *Ranunculus auricomus*																		
Enchanters Nightshade *Circaea mascula*				✓	✓		✓				✓				✓			
Hard Fern *Blechnum spicant*																		
Hartstongue Fern *Asplenium scolopendrium*								✓										
Herb Bennet/Wood Avens *Geum urbanum*	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Heath Bedstraw *Galium saxatile*																		
Herb Robert *Geranium robertianum*	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lady Fern *Athyrium filix-femina*																		
Lords and Ladies *Arum maculatum*																		
Male Fern *Dryopteris filix mas*																		
Pignut *Conopodium majus*																		
Primrose *Primula vulgaris*															✓	✓		
Ransoms *Allium ursinum*																		
Sanicle *Sanicula europaea*																		
Sweet Violet *Viola odorata*													✓					
Tormantil *Potentilla erecta*																		
Wild Strawberry *Fragaria vesca*											✓	✓						
Wood Anemone *Anemone nemerosa*																		
Wood Melick *Melica uniflora*													✓				✓	✓
Wood Sedge *Carex sylvatica*																		
Wood Sorrel *Oxalis acetosella*																		
Wood Speedwell *Veronica montana*																		
Pignut (*Conopodium majus)*																		
Total Woodland Species	**2**	**3**	**N/A**	**3**	**3**	**2**	**5**	**4**	**2**	**1**	**5**	**4**	**5**	**3**	**4**	**4**	**5**	**5**

Hedgerow ID	**H28 Sec 1**	**H28 Sec 2**	**H29**	**H30 Sec 1**	**H30 Sec 2**	**H30 Sec 3**	**H31 Sec 1**	**H31 Sec 2**	**H31 Sec 3**	**H32 Sec 1**	**H32 Sec 2**	**H33 Sec 1**	**H33 Sec 2**	**H34 Sec 1**	**H34 Sec 2**	**H34 Sec 3**	**H35 Sec 1**	**H35 Sec 2**
Woodland Species (as recorded on site)																		
Barren Strawberry *Potentilla sterilis*							✓	✓	✓									
Bluebell *Hyacinthoides non scipta*																		
Broad Buckler Fern *Dryopterisdilatata*														✓	✓	✓		
Bugle *Ajuga reptans*																		
Common polypody *Polypodium vulgare*							✓	✓	✓	✓	✓							
Common Dog Violet *Viola riviniana*			✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
Early Dog Violet *Viola reichenbachiana*			✓											✓	✓	✓		
Dog's Mercury *Mercurialis perennis*																		
Goldilocks Buttercup *Ranunculus auricomus*																		
Enchanters Nightshade *Circaea mascula*	✓	✓																✓
Hard Fern *Blechnum spicant*																		
Hartstongue Fern *Asplenium scolopendrium*						✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
Herb Bennet/Wood Avens *Geum urbanum*	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		
Heath Bedstraw *Galium saxatile*																		
Herb Robert *Geranium robertianum*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lady Fern *Athyrium filix-femina*																		
Lords and Ladies *Arum maculatum*																		
Male Fern *Dryopteris filix mas*																		
Pignut *Conopodium majus*																		
Primrose *Primula vulgaris*	✓				✓									✓	✓	✓	✓	✓
Ransoms *Allium ursinum*																		
Sanicle *Sanicula europaea*																		
Sweet Violet *Viola odorata*																		
Tormantil *Potentilla erecta*																		
Wild Strawberry *Fragaria vesca*							✓	✓	✓			✓	✓				✓	✓
Wood Anemone *Anemone nemerosa*																		
Wood Melick *Melica uniflora*			✓															
Wood Sedge *Carex sylvatica*																		
Wood Sorrel *Oxalis acetosella*																		
Wood Speedwell *Veronica montana*																		
Pignut (*Conopodium majus)*																		
Total Woodland Species	**4**	**3**	**5**	**3**	**4**	**3**	**7**	**7**	**6**	**3**	**3**	**5**	**5**	**7**	**7**	**7**	**5**	**5**

Hedgerow ID	**H36 Sec 1**	**H36 Sec 2**	**H36 Sec 3**	**H37 Sec 1**	**H37 Sec 2**	**H38 Sec 1**	**H38 Sec 2**	**H39 Sec 1**	**H39 Sec 2**	**H40 Sec 1**	**H40 Sec 2**	**H41 Sec 1**	**H41 Sec 2**	**H41 Sec 3**	**H42**	**H43**	**H44 Sec 1**	**H44 Sec 2**
Woodland Species (as recorded on site)																		
Barren Strawberry *Potentilla sterilis*																✓		
Bluebell *Hyacinthoides non scipta*																		
Broad Buckler Fern *Dryopterisdilatata*																		
Bugle *Ajuga reptans*																		
Common polypody *Polypodium vulgare*																		
Common Dog Violet *Viola riviniana*	✓	✓	✓	✓	✓			✓	✓	✓					✓	✓		
Early Dog Violet *Viola reichenbachiana*																		
Dog's Mercury *Mercurialis perennis*																		
Goldilocks Buttercup *Ranunculus auricomus*																		
Enchanters Nightshade *Circaea mascula*	✓	✓	✓		✓	✓		✓	✓									
Hard Fern *Blechnum spicant*																		
Hartstongue Fern *Asplenium scolopendrium*	✓	✓		✓	✓	✓	✓	✓		✓	✓					✓	✓	✓
Herb Bennet/Wood Avens *Geum urbanum*	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓
Heath Bedstraw *Galium saxatile*															✓			
Herb Robert *Geranium robertianum*	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Lady Fern *Athyrium filix-femina*															✓			
Lords and Ladies *Arum maculatum*															✓			
Male Fern *Dryopteris filix mas*																		
Pignut *Conopodium majus*																		
Primrose *Primula vulgaris*	✓	✓	✓						✓	✓								
Ransoms *Allium ursinum*																		
Sanicle *Sanicula europaea*																		
Sweet Violet *Viola odorata*																		
Tormantil *Potentilla erecta*																		
Wild Strawberry *Fragaria vesca*	✓	✓									✓	✓				✓		
Wood Anemone *Anemone nemerosa*															✓		✓	✓
Wood Melick *Melica uniflora*							✓										✓	✓
Wood Sedge *Carex sylvatica*																		
Wood Sorrel *Oxalis acetosella*																		
Wood Speedwell *Veronica montana*																		
Pignut (*Conopodium majus)*																		
Total Woodland Species	**7**	**7**	**5**	**4**	**5**	**4**	**4**	**5**	**4**	**4**	**4**	**3**	**1**	**1**	**7**	**6**	**5**	**5**

Hedgerow ID	**H45 Sec 1**	**H45 Sec 2**	**H45 Sec 3**	**H46**	**H47 Sec 1**	**H47 Sec 2**	**H48**	**H49 Sec 1**	**H49 Sec 2**	**H50**	**H51 Sec 1**	**H51 Sec 2**	**H52**	**H53**	**H54 Sec 1**	**H54 Sec 2**
Woodland Species (as recorded on site)																
Barren Strawberry *Potentilla sterilis*																
Bluebell *Hyacinthoides non scipta*																
Broad Buckler Fern *Dryopterisdilatata*									✓							
Bugle *Ajuga reptans*																
Common polypody *Polypodium vulgare*	✓		✓													
Common Dog Violet *Viola riviniana*					✓	✓	✓								✓	✓
Early Dog Violet *Viola reichenbachiana*																
Dog's Mercury *Mercurialis perennis*																
Goldilocks Buttercup *Ranunculus auricomus*																
Enchanters Nightshade *Circaea mascula*				✓	✓	✓	✓							✓		
Hard Fern *Blechnum spicant*																
Hartstongue Fern *Asplenium scolopendrium*			✓	✓												
Herb Bennet/Wood Avens *Geum urbanum*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Heath Bedstraw *Galium saxatile*							✓									
Herb Robert *Geranium robertianum*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Lady Fern *Athyrium filix-femina*																
Lords and Ladies *Arum maculatum*																
Male Fern *Dryopteris filix mas*																
Pignut *Conopodium majus*																
Primrose *Primula vulgaris*																
Ransoms *Allium ursinum*																
Sanicle *Sanicula europaea*																
Sweet Violet *Viola odorata*																
Tormantil *Potentilla erecta*																
Wild Strawberry *Fragaria vesca*																
Wood Anemone *Anemone nemerosa*																
Wood Melick *Melica uniflora*																
Wood Sedge *Carex sylvatica*																
Wood Sorrel *Oxalis acetosella*																
Wood Speedwell *Veronica montana*																
Pignut (*Conopodium majus)*																
Total Woodland Species	**3**	**2**	**4**	**4**	**4**	**4**	**5**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**

Hedgerow ID	**H55 Sec 1**	**H55 Sec 2**	**H56 Sec 1**	**H56 Sec 2**	**H57 Sec 1**	**H57 Sec 2**	**H57 Sec 3**	**H58 Sec 1**	**H58 Sec 2**	**H59**	**H60**	**H61 Sec 1**	**H61 Sec 2**	**H61 Sec 3**	**H62**	**H63**	**H64**	**H65**	**H66**
Woodland Species (as recorded on site)																			
Barren Strawberry *Potentilla sterilis*																			
Bluebell *Hyacinthoides non scipta*																			
Broad Buckler Fern *Dryopterisdilatata*																			
Bugle *Ajuga reptans*																			
Common polypody *Polypodium vulgare*						✓	✓											✓	✓
Common Dog Violet *Viola riviniana*					✓			✓	✓			✓						✓	
Early Dog Violet *Viola reichenbachiana*													✓						
Dog's Mercury *Mercurialis perennis*																			
Goldilocks Buttercup *Ranunculus auricomus*																			
Enchanters Nightshade *Circaea mascula*											✓								
Hard Fern *Blechnum spicant*																			
Hartstongue Fern *Asplenium scolopendrium*								✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Herb Bennet/Wood Avens *Geum urbanum*			✓	✓				✓	✓	✓	✓		✓	✓	✓	✓	✓		
Heath Bedstraw *Galium saxatile*																			
Herb Robert *Geranium robertianum*	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lady Fern *Athyrium filix-femina*																			
Lords and Ladies *Arum maculatum*																			
Male Fern *Dryopteris filix mas*																			
Pignut *Conopodium majus*																			
Primrose *Primula vulgaris*					✓	✓	✓				✓								
Ransoms *Allium ursinum*																			
Sanicle *Sanicula europaea*																			
Sweet Violet *Viola odorata*																			
Tormantil *Potentilla erecta*																			
Wild Strawberry *Fragaria vesca*																			
Wood Anemone *Anemone nemerosa*																			
Wood Melick *Melica uniflora*																			
Wood Sedge *Carex sylvatica*																			
Wood Sorrel *Oxalis acetosella*																			
Wood Speedwell *Veronica montana*																			
Pignut (*Conopodium majus)*																			
Total Woodland Species	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**4**	**4**	**3**	**4**	**3**	**4**	**3**	**3**	**3**	**3**	**4**	**3**

4 Evaluation

4.1 Basis for Evaluation

The hedgerows will be evaluated under:

1) The criteria for determining 'important' hedgerows under the current Hedgerow Regulation 1997 as listed in Appendix II

*All Hedgerows are listed in the Environment (Wales) Act 2016 as a Habitat of Principal Importance for the conservation of Biodiversity in relation to Wales.

4.2 General

All of the true hedgerows surveyed offered potential opportunities for a wide range of small mammal, reptile, amphibian and bird species. Ground flora was sparse in places and the overall species diversity varied between hedgerows and within different sections of the same hedge.

Hedgerows H9, H12, and H48 showed the greatest diversity of native woody species all with a total of eight (8). Hedgerow H12 showed the greatest diversity of woodland species within the ground flora with more than eight (8) qualifying species recorded within the combined ground and field layers.

Two of the hedgerows H34 and H35 lie adjacent to a bridleway, carriageway or public footpath.

Most of the field hedgerows showed signs of historic management particularly management from traditional hedge laying.

A hedge bank was recorded on a large percentage of the field hedgerows but was absent for significant lengths of those hedges bordering the A40. The extent and height of the bank varied between hedgerows and along sections of the same hedge.

Ten (10) of the hedgerows H3, H11, H45, H46, H47, H48, H58, H63, H65 and H66 had a connection with deciduous woodland.

No hedgerows had a connection with a pond.

All the hedgerows appeared suitable habitat for the hazel dormouse (*Muscardinus avellanarius*).

4.3 Hedgerow Regulations 1997

4.4.1 History and Archaeology

This report has been produced based on Part II Landscape and Wildlife criteria, and does not include assessments based on the History and Archaeology criteria of the Hedgerow Regulations 1997.

4.4.2 Wildlife and Landscape

Under the current Hedgerow Regulations forty three (43) of the sixty eight (68) hedgerows present on site qualify as 'Important' based on the Landscape and Wildlife criteria of the Regulations. The important hedgerows are H1, H4, H6, H7, H8, H9, H11, H12, H13, H15, H15A, H17, H19, H19A, H20, H21, H23, H25, H26, H27, H28, H29, H33, H34, H35, H36, H37, H38, H39, H40, H42, H43, H44, H45, H48, H49, H53, H55, H56, H60, H65 and H66.

Ten (10) of the hedgerows, H9, H11, H15, H26, H27, H29, H36, H42, H43, and H66 qualify by containing a minimum of seven (7) woody species.

Seventeen (17) of the hedgerows, H4, H12, H13, H15A, H17, H19, H20, H21, H25, H34, H37, H38, H40, H56, H57, H60 and H66 qualify by containing a minimum of six woody species and a minimum of three associated qualifying features.

Sixteen (16) qualify by containing a minimum of five (5) woody species and a minimum of four associated features, these are, H1, H6, H7, H8, H23, H28, H30, H33, H35, H39, H44, H45, H48, H49, H53 and H55.

Hedgerows H1 (not a true hedge), H2, H10, H14 and H16 (not a true hedge) do not meet the criteria based on landscape and wildlife features.

The presence of certain species within a hedgerow automatically qualifies that hedgerow as 'important' under the Hedgerow Regulations. No records for any such species within the survey boundary were found during the data search carried out as part of the Phase I survey.

The presence of dormouse within hedgerows would qualify the hedgerow as 'important'. A dormouse survey of the site is currently being undertaken and the results of this survey has the potential to add a further qualifying criteria to those hedgerows already considered 'important'

The main qualifying features for each hedgerow are shown in table 3.

Table 3 Summary of Criteria met for each of the hedgerows surveyed.

Hedgerow ID	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12
Qualifying Criteria												
Number of woody Species	5	4	3	6	4	5	5	5	7	3	7	6
Number of Woodland Species	2	3	5	6	4	5	5	6	4	4	5	7
Bank or wall	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Ditch	N	Y	N	N	N	Y	N	Y	Y	N	N	Y
Minimum of 1 standard tree per 50m	Y	N	Y	N	N	N	Y	Y	Y	N	Y	Y
Parallel hedge within 15m	N	N	Y	Y	N	N	N	Y	N	N	N	Y
Number Hedgerow connections	4	3	1	2	2	4	4	4	4	4	4	3
Pond Connections	0	0	0	0	0	0	0	0	0	0	0	0
Number of woodland connections	0	0	1	0	0	0	0	0	0	0	1	0
Total Connection Points Awarded	4	3	3	2	4	4	4	6	4	4	6	5
Less than 10% gaps	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Adjacent to Footpath, bridleway, RUP	N	N	N	N	N	N	N	N	N	N	N	N
Qualifies under the 1997 Hedgerow Regulations Wildlife and Landscape Criteria as 'Important Hedgerow'	YES	NO	NO	YES	NO	YES	YES	YES	YES	NO	YES	YES
Qualifies under the 1997 Hedgerow Regulations Archaeology and History Criteria as 'Important Hedgerow'	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

KEY	Qualifies with 7 woody species	Qualifies with 6 woody species + min 3 qualifying features	Qualifies with 5 woody species + min 4 qualifying features

* All Hedgerows Qualify as a Habitat of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales

Hedgerow ID	H13	H14	H14A	H15	H15A	H16	H17	H18	H19	H19A	H20	H21
Qualifying Criteria												
Number of woody Species	6	5	4	7	6	4	6	N/A Fence	6	6	6	6
Number of Woodland Species	3	3	3	3	3	3	3		3	3	3	5
Bank or wall	N	N	N	Y	Y	Y	Y		Y	Y	Y	N
Ditch	N	N	N	Y	Y	N	N		N	N	Y	N
Minimum of 1 standard tree per 50m	Y	N	N	Y	Y	Y	Y		Y	Y	Y	Y
Parallel hedge within 15m	N	N	N	Y	Y	N	N		N	N	N	N
Number Hedgerow connections	3	4	4	4	4	4	3		3	3	5	3
Pond Connections	0	0	0	O	0	0	0		0	0	0	0
Number of woodland connections	0	0	0	O	O	0	0		0	O	0	0
Total Connection Points Awarded	3	4	4	6	6	4	3		3	3	5	3
Less than 10% gaps	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y
Adjacent to Footpath, bridleway, RUP	N	N	N	N	N	N	N		N	N	N	N
Qualifies under the 1997 Hedgerow Regulations Wildlife and Landscape Criteria as 'Important Hedgerow'	YES	NO	NO	YES	YES	NO	YES		YES	YES	YES	YES
Qualifies under the 1997 Hedgerow Regulations Archaeology and History Criteria as 'Important Hedgerow'	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

KEY	Qualifies with 7 woody species	Qualifies with 6 woody species + min 3 qualifying features	Qualifies with 5 woody species + min 4 qualifying features

* All Hedgerows Qualify as a Habitat of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales

Hedgerow ID	H22	H23	H24	H25	H26	H27	H28	H29	H30	H31	H32	H33
Qualifying Criteria												
Number of woody Species	4	5	4	6	7	7	5	7	5	4	4	5
Number of Woodland Species	2	5	4	4	5	5	4	5	3	7	3	5
Bank or wall	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ditch	N	Y	N	N	N	N	N	N	N	N	N	N
Minimum of 1 standard tree per 50m	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Parallel hedge within 15m	N	N	N	N	N	N	Y	N	N	Y	Y	N
Number Hedgerow connections	3	3	4	4	4	4	4	4	4	4	4	4
Pond Connections	0	0	0	0	0	0	0	0	0	0	0	0
Number of woodland connections	0	0	0	0	0	0	0	0	0	0	0	0
Total Connection Points Awarded	3	3	4	4	4	4	4	4	4	6	6	4
Less than 10% gaps	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Adjacent to Footpath, bridleway, RUP	N	N		N	N	N	N	N	N	N	N	N
Qualifies under the 1997 Hedgerow Regulations Wildlife and Landscape Criteria as 'Important Hedgerow'	NO	YES	NO	YES	YES	YES	YES	YES	YES	NO	NO	YES
Qualifies under the 1997 Hedgerow Regulations Archaeology and History Criteria as 'Important Hedgerow'	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

KEY	Qualifies with 7 woody species	Qualifies with 6 woody species + min 3 qualifying features	Qualifies with 5 woody species + min 4 qualifying features

* All Hedgerows Qualify as a Habitat of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales

Hedgerow ID	H34	H35	H36	H37	H38	H39	H40	H41	H42	H43	H44	H45
Qualifying Criteria												
Number of woody Species	6	5	7	6	6	5	6	6	7	7	5	5
Number of Woodland Species	7	5	6	5	4	5	4	2	7	6	5	3
Bank or wall	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y
Ditch	N	N	N	N	N	N	N	N	N	N	N	N
Minimum of 1 standard tree per 50m	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y
Parallel hedge within 15m	Y	Y	N	N	N	N	N	N	Y	Y	N	N
Number Hedgerow connections	3	3	5	5	5	4	5	3	3	3	4	3
Pond Connections	0	0	0	0	0	0	0	0	0	0		0
Number of woodland connections	0	0	0	0	0	0	0	0	0	0	0	1
Total Collection Points Awarded	5	5	5	5	5	4	5	3	5	5	4	5
Less than 10% gaps	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Adjacent to Footpath, bridleway, RUP	Y	Y	N	N	N	N	N	N	N	N	N	N
Qualifies under the 1997 Hedgerow Regulations Wildlife and Landscape Criteria as 'Important Hedgerow'	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES
Qualifies under the 1997 Hedgerow Regulations Archaeology and History Criteria as 'Important Hedgerow'	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

KEY	Qualifies with 7 woody species	Qualifies with 6 woody species + min 3 qualifying features	Qualifies with 5 woody species + min 4 qualifying features

* All Hedgerows Qualify as a Habitat of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales

Hedgerow ID	H46	H47	H48	H49	H50	H51	H52	H53	H54	H55	H56
Qualifying Criteria											
Number of woody Species	4	4	5	5	3	2	1	5	5	5	6
Number of Woodland Species	4	4	5	3	2	2	2	3	2	1	2
Bank or wall	Y	Y	Y	Y	N	N	N	Y	Y	Y	N
Ditch	N	N		N	N	N	N	N	N	N	N
Minimum of 1 standard tree per 50m	Y	Y	Y	N	N	N	N	N	N	Y	Y
Parallel hedge within 15m	Y	N	N	N	N	N	N	N	N	N	N
Number Hedgerow connections	1	3	3	4	4	4	3	4	4	4	4
Pond Connections	0	0	0	0	0	0	0	0	0	0	0
Number of woodland connections	1	1	1	0	0	0	0	0	0	0	0
Total Collection Points Awarded	3	5	5	4	4	4	3	4	4	4	4
Less than 10% gaps	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Adjacent to Footpath, bridleway, RUP	N	N	N	N	N	N	N	N	N	N	N
Qualifies under the 1997 Hedgerow Regulations Wildlife and Landscape Criteria as 'Important Hedgerow'	NO	NO	YES	YES	NO	NO	NO	YES	NO	YES	YES
Qualifies under the 1997 Hedgerow Regulations Archaeology and History Criteria as 'Important Hedgerow'	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

KEY	Qualifies with 7 woody species	Qualifies with 6 woody species + min 3 qualifying features	Qualifies with 5 woody species + min 4 qualifying features

* All Hedgerows Qualify as a Habitat of Principal Importance for maintaining and enhancing Biodiversity in relation to Wales

Hedgerow ID	H57	H58	H59	H60	H61	H62	H63	H64	H65	H66	
Qualifying Criteria											
Number of woody Species	6	3	4	6	4	4	3	4	6	7	
Number of Woodland Species	2	4	3	4	3	3	3	3	4	3	
Bank or wall	Y	N	N	Y	N	N	N	N	Y	Y	
Ditch	N	N	N	N	N	N	N	N	Y	Y	
Minimum of 1 standard tree per 50m	Y	Y	N	Y	Y	N	Y	Y	Y	Y	
Parallel hedge within 15m	N	N	N	N	N	N	N	N	N	N	
Number Hedgerow connections	4	3	4	4	4	4	4	4	2	2	
Pond Connections	0	0	0	0	0	0	0	0	0	0	
Number of woodland connections	0	1	0	0	0	0	1	0	1	1	
Total Connection Points Awarded	4	5	4	4	4	4	6		4	4	
Less than 10% gaps	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Adjacent to Footpath, bridleway, RUP	N	N	N	N	N	N	N	N	N	N	
Qualifies under the 1997 Hedgerow Regulations Wildlife and Landscape Criteria as 'Important Hedgerow'	YES	NO	NO	YES	NO	NO	NO	NO	YES	YES	
Qualifies under the 1997 Hedgerow Regulations Archaeology and History Criteria as 'Important Hedgerow'	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

KEY	Qualifies with 7 woody species	Qualifies with 6 woody species + min 3 qualifying features	Qualifies with 5 woody species + min 4 qualifying features

References

Anonymous (1997) The Hedgerow Regulations- your questions answered. Department of the Environment.

Bickmore (2007) The Hedgerow Survey Handbook, a standard procedure for local surveys in the UK. UK steering group for Biodiversity Action Plan.

DEFRA (2003) Protection of boundary features and amendments of the Hedgerow Regulation 1997, consultation document.

MAFF (1997) The Hedgerow Regulation 1997, a guide to good practice

Appendix I

Map Showing Hedgerow System and Identification Numbers

TerrAqua Ecological Services Ltd

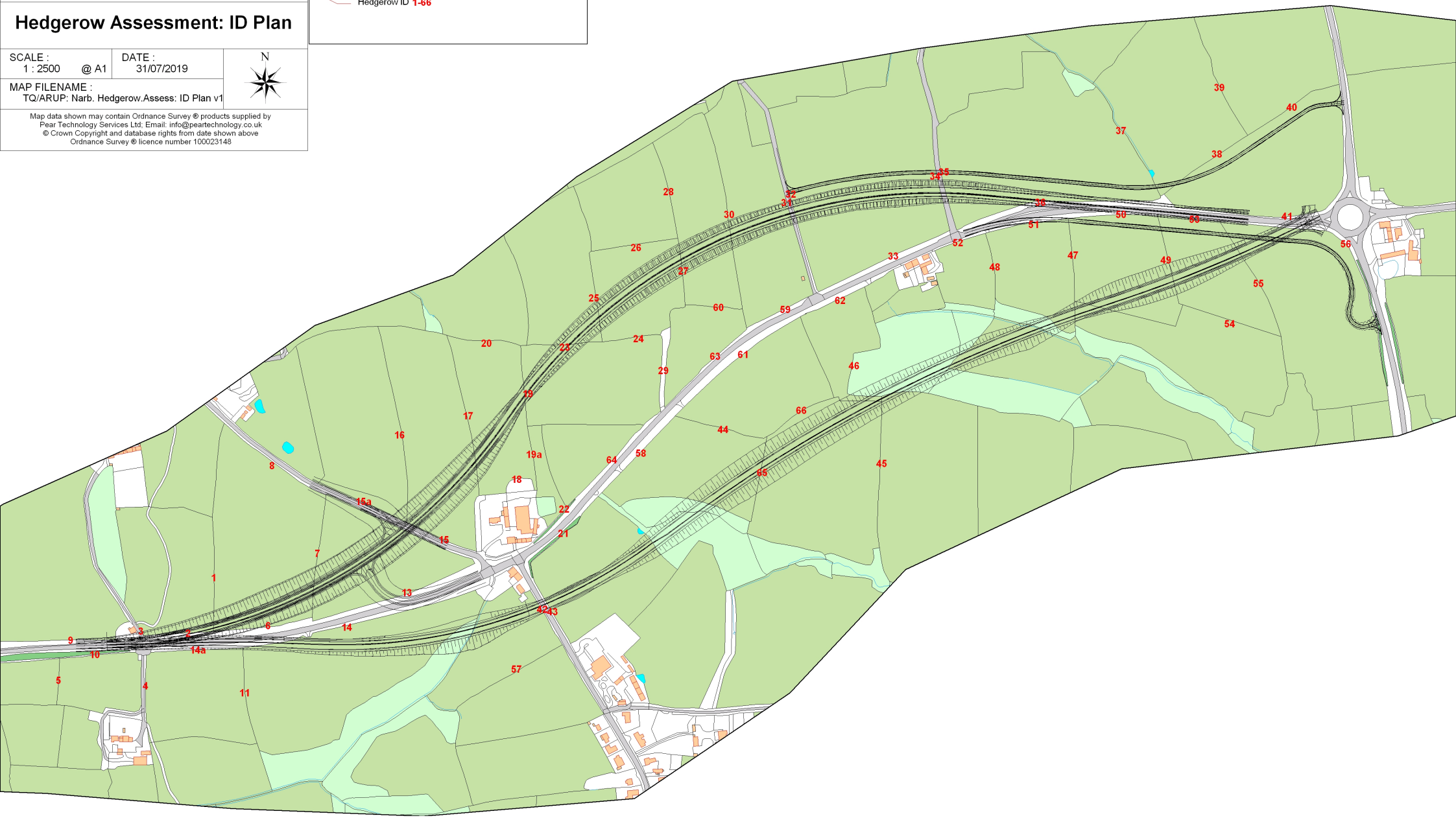
A40: Narberth
for ARUP

Hedgerow Assessment: ID Plan

SCALE :	DATE :	N
1 : 2500 @ A1	31/07/2019	
MAP FILENAME : TQ/ARUP: Narb. Hedgerow.Assess: ID Plan v1		

Legend

Hedgerow ID **1-66**



Appendix II

Hedgerow Regulations 1997 Criteria

SCHEDULE 1

Regulations 2(3) and 4

ADDITIONAL CRITERIA FOR DETERMINING "IMPORTANT" HEDGEROWS

PART I

INTERPRETATION

In this Schedule—

"building" includes structure;

"Record Office" means—

(a) a place appointed under section 4 of the Public Records Act 1958(**1**) (place of deposit of public records),

(b) a place at which documents are held pursuant to a transfer under section 144A(4) of the Law of Property Act 1922(**2**) or under section 36(2) of the Tithe Act 1936(**3**), including each of those provisions as applied by section 7(1) of the Local Government (Records) Act 1962(**4**), or

(c) a place at which documents are made available for inspection by a local authority pursuant to section 1 of the Local Government (Records) Act 1962;

"relevant date" means the date on which these Regulations are made;

"Sites and Monuments Record" means a record of archaeological features and sites adopted—

(a) by resolution of a local authority within the meaning of the Local Government Act 1972(**5**), or

(b) in Greater London, by the Historic Buildings and Monuments Commission(**6**);

"standard tree"—

(a) in the case of a multi-stemmed tree, means a tree which, when measured at a point 1.3 metres from natural ground level, has at least two stems whose diameters are at least 15 centimetres;

(b) in the case of a single-stemmed tree, means a tree which, when measured at a point 1.3 metres from natural ground level, has a stem whose diameter is at least 20 centimetres;

"woodland species" means the species listed in Schedule 2; and

"woody species" means the species and sub-species listed in Schedule 3, and any hybrid, that is to say, any individual plant resulting from a cross between parents of any species or sub-species so listed, but does not include any cultivar; and

references to the documents in paragraph 6(3)(b) and (4) are to those documents as at the relevant date, without taking account of any subsequent revisions, supplements or modifications.

(**1**) 1958 c. 51.
(**2**) 1922 c. 16; section 144A was inserted by the Law of Property (Amendment) Act 1924 (c. 5), Schedule 2.
(**3**) 1928 c. 2.
(**4**) 1962 c. 56.
(**5**) 1972 c. 70.
(**6**) The Commission was established by section 32 of the National Heritage Act 1993 (c. 47).

PART II

CRITERIA

Archaeology and history

1. The hedgerow marks the boundary, or part of the boundary, of at least one historic parish or township; and for this purpose "historic" means existing before 1850.

2. The hedgerow incorporates an archaeological feature which is—

(a) included in the schedule of monuments compiled by the Secretary of State under section 1 (schedule of monuments) of the Ancient Monuments and Archaeological Areas Act 1979(**7**); or

(b) recorded at the relevant date in a Sites and Monuments Record.

3. The hedgerow—

(a) is situated wholly or partly within an archaeological site included or recorded as mentioned in paragraph 2 or on land adjacent to and associated with such a site; and

(b) is associated with any monument or feature on that site.

4. The hedgerow—

(a) marks the boundary of a pre-1600 AD estate or manor recorded at the relevant date in a Sites and Monuments Record or in a document held at that date at a Record Office; or

(b) is visibly related to any building or other feature of such an estate or manor.

5. The hedgerow—

(a) is recorded in a document held at the relevant date at a Record Office as an integral part of a field system pre-dating the Inclosure Acts(**8**); or

(b) is part of, or visibly related to, any building or other feature associated with such a system, and that system—

(i) is substantially complete; or

(ii) is of a pattern which is recorded in a document prepared before the relevant date by a local planning authority, within the meaning of the 1990 Act(**9**), for the purposes of development control within the authority's area, as a key landscape characteristic.

Wildlife and landscape

6.—(1) The hedgerow—

(a) contains species listed or categorised as mentioned in sub-paragraph (3); or

(b) is referred to in a record held immediately before the relevant date by a biological record centre maintained by, or on behalf of, a local authority within the meaning of the Local Government Act 1972(**10**), and in a form recognised by the Nature Conservancy Council for England, the Countryside Council for Wales(**11**) or the Joint Nature Conservation Committee(**12**), as having contained any such species—

(**7**) 1979 c. 46.
(**8**) *See* the Short Titles Act 1896 (c. 14).
(**9**) *See* section 1 of the Town and Country Planning Act 1990, as amended by the Local Government (Wales) Act 1994 (c. 19).
(**10**) *See* the definition of "local authority" in section 270(1), as amended by the Local Government Act 1985 (c. 51), Schedule 17 and the Local Government (Wales) Act 1994, Schedule 1, paragraphs 1 and 57.
(**11**) *See* section 128(1) of the Environmental Protection Act 1990 (c. 43); subsection (1) of section 128 was amended by the National Heritage (Scotland) Act 1991 (c. 28).
(**12**) *See* section 128(4) of the Environmental Protection Act 1990.

(i) in the case of animals and birds, subject to sub-paragraph (2), within the period of five years immediately before the relevant date.

(ii) in the case of plants, subject to sub-paragraph (2), within the period of ten years immediately before the relevant date;

(2) Where more than one record referable to the period of five or, as the case may be, ten years before the relevant date is held by a particular biological record centre, and the more (or most) recent record does not satisfy the criterion specified in sub-paragraph (1)(b), the criterion is not satisfied (notwithstanding that an earlier record satisfies it).

(3) The species referred to in sub-paragraph (1) are those—

(a) listed in Part I (protection at all times) of Schedule 1 (birds which are protected by special penalties), Schedule 5 (animals which are protected) or Schedule 8 (plants which are protected) to the Wildlife and Countryside Act 1981(**13**);

(b) categorised as a declining breeder (category 3) in "Red Data Birds in Britain" Batten LA, Bibby CJ, Clement P, Elliott GD and Porter RF (Eds.), published in 1990 for the Nature Conservancy Council and the Royal Society for the Protection of Birds (ISBN 0 85661 056 9); or

(c) categorised as "endangered", "extinct", "rare" or "vulnerable" in Britain in a document mentioned in sub-paragraph (4).

(4) The documents referred to in sub-paragraph (3)(c) are—

(a) of the books known as the British Red Data Books:

(1) "Vascular Plants" Perring FH and Farrell L, 2nd Edition, published in 1983 for the Royal Society for Nature Conservation (ISBN 0 902484 04 4);

(2) "Insects" Shirt DB (Ed.), published in 1987 for the Nature Conservancy Council (ISBN 0 86139 380 5); and

(3) "Invertebrates other than insects" Bratton JH (Ed.), published in 1991 for the Joint Nature Conservation Committee (ISBN 1 873701 00 4); and

(b) of the books known as the Red Data Books of Britain and Ireland:

"Stoneworts" Stewart NF and Church JM, published in 1992 for the Joint Nature Conservation Committee (ISBN 1 873701 24 1).

7.—(1) Subject to sub-paragraph (2), the hedgerow includes—

(a) at least 7 woody species;

(b) at least 6 woody species, and has associated with it at least 3 of the features specified in sub-paragraph (4);

(c) at least 6 woody species, including one of the following—

black-poplar tree *(Populus nigra* ssp *betulifolia)*;

large-leaved lime *(Tilia platyphyllos)*;

small-leaved lime *(Tilia cordata)*;

wild service-tree *(Sorbus torminalis)*; or

(d) at least 5 woody species, and has associated with it at least 4 of the features specified in sub-paragraph (4),

and the number of woody species in a hedgerow shall be ascertained in accordance with sub-paragraph (3).

(**13**) 1981 c. 69. Schedule 5 is amended by S.I.1988/288, 1989/906, 1991/367 and 1992/2350.

(2) Where the hedgerow in question is situated wholly or partly in the county (as constituted on 1st April 1997) of the City of Kingston upon Hull, Cumbria, Darlington, Durham, East Riding of Yorkshire, Hartlepool, Lancashire, Middlesbrough, North East Lincolnshire, North Lincolnshire, Northumberland, North Yorkshire, Redcar and Cleveland, Stockton-on-Tees, Tyne and Wear, West Yorkshire or York(**14**), the number of woody species mentioned in paragraphs (a) to (d) of sub-paragraph (1) is to be treated as reduced by one.

(3) For the purposes of sub-paragraph (1) (and those of paragraph 8(b))—

(a) where the length of the hedgerow does not exceed 30 metres, count the number of woody species present in the hedgerow;

(b) where the length of the hedgerow exceeds 30 metres, but does not exceed 100 metres, count the number of woody species present in the central stretch of 30 metres;

(c) where the length of the hedgerow exceeds 100 metres, but does not exceed 200 metres, count the number of woody species present in the central stretch of 30 metres within each half of the hedgerow and divide the aggregate by two;

(d) where the length of the hedgerow exceeds 200 metres, count the number of woody species present in the central stretch of 30 metres within each third of the hedgerow and divide the aggregate by three.

(4) The features referred to in sub-paragraph (1)(b) and (d) (which include those referred to in paragraph 8(b)) are—

(a) a bank or wall which supports the hedgerow along at least one half of its length;

(b) gaps which in aggregate do not exceed 10% of the length of the hedgerow;

(c) where the length of the hedgerow does not exceed 50 metres, at least one standard tree;

(d) where the length of the hedgerow exceeds 50 metres but does not exceed 100 metres, at least 2 standard trees;

(e) where the length of the hedgerow exceeds 100 metres, such number of standard trees (within any part of its length) as would when averaged over its total length amount to at least one for each 50 metres;

(f) at least 3 woodland species within one metre, in any direction, of the outermost edges of the hedgerow;

(g) a ditch along at least one half of the length of the hedgerow;

(h) connections scoring 4 points or more in accordance with sub-paragraph (5);

(i) a parallel hedge within 15 metres of the hedgerow.

(5) For the purposes of sub-paragraph (4)(h) a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broad-leaved trees scores 2 points; and a hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued.

8. The hedgerow—

(a) is adjacent to a bridleway or footpath, within the meaning of the Highways Act 1980(**15**), a road used as a public path, within the meaning of section 54 (duty to reclassify roads used as public paths) of the Wildlife and Countryside Act 1981(**16**), or a byway open to all traffic, within the meaning of Part III of the Wildlife and Countryside Act 1981(**17**), and

(**14**) In relation to the City of Kingston upon Hull, North and North East Lincolnshire and the East Riding of Yorkshire, *see* S.I. 1995/600; to Darlington and Durham, *see* S.I. 1995/1772; to Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton-on-Tees, *see* S.I. 1995/1747; to Lancashire, *see* S.I. 1996/1868; and to North Yorkshire and York, *see* S.I. 1995/610.
(**15**) 1980 c. 66. *See* the definition of "bridleway" and "footpath" in section 3.
(**16**) 1981 c. 69.
(**17**) *See* the definition in section 66(1).

(b) includes at least 4 woody species, ascertained in accordance with paragraph 7(3) and at least 2 of the features specified in paragraph 7(4)(a) to (g).

SCHEDULE 2

Regulation 2(3) and Schedule 1, Part I

WOODLAND SPECIES

Barren strawberry *(Potentilla sterilis)*
Bluebell *(Hyacinthoides non-scriptus)*
Broad buckler fern *(Dryopteris dilatata)*
Broad-leaved helleborine *(Epipactis helleborine)*
Bugle *(Ajuga reptans)*
Common cow-wheat *(Melampyrum pratense)*
Common dog violet *(Viola riviniana)*
Common polypody *(Polypodium vulgare)*
Dog's mercury *(Mercurialis perennis)*
Early dog violet *(Viola reichenbachiana)*
Early purple orchid *(Orchis mascula)*
Enchanter's nightshade *(Circaea lutetiana)*
Giant fescue *(Festuca gigantea)*
Goldilocks buttercup *(Ranunculus auricomus)*
Great bell-flower *(Campanula latifolia)*
Greater wood-rush *(Luzula sylvatica)*
Hairy brome *(Bromus ramosus)*
Hairy woodrush *(Luzula pilosa)*
Hard fern *(Blechnum spicant)*
Hard shield fern *(Polystichum aculeatum)*
Hart's tongue *(Asplenium scolopendrium)*
Heath bedstraw *(Galium saxatile)*
Herb paris *(Paris quadrifolia)*
Herb-robert *(Geranium robertianum)*
Lady fern *(Athyrium filix-femina)*
Lords-and-ladies *(Arum maculatum)*
Male fern *(Dryopteris filix-mas)*
Moschatel *(Adoxa moschatellina)*
Narrow buckler-fern *(Dryopteris carthusiana)*
Nettle-leaved bell-flower *(Campanula trachelium)*
Oxlip *(Primula elatior)*
Pignut *(Conopodium majus)*
Primrose *(Primula vulgaris)*

Ramsons *(Allium ursinum)*
Sanicle *(Sanicula europaea)*
Scaly male-fern *(Dryopteris affinis)*
Small cow-wheat *(Melampyrum sylvaticum)*
Soft shield fern *(Polystichum setiferum)*
Sweet violet *(Viola odorata)*
Toothwort *(Lathraea squamaria)*
Tormentil *(Potentilla erecta)*
Wild strawberry *(Fragaria vesca)*
Wood anemone *(Anemone nemorosa)*
Wood avens/Herb bennet *(Geum urbanum)*
Wood false-brome *(Brachypodium sylvaticum)*
Wood horsetail *(Equisetum sylvaticum)*
Wood meadow-grass *(Poa nemoralis)*
Wood melick *(Melica uniflora)*
Wood millet *(Millium effusum)*
Wood sage *(Teucrium scorodonia)*
Wood sedge *(Carex sylvatica)*
Wood sorrel *(Oxalis acetosella)*
Wood speedwell *(Veronica montana)*
Wood spurge *(Euphorbia amygdaloides)*
Woodruff *(Galium odoratum)*
Yellow archangel *(Lamiastrum galeobdolon)*
Yellow pimpernel *(Lysimachia nemorum)*

SCHEDULE 3

Regulation 2(3) and Schedule 1, Part I

WOODY SPECIES

Alder *(Alnus glutinosa)*
Apple, crab *(Malus sylvestris)*
Ash *(Fraxinus excelsior)*
Aspen *(Populus tremula)*
Beech *(Fagus sylvatica)*
Birch, downy *(Betula pubescens)*
Birch, silver *(Betula pendula)*
Black-poplar *(Populus nigra sub-species betulifolia)*
Blackthorn *(Prunus spinosa)*
Box *(Buxus sempervirens)*
Broom *(Cytisus scoparius)*

Buckthorn *(Rhamnus cathartica)*
Buckthorn, alder *(Frangula alnus)*
Butcher's-broom *(Ruscus aculeatus)*
Cherry, bird *(Prunus padus)*
Cherry, wild *(Prunus avium)*
Cotoneaster, wild *(Cotoneaster integerrimus)*
Currant, downy *(Ribes spicatum)*
Currant, mountain *(Ribes alpinum)*
Dogwood *(Cornus sanguinea)*
Elder *(Sambucus nigra)*
Elm *(Ulmus species)*
Gooseberry *(Ribes uva-crispa)*
Gorse *(Ulex europaeus)*
Gorse, dwarf *(Ulex minor)*
Gorse, western *(Ulex gallii)*
Guelder rose *(Viburnum opulus)*
Hawthorn *(Crataegus monogyna)*
Hawthorn, midland *(Crataegus laevigata)*
Hazel *(Corylus avellana)*
Holly *(Ilex aquilfolium)*
Hornbeam *(Carpinus betulus)*
Juniper, common *(Juniperus communis)*
Lime, large-leaved *(Tilia platyphyllos)*
Lime, small-leaved *(Tilia cordata)*
Maple, field *(Acer campestre)*
Mezereon *(Daphne mezereum)*
Oak, pedunculate *(Quercus robur)*
Oak, sessile *(Quercus petraea)*
Osier *(Salix viminalis)*
Pear, Plymouth *(Pyrus cordata)*
Pear, wild *(Pyrus pyraster)*
Poplar, grey *(Populus x canescens)*
Poplar, white *(Populus alba)*
Privet, wild *(Ligustrum vulgare)*
Rose *(Rosa species)*
Rowan *(Sorbus aucuparia)*
Sea-buckthorn *(Hippophae rhamnnoides)*
Service-tree, wild *(Sorbus torminalis)*
Spindle *(Euonymus europaeus)*
Spurge-laurel *(Daphne laureola)*

Walnut *(Juglans regia)*
Wayfaring-tree *(Viburnum lantana)*
Whitebeam *(Sorbus species)*
Willow *(Salix species)*
Yew *(Taxus baccata)*

SCHEDULE 4

Regulation 5(1)

FORM OF HEDGEROW REMOVAL NOTICE The Environment Act 1995The Hedgerows Regulations 1997

To: *(Name and address of local planning authority)*.....
.....
.....

From: *(Name and address of person giving the notice)*.....
.....
.....

1. I give you notice under regulation 5(1)(a) of the above Regulations that I propose to remove the [stretch(es) of] hedgerow(s) indicated on the attached plan. *(If possible, please provide a plan to a scale of 1:2500. A different scale can be used so long as it shows clearly the location and length of the hedgerow or hedgerows that you wish to remove.)*

2. The reasons why I propose to remove it/them are the following:—

3. Of the [stretch(es) of] hedgerow(s) indicated, those marked with an "X" were planted less than 30 years ago. Evidence of the date of planting is attached.

4. I am/We are the owner(s) of the freehold of the land concerned.

OR (please delete as appropriate)

I am/We are the tenant(s) of the agricultural holding concerned.

OR (please delete as appropriate)

I am/We are the tenant(s) under the farm business tenancy concerned

OR (please delete as appropriate)

I am/act for the utility operator concerned.

....
(Signature of person giving notice) *(Date)*

Bat Survey Report for A40 upgrade between Penblewin and Redstone Cross

Version 2.2

Presented to Arup

January 2020

CONTENTS

Non-Technical Summary

The proposed development is for the A40 road improvement between Penblewin and Redstone Cross, in Pembrokeshire, South Wales. There are two possible options for the scheme - one route option runs to the north of the existing A40 road and the other option runs to the south.

A number of bat surveys were carried out during 2019 to establish the presence of bat roosts and to gain insight into the use of the site by bats.

Bat activity transect surveys were carried out along both route options between May and October. These transect surveys found that the site is mainly used by bats for commuting, foraging and feeding especially within the hedgerows, streams and woodlands on both the northern and southern route options.

An assessment of buildings and trees (ground and aerial) was conducted to identify potential roost sites within 50m of both route options. The survey identified nine buildings with potential to support roosting bats (between low and high potential), and 91 trees were assessed as providing some suitability for roosting bats, nine of which had moderate to high potential.

Further emergence and re-entry surveys were carried out on buildings and trees with potential to support roosting bats, to establish their presence or absence. The surveys confirmed the presence of bat roosts within five of the buildings surveyed. One of the trees was confirmed as a bat roost.

Declaration

We confirm that the information provided in this document is truthful and accurate at the time of completion.

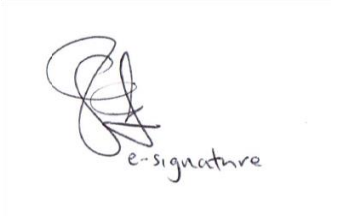
Name of ecologist: Olatz Gartzia MSc ACIEEM

Signature of ecologist:

Date: 4th November 2019

Quality assurance: Jon Davies

Signature:



Date: 12th November 2019

1.0 Introduction

Biocensus was commissioned by Arup to undertake a suite of ecological survey work to inform the proposed A40 improvement works on two possible route options between Penblewin and Redstone Cross (hereafter referred to as 'the scheme options').

Preliminary surveys carried out by Arup identified the need to carry out bat surveys on all areas within 50m of the scheme, including bat activity transect surveys, external building inspections, ground level and aerial inspections on trees and emergence / re-entry surveys on buildings and trees with bat roosting potential.

This report provides details of bat surveys carried out and identifies potential issues (constraints and opportunities) associated with the development.

2.0 Site Description

The site is located between Penblewin roundabout and west of Redstone Cross on the A40 near Narberth, Pembrokeshire. There are two possible options for the scheme - one route option runs to the north of the existing A40 road and is centred on grid reference SN 11227 16624, the other option runs to the south and is centred on grid reference SN 11238 16321. Both options are shown in Figure 1, **Appendix 1**.

The northern route covers areas that support improved and semi-improved grasslands with well-established hedgerows and a small wooded area. The southern route predominantly encompasses improved grassland fields with hedgerows, but it also supports areas of broadleaved woodland, carr and marshy grassland.

3.0 Methodology

All survey methodology was agreed with Natural Resources Wales, and followed recommended best practice (Collins, 2016) (Bat Conservation Trust, 2012). The field survey comprised different components as follows:

3.1 Bat Activity Transect Surveys

Two walked transect surveys were developed to sample each route option – one in the north and one in the south. The aim of the transects was to record which bat species were present, and to help evaluate the relative importance of different areas for commuting and foraging bats.

Each transect was walked once a month at dusk with two experienced surveyors walking a pre-determined transect route at a steady pace in suitable weather conditions. The start points and direction of each transect was varied across the months to reduce bias.

Transect surveys began at sunset and continued for up to 2 hours after sunset. Bat calls were recorded with full spectrum (Batlogger M) or frequency division (Anabat Express, recording in zero-crossing) handheld bat detectors to assist with species identification, which tagged the calls with a GPS and time stamp.

Bat echolocation call analysis was undertaken manually by a suitably experienced ecologist, with support from reference material including the *British Bat Calls Species Identification Guide* (Russ, 2012). All data collected from bat activity transects were analysed using BatExplorer or Analook software.

Due to the overlapping call parameters associated with individual *Myotis* spp., no attempt was made to identify them to species level, as to do so would be to suggest a false degree of accuracy.

Survey dates, times and weather conditions are presented in **Table 2**.

3.2 Bat Roosts in Buildings

a) External Building Inspections

All buildings within 50m of the scheme, including those that were between the northern and southern options of the scheme, were evaluated for their bat roosting potential through an external inspection by a Natural England Class Level 2 bat licence-holder.

The exterior of the buildings was observed from ground level using a high-powered torch, paying particular attention to potential roosting and access points for bats. Areas of particular suitability include crevices in stone or brickwork and gaps beneath roof tiles. The interior of the buildings was not accessed by the surveyors.

The criteria used to categorise the bat roost potential (BRP) of buildings and trees are summarised in **Table 1**, below (based on Collins, 2016).

b) Emergence / re-entry surveys

Buildings with 'low' to 'high' potential or confirmed roosts were subject to follow-up dusk emergence and dawn re-entry surveys between June and September 2019. Each survey consisted of a team of surveyors (between 2 and 3) observing potential bat roost exit or re-entry points. Bat activity in the vicinity of the buildings was also recorded.

Dusk emergence surveys started approximately 15 minutes before sunset and continued for 2.5 hours, while any dawn re-entry surveys started around 1.5 to 2 hours before sunrise and continued for 15 minutes after dawn.

Bat echolocation calls were recorded during the surveys using handheld detectors recording bat calls to assist with species identification. Analysis was manually undertaken by a suitably qualified ecologist. Detectors and analysis software included the following;

- Full spectrum Anabat Scout recorded zero-crossing files that were analysed with Analook software.
- Frequency division Anabat Express recorded zero-crossing files that were analysed with Analook software. Surveyors using this detector were assisted with heterodyne Petterson D240x detector to be able to listen calls in the field.
- Full spectrum EM Touch and EM3+ detectors recorded calls in WAV format which were analysed using Audacity software.

Weather conditions during these surveys were largely considered favourable for bat surveys and are summarised in **Table 2**.

Table 1 Tree and Building Bat Roost Categories (after Collins, 2016)

Category	Description
Known or confirmed bat roost	Bats or evidence of bats recorded, both of recent and/or historic activity. Signs of bats include live animals, corpses, droppings, urine staining, feeding remains (e.g. moth and butterfly wings) and scratches. **Works affecting a roost are licensable. Further survey effort (e.g. dusk emergence/dawn re-entry survey(s) in accordance with best practice) is required to determine the bat species present, nature of roost and level of use before mitigation can be determined.**
High to moderate bat roost potential (BRP) **Buildings/trees with features capable of supporting a bat roost.**	Features include holes, cracks or crevices that extend or appear to extend back to cavities suitable for bats. In trees, examples include rot holes, woodpecker holes, splits and flaking or raised bark which could provide roosting opportunities. Any ivy cover is sufficiently well-established and matted so as to create potential crevices beneath. In buildings, features such as gaps beneath ridge- and roof-tiles, gaps beneath fascia and barge boards and access points into internal loft voids or cellars are all features of roosting potential for bats. **Further survey effort is required to determine whether or not bats are present and if so, the bat species present, nature of roost and level of use. Appropriate mitigation and potentially licensing requirements may then be determined.**
Low BRP	Buildings: The building may exhibit features that would have some limited bat roosting opportunities. **A further survey for emerging or re-entering bats is required to help confirm the building's low suitability, or to identify any roosting bats present.** Trees: From the ground, the tree appears to have features (e.g. holes, cavities or cracks) that may extend back into a cavity. However, owing to the characteristics of the feature, they are deemed to be sub-optimal for roosting bats. Alternatively, if no features are visible but owing to the size and age and structure, hidden features, sub-optimal for roosting bats, may occur that only an elevated inspection may reveal. **No further survey is required. Works may proceed using reasonable precautions.**

Negligible	An inspected building or tree that is considered not to have potential for roosting bats. **No further survey or mitigation required.**

3.3 Bat Roosts in Trees

a) Ground Level Tree Assessment

All trees present within 50m of both options of the scheme were classified into categories dependent on the presence (or absence) of features suitable for roosting bats.

Assessments were carried out between 20th and 22nd May 2019 and involved a search for features from the ground such as rot holes and cavities, woodpecker holes, cankers, splits and cracks, lifting and peeling bark and thick-stemmed ivy. Signs of bats were also searched for, including live or dead bats, droppings and staining around potential roost entrance and exit holes. Binoculars, torches and extendable mirrors were used where necessary.

Table 1, above, provides descriptions of the roost potential categories for trees.

b) Aerial Tree Assessment

Following the ground-level tree assessment, those trees classified as providing 'Moderate' or 'High' bat roost potential were subject to an aerial tree assessment, which was conducted between 10th and 14th June 2019. Trees were inspected at height by a certified and NRW bat licenced tree climber using rope and harness techniques. A second surveyor was positioned at the base of the tree for safety reasons. All accessible potential roosting opportunities were inspected by the climber using a torch and endoscope.

Where appropriate, the additional information from the aerial inspections led to the re-categorisation of trees in accordance with Bat Conservation Trust guidance (Collins, 2016).

c) Emergence / re-entry surveys

Following the re-categorisation of tree roosting potential via aerial assessment, trees with confirmed roosts, or with 'high' or 'moderate' bat roosting potential, were subject to follow-up dusk emergence and dawn re-entry surveys between July and September 2019. Each survey consisted of surveyors observing potential bat roost exit or re-entry points. Bat activity in the vicinity of the tree(s) was also recorded.

Dusk emergence surveys started approximately 15 minutes before sunset and continued for 2.5 hours, while any dawn re-entry surveys started around 1.5 to 2 hours before sunrise and continued for 15 minutes after dawn.

Bat echolocation calls were recorded during the surveys using handheld detectors recording bat calls to assist with species identification. Analysis was manually

undertaken by a suitably qualified ecologist. Detectors and analysis software included the following;

- Full spectrum Anabat Scout recorded zero-crossing files that were analysed with Analook software.
- Frequency division Anabat Express recorded zero-crossing files that were analysed with Analook software. Surveyors using this detector were assisted with heterodyne Petterson D240x detector to be able to listen calls in the field.
- Full spectrum EM Touch and EM3+ detectors recorded calls in WAV format which were analysed using Audacity software.
- Full spectrum Peersonic detectors recorded calls in WAV format which were analysed using Audacity software.

Weather conditions during these surveys were largely considered favourable for bat surveys, and are provided in **Table 2**, below.

Table 2 Survey dates, timings and weather conditions

Survey date	Survey	Sunset/ Sunrise	Start	End	Weather contitions (Start/End)
Bat Activity Transect Surveys					
25 April 2019	North and south transect	20:33	20:33	22:26	10°C/9°C, cloud cover 100%, wind beaufort 2/3, heavy rain at sunset for 20 min
21 May 2019	South transect	21:14	21:14	22:45	13°C/11°C, cloud cover 100%, wind beaufort 1/2, no rain
22 May 2019	North transect	21:16	21:16	23:07	15°C/9°C, cloud cover 20-10%, wind beaufort 0, no rain
26 June 2019	South transect	21:43	21:43	23:43	18°C/16°C, cloud cover 0%, wind beaufort 1/4, no rain
27 June 2019	North transect	21:42	21:42	22:10	Survey cancelled due to inclement weather
02 July 2019	North transect	21:42	21:42	23:48	14°C/12°C, cloud cover 10-0%, wind beaufort 2/1, no rain
03 July 2019	South transect	21:41	21:41	23:30	13°C/12°C, cloud cover 0%, wind beaufort 0/1, no rain
25 July 2019	North transect	21:19	21:19	23:00	24°C/18°C, cloud cover 60/80%, wind beaufort 2/3, no rain
14 Aug 2019	North and south transect	20:44	20:45	22:41	16°C/14°C, cloud cover 70%, wind beaufort 2, no rain
14 Sept 2019	North and south transect E	19:36	19:37	21:37	14°C/13°C, cloud cover 0%, wind beaufort 0, no rain
15 Sept 2019	North and south transect W	19:34	19:35	21:25	17°C/16°C, cloud cover 100%, wind beaufort 1, no rain
22 Oct 2019	North and south transect	18:11	18:11	19:50	16°C/13 °C, cloud cover 100%, wind beaufort 1, no rain
Building emergence and re-entry surveys					
24 June 2019	RSX 1 Dusk	21:42	21:27	23:42	14°C/13°C, cloud cover 40%/30%, wind beaufort 1, no rain
24 June 2019	RSX 5 + 7 Dusk	21:42	21:25	23:15	16°C/14°C, cloud cover 10%/90%, wind beaufort 1/2, no rain
25 June 2019	RSX 9 Dawn	05:01	03:20	05:15	13°C/11°C, cloud cover 80%/80%, wind beaufort 0/1, no rain
26 June 2019	RSX 4 Dawn	05:01	03:20	05:15	15°C/13°C, cloud cover 80%/80%, wind beaufort 1/3, no rain
26 June 2019	RSX 2 Dawn	05:01	03:31	05:16	15°C/16.5°C, cloud cover 90%/20%, wind beaufort 1/2, no rain

Survey date	Survey	Sunset/ Sunrise	Start	End	Weather contitions (Start/End)
26 June 2019	RSX 13 Dusk	21:42	21:25	23:10	17°C/15°C, cloud cover 0%, wind beaufort 4, no rain
26 June 2019	RSX 10 Dusk	21:42	21:27	23:12	17°C/16°C, cloud cover 5%/0%, wind beaufort 1/2, no rain
27 June 2019	RSX 8 Dawn	05:02	03:32	05:17	14°C/13°C, cloud cover 10%/10%, wind beaufort 3/3, no rain
11 July 2019	RSX 5 + 7 Dawn	05:11	03:25	05:25	17°C/15°C, cloud cover 80%/80%, wind beaufort 0/1, light drizzle
15 July 2019	RSX 4 Dusk	21:32	21:20	23:10	18°C/14°C, cloud cover 80%/20%, wind beaufort 1/0, no rain
15 July 2019	RSX 1 Dusk	21:32	21:17	23:32	17°C/16°C, cloud cover 80%/40%, wind beaufort 0/1, no rain
16 July 2019	RSX 9 Dusk	21:32	21:15	23:00	20°C/15°C, cloud cover 0%/0%, wind beaufort 1/1, no rain
17 July 2019	RSX 13 Dawn	05:17	03:17	05:32	13°C/13°C, cloud cover 100%/100%, wind beaufort 1/1, no rain
18 July 2019	RSX 10 Dawn	05:19	03:49	05:34	16°C/15°C, cloud cover 90%/100%, wind beaufort 1/1, no rain
18 July 2019	RSX 8 Dusk	21:28	21:13	21:28	17°C/16°C, cloud cover 50%/0%, wind beaufort 1/1, no rain
13 Aug 2019	RSX 13 Dawn	05:59	04:29	06:14	11°C/10.5°C, cloud cover 80%/40%, wind beaufort 1/1, no rain
15 Aug 2019	RSX 10 Dawn	06:02	04:32	06:17	16°C/15°C, cloud cover 30%/30%, wind beaufort 3/4, no rain
16 Aug 2019	RSX 8 Dawn	06:03	04:33	06:15	15°C/16°C, cloud cover 100%/100%, wind beaufort 2/3, no rain
21 Aug 2019	RSX 5 + 7 Dusk	20:31	20:15	21:55	14°C/13°C, cloud cover 25%/5%, wind beaufort 2/4, no rain
10 Sept 2019	RSX 1 Dusk	19:46	19:31	21:46	15°C/14°C, cloud cover 90%, wind beaufort 2/1, no rain
Tree emergence and re-entry surveys					
23 July 2019	Tree 68 Dusk	21:22	21:05	22:50	20°C/19°C, cloud cover 10%/85%, wind beaufort 2, no rain
2 Aug 2019	Tree 37 Dusk	21:07	20:50	22:35	19°C/18°C, cloud cover 0%, wind beaufort 0, no rain
13 Aug 2019	Trees 21 + 999 Dawn	06:00	04:50	06:09	15°C/13°C, cloud cover 0%, wind beaufort 0, no rain
19 Aug 2019	Tree 36 Dusk	20:35	20:15	21:29	14°C/12 °C, cloud cover 5%, wind beaufort 3, no rain
20 Aug 2019	Tree 42 Dusk	20:33	20:15	21:42	22°C/16 °C, cloud cover 0%, wind beaufort 1, no rain

Survey date	Survey	Sunset/ Sunrise	Start	End	Weather contitions (Start/End)
23 Aug 2019	Tree 43 Dawn	06:16	05:15	06:22	16°C/15 °C, cloud cover 80%/100%, wind 0, light drizzle at the start
29 Aug 2019	Tree 21 + 999 Dawn	06:24	04:45	06:25	14 °C, cloud cover 30%, wind beaufort 2, no rain
30 Aug 2019	Tree 43 Dawn	06:28	04:55	06:30	14 °C, cloud cover 80%, wind beaufort 2, no rain
12 Sept 2019	Tree 999 Dusk	19:42	19:27	20:25	17.5°C/17 °C, cloud cover 100%, wind beaufort 2/1, light drizzle
11 Sept 2019	Trees 42 +43 Dusk	19:44	19:20	20:44	16°C/14 °C, cloud cover 30%/80%, wind beaufort 1, no rain
18 Sept 2019	Trees 37 + 36 Dusk	19:28	19:10	19:28	14°C/9.8 °C, cloud cover 0%, wind beaufort 0, no rain
23 Sept 2019	Tree 71 Dusk	19:15	18:55	19:55	16°C/15 °C, cloud cover 100%, wind beaufort 1, heavy rain for 10 min midway through the survey
1 Oct 2019	Tree 71 Dusk	18:57	18:30	19:40	14.8°C/13.4 °C, cloud cover 30%, wind beaufort 1/2, no rain

4.0 Survey Notes and Limitations

4.1 Bat Activity Transect Surveys

Activity surveys are species-biased, with bats that make louder calls (such as noctule *Nyctalus noctula*) being picked up from a greater distance than the quieter-calling species (such brown long-eared bats *Plecotus auritus*), or those with directional calls (such as lesser horseshoe *Rhinolophus hipposideros*). In addition, using recorded echolocations to identify bats within the genus *Myotis* to species level is not always possible with a high degree of confidence, owing to overlap in call characteristics, together with their range of different calls. Interpretation of results in this report takes these factors into account, and the quantitative data presented in the appendices should be considered with this in mind.

The northern transect survey planned for June had to be cancelled due to heavy rain and was re-scheduled for early July.

The consistency of transect routes and transect walking speed varied across the months due to the presence of lively cattle in some of the fields. Transect routes were kept as similar as possible across the months, but on occasion the presence of cattle meant some fields had to be avoided. Transect routes and their variations are shown in **Appendix 2**.

Due to a technical failure, transects were conducted with different recording equipment – a full spectrum Batlogger M between April and early July and a frequency division Anabat Express from late July onwards. Due to the differences of call recording between the two detectors, a quantitative comparison between months could not be conducted; however, this is not considered to be a major constraint on the assessment.

Additionally, the start points and direction of each transect was varied across the months to reduce bias. During August and September, surveyors walked the route from the centre of both transect routes splitting each transect between two teams. However, on both occasions one team went in the wrong direction, meaning the entirety of the southern transect in August was conducted within 1 hour after dusk, while the entirety of the northern transect was conducted from 1-2 hours after dusk. The same error occurred in September but in reverse.

Furthermore, during September, the transects were conducted on consecutive days – the eastern section of both transects on the 14th of September and the western on the 15th, splitting each transect in half. Given conditions to survey bats were optimal during all transect surveys, this change in methodology is not considered a major constraint on the assessment.

4.2 Building Inspections

The northern elevation of building RSX 9 could not be inspected due to the presence of cattle. A thorough external assessment was undertaken of the remainder of the building and follow up emergence and re-entry surveys were undertaken.

4.3 Ground and aerial tree assessments

Tree assessments were undertaken at a sub-optimal time of year, as the trees were in full leaf and therefore potential bat roosting sites or signs of bat presence may have been obscured by the canopy.

Three of the trees (68, 98 and 37) could not be fully inspected by aerial inspection due to health and safety restrictions and/or to fragility of bat roosting features. These trees did not have their bat roosting potential category altered from the original assigned category. Tree 68 and 37 subsequently had tree emergence/re-entry surveys. No aerial tree assessment or emergence surveys were conducted on tree 98 due to the presence of cattle in the fields surrounding the tree.

4.4 Emergence / re-entry surveys in buildings and trees

Some of the emergence/re-entry survey visits were carried out in sub-optimal conditions for bat surveys due to light rain / drizzle (at buildings RSX 5-7 and trees 43 and 71) or due to strong gusty winds (at building RSX 10). These limitations are not thought to have had a significant effect on the survey outcomes because the suboptimal conditions only affected part of the survey visit, the conditions were only minor, and because bat activity was recorded in all surveys even with these sub-optimal conditions.

Emergence and/or re-entry surveys on tree 71 were only conducted in late September/early October as a result of a change in the scheme layout impacting this tree and suboptimal weather for bat surveys in September.

Additionally, some bats produced quiet or non-echolocating calls when emerging, so these bats could not be recorded and therefore the bat could not be identified with certainty.

5.0 Field Survey Results

The results of the field surveys are presented in **Appendices 2 - 4** and are summarised below.

5.1 Bat Activity Transect Surveys

The bat activity transect surveys carried out between April and October 2019 recorded at least six bat species on both the north and south transects. April's transect was conducted by Arup staff. Both transect routes had high levels of bat activity, soprano pipistrelles in particular. Two greater horseshoe bat calls were recorded during May's northern transect survey.

Soprano pipistrelles were encountered most frequently and across most of the survey area with much lower encounter rates for other species such as noctule and *Myotis* species bats. On the northern transect, the surveys confirmed that most hedgerows and tree lines are important bat feeding and commuting habitat, with particularly high levels of bat activity on the hedgerows north east of Redstone farm and north east of

Blackmoor Hill farm (see Figure 5, **Appendix 2**).

Along the southern transect, bat activity hotspots were recorded around the woodland edge and outgrown hedgerows south of Blackmore Hill Farm. The surveys also confirmed that the majority of hedgerows in the southern transect were important commuting routes (see Figure 6, **Appendix 2**).

Results of all the bat activity transect surveys are summarised in **Appendix 2**.

5.2 Bat Roosts in Buildings

a) External Building Inspections

Thirteen buildings were assessed for their potential to support roosting bats in May 2019. The results of the assessment, including building descriptions, are provided in **Table 3**. Building locations are included in Figures 7 and 8 in **Appendix 3** and photographs are included in **Table 10** in **Appendix 3**.

Table 3 External building inspection results

Building	Building Description	Initial BRP Category
RSX 1	The Lodge A small single-storey cottage, approximately 150 years old, with rendered walls and a hipped roof clad with tightly-fitted slate tiles. Wooden soffit present in good condition. PVC windows were well-sealed into walls. Ridge tiles were loosely fitted leaving several gaps in the northern and southern elevations. The wooden doorframe on the western elevation was partly rotten and had a hole that could lead into a cavity. Excellent bat foraging habitat surrounding the building.	High
RSX 2	Redstone Cottages Two semi-detached residential buildings dating back to 1860. Two-storey brick buildings with rendered walls and a pitched roof with slate tiles that were tightly fitted. PVC soffit and windows were all well-sealed into surrounding brickwork. Narrow gaps were present under the ridge tiles in the western elevations and over the valley trough on the northern elevation, which provided some limited potential for roosting bats.	Low
RSX 3	Recently built commercial building – approximately 2 years old. Single storey with a pitched roof clad with slate tiles. No gaps present.	Negligible
RSX 4	Old Forge A small, derelict building, more than 200 years old. Single-story, pitched-roofed building with stone walls. Roof comprised of corrugated metal sheets. The majority of the building is covered in thick ivy. Windows sealed with asbestos sheets, but there was a metal gate on the eastern aspect of the building with wide gaps that could provide access to roosting bats. Interior of the building likely light and exposed.	Moderate

Building	Building Description	Initial BRP Category
RSX 5	Redstone Farm Building of approximately 50 years of age. Rendered brick walls, PVC windows and soffit were all mostly intact and well-sealed. A small gap was present below soffit on the western elevation, but it was narrow and cobwebbed. The hipped roof had interlocking concrete tiles that were tightly fitted. Brickwork on chimneys well pointed. A single gap was noted between a tile and the lead flashing around the chimney on the western aspect of the building.	Low
RSX 6	Redstone Farm Workshop Single storey workshop with brick, rendered walls and a pitched metal roof in good condition. There were lifted metal sheets present to allow for ventilation, but these did not provide opportunities for roosting bats. Skylights present making interior light and exposed. No place of shelter in the interior.	Negligible
RSX 7	Redstone Farm Garage Standalone garage with rendered walls and a pitched roof with corrugated asbestos sheets. Well-sealed wooden fascia boards and windows. Lifted ridge tile in the centre of the roof for ventilation which may provide limited opportunities for bats. There was a small gap between the corrugated cement roof and the wall on the south -western aspect of the building.	Low
RSX 8	Redstone Farmhouse Two-storey farmhouse of brick construction and rendered walls of approximately 150 years. Pitched roof clad with slate tiles and concrete ridge tiles all intact and well-sealed. Gap present between chimney render and ridge tiles facing east but feature angle not optimal for bats emerging. There was a wooden fascia board on the southern elevation with a gap beneath it which could provide potential for crevice dwelling bats. The building had a long, pitched roofed extension on the eastern elevation. The stone walls were well-pointed. Roof was composed of corrugated asbestos sheets. Permanently opened windows and doorways present which made the interior light and exposed.	Moderate
RSX 9	Restone Farmhouse outbuilding A single storey outbuilding with stone walls and a pitched roof with corrugated metal sheeting. The buildings exterior stonework is generally well pointed but there are some gaps present between 2.5m-3.5m height on the southern elevation that have some potential for crevice-dwelling bats. These crevices may also be present on the internal wall and could offer some potential to hibernating bats. The building is in constant use and had permanently opened windows and doorways, which made the interior light and exposed. The interior	Moderate

Building	Building Description	Initial BRP Category
	could be observed from the outside and no obvious place of shelter was recorded. The northern elevation could not be inspected due to the presence of cattle, and the western elevation was shielded by a steel-framed farm structure with corrugated tin roof and sides of tin, which was considered to offer very little potential for bats.	
RSX 10	Blackmore Hill Cottages Two semi-detached residential properties, approximately 70 years old. The building was a two-storey build with rendered brick walls and a pitched roof with slate tiles that were in good condition. The fascia boards present on the northern and southern elevations had gaps that could lead to a cavity. There was wooden weather-boarding over the doorways (2m height) on the northern aspect, which had gaps providing some potential for roosting bats. The southern elevation had a single storey extension with a flat roof covered in roofing felt in good condition. There were two small sheds with flat, corrugated tin roofs on the eastern elevation which provided little opportunities for bats.	Moderate
RSX 11	Blackmore Hill Garden Shed Sectional concrete standalone outbuilding. Flat roof with corrugated metal sheets. Well-sealed PVC fascia boards. No gaps or crevices that could provide roosting opportunities for bats.	Negligible
RSX 12	Blackmore Hill Garage Standalone garage with rendered airbrick walls and a pitched roof with corrugated asbestos sheets. Skylights present on the roof. No fascia boards. There were gaps providing access into the building such as a broken window on the northern aspect and a gap above the metal roof on the western aspect. The interior however was very exposed and there were no places of shelter for bats.	Negligible
RSX 13	Blackmore Hill Outbuilding A single-storey building used for storage with stone walls and a pitched roof clad with tightly-fitted, unbroken slate tiles. The roof had three lifted ridge tiles that could provide access to the interior of the building. There was a gap between the ridge board and the gable end stonework on the eastern elevation. Thick ivy covers most of the southern and western elevations, and there was a permanently opened window facing south. The stonework on the exterior's wall on the western aspect of the building had crevices between 1.5m and 5m that were potentially suitable to hibernating bats.	High

b) Emergence / re-entry surveys

Bat dusk emergence and / or dawn re-entry surveys were conducted on eight buildings that were initially assessed as providing some potential for roosting bats in the months

of June, July, August and September 2019. The summary of the findings is provided in **Table 4**, below, and photographs with roost locations are shown in **Table 10** in **Appendix 3**. Surveyor number and location details can be found on **Table 12**, **Appendix 5.** Raw data is available on request.

Table 4 Summary of building emergence / re-entry survey results in 2019

Building	Emergence survey dates and summary	Roost Status
RSX 1	*24 June (dusk survey)* – Activity started 16 minutes after sunset with a soprano pipistrelle commuting from off-site and foraging above building and garden. Activity continued with common and soprano pipistrelles foraging over the garden and around the house for the duration of the survey. Other bats recorded include passes by noctule and greater horseshoe bat. No bats were seen emerging the building. *15 July (dusk survey)* – The first bat, a common pipistrelle, was seen commuting from across the road towards north 10 minutes after sunset. Other common and soprano pipistrelle bats followed the same pattern shortly after. Activity continued with a high level of commuting and foraging common and soprano pipistrelle bats that lasted until the end of the survey. No bats were seen emerging the building. *10 September (dusk survey)* – Activity started at sunset with soprano pipistrelle bats commuting across the site and foraging in the garden. Activity continued with a high level of soprano and common pipistrelle bats commuting and foraging on site until the end of the survey. Noctule passes were also recorded during the survey. No bats were seen emerging the building.	Likely no roost
RSX 2	*26 June (dawn survey)* – The first bat, a common pipistrelle, was heard foraging at the southern end of the garden. Intermittent common and soprano pipistrelle passes were heard during the survey until 42 minutes before sunrise. Noctule passes were also recorded flying high above the building towards the end of the survey. No bats were seen returning to the building.	Likely no roost
RSX 4	*24 June (dusk survey)* – Occassional bat passes were recorded from the start of the survey. Activity included common and soprano pipistrelles, and a noctule bat. No bats were seen emerging from the building. *15 July (dusk survey)* – Activity started 3 minutes after sunset with commuting noctule activity. A soprano pipistrelle was seen commuting from off-site and heading east 45 minutes after sunset. Occasional activity was recorded with commuting noctules, common and soprano pipistrelle bats. No bats were seen emerging from the building.	Likely no roost
RSX 5 [1]	*24 June (dusk survey)* – Activity started 17 minutes after sunset with common pipistrelle bats commuting south across the site. Common and soprano pipistrelles continued using the garden on-site to	Brown long eared – likely small maternity

[1] Note – The resident of the building reported the presence of bats in her attic in July 2019

Building	Emergence survey dates and summary	Roost Status
	commute and forage occasionally throughout the survey. Noctules were also recorded. Three brown long-eared bats emerged from under a ridge tile on the western aspect of the roof at 22:12, 23:00 and 23:04, respectively, and flew on a southerly direction. *11 July (dawn survey)* – there was a moderate level of activity on the site from the start of the survey, with commuting and foraging passes of mostly brown long-eared, common and soprano pipistrelle bats. A brown long-eared bat appeared from the south of the site and was seen re-entering the roost under a gap on the apex of the ridge line on the western aspect of the roof at 04:32. A common pipistrelle bat was also seen approaching a gap between a tile and the lead flashing around the chimney on the western aspect of the building, and finally entered at 04:34. 21 August (dusk survey) – First bat activity started 18 minutes after sunset, with soprano pipistrelles commuting and foraging across the site. Common pipistrelles were also heard occassionally. At 21:14, a brown long-eared bat was recorded emerging from under a ridge tile on the western elevation.	roost. Common pipistrelle day roost
RSX 7	*24 June (dusk survey)* – No bats were seen emerging from the building. Bat activity as described above. *11 July (dawn survey)* – a soprano pipistrelle bat was seen re-entering the building at 4:48 into a gap between the corrugated cement roof and the fascia on the south-western aspect of the building. Bat activity described above. 13 August (dusk survey) – Bat activity commenced with a soprano pipistrelle emerging from a gap between the fascia and the roof 7 minutes after sunset (20:38); 2 more pipistrelle bats, likely soprano, then emerged at 20:45. Activity continued with soprano pipistrelle bats foraging across the site.	Soprano pipistrelle roost – possible maternity
RSX 8	*27 June (dawn survey)* – the site had a high level of activity from the start of the survey, with commuting and foraging passes of mostly common pipistrelles but also greater horseshoe, soprano pipistrelle and noctule bats. 29 minutes before sunrise, a non-echolocating bat was seen entering the opened window at the eastern gable end of the building. 2 minutes before sunrise, a bat was seen entering the same window, but again did not echolocate. From their appearance and flight behaviour, these bats were considered likely to be pipistrelle species bats. *18 July (dusk survey)* – activity started soon after sunset with noctule bats recorded nearby. A soprano pipistrelle was seen emerging from the narrow window on the eastern gable end 25 minutes after sunset. Bat activity continued at high levels, with common and soprano pipistrelle bats, brown long-eared and noctule bats foraging and commuting across the site. *16 August (dawn survey)* – low levels of activity were recorded from the start of the survey, with soprano pipistrelles and common pipistrelles occasionally commuting or foraging near the building. 39 minutes before sunrise, a non-echolocating bat (likely pipistrelle	Soprano pipistrelle day roost / Pipistrelle species day roost

Building	Emergence survey dates and summary	Roost Status
	species) was seen entering the opened window at the eastern gable end of the building.	
RSX 9	*25 June (dawn survey)* – there were occassional bat calls that included common and soprano pipistrelles, lesser horseshoe, and a myotis species for the duration of the survey. No bats were seen re-entering the building. *16 July (dusk survey)* – Activity started 10 minutes after sunset with a noctule bat commuting across the site. Soprano pipistrelle bats were then seen foraging around the building. Low bat activity continued throughout the survey, with occasional passes of common and soprano pipistrelles, noctule, lesser horseshoe and a myotis species bat. No bats were recorded emerging from the building.	Likely no roost
RSX 10	*26 June (dusk survey)* – the first bat detected was a soprano pipistrelle emerging from a gap under the fascia board on the south-eastern corner of the property. Activity continued with soprano pipistrelle foraging and commuting across the site. Later, between 22:22 and 22:29 (40-47 minutes after sunset), three more bats emerged from under the same location but did not echolocate. Soprano pipistrelles continued foraging locally, with single passes by common pipistrelle and noctule bats also recorded. 18 July (dawn survey) – A high level of activity was recorded from the start of the survey, with mostly soprano pipistrelle bats commuting and foraging across the site. A high number of soprano pipistrelle social calls were also recorded during the survey. A non-echolocating bat was seen landing on the fascia board several times until it entered the gap at 4:43. A soprano pipistrelle bat followed 04:57. 15 August (dawn survey) – A high level of commuting and foraging bat activity was recorded, including noctule, brown long-eared and soprano pipistrelle bats. Five soprano pipistrelle bats were seen re-entering the gap under the fascia board on the south-eastern corner of the building between 35 and 5 minutes before sunrise. Additionally, a bat (likely soprano pipistrelle) was seen re-entering through a missing piece of render on the wall on the north-eastern corner of the house 31 minutes before sunrise.	Soprano pipistrelle maternity roost. Possible day roost/maternity roost of unknown bat species
RSX 13	*26 June (dusk survey)* – the first bat detected was a common pipistrelle emerging from a gap between the ridge-board and the gable-end stonework on the eastern elevation 13 minutes after sunset. There were also passes of commuting noctules and foraging common and soprano pipistrelles across the site. *17 July (dawn survey)* – Activity started soon after the start of the survey, with a noctule commuting across site. Activity continued at low levels with noctules and soprano pipistreles commuting and foraging across the site. No bats were seen re-entering the surveyed building but a bat – likely a pipistrelle species – was seen entering a gap under the fascia board of the neighbouring building (RSX 10). 13 August (dawn survey) – Bat activity was recorded at high levels from the start of the survey, with mostly soprano pipistrelles but also noctules, serotine and brown long-eared bats commuting and foraging across the site. No bats were seen re-entering the surveyed	Common pipistrelle day roost

Building	Emergence survey dates and summary	Roost Status
	building, but three bats were seen entering a gap under the fascia board of the neighbouring building (RSX 10).	

5.3 Bat Roosts in Trees

a) Ground-Level Tree Assessment

All trees within 50m of both route options were categorised as having low, moderate or high potential for roosting bats during a ground-level tree assessment carried out on 20th and 22nd May 2019. A total of 91 trees were identified as having low to high potential across both routes, 53 of which were assessed as having a moderate or high suitability for bats and therefore required further aerial assessment.

b) Aerial Tree Assessment

The 53 trees that were initially assessed as having moderate or high potential were re-assessed during an aerial assessment carried out in June 2019. Following closer inspection, 44 of the trees were downgraded to low or negligible suitability for bats, while nine of the trees maintained their moderate or high classification (see **Appendix 4** for full details) as follows,

- High suitability – 999, 43 and 68
- Moderate suitability – 21, 36, 37, 42, 71 and 98

Trees 68, 98 and 37 could not be fully inspected by aerial inspection for health and safety reasons or due to fragility of the potential bat roosting features. These trees maintained their initial classification.

c) Emergence / re-entry surveys

Further bat emergence and re-entry surveys were carried out on eight of the trees that were assessed as providing moderate or high potential to support roosting bats.

These were trees 999, 21, 36, 37, 43, 42, 71 and 68 (see Figure 8 and 9 on **Appendix 4**). Two to three emergence surveys were conducted on each tree depending on their suitability as per guidelines (Collins, 2016). A single emergence survey was conducted on tree 68, as it could not be fully inspected during the aerial tree assessment but was later de-prioritised as it was outside of the A40 proposed construction area.

The summary of the findings is provided in **Table 5**, surveyor location details can be found on **Table 12**, **Appendix 5**. Raw data is available on request.

Table 5 Summary of tree emergence / re-entry survey results in 2019

Tree No.	Emergence survey dates and summary	Roost Status
999	*13 August (dawn survey)* – No bats were seen entering the tree. A low level of activity was recorded on site, including single serotine and noctule passes. *29 August (dawn survey)* – No bats were seen entering the tree. A low number of soprano pipistrelles were recorded using the site during the survey. 12 September (dusk survey) - No bats were seen emerging from the tree. Several soprano pipistrelle passes were recorded around the site.	Likely no roost
21	*13 August (dawn survey)* – No bats were seen entering the tree. A low level of activity was recorded on site, including a single pipistrelle species bat pass and a single commuting noctule. *29 August (dawn survey)* – No bats were seen entering the tree. A low level of activity was recorded on site, including common and soprano pipistrelle passes.	Likely no roost
36	*19 August (dusk survey)* – No bats were seen emerging from the tree. A high level of activity was recorded on site, however, mostly with commuting and foraging soprano pipistrelle bats. A serotine pass was also recorded. *18 September (dusk survey)* – No bats were seen emerging from the tree. Moderate levels of bat activity were recorded during the survey, including common and soprano pipistrelle bats commuting along the treeline on site.	Likely no roost
37	*2 August (dusk survey)* – No bats were seen emerging from the tree. Activity recorded on site included foraging soprano pipistrelle bats and a commuting noctule. Visibility of the tree was limited by 21:40 (30 minutes after sunset). *18 September (dusk survey)* – No bats were seen emerging from the tree. Moderate levels of bat activity were recorded during the survey, including common and soprano pipistrelle bats commuting and foraging within the crown of the tree and along the tree line.	Likely no roost
43	*23 August (dawn survey)* – No bats were seen entering the tree features. Very low levels of activity were recorded near the tree, including two brief soprano pipistrelle passes. *30 August (dawn survey)* – No bats were seen entering the tree. Moderate levels of activity were recorded, including common pipistrelle, soprano pipistrelle and brown long-eared bats. *11 September (dusk survey)* – No bats were seen emerging from the tree. A small number of soprano pipistrelle passes were heard during the survey.	Likely no roost
42	*20 August (dusk survey)* – No bats were seen emerging from the tree. No bat activity was heard on site during the survey. *11 September (dusk survey)* – No bats were seen emerging from the tree. A low level of bat activity was recorded, including soprano pipistrelle bats commuting across the site.	Likely no roost

Tree No.	Emergence survey dates and summary	Roost Status
71	*23 September (dusk survey)* – No bats were seen emerging from the tree features. Very low levels of activity were recorded near the tree, including occasional soprano pipistrelle passes. *01 October (dusk survey)* – No bats were seen using the features on the tree as a roost. Incidental activity included a common pipistrelle bat foraging along the southern field boundary.	Likely no roost
68	*23 July (dusk survey)* – a common pipistrelle bat emerged from the end of the southern branch 18 minutes after sunset. A non-echolocationg bat also emerged from under the ivy on the western side of the tree. General bat activity included common and soprano pipistrelle bats commuting along the hedgerow and a noctule pass.	Common pipistrelle day roost. Unknown bat day roost

6.0 Bibliography

Bat Conservation Trust (2012). *Bat surveys - Good Practice Guidelines*. Bat Conservation Trust, London.

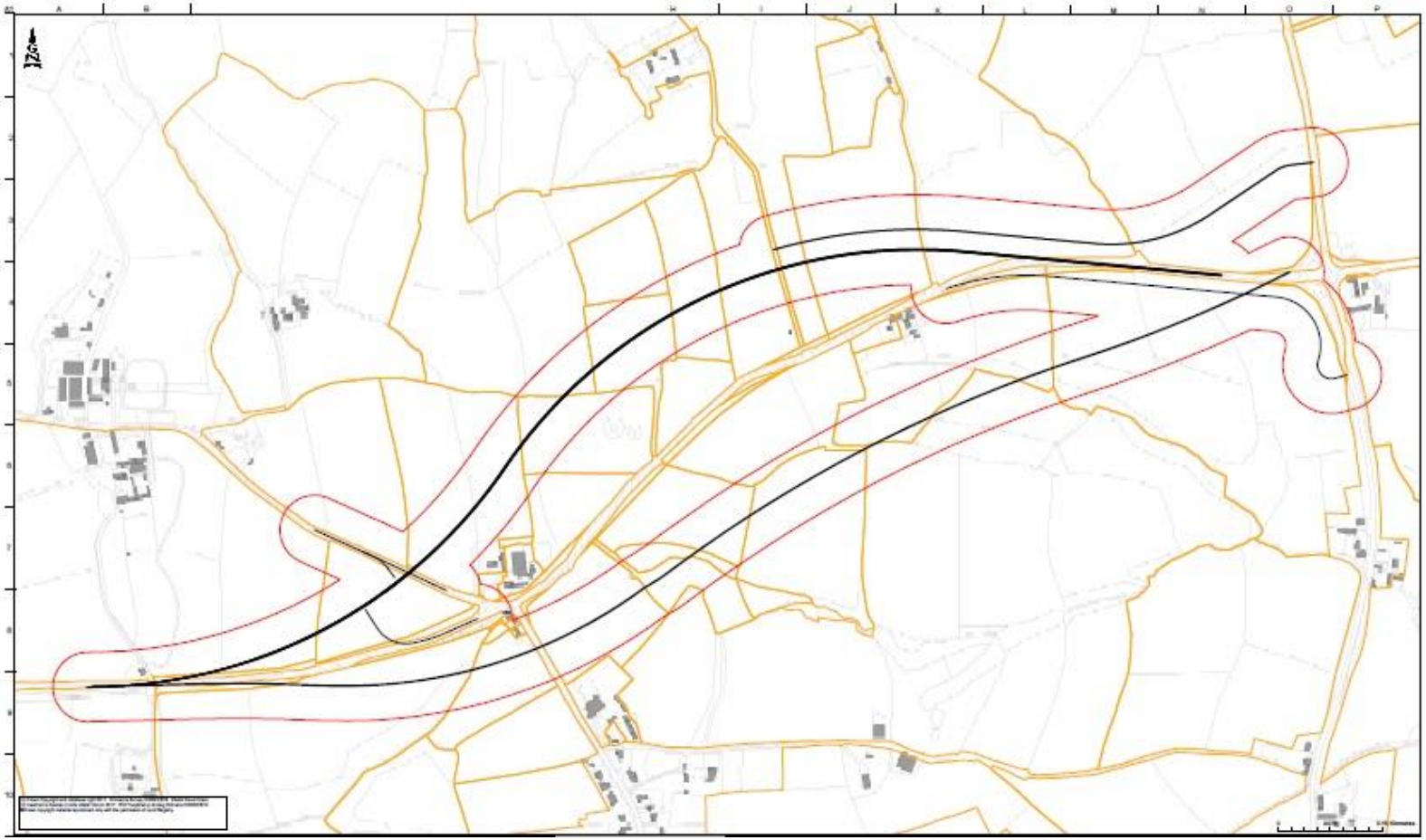
Chadwick, J. (2013). *Bat Tree Habitat Key (2nd Edition).*

Collins, J. (2016). *Bat Surveys for Professional Ecologists – Good Practice Guidelines 3rd Edition.* The Bat Conservation Trust.

Russ, J. (2012). *British Bat Calls: A Guide to Species Identification.* Exeter: Pelagic Publishing.

Appendix 1 - Proposed scheme and route options

Figure 1 Proposed scheme route options with their respective 50m buffer.



Appendix 2 – Bat activity transect surveys

Figure 2 Bat survey transect routes over the northern scheme option

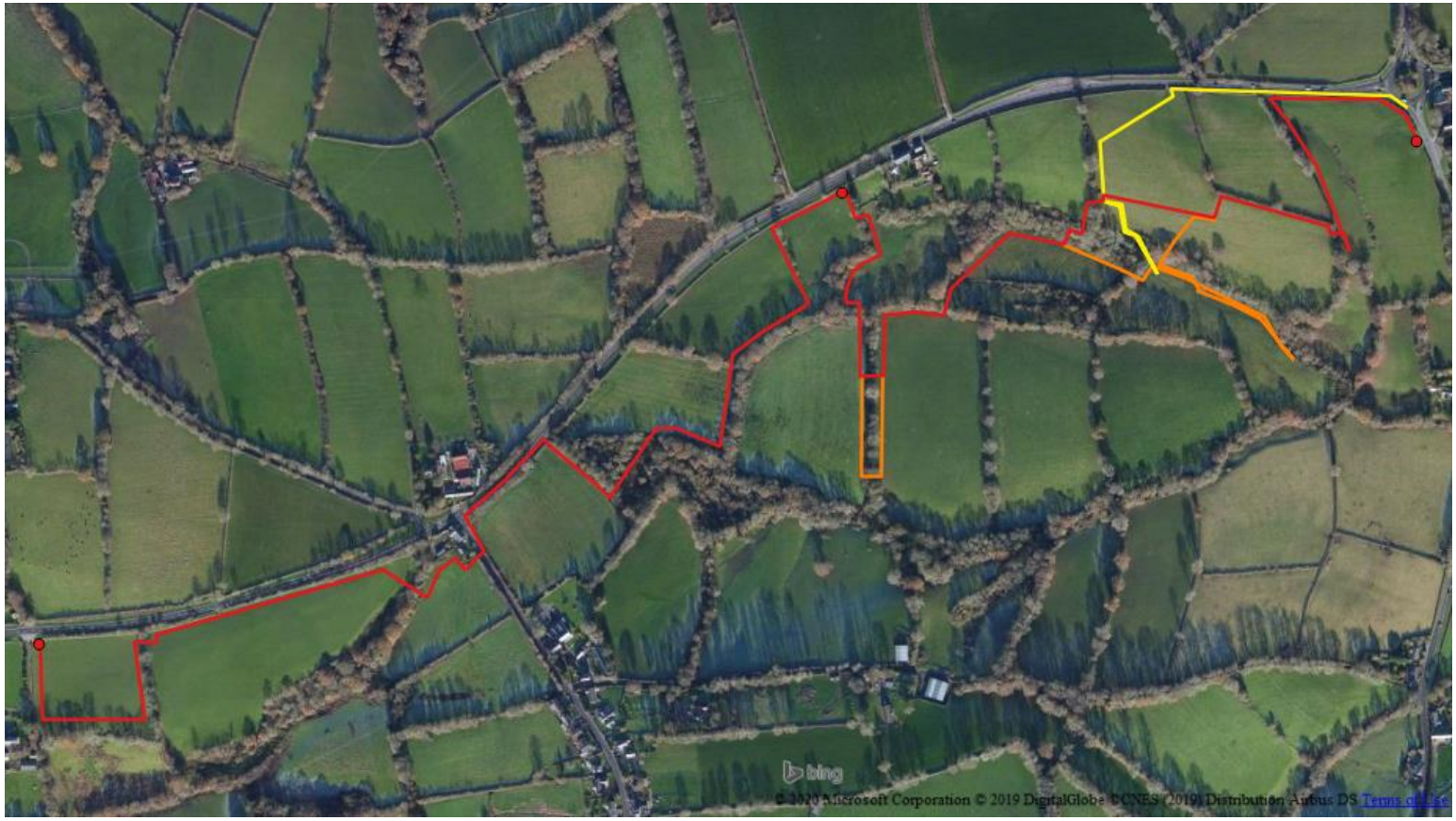
Legend

- Original transect route
- August - October route
- Start points
- July-October route variation
- August variation

A40 Penblewin – Redstone Cross upgrade

Scale 1:10500

Figure 3 Bat survey transect routes over the southern scheme option



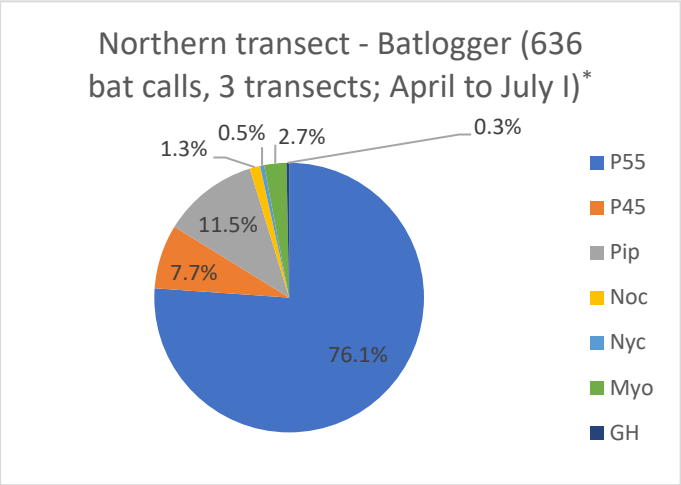
Legend

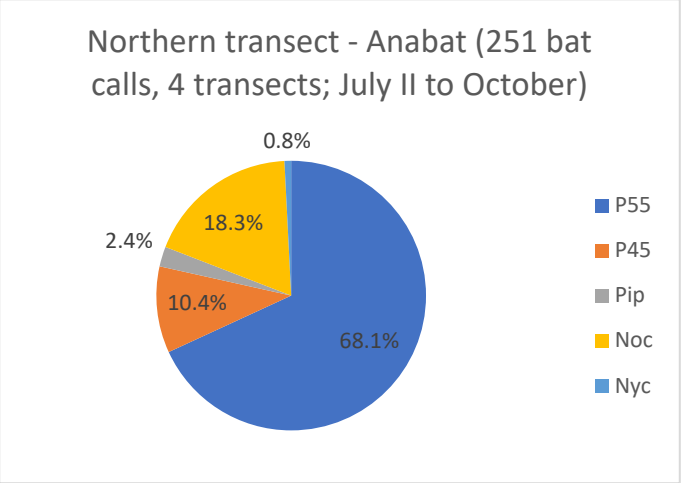
- Original transect route
- July route variation
- August / September route variation
- Start points

A40 Penblewin – Redstone Cross upgrade

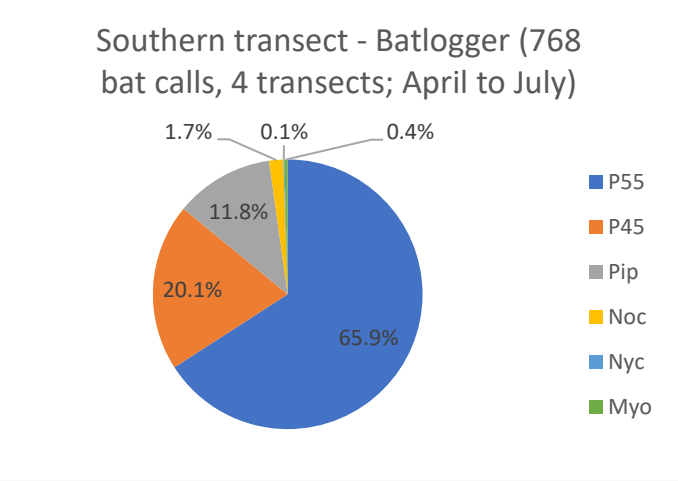
Scale 1:10000

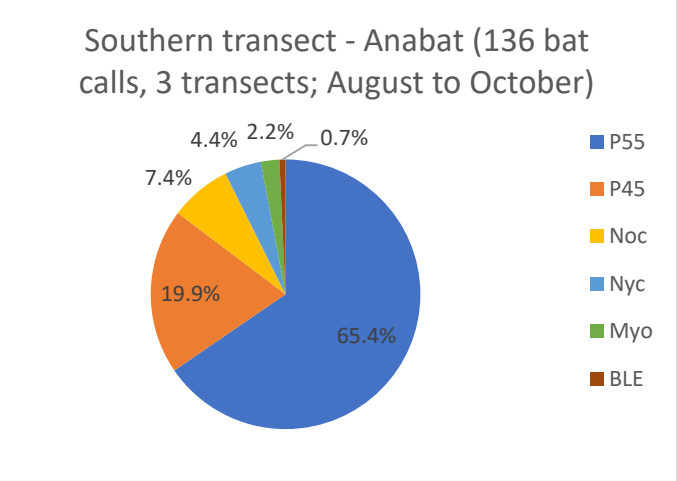
Figure 4 Charts showing a summary of transect results (April-October) on each detector type





*The northern transect in June was cancelled and was conducted in early July instead (July I). A second transect was conducted later in July (July II).





Key:
P45 = soprano pipistrelle
P55 = common pipistrelle
Pip= pipistrelle of unidentified species
Noc = noctule
Nyc = Nyctalus species
Myo = Myotis species
GH = greater horseshoe
BLE = brown long-eared

Table 6 Summary of transect survey results (bat passes) for each survey month on the Northern transect

Species	April	May	July I	July II	August	September	October
Soprano Pipistrelle	14	199	271	42	53	55	21
Common Pipistrelle	-	28	21	10	10	4	2
***Pipistrellus* species**	13	30	30	6	-	-	-
Noctule	-	1	7	43	2	1	-
***Nyctalus* species**	-	3	-	-	-	2	-
***Myotis* species**	-	17	-	-	-	-	-
Greater Horseshoe	-	2	-	-	-	-	-
Grand Total	27	280	329	101	65	62	23

Table 7 Summary of transect survey results (bat passes) for each survey month on the Southern transect

Species	April	May	June	July	August	September	October
Soprano Pipistrelle	14	164	178	150	30	52	7
Common Pipistrelle	-	-	132	22	13	14	-
***Pipistrellus* species**	3	7	44	37	-	-	-
Noctule	-	1	-	12	5	5	-
***Nyctalus* species**	-	-	1	-	3	3	-
***Myotis* species**	-	3	-	-	-	2	1
Brown long-eared bat	-	-	-	-	1	-	-
Grand Total	17	175	355	221	52	76	8

Figure 5 Bat activity hotspots identified during Northern transect surveys

Legend

- *Pipistrellus* sp. hotspot
- *Nyctalus* sp. hotspot
- *Myotis* sp. hotspot
- Greater horseshoe recording

A40 Penblewin – Redstone Cross upgrade

Scale 1:10100

Figure 6 Bat activity hotspots identified during Southern transect surveys

Legend

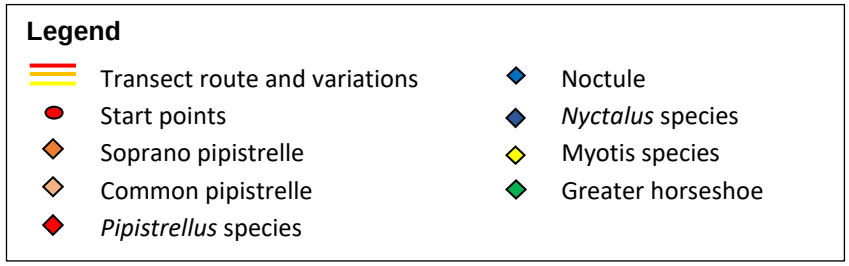
- *Pipistrellus* sp. hotspot
- *Nyctalus* sp. hotspot
- *Myotis* sp. hotspot
- Brown long-eared recording

A40 Penblewin – Redstone Cross upgrade

Scale 1:10000

Table 8 Summary of transect survey results for each survey month on the Northern transect

Transect summary	Map
25 April 2019 Surveyors started on the eastern end of the site and walked on a westerly direction. First bat activity was recorded 31 minutes after sunset along the hedgerows north west of Blackmore Hill Farm with pipistrelle species bats commuting and foraging along the fields hedge. A low level of bat activity was recorded in the remainder of the transect, with low levels of soprano and pipistrelle species bats commuting along the hedgerows north of the road between Redstone Farm and Blackmore Hill Farm.	



22 May 2019 Surveyors started on the western end of the site and walked on an easterly direction. Activity started 9 minutes after sunset with pipistrelle bats commuting from east and foraging along the northern field hedgerow, indicating a roost nearby. Activity continued with mostly soprano pipistrelle bats commuting and foraging along hedgerows, with activity peaking midway through the transect along the thick hedgerows north east of Redstone farm and north east of Blackmoore Hill farm. The hedgerows to the north east of Blackmoore Hill Farm had highest bat diversity, with recordings of *Nyctalus* species, *Myotis* species and greater horseshoe bat passes.	
2 July 2019 (July I) Surveyors started on the eastern end of the site and walked on a westerly direction. First bat activity was recorded 24 minutes after sunset with noctule bats commuting high along hedgerow towards the west. The hedgerows to the north west of Blackmore Hill Farm had and north east of Redstone farm had highest pipistrelle bat activity, particularly soprano pipistrelles.	

25 July 2019 (July II) Surveyors started on the eastern end of the site and walked on a westerly direction. First bat activity was recorded shortly after sunset with a high level of noctule bats activity commuting and foraging high along the hedgerows north east of Blackmore Hill Farm. At least 5 noctules were recorded simultaneously. This activity could indicate a nearby roost. A moderate level of pipistrelle bat activity, particularly soprano pipistrelles were recorded along the hedgerows to the north west of Blackmore Hill Farm and along the road on the west of Redstone farm.	
14 August 2019 Two teams of surveyors walked the transect simultaneously from each end of the transect on an easterly and westerly direction, starting approximately 45 minutes after sunset (see limitations). There was an overall low to moderate activity across the site, mostly composed of soprano pipistrelle activity, but there were also passes of common pipistrelles and a noctule bat. The thick hedgerow on the fields north west of Penblewin roundabout were particularly active with soprano pipistrelles foraging up and down the hedge.	

14 and 15 September 2019 Surveyors started the transect on the center of the site, from a point on the road just west of Blackmore Hill Farm, and was walked by two teams of surveyors on an easterly and westerly direction on consecutive days (see limitations). First bat activity was recorded 20 minutes after sunset with soprano pipistrelles commuting and foraging along the hedgerows present on the fields north west of Penblewin roundabout, noctule passes were also heard in this location. Roosts are likely to be located nearby. The western end of the site (walked the following day) recorded low to moderate levels of soprano pipistrelle bat activity, particularly along the road heading north west from Redstone Farm. A *Myotis* species bat pass was recorded on the western end of the site towards the end of the survey.	
22 October 2019 Surveyors started on the eastern end of the site and walked on a westerly direction. First bat activity was recorded 45 minutes after sunset along the hedgerows north west of Blackmore Hill Farm with soprano pipistrelle bats commuting and foraging along the fields hedge. A low level of bat activity was recorded in the remainder of the survey, with low levels of soprano and common pipistrelle bats commuting on hedges north east of Redstone Farm.	

Table 9 Summary of transect survey results for each survey month on the Southern transect

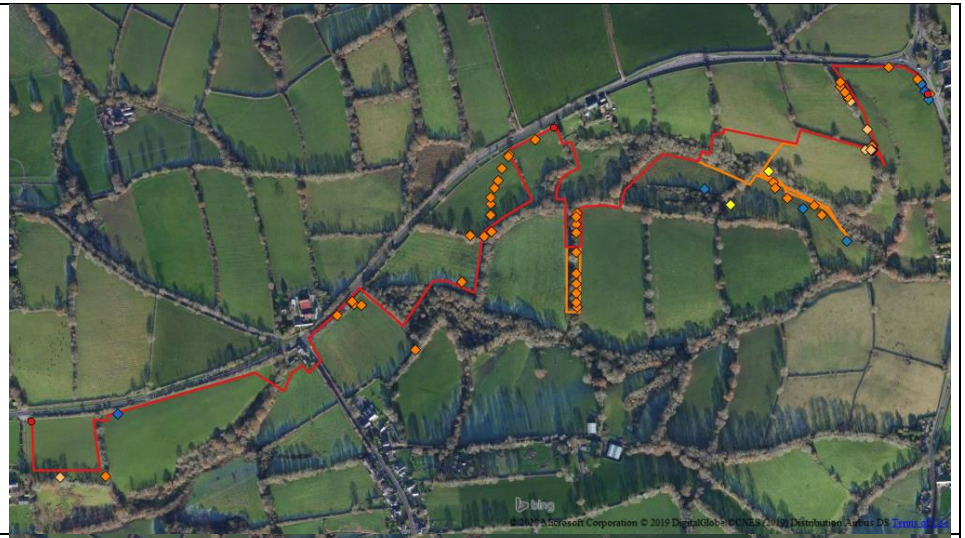
Transect summary	Map
25 April 2019 Surveyors started on the eastern end of the site and walked on a westerly direction. First bat activity was recorded 50 minutes after sunset along the edges of woodland patches south of Blackmore Hill Farm with soprano pipistrelle bats. Low levels of bat activity were recorded in the remainder of the transect, with the vast majority of bats recorded south of Blackmore Hill. Most bats were identified as soprano pipistrelle bats, but a low number of unidentified pipistrelle bats were also recorded.	

Legend

- Transect route and variations
- Start points
- Soprano pipistrelle
- Common pipistrelle
- *Pipistrellus* species
- Noctule
- *Nyctalus* species
- Myotis species
- Greater horseshoe

21 May 2019 Surveyors started on the western end of the site and walked on an easterly direction. Activity started 25 minutes after sunset along the hedges and tree lines south west of Blackmore Hill Farm with soprano pipistrelle bats commuting and foraging on site. Most activity and bat diversity was recorded south of Blackmore Hill Farm with mostly recordings of soprano pipistrelles, but also passes of *Pipistrellus* species, noctules and *Myotis* species bats.	
26 June 2019 Surveyors started on the eastern end of the site and walked on a westerly direction. The first bat was noted by the surveyors (not recorded by detector) at sunset with a *Pipistrellus* species bat crossing the road over Penblewin roundabout in a southerly direction, indicating a roost present nearby. High levels of activity was then recorded along the hedges of patches of woodland present south of Blackmore Hill Farm, with mostly common and soprano pipistrelle bats. Bat activity was also recorded along the hedges of the woodland patches present further west with soprano pipistrelles, common pipistrelle and single passes of *Nyctalus* species bats.	

03 July 2019 Surveyors started on the western end of the site and walked on an easterly direction. Activity started 28 minutes after sunset along the western edge of the woodland. Moderate activity was the recorded along woodland edges and hedgerows present south of Blackmore Hill Farm, comprising mostly soprano pipistrelle bats, but also common pipistrelles, noctule and *Pipistrellus* species bats.	
14 Aug 2019 Surveyors started the transect on the center of the site, from a point on the road just west of Blackmore Hill Farm, and was walked by two teams of surveyors on an easterly and westerly direction (see limitations). First activity was recorded 8 minutes after sunset with soprano pipistrelle bats foraging along hedgerows and woodland hedges south of Blackmore Hill Farm, indicating a nearby roost. Moderate activity was recorded on the remainder of the site, with soprano and common pipistrelle bat activity and single passes of *Nyctalus* species bats and a brown long eared pass along the woodland hedge south of Redstone Farm.	

14 and 15 Sept 2019 Surveyors walked the transect from each end of the transect on an easterly and westerly direction, starting approximately 45 minutes after sunset (see limitations). The western end of the site had low levels of bat activity, with the majority of activity comprising soprano pipistrelle bats commuting and foraging along woodland edges and hedgerows. On the eastern end of the site (conducted the following day), surveyors recorded moderate levels of soprano pipistrelle, common pipistrelle and *Nyctalus* species bat activity along most hedgerows and woodland margins. *Myotis* species bat passes were also recorded on the woodland patches present on the south eastern end of Blackmore Hill Farm.	
22 Oct 2019 Surveyors started on the eastern end of the site and walked on a westerly direction. First bat activity was recorded 46 minutes after sunset along the edges of woodland patches south of Blackmore Hill Farm with soprano pipistrelle bats. Low levels of bat activity were recorded in the remainder of the transect, with occasional soprano pipistrelle passes. A *Myotis* species bat pass was also recorded on a field edge west of Redstone Cross.	

Appendix 3 - Building survey results

Figure 7 Building assessment results on A40 Penblewin and Redstone Cross upgrade - west side

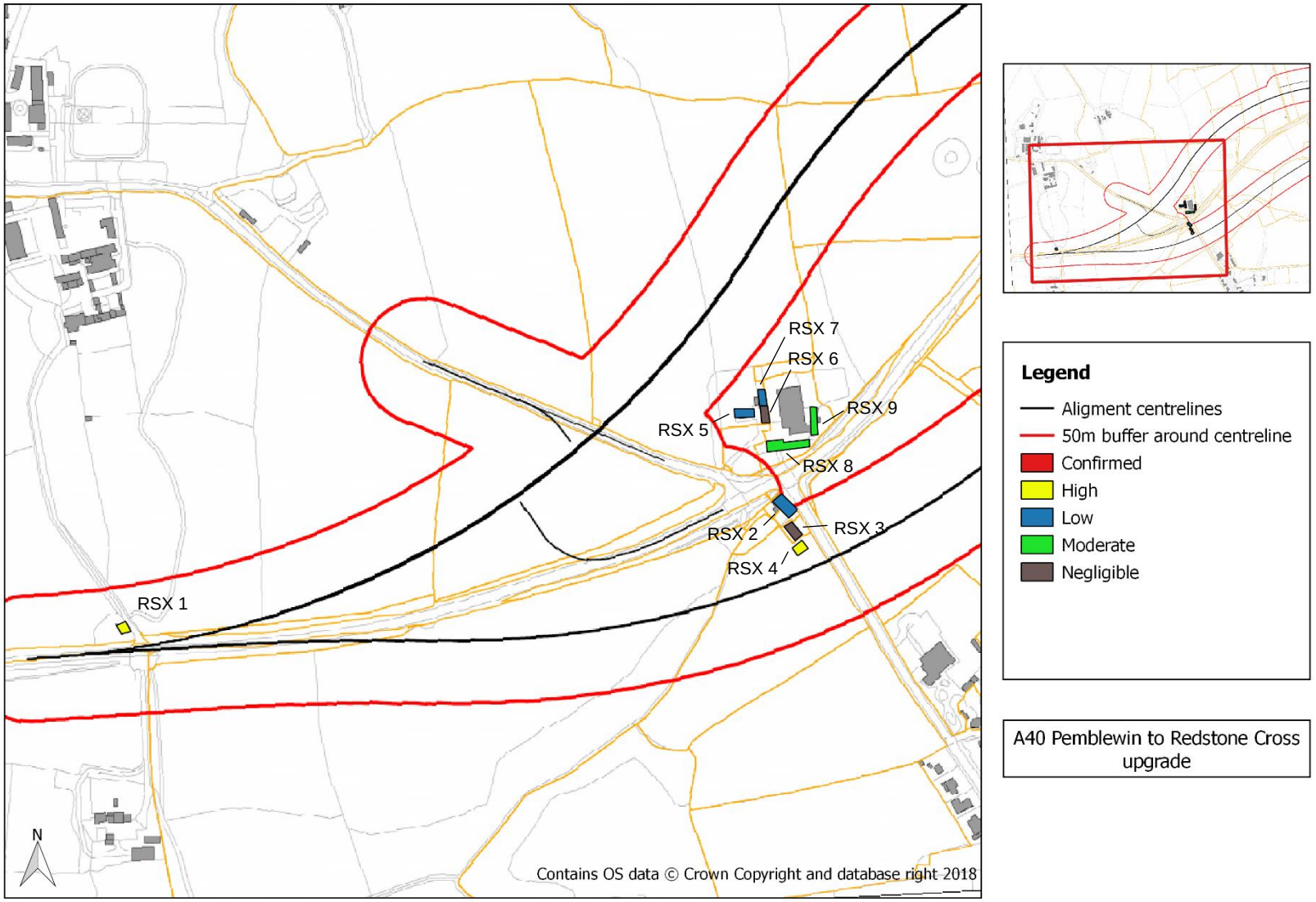


Figure 8 Building assessment results on A40 Penblewin and Redstone Cross upgrade - east side

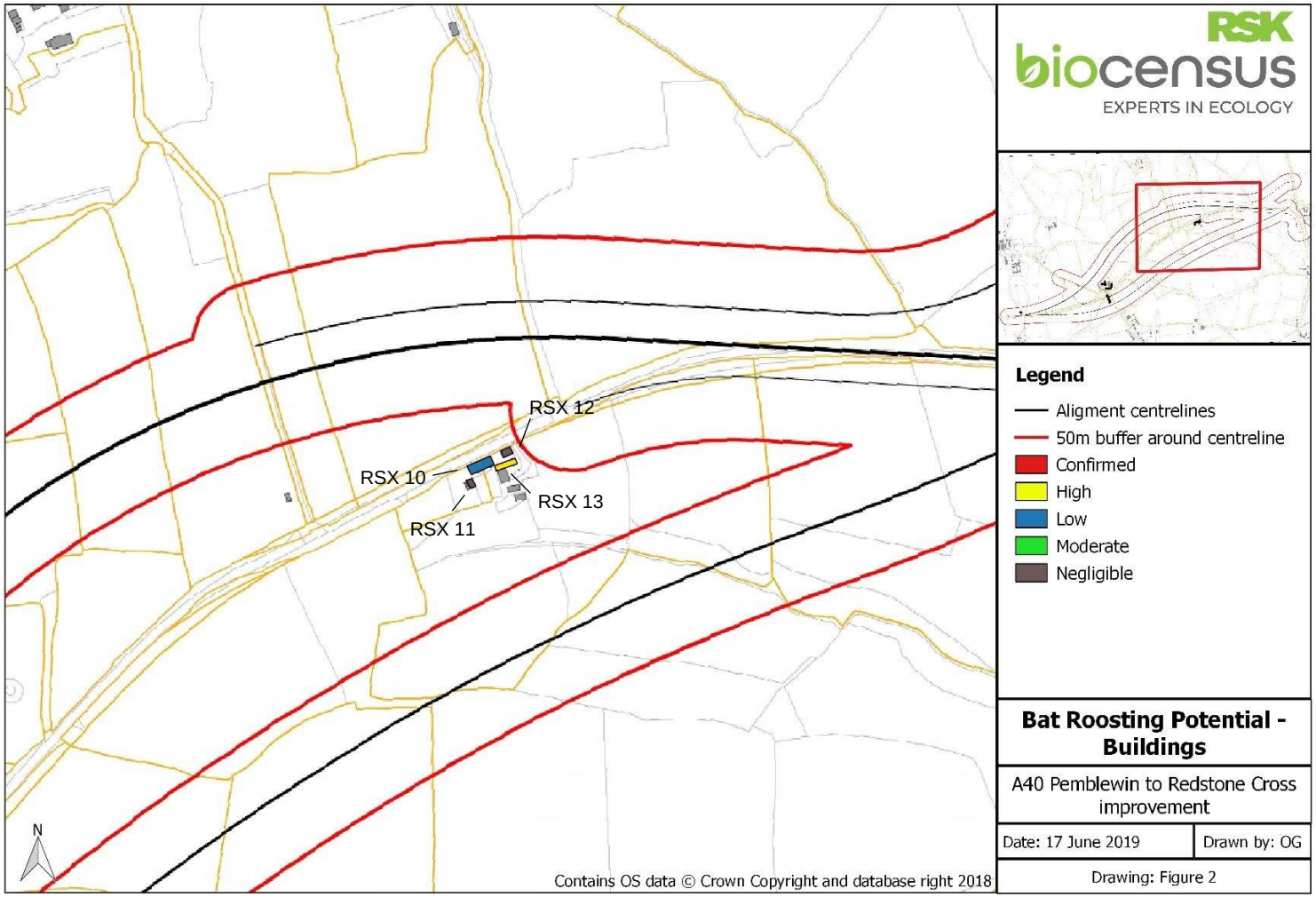


Table 10 Building photographs and roosts locations

Structure	Photographs	Bat roost potential/evidence
RSX 1		Assessed as providing a High bat roosting potential Three emergence surveys conducted – No bats emerged

RSX 2			Assessed as providing a Low bat roosting potential A single emergence survey was conducted – No bats emerged
RSX 3			A new build - Assessed as providing a Negligible bat roosting potential No bat emergence surveys conducted
RSX 4			Initially assessed as providing a High potential to support roosting bats but subsequently downgraded to Moderate potential following two emergence surveys with low bat activity.

RSX 5	  	Assessed as providing a Low potential to support roosting bats Brown long-eared bats seen emerging from apex of ridge line on initial survey. Two more surveys conducted – a common pipistrelle roost also discovered
RSX 6	 	Assessed as providing Negligible bat roosting potential No bat emergence surveys conducted

RSX 7	 	Initially assessed as providing a Low potential to support roosting bats Soprano pipistrelle bat day-roost discovered after initial emergence survey
RSX 8	   	Assessed as providing a Moderate potential to support roosting bats. Individual soprano pipistrelle and *Pipistrellus* species seen emerging / re-entering eastern gable end window.

RSX 9	 	Assessed as providing a Moderate potential to support roosting bats. Building provides some potential for hibernating bats. Two emergence and re-entry surveys conducted and no bats were seen entering the building.
RSX 10	   	Initially assessed as providing a Low potential to support roosting bats. Soprano pipistrelle bats were seen emerging from a gap under the fascia board corner on the south-eastern end.

RSX 11			Garden shed - assessed as providing Negligible bat roosting potential No bat emergence surveys conducted
RSX 12			Outbuilding - assessed as providing Negligible bat roosting potential No bat emergence surveys conducted
RSX 13			Assessed as providing a High potential to support roosting bats. The exterior's wall have crevices on the stonework that could provide opportunities to support hibernating bats. Three emergence surveys conducted – a common pipistrelle bat was seen emerging from a gap between

			the ridge board and the stonework on the eastern gable end.

Appendix 4 – Tree Assessment Results

Table 11 Classification of trees for their suitability for roosting bats – trees were numbered up to 105 (plus a Tree numbered 999), six trees that were identified in the field were scoped out so six Tree ref numbers are missing (46, 55, 61, 69, 94, 95). Nine trees were assessed as negligible, so 91 trees low to high potential in total.

Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
1	Common Ash *Fraxinus excelsior*	40	Ivy cover – thin stemmed	Neg	-	-
2	Common Ash *Fraxinus excelsior*	40	Ivy cover – thin stemmed	Neg	-	-
3	Common Ash *Fraxinus excelsior*	60	Ivy cover – thin stemmed	Neg	-	-
4	English oak *Quercus robur*	40	Ivy cover – thin stemmed	Neg	-	-
5	Common Ash *Fraxinus excelsior*	70	No features	Neg	-	-
6	English oak *Quercus robur*	40	Ivy cover – thin stemmed	Neg	-	-
7	Common Ash *Fraxinus excelsior*	60	No features	Neg	-	-
8	English oak *Quercus robur*	50	Ivy cover – thick stemmed but superficial	Low	-	-
9	English oak *Quercus robur*	70	Ivy cover – thick stemmed, some gaps present but superficial	Low	-	-
10	Common Ash *Fraxinus excelsior*	90	Small trunk cavity and ivy cover – thick stemmed but superficial	Low	-	-
11	Common Ash *Fraxinus excelsior*	40	Ivy cover – thick stemmed but superficial	Low	-	-
12	Hawthorn *Crataegus monogyna*	20	Branch cavity on northern aspect	Mod	No cavities with sufficient depth observed	Neg
13	Common Ash	120	Ivy cover – thick stemmed but superficial	Low	-	-

Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
	Fraxinus excelsior					
14	Common Ash *Fraxinus excelsior*	60	Ivy cover – thick stemmed but superficial	Low	-	-
15	Common Ash *Fraxinus excelsior*	80	Ivy all over, branch cavity on northern aspect but closed up	Low	-	-
16	Common Ash *Fraxinus excelsior*	90	Loose bark on dead branch facing east	Low	-	-
17	Common Ash *Fraxinus excelsior*	80	No features	Neg	-	-
18	Common Ash *Fraxinus excelsior*	20	No features	Neg	-	-
19	Common Ash *Fraxinus excelsior*	120	Branch cavity (6m, S), bark roll (W 7m)	Mod	Several callus rolls and ivy cover present but is superficial	Low
20	Common Ash *Fraxinus excelsior*	200	Ivy cover – thick stemmed but superficial	Low	-	-
999	Common Ash *Fraxinus excelsior*	110	Large tree with failed limb – hazard beam and woodpecker hole present facing S - SE	High	Split in the middle of a fallen branch, 4cm wide and 25cm long. Deep woodpecker hole 10cm towards tip deep and 25cm towards stem	High
21	Common Ash *Fraxinus excelsior*	100	Canker wound facing south, ivy cover – thick stemmed	Mod	Goes in approx 10cm, dry and well sheltered but narrow (6cm)	Mod
22	Dead		Dead tree (grounded) – trunk cavity on western aspect, thin vertical cracks	High	Cavity is facing up, cavity also appears to go down the limb and will be exposed	Low
23	Common Ash *Fraxinus excelsior*	200	Ivy cover – thick stemmed but superficial	Low	-	-
24	Alder *Alnus glutinosa*	200	Ivy cover – thick stemmed but superficial	Low	-	-
25	Common Ash *Fraxinus excelsior*	220	Ivy cover – thick stemmed, branch cavity and split – south facing	Mod	Numerous splits and tear outs but not forming deep cavities	Low

Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
26	Alder *Alnus glutinosa*	90	Dead tree. Ivy cover – thick stemmed. Loose bark	Mod	No significant gaps or cavities. Superficial flaking bark	Low
27	English oak *Quercus robur*	90	East facing branch cavity	Mod	Cavity around dead stub, does not extend inward. Shallow and exposed	Low
28	English oak *Quercus robur*	70	Ivy cover – thick stemmed but superficial	Low	-	-
29	Willow *Salix sp*	40	West facing branch split, narrow east facing holes	Low	-	-
30	English oak *Quercus robur*	100	Two wounds on limb, with exposed heartwood and occlusion wood. Superficial splits	Mod	Minimal shelter - larger wound provides 5cm around top lip of wound wood	Low
31	Common Ash *Fraxinus excelsior*	110	South facing split in bark. Several wounds and cankers throughout crown. South facing wound	Mod	Wounds and cankers inspected and found to be shallow. Split just superficial bark lifting with no cavities	Low
32	Common Ash *Fraxinus excelsior*	90	Knott holes, north facing	Mod	Both knotholes inspected and found to be shallow and exposed	Neg
33	English oak *Quercus robur*	60	Split branch cavity and south facing wound	High	Branch cavity shallow with little cover, wound shallow with nesting material	Low
34	Common Ash *Fraxinus excelsior*	80	South facing knothole	Mod	Hole shallow and exposed	Neg
35	English oak *Quercus robur*	110	Failed limb and loose bark. Light ivy cover	Mod	Failed limb into hawthorn, bark has not lifted. Loose bark not lifted – does not provide any shelter	Neg
36	English oak *Quercus robur*	110	Hazard beams and knothole	Mod	Hazard beam extends in toward stem by 30cm, toward tip 15cm. Clean and dry toward end. Narrow, single crevice, fairly exposed	Mod
37	English oak (dead) *Quercus robur*	80	Dead tree, several large bark loose bark plates. Light ivy cover	Mod	Too fragile to climb, needs emergence surveys	Mod
38	English oak	80	Ivy cover – thick stemmed but superficial	Low	-	-

Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
	Quercus robur					
39	Common Ash *Fraxinus excelsior*	130	Ivy cover, south facing branch cavity	Mod	Light stemmed ivy, knothole shallow and narrow	Low
40	Sycamore *Acer pseudoplatanus*	40	Split branch at 3m with shallow gap	Low	-	-
41	English oak *Quercus robur*	120	Dead branch with south facing small split	Low	-	-
42	Goat willow *Salix caprea*	45	Hazard beam and loose bark	High	Access at top 20cm diameter, leading into split which goes toward tip of limb and twists, providing shelter.	Mod
43	Goat willow *Salix caprea*	45	Two failed limbs, stem cavity. Light ivy cover	Mod	Stem cavity extending in and upward 25cm. Bird nesting material present at base. Dry, well sheltered.	High
44	Alder *Alnus glutinosa*	100	Ivy cover – thick stemmed but superficial	Low	-	-
45	Common Ash *Fraxinus excelsior*	110	Ivy cover – thick stemmed but superficial	Low	-	-
47	Common Ash *Fraxinus excelsior*	60	Moderate ivy cover – thin stemmed. Knothole on side branch from northern trunk	Mod	Several pruning wounds/knot hole but none suitable	Neg
48	Common Ash *Fraxinus excelsior*	50	High, thick-stemmed ivy cover	High	Light thin stemmed ivy with limited shelter	Neg
49	English oak *Quercus robur*	45	Dead branch with gaps under flaking bark	Mod	Several areas of flaking bark no sheltered areas	Neg
50	Common Ash *Fraxinus excelsior*	20	Moderate ivy-cover – thin stemmed Flaking bark on dead trunk section	Mod	Light thin stemmed, no other features observed	Low
51	Common Ash *Fraxinus excelsior*	60	Light ivy cover. Dead branch on roadside with gaps under flaking bark and small crevice	Mod	Dead limbs and pruning wounds, no suitable features	Low
52	Sycamore	70	Moderate ivy-cover – thin stemmed.	Low	-	-

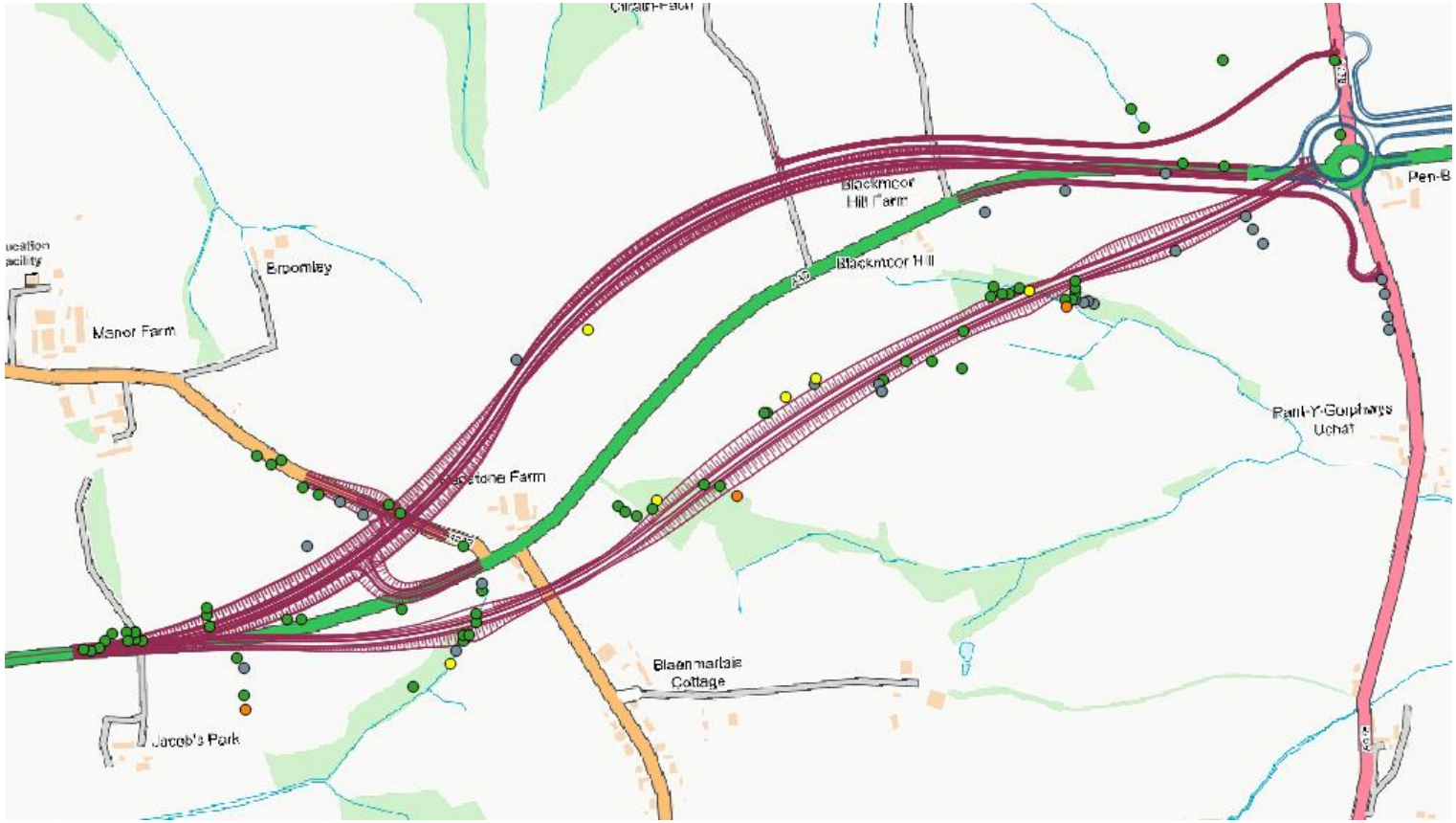
Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
	Acer pseudoplatanus					
53	Common Ash *Fraxinus excelsior*	80	Moderate ivy-cover – thin stemmed. Knotholes, pointing up. Small broken branches	High	Features inspected and re-classified	Low
54	Common Ash *Fraxinus excelsior*	60	High, thick-stemmed ivy cover.	High	Light thin stemmed ivy, no other suitable features observed	Low
56	Common Ash *Fraxinus excelsior*	50	High, thick-stemmed ivy cover. Shallow knotholes. Small dead branches	High	Light thin stemmed ivy, no other suitable features observed	Low
57	Common Ash *Fraxinus excelsior*	60	High, thick-stemmed ivy cover. Small dead branches	High	Light thin stemmed ivy, no other suitable features observed	Low
58	Common Ash *Fraxinus excelsior*		Group of three trees. Moderate ivy-cover – thin stemmed.	Low	-	-
59	Common Ash *Fraxinus excelsior*	50	Moderate ivy-cover – thin stemmed.	Low	-	-
60	English oak *Quercus robur*	18	Narrow trunk with low hole leading to potentially significant cavity	Mod	Two wounds – one extends upward 5cm, very shallow, other extends downward, damp and sludgy	Low
62	Hawthorn *Crataegus monogyna*	20	Thick stemmed ivy cover at base	Low	-	-
63	Hawthorn *Crataegus monogyna*	30	Thick stemmed ivy cover at base	Low	-	-
64	English oak *Quercus robur*	60	Moderate ivy-cover – thin stemmed. Cavity in knot formed by limb drop. Crevice between bark and dead limb.	Mod	Two small crevices, each going straight back less than 8cm. Slugs and woodlice present	Low
65	Common Ash *Fraxinus excelsior*	50	Shallow crack up northern trunk	Low	-	-
66	Common Ash *Fraxinus excelsior*	50	Light ivy cover. Hole on underside of spreading limb; small cavities at ends of two broken-off limbs. Split truck.	High	Several snapped out limbs with wounds, all superficial providing no shelter	Neg

Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
67	Common Ash *Fraxinus excelsior*	45	Moderate ivy-cover – thin stemmed. Hole with blue-tit nest on underside of limb.	Mod	Hole with nest present at base – shallow and exposed	Low
68	Common Ash *Fraxinus excelsior*	55	High, thick-stemmed ivy cover. Numerous cavities and holes, one with blue tit nest. Lots of flaking bark; dead in upper half with lots of *Daldinia* (King Alfred's Cakes)	High	Unsafe to climb. Needs emergence surveys	High
70	English oak *Quercus robur*	110	Knothole and loose bark present	Mod	Shallow, exposed knothole. Loose bark with limited shelter. Tear with delaminated fibres	Low
71	English oak *Quercus robur*	70	At least one crevice at end of broken limb. Deadwood	Mod	Split on limb goes back 12cm – dry inside. Woodpecker hole that goes inward and up 8cm with a split at the top slightly exposing feature to elements	Mod
72	English oak *Quercus robur*	50	Crevices and cracks on and at base of dead lower limbs. Flaking bark on dead lower limbs	High	Several wounds / knot holes but all shallow and superficial.	Neg
73	English oak *Quercus robur*	60	Crevices and cracks on and at base of dead lower limbs	High	Minor cavities around root buttresses. Knotholes/wounds present with heartwood intact.	Low
74	English oak *Quercus robur*	70	Crevices and cracks on and at base of dead lower limbs	High	Minor cavities around root buttresses. Knotholes/wounds present with heartwood intact.	Low
75	Common Ash *Fraxinus excelsior*	20	Moderate ivy-cover – thin stemmed.	Mod	Light thin stemmed ivy cover no other feature observed	Low
76	English oak *Quercus robur*	70	At least two small holes	Mod	Overall good condition, several small knot holes with heartwood present. No suitable features observed	Low
77	English oak *Quercus robur*	25	Moderate ivy-cover – thin stemmed. 3 cavities on lower and mid trunk	High	Six wounds/holes on northern aspect all shallow and superficial	Low

Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
78	Sycamore *Acer pseudoplatanus*	45	Flaking bark around scar halfway up trunk	Mod	Some areas of exposed hard wood	Low
79	Horse chestnut *Aesculus hippocastanum*	35	Cavity below bird box	Mod	Wound on east aspect open and exposed from the top	Neg
80	Common Ash Fraxinus *excelsior*	45	Moderate ivy-cover – thick stemmed. Large knot hole. Small amounts flaking bark and dead wood	High	Light ivy cover. Knothole shallow and exposed, only 6cm deep and open to elements	Low
81	Conifer		Moderate ivy-cover – thin stemmed.	Low	-	-
82	Sycamore *Acer pseudoplatanus*	30	Small knot hole. Crossing trunk. Loose bark.	Mod	Weld, slightly open at top but not providing any shelter. No other access points.	Low
83	Conifer		Moderate ivy-cover – thin stemmed.	Low	-	-
84	Beech *Fagus sylvatica*	60	Small, shallow knot holes. Crossing branches	Low	-	-
85	Leyland cypress *Cupressus x leylandii*	20	Loose bark high up	Low	-	-
86	Yew *Taxus baccata*	50	Crossing branches providing some limited shelter	Low	-	-
87	Common Ash *Fraxinus excelsior*	40	Moderate ivy-cover – thin stemmed.	Low	-	-
88	Apple tree *Malus domestica*	10	Moderate ivy-cover – thin stemmed.	Low	-	-
89	Common Ash *Fraxinus excelsior*	60	Moderate ivy-cover – thin stemmed.	Low	-	-
90	English oak *Quercus robur*	10	Moderate ivy-cover – thick stemmed.	Mod	Ivy only providing superficial shelter	Low
91	Common Ash *Fraxinus excelsior*	20	Moderate ivy-cover – thin stemmed.	Low	-	-

Tree Ref.	Species	DBH (cm)	Description	Initial BRP category	Feature description from Aerial assessment	BRP Category after aerial
92	Sycamore *Acer pseudoplatanus*	40	Moderate ivy-cover – thick stemmed.	High	Dense thick stemmed ivy forming a matt of shelter	Low
93	Sycamore *Acer pseudoplatanus*	45	Moderate ivy-cover – thick stemmed.	High	Thick stemmed ivy, forming a dense mat with some shelter. Stem cavity with limited shelter	Low
96	Common Ash *Fraxinus excelsior*	100	Moderate ivy-cover – thin stemmed.	Low	-	-
97	English oak *Quercus robur*	35	West facing knothole	Mod	Knothole does not lead anywhere	Neg
98	Common Ash *Fraxinus excelsior*	60	South facing callus roll and superficial loose bark	Mod	Tree could not be further assessed (aerial or emergence surveys) due to the presence of cattle	Mod
99	Common Ash *Fraxinus excelsior*	70	Callus roll with small gap inside	Low	-	-
100	Common Ash *Fraxinus excelsior*	60	East facing branch cavity providing limited shelter	Low	-	-
101	English oak *Quercus robur*	60	West facing cavity in branch	Mod	Knothole providing limited shelter	Low
102	English oak *Quercus robur*	50	Moderate ivy-cover – thin stemmed.	Low	-	-
103	Common Ash *Fraxinus excelsior*	50	Tear out facing south-west	Mod	Tear out – goes straight back but is fairly exposed	Low
104	Common Ash *Fraxinus excelsior*	90	Moderate ivy-cover – thick stemmed	Mod	Thick stemmed ivy, forming a dense mat with some shelter.	Low
105	Common Ash *Fraxinus excelsior*	80	Thin cracks along branch	Low	-	-

Figure 8 Tree suitability for roosting bats following ground level and aerial inspections



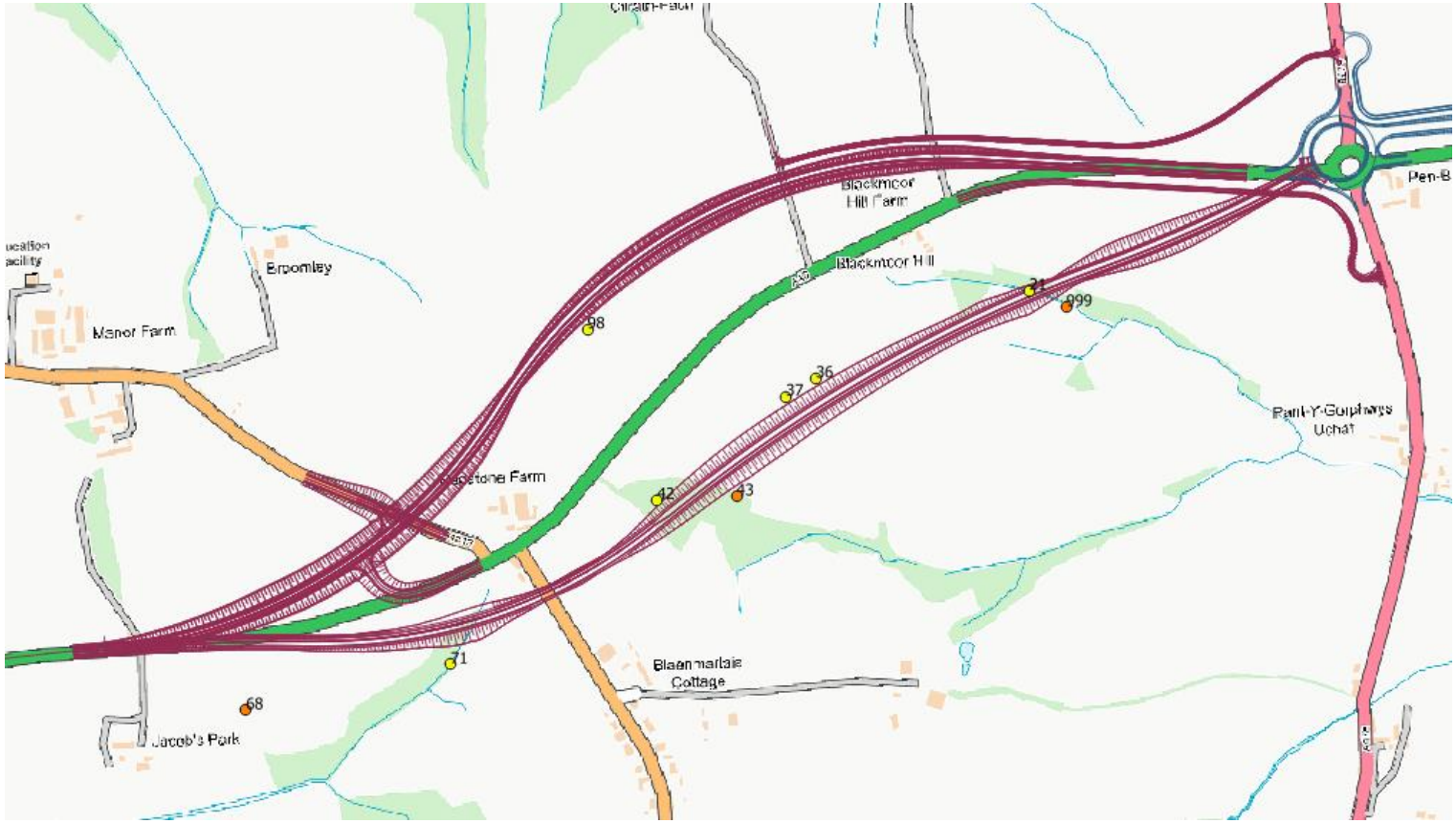
Legend

- *High suitability*
- *Moderate suitability*
- Low suitability
- Negligible suitability
- A40 upgrade

A40 Penblewin – Redstone Cross upgrade

Scale 1:12000

Figure 9 High and moderate tree suitability for roosting bats following ground level and aerial inspections



Legend

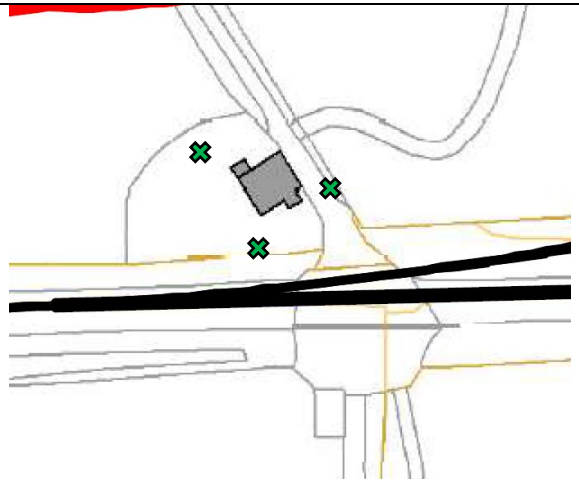
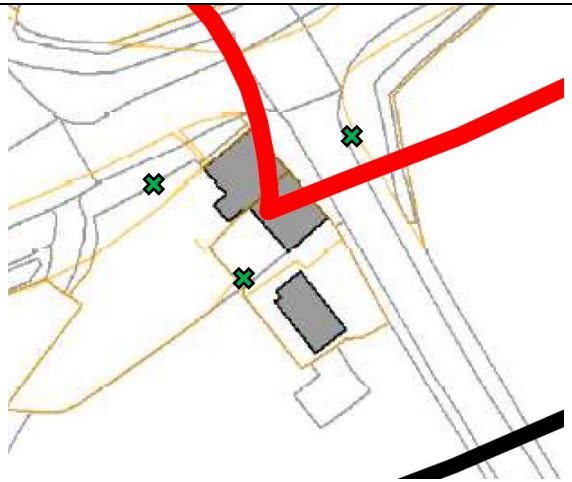
- *High suitability*
- *Moderate suitability*
- A40 upgrade

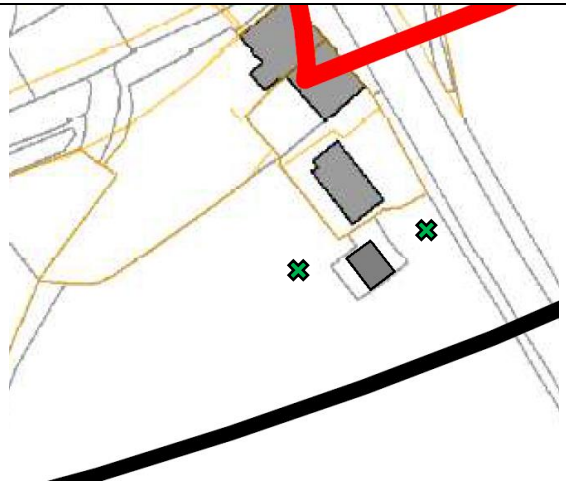
A40 Penblewin – Redstone Cross upgrade

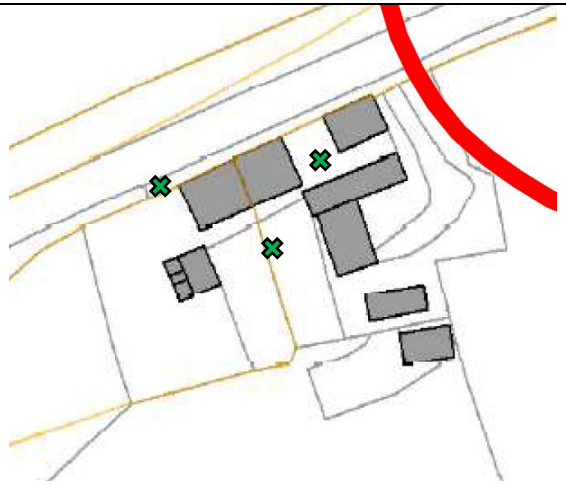
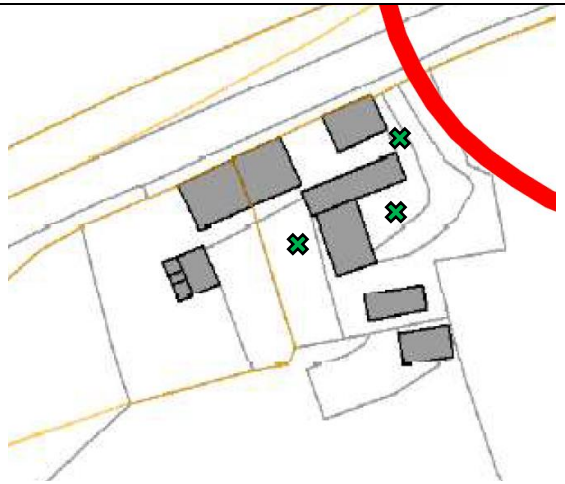
Scale 1:12000

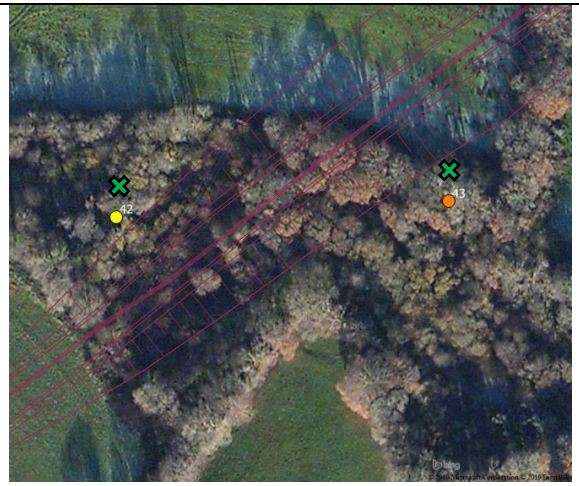
Appendix 5 – Surveyor locations

Table 12 Surveyor location during bat emergence and re-entry surveys

Structure/ surveyor number	Map	Structure/ surveyor number	Map
Building RSX1 – 3 surveyors		Building RSX 2 – 3 surveyors	

Building RSX 4 – 2 surveyors		Buildings RSX 5 & 7 – 2 surveyors	
Building RSX 8 – 3 surveyors		Building RSX 9 – 2 surveyors	

Building RSX 10 – 3 surveyors		Building RSX 13 – 3 surveyors	
Trees 999 and 21		Trees 36 and 37	

Trees 43 and 42		Tree 71	
Tree 68			

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 8.5 Bat Activity Survey Report

A40PRC-ARP-EBD-SWI-RP-LE-0010

P01 | S3

14/02/20

Contents

1 Introduction

1.1.1 Ove Arup and Partners Ltd (Arup) was commissioned by Welsh Government to undertake ecological surveys in relation to the A40 Penblewin to Redstone Cross Improvements. Surveys were required to provide baseline information for the Ecological Impact Assessment (EcIA) as part of an Environmental Statement.

1.1.2 At the time of the instruction there were three scheme options, one to the south of the existing A40 and two to the north. The two to the north shared the same central alignment but one had a staggered junction north of Redstone Cross and the other featured a T-Junction. The central alignments of these scheme options are shown in **Design Options Development** (ES Volume 2, Figure 3.2).

1.1.3 This report sets out the methodology, results and conclusions of the passive bat monitoring surveys carried out in suitable habitat along these scheme options north and south of the existing A40.

1.2 Background

1.2.1 Suitable habitat for commuting and foraging bats in the form of woodlands and hedgerow which form linear corridors throughout the study area were identified during the initial Phase 1 Habitat survey, see **Extended Phase 1 Habitat Survey** (ES Volume 3, Appendix 8.1).

1.2.2 The A40 Penblewin to Redstone Cross Improvements is an extension to the A40 Llanddewi Velfry to Penblewin Improvements for which an Environmental Statement was published in July 2019[1]. Passive bat monitoring surveys were carried out in the study area for this adjacent scheme in 2017 and have also been repeated in 2019. The results of the 2017 surveys are discussed in the desk study results (Section 3.1).

1.3 Survey Area

1.3.1 The alignment of the northern route options passes through improved and semi-improved grasslands with well-established hedgerows. The southern (preferred) route predominantly encompasses improved

[1] Welsh Government (2019) A40 Llanddewi Velfrey to Penblewin Improvements Environmental Statement Chapter 8 Nature Conservation. https://gov.wales/sites/default/files/publications/2019-08/a40-llanddewi-velfrey-to-penblewin-environmental-statement-volume-1-july-2019.pdf

grassland fields with hedgerows, but it also supports areas of broadleaved woodland, carr and marshy grassland.

1.3.2 The passive monitoring survey locations were points on linear features, predominantly hedgerows but also some woodland features which will be bisected by the proposed alignments.

1.4 Survey Objectives

1.4.1 The main objectives of the surveys were to record and identify levels of bat activity, using static bat detectors at different locations within the survey area and to identify the range of species present and their relative abundance in terms of activity levels at these locations.

1.4.2 Bat activity transect surveys and bat emergence/re-entry surveys of trees and buildings have been undertaken and reported separately, see **Bat Roost and Transect Survey Report** (ES Volume 3, Appendix 8.4).

1.5 Legislation

1.5.1 All UK bat species are afforded protection under both European and national law. All bats are listed as European Protected Species (EPS) under the provisions of the Conservation of Habitats and Species Regulations 2017 (as amended) (known as the 'Habitats Regulations'). Additionally, all bat species are afforded protection under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended).

1.5.2 Together this legislation makes it an offence to:

a) intentionally or recklessly kill, injure or capture a bat;

b) intentionally or recklessly disturb a bat such as to affect its ability to survive, breed or rear its young;

c) damage, destroy or obstruct access to a breeding site or resting place (e.g. roost) used by a bat, or disturb bats while they are using such a place; and

d) possess or control a live, or dead bat, or any part of a bat.

1.5.3 Various bat species are also listed as Species of Principal Importance for the conservation of biodiversity in Wales, under the provisions of Section 7 of the Environment (Wales) Act 2016. The Act includes a duty on all public authorities to have regard for the conservation of

biodiversity in the exercise of their functions. This duty applies to government bodies, local authorities and statutory undertakers.

1.5.4 Actions that are prohibited by legislation can be made lawful on the approval and granting of a licence from Natural Resources Wales (NRW), subject to conditions.

2 Methodology

2.1 Desk Study

2.1.1 Protected species records were obtained from the West Wales Biodiversity Record Centre (WWBRC), for the area within a 2km radius of the scheme, and records of roosting bats were obtained for the area within 5km from the centrelines of the scheme options. The data search was carried out on 11th June 2019. Only records from within the last 10 years were considered relevant.

2.1.2 A search was undertaken of statutory designated sites within a 10km radius of the centrelines of the scheme options, and a 30km radius for bat Special Areas for Conservation (SACs).

2.2 Static Detector Surveys

2.2.1 The surveys were carried out in general accordance with the Bat Conservation Trust's Good Practice Guidelines (Collins, 2016). Twelve full spectrum static bat detectors (Song Meter SM2 and SM4, Wildlife Acoustics) were deployed for a minimum of five nights in April, May, June, July, September and October 2019.

2.2.2 Six locations (R1 to R6) were selected along the preferred alignment to the south of the existing A40 and six locations (R7 to R12) along the alignment of the northern options. These passive detectors automatically record bat echolocation calls which are saved on memory cards for later analysis.

2.2.3 The detectors were set to record every night from 30 minutes before sunset until 30 minutes after sunrise.

2.2.4 The locations of the static detectors are shown in Figures 1 to 7 in section 6 belowand the dates that they were deployed for are given in Table 1 below. The detectors were placed within hedgerows and woodland habitat at approximately chest height. In some cases, cables were used to raise the microphones higher in areas of tall vegetation.

2.2.5 The microphones used with the detectors during the course of the surveys were regularly checked and calibrated using a Wildlife Acoustics Calibration Unit to ensure that they were functioning

properly. Microphones that did not show a significant response to the output of the calibration unit were replaced.

Table 1: Dates of static detector surveys

Month	Location R1	Location R2	Location R3	Location R4	Location R5	Location R6	Location R7	Location R8	Location R9	Location R10	Location R11	Location R12
April	16/04/19-21/04/19	16/04/19-21/04/19	Equipment failure	Equipment failure	16/04/19-21/04/19	-	16/04/19-21/04/19	16/04/19-21/04/19	16/04/19-21/04/19	16/04/19-21/04/19	16/04/19-21/04/19	16/04/19-21/04/19
May	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19	03/05/19-08/05/19
June	07/06/19-12/06/19	-	07/06/19-12/06/19	07/06/19-12/06/19	07/06/19-12/06/19	07/06/19-12/06/19	07/06/19-12/06/19	07/06/19-12/06/19	07/06/19-12/06/19	07/06/19-12/06/19	Equipment failure	07/06/19-12/06/19
July	26/07/19-31/07/19	26/07/19-31/07/19	26/07/19-31/07/19	26/07/19-31/07/19	-	26/07/19-31/07/19	26/07/19-31/07/19	-	26/07/19-31/07/19	26/07/19-31/07/19	26/07/19-31/07/19	-
August[2]	-	-	-	-	-	-	-	-	-	-	-	-
September	18/09/19–23/09/19	18/09/19–23/09/19	18/09/19–23/09/19	-	18/09/19–23/09/19	18/09/19–23/09/19	-	-	-	-	18/09/19–23/09/19	18/09/19–23/09/19
October	22/10/19-27/10/19	22/10/19-27/10/19	22/10/19-27/10/19	22/10/19-27/10/19	22/10/19-27/10/19	22/10/19-27/10/19	-	-	22/10/19-27/10/19	-	22/10/19-27/10/19	22/10/19-27/10/19

[2] No monitoring was undertaken in August due to logistical difficulties and equipment failure.

2.3 Sound Analysis

2.3.1 The detectors recorded bat activity in Wildlife Acoustics Compression files (.wac). These were downloaded from the detectors and processed using Kaleidoscope Pro Software to produce audio files (.wav) and zero crossing files. The processing also included the automatic identification of bat species based on the classifiers developed by Wildlife Acoustics (Bats of Europe 4.3.0).

2.3.2 The files produced by the processing were then reviewed to ensure correct identification of species and to identify where possible the bat species for any calls which could not be recognised by the software. All calls identified as being either common pipistrelle *Pipistrellus pipistrellus*, or soprano pipistrelle *P. pygmaeus*, were not reviewed except where high levels of insect noise had been recorded leading to uncertainty over the accuracy of identification. All other calls were checked either by Pete Wells, (a bat specialist with over 20 years of experience in bat work). Identification of calls was aided by published reference material including British Bat Calls (Russ, 2012), Social Calls of the Bats of Britain and Ireland (Middleton, Froud, & French, 2014), and Bats of Britain and Europe (Dietz & Kiefer, 2018).

2.3.3 The number of files (sound clips) recorded by the detectors each night was taken as a proxy value to the number of bat passes. This was then used to calculate a Bat Activity Index (BAI) for each species at each location during each session. The BAI was calculated on the first five nights recorded each month. In some cases, the detector also recorded data on the sixth and sevenths nights. These additional nights have been excluded from the BAI as it could not be certain that the detector had recorded data for the entire night. However, where rarer or more notable species were recorded on these additional nights, they have been included to ensure their representation within the data in terms of species diversity.

2.3.4 The average BAIs for all species (sum of individual BAIs) at each location has been calculated over the survey season and for each month of recording.

2.3.5 The time of recording of the first bat of each species, each night, and time of last recording were also compared to sunset and sunrise times obtained using Anasun software to infer the potential proximity of roost

sites.

2.4 Limitations

2.4.1 Due to the subjective element within professional judgement of bat call analysis, it is possible that other ecologists may differ in opinion on the identification of calls; however current reference works have been used and all analyses were undertaken by experienced ecologists.

2.4.2 Since the study area is predominantly used for cattle production, there were occasions when the surveyors could not access particular monitoring locations due to the presence of potentially dangerous cattle. Due to unknown technical reasons, at some of the monitoring locations there were equipment failures which meant no data was recorded. These locations are listed in Table 2 for each month of the monitoring period together with the reason for the data gaps.

2.4.3 Passive detectors were not deployed during August due to logistical difficulties and equipment failure. Since this is only one month out of the seven-month survey period which was missed, and the other months representing the breeding season were sampled (June, July), this limitation is not considered to affect the integrity of the survey or overall conclusions. In addition, six recording locations were monitored each month which is over and above the recommended two locations per walked transect in the guidance (Collins, 2016).

Table 2 Data gaps for each month of the passive monitoring surveys

Month	Southern (preferred alignment)	Northern alignment
April	R3 – equipment failure R6 – equipment failure	N/A
May	N/A	
June	R2 – detector was functioning throughout, but no bats recorded	R11 – equipment failure
July	R5 – detector was functioning throughout, but no bats recorded	R8 – detector was functioning throughout, but no bats recorded R12 – detector was functioning throughout, but no bats recorded
August	Data gaps at all locations due to logistical difficulties and equipment failure	
September	R4 – detector was functioning throughout, but no bats recorded	R7– detector was functioning throughout, but no bats recorded R8 – no access due to cattle R9 – no access due to cattle R10 – detector was functioning throughout, but no bats recorded
October	N/A	R7 – detector was functioning throughout, but no bats recorded R8 – detector was functioning throughout, but no bats recorded R10 – detector was functioning throughout, but no bats recorded

2.4.4 It should be stressed that the findings presented in this study represent those at the time of survey and reporting, and data collected from available sources. Ecological surveys are limited by factors which affect the presence of species, such as temporal weather conditions, migration patterns and behaviour.

2.4.5 Weather was not considered to be a limitation, as the surveys were undertaken during weather conditions which were typical for Pembrokeshire at that time of year. Additionally, the surveys were undertaken within the optimum period for such work (April to October inclusive).

2.4.6 Every effort has been made to ensure that the findings of this report present as accurate an interpretation as possible of the species within the study area.

3 Results

3.1 Desk Study

3.1.1 Three SACs for which bats are a qualifying feature are present within 30km of the scheme (Table 3).

Table 3: SACs for which bats are a designated feature

Site name	Distance & direction from scheme	Reasons for designation
Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC	7.4km West	Annex II species that are a primary reason for selection of this site: greater horseshoe bat *Rhinolophus ferrumequinum*. Annex II species present as a qualifying feature, but not a primary reason for site selection: lesser horseshoe bat *Rhinolophus hipposideros*
Limestone Coast of South West Wales / Arfordir Calchfaen De Orllewin Cymru SAC	17.1km S	Annex II species that are a primary reason for selection of this site greater horseshoe bat.
North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC	18.4km N	Annex II species that are a primary reason for selection of this site: barbastelle *Barbastella barbastellus*.

3.1.2 The WWBIC data search returned records of 11 species of bat and one species group within 5km of the scheme: barbastelle, greater horseshoe bat, lesser horseshoe bat, serotine *Eptesicus serotinus*, Daubenton's bat *Myotis daubentonii*, whiskered bat *Myotis mystacinus*, Natterer's bat *Myotis nattereri*, noctule *Nyctalus noctula*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared bat *Plecotus auritus*, and unidentified *Myotis* species.

3.1.3 A total 193 records of bat roosts were returned with the WWBIC data search within 5km of the scheme, 83 of these were from the last 10 years (2009 or later). Four of these roost records were of greater horseshoe bat (a feature of the Pembrokeshire Bat Sites and Bosherton Lakes SAC and the Limestone Coast of South West Wales SAC). Two of the roosts were of lesser horseshoe bat (a feature of the Limestone Coast of South West Wales SAC), all over 4.5km away from the scheme. The remaining roosts were: whiskered bat (one roost); noctule (one roost); natterer's bat (three roosts); common pipistrelle (13 roosts); brown long-eared (20 roosts); soprano pipistrelle (24 roosts); Myotis

species (one roost); *Plecotus* species (two roosts); pipistrelle species (six roosts); and unidentified bat species (six roosts).

3.1.4 The closest roosts to the scheme were two soprano pipistrelle roosts approximately 500m north of the scheme and a common pipistrelle roost approximately 1.1km south of the scheme in Narberth.

3.1.5 A record of a greater horseshoe bat roost was provided by NRW in November 2019 with its response to the scoping report.[3] The record is located approximately 400m to the northwest of the scheme near Sodston Manor Farm.

3.1.6 A total of 15 buildings and three trees were identified as confirmed bat roosts during the baseline surveys for the adjacent A40 Llandewwi Velfry to Penblewin Improvements[1]. The closest of these roosts to the scheme were a soprano pipistrelle day roost and an unidentified pipistrelle species day roost in buildings at Penblewin Farm adjacent to Penblewin roundabout.

3.1.7 Activity surveys undertaken in 2017 on the adjacent A40 Llandewwi Velfry to Penblewin Improvements included both walked transect and passive monitoring. Common and soprano pipistrelle bats were the most frequently recorded species followed by Myotis species and noctule. Other species including long-eared species, Leisler's bat *Nyctalus leisleri*, serotine, Nathusius' pipistrelle *Pipistrellus nathusii*, barbastelle, lesser horseshoe bat and greater horseshoe bat were also recorded in low numbers.

3.2 Static Detector Surveys

3.2.1 The results of the static detector surveys are described below. Bats were recorded at all locations. Tables showing the results of the activity monitoring are provided in Appendix C.

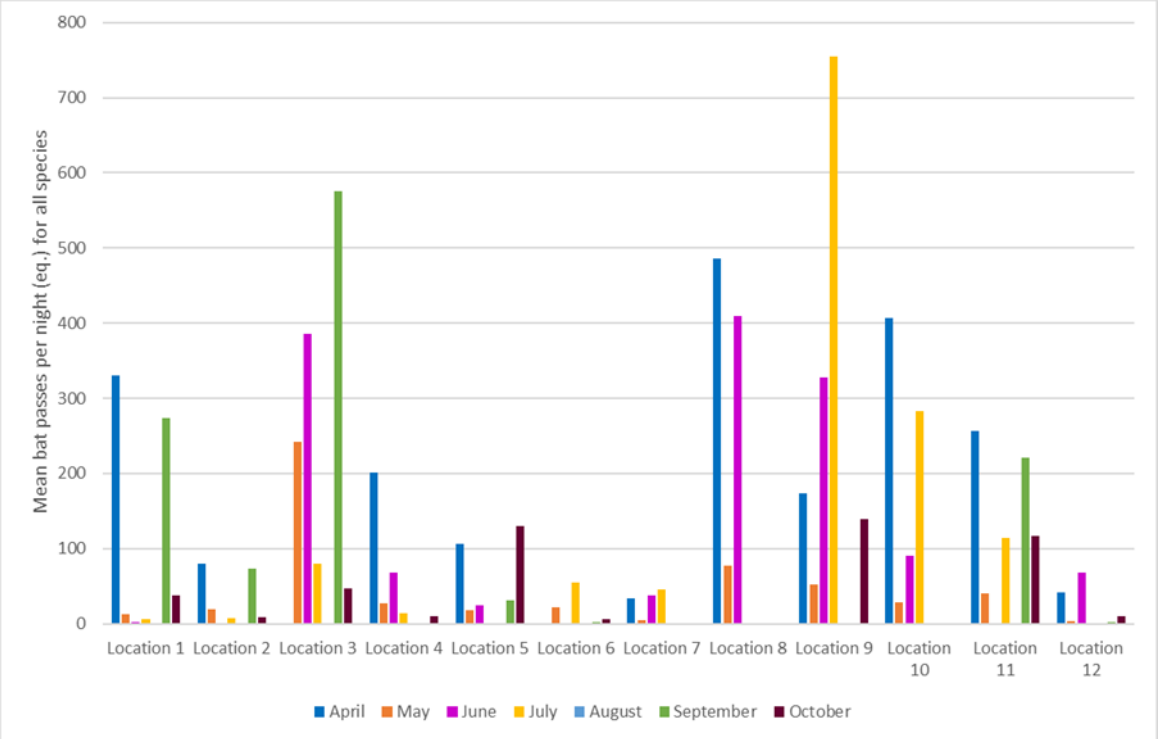
3.2.2 Monitoring location R9 recorded the highest mean level of activity across the survey season (248.7 bat passes (eq.) per night), followed by R3 (256.96 bat passes (eq.) per night) and R8 (191.7 bat passes (eq.) per night). Locations R8 and R9 were situated on the alignment of the northern options within mature hedgerow with trees. Location R3 was

[3] Letter from Natural Resources Wales (NRW) in response to A40 Penblewin to Redstone Cross Improvements Scoping Report, Reference: CAS 103638 (dated 07 November 2019).

located on hedgerow at ch1+120 of the preferred (southern) option.

3.2.3 Location R9 recorded the highest level of bat activity (BAI) in a single recording period, with over 750 passes (eq.) per night recorded during July. Location R9 was positioned along the northern alignment within mature hedgerow at a field corner.

3.2.4 The lowest levels of bat activity were recorded at locations R6 and R12, both at the western end of the scheme. R6 is situated above the stream within the woodland to the southwest of Redstone Cross junction. R12 is situated along a field boundary of the field to the west of Redstone Cross junction (north side of the existing A40). The mean BAI for the full season at these locations was 17.2 and 18.4 bat passes (eq.) per night respectively. The highest level of activity at these locations was 44.6 bat passes (eq.) per night at location R6 (July) and 53 bat passes (eq.) per night at R12 (June).



Graph 1: Bat activity indices (5-night average)

3.2.5 With regards to the six recording locations on the southern (preferred) route alignment, the highest levels of bat activity were recorded at location R3 as described above. The location with the second highest levels of activity was R1 with a mean BAI of 109.97 bat passes (eq.)

per night across the monitoring period.

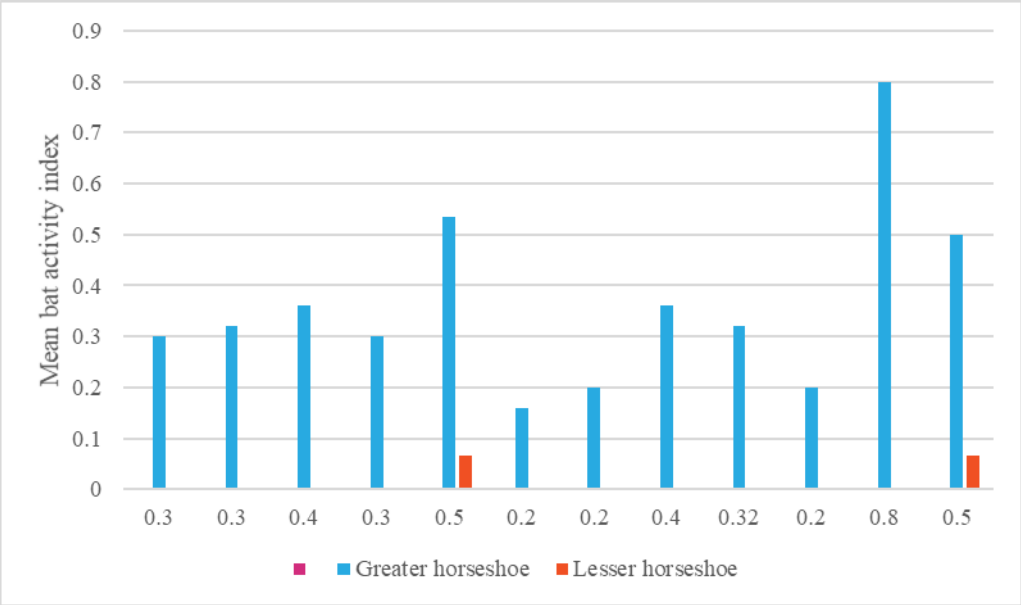
SAC Species

3.2.6 Of the three species which are features of nearby SACs (Table 3) greater horseshoe bat was the most frequently recorded species, being recorded at all of the monitoring locations. Low numbers of lesser horseshoe bat were recorded at location R5, consisting of a single pass in April and a single pass in October. Two passes were recorded at location R12 in September. Barbastelle bat was recorded at location R4 in April only, consisting of a single pass.

3.2.7 Location R11 recorded the highest level of activity by greater horseshoe across the survey period (Graph 2). The mean BAI is very low at all locations i.e. less than one pass per night (eq.).

3.2.8 The earliest recordings of greater horseshoe occurred 30-40 minutes after sunset (locations R3, R5, R8 and R12) and the latest recordings were 30-40 minutes before sunrise (location R8). Based on the median emergence times predicted for greater horseshoe bat (Jones & Rydell, 1994) it is considered likely that the species may be roosting in the vicinity of the study area. The proximity of a roost for this species was confirmed by NRW in the response to the Scoping Report[4].

[4] Letter from Natural Resources Wales in response to A40 Penblewin to Redstone Cross Improvements Scoping Report, Reference: CAS 103638 (dated 07 November 2019).



Graph 2: Mean bat activity indices for SAC species over the full survey period

Nyctalus Species

3.2.9 A small number of Leisler's bat *Nyctalus leisleri*, passes were recorded at locations R1 (a single pass in September), R4 (a single pass in May), and R5 (a single pass in October) and R9 (four passes in April).

3.2.10 Noctule bat was recorded at all locations in low numbers with the highest average level of activity being 12 passes (eq.) per night at Location R7 across the full monitoring period.

3.2.11 *Nyctalus* species were recorded within 10 minutes of sunset at multiple locations and also less than 10 minutes before sunrise. It is therefore highly likely that the species are roosting in the vicinity of the study area.

Myotis Species

3.2.12 Myotis species were recorded at all locations. The highest level of Myotis activity was recorded at location R1, with a mean of 7.4 bat passes (eq.) per night across the full survey period. The highest BAI at this location was 15.8 bat passes (eq.) per night recorded in April.

3.2.13 The earliest recordings of myotis species occurred 20-30 minutes after sunset (locations R5 and R11) and the latest recordings were 30-40 minutes before sunrise (location R8).

3.2.14 Due to the variation in emergence times of the different Myotis species (Jones & Rydell, 1994) it is not possible to infer the proximity of roosts from the earliest time when bats were recorded. However, as Myotis bats were recorded from approximately 36 minutes after sunset, it is likely that some species may be roosting in the vicinity of the study area.

Pipistrelle Species

3.2.15 Common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle bats were recorded during the monitoring period. Graph 3 shows mean BAI for these species at each recording location.

3.2.16 In addition to the results described below, numerous *Pipistrellus* calls were recorded which could not be separated to species level between soprano and common pipistrelle. These are shown in Graph 3 as Pipistrelle sp.

Soprano pipistrelle

3.2.17 Soprano pipistrelle was the most commonly recorded pipistrelle species. The highest levels of soprano pipistrelle activity were recorded at location R9, with a mean count of 213.4 passes (eq.) per night across the full monitoring period.

3.2.18 Soprano pipistrelle passes were recorded within 10 minutes of sunset at all recording locations except location R7 and location R12. It is therefore highly likely that there are roosts of this species within the vicinity of the study area. The highest number of soprano pipistrelle passes recorded less than 10 minutes after sunset were at location R3. This is located at an intersection of hedgerows which are connected to areas of broadleaved woodland.

Common Pipistrelle

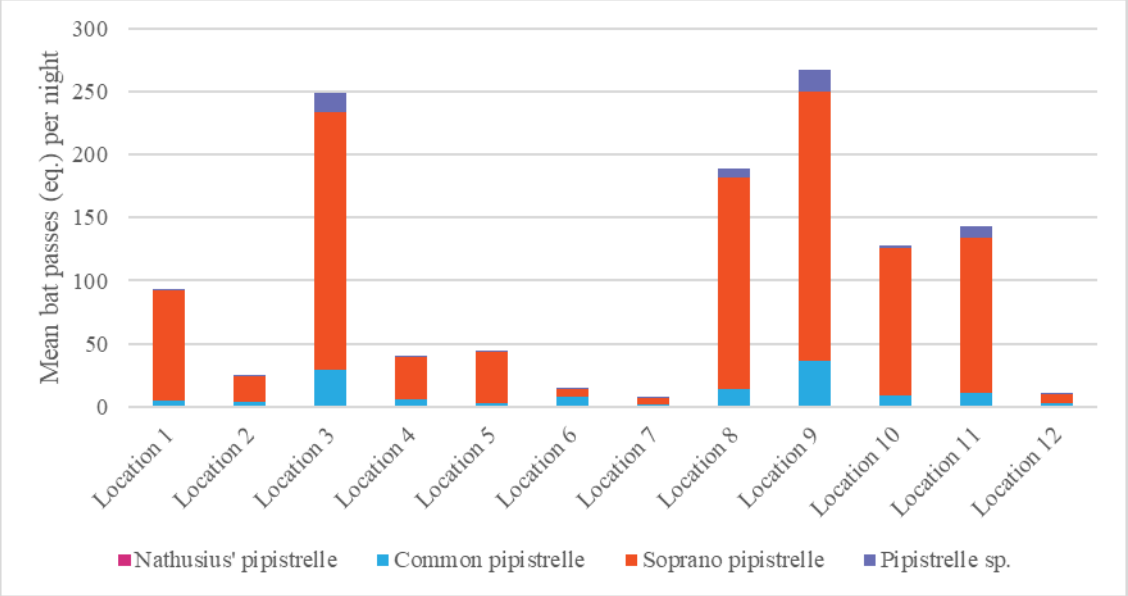
3.2.19 Common pipistrelle was the second most commonly recorded pipistrelle species across the full monitoring period. The highest number of common pipistrelle passes was recorded at location R9. A mean 36.5 common pipistrelle passes (eq.) per night were recorded at this location.

3.2.20 Common pipistrelle was recorded within 10 minutes after sunset at locations R2, R3, R4, R6, R8 and R9. The species was also recorded

within 10 minutes of sunrise at locations R3 and R6. It is therefore highly likely that there are roosts of this species within the vicinity of the study area.

Nathusius' Pipistrelle

3.2.21 Nathusius' pipistrelle was recorded at location R7 in July and R9 in April. A maximum of four passes were recorded at each location R9. The earliest passes were recorded 20-30 minutes after sunset (locations R7 and R9). The latest passes were recorded 75-90 minutes before sunrise. It is difficult to infer from this small number of recordings whether Nathusius' pipistrelle roosts are present in proximity to the scheme; however this cannot be ruled out based on the presence of the species within 30 minutes after sunset.



Graph 3: Mean bat activity indices for *Pipistrellus* species over the full monitoring period.

Long-eared species

3.2.22 Long-eared species, most likely brown long-eared bat, were recorded at all locations, with the exception of location R8. The highest level of activity was recorded at Location R1 with a mean of 1.6 bat passes (eq.) per night.

3.2.23 The earliest recordings of this species group were 20-30 minutes after sunset, which is earlier than the median emergence time for brown long-eared bat as given in Andrews & Pearson (2016). It is therefore likely that roosts are present within the vicinity of the study area.

Serotine

3.2.24 Serotine bat passes were recorded in the early part of the season. A single pass was recorded in April at location R9 and two passes were recorded in May at location R4. The passes were recorded more than two hours after sunset and more than four hours before sunrise. These timings do not indicate that there are roosts of this species within the vicinity of the study area.

4 Conclusions

4.1.1 The passive monitoring undertaken on the scheme provides an overview of the usage of the site by local bat populations.

4.1.2 It is likely that the lesser horseshoe, greater horseshoe and barbastelle bats recorded form part of the populations designated as features of the Pembrokeshire Bat Sites and Bosherton Lakes SAC, Limestone Coast of South West Wales SAC and North Pembrokeshire Woodlands SAC. These are therefore of International importance.

4.1.3 The assemblage of other species including pipistrelle, Myotis, long-eared, serotine and Nyctalus species is considered to be common and of local importance.

4.1.4 This report has been written as the result of survey effort undertaken in 2019. Changes in legislation, guidance, best practice, etc. may necessitate a re-assessment/survey. It is also advised that if there is a delay of over two years in undertaking the scheme, an update survey will be required.

4.1.5 A complete assessment of the impacts on designated sites, habitats and protected and notable species will be carried out for the scheme as part of an environmental impact assessment, the results of which will be presented in the Environmental Statement together with the mitigation and compensation measures proposed.

4.1.6 This report is produced solely for the benefit of Welsh Government and no liability is accepted for any reliance placed on it by any other party. This report is prepared for the proposed uses stated in the report and should not be used in a different context.

5 References

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- Dietz, & Kiefer. (2018). Bats of Britain and Europe.
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6 Figures

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 8.6: Dormouse Survey Report

A40PRC-ARP-EBD-SWI-RP-LE-0003

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Contents

1 Introduction

1.1.1 Ove Arup and Partners Ltd (Arup) was commissioned by the Welsh Government to undertake ecological surveys in relation to the A40 Penblewin to Redstone Cross Improvements.

1.1.2 At the time of the instruction there were three scheme options, one to the south of the existing A40 and two to the north. The two to the north shared the same central alignment but one had a staggered junction north of Redstone Cross and the other featured a T-Junction. The central alignments of these scheme options are shown in **Alternative Options Drawings** (ES Volume 3, Appendix 3.1)

1.1.3 This report sets out the methodology, results and conclusions of the dormouse *Muscardinus avellanarius*, survey carried out along these scheme options, north and south of the existing A40 during 2019.

1.2 Background

Conservation Status

1.2.1 At a European level, the dormouse is listed on Annex IV of the Habitats Directive 1992, which is translated into UK legislation as the Conservation of Habitats & Species Regulations 2017 (Habitats Regulations). Dormouse is listed on Schedule 2 of these regulations. It is also partially protected under Schedule 5 of the Wildlife & Countryside Act 1981 (added in 1988).

1.2.2 The dormouse is a Species of Conservation Concern in the UK. The national dormouse conservation plan aims to maintain dormice where they still exist, enhance populations where possible and reintroduce dormice to areas where they are now extinct. The National Dormouse Monitoring Programme (NDMP) was set up in 1990 by the People's Trust for Endangered Species (PTES) to monitor the UK dormouse population. The data collected from the NDMP has shown a steady decline in the counts of dormice since the mid-1990s with a rate of decline equivalent to a fall of 55% over 25 years[1].

1.2.3 Dormice are considered to be widespread across Wales, where they are found in all counties, except Anglesey[2]. The main threats to dormice in

[1] Wembridge D., Al-Fulaij N. and Langton S. (2016) The State of Britain's Dormice 2016. People's Trust for Endangered Species.
[2] Wales Mammal Biodiversity Action Forum (2013) Dormouse Action Plan for Wales.

Wales are habitat loss and degradation from agriculture, infrastructure development, loss of hedgerows and the demise of traditional woodland management practices including coppicing/pollarding.

1.2.4 Pembrokeshire Biodiversity Partnerships' Local Species Action Plan for dormouse[3] states populations of dormice have regularly been recorded in the woodlands and hedgerows of the Nevern and Gwaun valleys, Pengelli Forest in North Pembrokeshire and in the gardens of houses on the edge of Newport and Carningli. New populations of dormice have been discovered in South Pembrokeshire in recent years, although there is insufficient information at present to gauge how widespread they might be, or whether the population is increasing or decreasing[4]. Overall, dormice populations are considered 'data deficient' for Pembrokeshire.

A40 Llanddewi Velfrey to Penblewin Improvements

1.2.5 The A40 Penblewin to Redstone Cross Improvements is an extension to the A40 Llanddewi Velfrey to Penblewin Improvements for which an environmental statement was submitted to Welsh Government in July 2019[5]. Mott MacDonald Limited carried out dormouse nest tube surveys in the study area for the Llanddewi Velfrey to Penblewin Improvements in 2016 and confirmed the presence of dormice (Section 3.1).

1.3 Survey Area

1.3.1 Dormouse nest tubes were installed in suitable habitat within a 250m radius of the scheme options (Figure 1)

1.4 Survey Objectives

1.4.1 The main objective of the survey was to determine the presence or likely absence of dormice within the survey area. A second objective was to gain information on the usage of the survey area by dormice, i.e. which hedgerows, woodland blocks, or areas of scrub/transitional habitat were occupied by dormice.

[3] Pembrokeshire Biodiversity Partnership (2015) Species Action Plan: Dormouse.
[4] Pembrokeshire Biodiversity Partnership (2016) State of Wildlife in Pembrokeshire Update: April 2016.
[5] Welsh Government (2019) A40 Llanddewi Velfrey to Penblewin Improvements Environmental Statement Chapter 8 Nature Conservation. https://gov.wales/sites/default/files/publications/2019-08/a40-llanddewi-Velfrey-to-penblewin-environmental-statement-volume-1-july-2019.pdf

2 Methodology

2.1 Desk Study

2.1.1 Protected species records were obtained from the West Wales Biodiversity Record Centre (WWBRC), for the area within a 2km radius from the centrelines of the scheme options. The data search was carried out on 11th June 2019.

2.1.2 The survey results from the adjacent A40 Llanddewi Velfrey to Penblewin Improvements were also assessed.

2.2 Field Survey

2.2.1 A dormouse nest tube survey was carried out by Arup in 2019 to determine the presence or likely absence of dormice. The survey was undertaken in accordance with standard best practice survey methods as set out in The Dormouse Conservation Handbook[6].

2.2.2 Standard dormouse nest tubes, comprising a double-walled black plastic corrugated sheet, folded into a 5 x 5cm tube, 25cm long, with a small plywood tray insert were used. The tubes were tied firmly onto the underside of horizontal branches to mimic natural features such as hollow branches. Dormice utilise the tubes for daytime shelter during the summer months and will occasionally use them for breeding.

2.2.3 The nest tubes were placed at 20m intervals in suitable hedgerow habitat within 250m of the centrelines of the scheme options. Due to the narrow linear-shaped nature of the areas of woodland within the survey area (southern option only), the nest tubes were also placed in a line in the woodlands, approximately every 20m, where accessible.

2.2.4 A total of 454 nest tubes were installed in April 2019, and checked in May, June, July, August, September, October and November 2019. The surveys were carried out by suitably qualified ecologists from Arup or sub-consultants of Arup (June survey only). At least one Natural Resource Wales (NRW) dormouse licence holder or an accredited agent of such a licence was present for all the visits to check the tubes.

2.2.5 Dormice are sensitive to poor weather conditions. Their fur is very fine

[6] Bright P., Morris P. and Mitchell-Jones T. (2006) The Dormouse Conservation Handbook second edition. English Nature.

and susceptible to wetting-out from rain[7] consequently surveys are largely carried out in suitable and dry weather conditions. The dates and weather conditions for each survey visit are shown in Table 1.

[7] Bright P., Morris P. and Mitchell-Jones T. (2006) The Dormouse Conservation Handbook second edition. English Nature.

Table 1 Survey Dates and Weather Conditions.

Site visit	2019 Survey Dates	Weather Conditions
Tubes were installed on the following dates:	08, 09, 10, 11, 12, 16, 26 April	N/A
Check 1	22 to 23 May	Sunny, 9-15°C, Windspeed 1, 30-50% cloud
Check 2	25, 27 June, 02 July	Dry, 16-17°C, Windspeed 1-2, 80% to 100% cloud.
Check 3	23, 24, 25 July	Dry, sunny, 20°C.
Check 4	19, 20, 21 August	Dry, clear, sunny, 15-16°C.
Check 5	24, 25, 26 September	Scattered showers, 16-17°C, Windspeed 1-4, 50-100% cloud
Check 6	22, 23, 24 October	Scattered showers, 9-12°C, Windspeed 1, 50-100% cloud
Check 7 & removal of tubes	21 November 11, 12 December	Scattered showers, 8-9°C, Windspeed 2-4, 100% cloud

2.2.6 For each survey visit the following equipment was carried by the surveyors: a mirror or mobile phone (in camera mode) for looking into nest tubes situated deep in thorny hedgerows, spare nest tubes, spare wooden inserts for nest tubes, gardening wire, a sharpie/tippex (for marking nest tube ID number), a stuffer (gloves/thick socks) to stuff into the end of nest tubes in the event a nest is found, a large clear plastic sack for emptying the nest tube into when a nest is found, spring balance for weighing any dormice found and a small clear bag to place any dormice found inside for weighing purposes.

2.3 Limitations

2.3.1 The land use across the survey area is predominantly pasture grazed by cattle. On occasions it was assessed by surveyors to be unsafe to enter fields with cattle. Due to a health and safety incident, for the June and July survey visits there was a project rule against entering fields with cattle which meant some nest tubes could not be checked. In the month of October, the nest tubes along the northern options (except for the field north west of Redstone Cross) were not checked due to time constraints. This is not considered to affect the integrity of the survey for the northern options because the nest tubes were checked during the other six months. A summary of which nest tubes could not be checked due to presence of cattle or other reasons is provided in Table 2.

2.3.2 The weather conditions during the visits to check tubes in September, October and November were sub-optimal as there were scattered showers. To reduce the risk of finding dormouse nests during rainfall the surveyors checked nest tubes in areas of the scheme where no dormice had previously been found, leaving the areas where evidence had previously been recorded to check during dry spells. This limited the risk of disturbing dormice during inclement weather. If nests were found during rain/drizzle, these were not disturbed and were returned to during a dry spell to investigate the nest for evidence of dormice.

2.3.3 During the November survey, surveyors also needed to remove the nest tubes from the vegetation. The process therefore took a lot longer and a further visit in early December was required to finish the survey and collect in all the tubes. This is not considered to affect the integrity of the final survey visit, the purpose of which was to record any last evidence of dormouse presence as they start to leave the canopy and go into hibernation.

Table 2 Nest tubes which could not be checked due to presence of cattle or other reasons.

Visit	North / South of existing A40	Tubes/fields not checked	Location	Cattle / other reason
Check 1 May	All fields checked			
Check 2 June	South	489-536 (47 tubes)	Field south west of Penblewin roundabout.	Cattle
	South	564-610 (46 tubes)	Field south of Blackmoor Hill Farm)	Cattle
	South	616-638 (22 tubes)	Between Redstone Cross and Blackmoor Hill Farm	Cattle
	South	776-799 (4 tubes)	Field south east of Redstone Cross	Cattle
	North	57-60 (4 tubes)	Field north of Blackmoor Hill Farm	Cattle
	North	91-159 (68 tubes)	Field to east of The Old Farm House Redstone Cross.	Cattle
Check 3 July	South	489-529 (40 tubes)	Field south west of Penblewin roundabout.	Cattle
	South	574-579 (5 tubes)	Field south west of Penblewin roundabout.	Cattle
	South	616-618 (2 tubes)	Field west of Blackmoor Hill Farm cottages.	Cattle

Visit	North / South of existing A40	Tubes/fields not checked	Location	Cattle / other reason
	North	132-135 (4 tubes)	Field to east of The Old Farm House Redstone Cross.	Cattle
	North	160-193 (33 tubes)	Fields north of Redstone Farm	Cattle
Check 4 August	North	121-159 (38 tubes)	Field to east of The Old Farm House Redstone Cross.	Cattle
Check 5 September	North	142-149 (8 tubes)	Field to east of The Old Farm House Redstone Cross.	Cattle
	North	30-35 (6 tubes)	Field north of Blackmoor Hill Farm	Cattle
Check 6 October	North	1-193 (193 tubes)	Field north west of Penblewin roundabout	Whole of northern option not checked (except most westerly field 54/1) – due to time constraints.
	North		Fields north of Blackmoor Hill Farm	
	North		Fields north east of The Old Farm House Redstone Cross	
	North		Fields north of Redstone Farm	
Check 7 November/ December (& collection)	All fields checked			

3 Results

3.1 Desk Study

3.1.1 No records of dormice were returned with the WWBIC data search for the 2km radius search area. However, evidence of dormice was found during the surveys for the adjacent A40 Llanddewi Velfrey to Penblewin Improvements in 2016. Dormice nests were found within nest tubes in two locations. One in a hedgerow adjacent to the Caermaenau-Fawr B&B (at approximate National Grid Reference: SN12111685, 200m northeast of the existing Penblewin roundabout) and the other in Castell-Gwyndy Wood to the north of Bethel Chapel (at approximate National Grid Reference: SN15891717, 3.8km east of the existing Penblewin roundabout).

3.2 Field Survey

Habitat Descriptions

3.2.1 The Phase 1 Habitat survey identified suitable dormouse habitat across both southern and northern options in the form of lowland mixed deciduous woodland and associated scrub communities, as well as well-connected native species rich hedgerows which serve as the field boundaries across the survey area. Fruiting hazel *Corylus avellane,* was present in numerous locations.

3.2.2 The Phase 1 Habitat survey map and further information on the species present in the woodland, scrub and hedgerow habitats across the site are detailed within ES Chapter 8 Appendix 8.1 Extended Phase 1 Habitat Survey.

Nest Tube Checks

3.2.3 No dormice were recorded during the monthly visits, only dormouse nests. Dormouse nests were recorded in a total of 13 nest tube locations across the survey area. The nest tube numbers where dormouse nests were found are listed in Table 3 and are shown on Figure 2. If a dormouse nest was recorded it was carefully maintained in the tube, therefore the same nests may have been counted twice. Table 3 provides a total number of nests as well as the total number of tube locations both north and south of the existing A40.

3.2.4 Wood mouse *Apodemus sylvaticus,* were abundant across the survey area and in some instances they were occupying what were considered to be dormouse nests (shown in Table 3).

Table 3 Dormouse Survey Results.

Site visit	Dormouse Nests (& Tube No.) North of Existing A40	Photo reference	Dormouse Nests (& Tube No.) South of Existing A40	Photo reference
Check 1 May	None		None	
Check 2 June	None		None	
Check 3 July	205 - dormouse nest occupied by woodmouse	Photograph 1 a) & b)	None	
Check 4 August	None		None	
Check 5 September	15 28 205 222	Photograph 2 a) & b) Photograph 3 a) & b) Photograph 4 Photograph 5	496 509 510	Photograph 6 Photograph 7 a) & b) Photograph 8 a) & b)
Check 6 October	205 220 dormouse nest occupied by woodmousePhotograph 1	Photograph 9 Photograph 10	509 dormouse nest now occupied by 5 x woodmouse 510 757 782	Photograph 11 Photograph 12 a) & b) Photograph 13 a) & b) Photograph 14 a) & b)
Check 7 November / December	69 200 dormouse nest occupied by woodmouse	Photograph 15 Photograph 16	510 753 757	Photograph 17 Photograph 18 Photograph 19
Totals	9 dormouse nests recorded (7 tube locations)		10 dormouse nests recorded (6 tube locations)	

3.2.5 The following nest tubes were left in situ during the last November/December check due to the presence of dormouse nests and the concern the nests could still be active due to unseasonably mild weather: 69, 200, 510, 753 and 757. These will be collected in 2020.

4 Conclusions

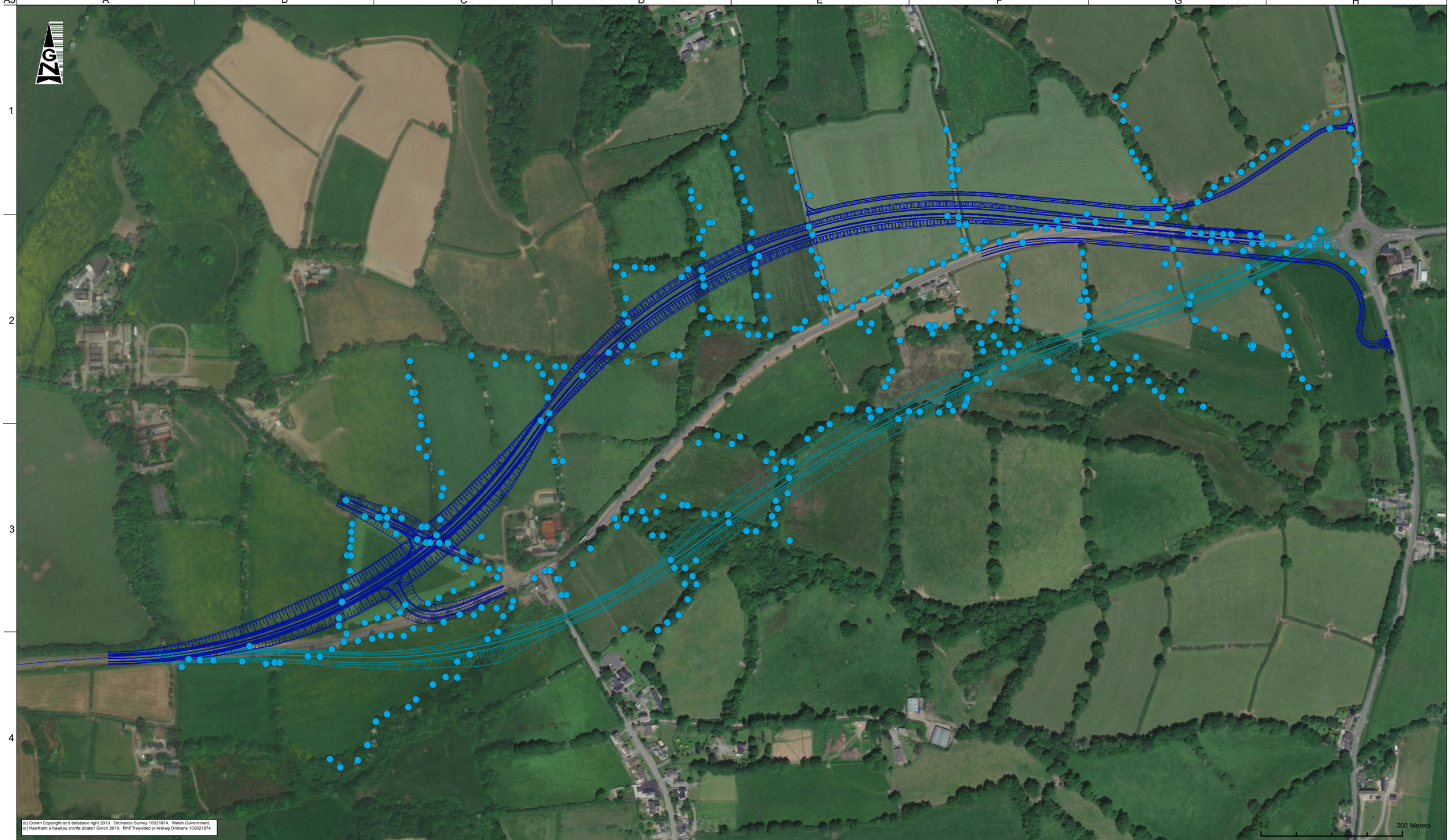
4.1.1 Dormouse nests were identified in a total of 13 nest tube locations across the survey area. No sightings of dormice were recorded throughout the seven checks. The results suggest a low population of dormice. The highest concentration of dormouse nests was found at the western end of the survey area (both north and south of the existing A40).

4.1.2 The lack of dormouse sightings is considered likely to be a result of the abundant wood mouse which out-compete with the dormice for nest sites.

5 Figures

A3 | A | B | C | D | E | F | G | H

1 | 2 | 3 | 4



LEGEND

- DORMOUSE TUBE LOCATIONS
- PROPOSED SCHEME (SOUTHERN OPTION)
- PROPOSED SCHEME (NORTHERN OPTIONS)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	16/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

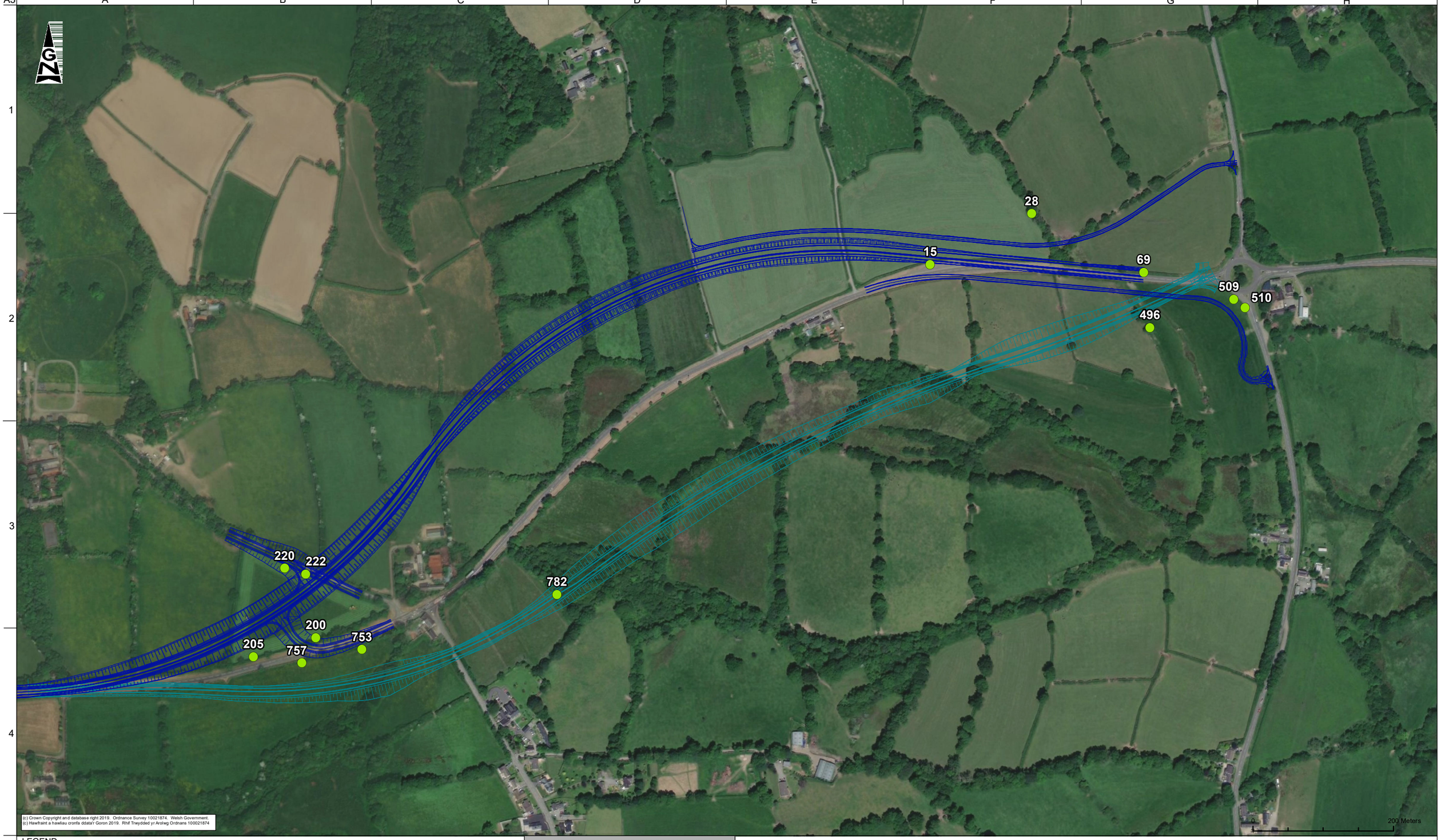
Drawing Title
FIGURE 1
DORMOUSE SURVEY LOCATION PLAN

Suitability
S3 | FIT FOR REVIEW AND COMMENT

Scale at A3
1:5,000

Rev	By	Chkd	Appd	Auth
P01	AC	CJ	PC	GD
	Date 16/01/20	Date 16/01/20	Date 16/01/20	Date 16/01/20

Name
A40PRC - ARP - EBD - SWI - DR - LE - 0010
Project | Originator | Volume | Location | Type | Role | Number



LEGEND

- DORMOUSE NEST
- PROPOSED SCHEME (NORTHERN OPTIONS)
- PROPOSED SCHEME (SOUTHERN OPTION)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None
Maintenance / Cleaning
None
Use
None
Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	16/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

Drawing Title
FIGURE 2
DORMOUSE SURVEY RESULTS

Suitability
S3 | FIT FOR REVIEW AND COMMENT

Scale at A3
1:5,000

Rev	By	Chkd	Appd	Auth
P01	AC	CJ	PC	GD
	Date 16/01/20	Date 16/01/20	Date 16/01/20	Date 16/01/20

Name
A40PRC - ARP - EBD - SWI - DR - LE - 0011
Project | Originator | Volume | Location | Type | Role | Number

6 Photographs

Photograph 1 a) &b) Dormouse nest in tube No.205, 23 July 2019 (occupied by wood mouse). Gps 51.811321, -4.748873

Photograph 2 a) & b) Dormouse nest in tube No.15, 25 September 2019. Nest contains polythene. Gps: 51.816713, -4.735139

Photograph 3 a) & b) Dormouse nest in tube No.28, 25 September 2019 Gps 51.817226, -4.732945

Photograph 4 Dormouse nest in tube No. 205, 24 September 2019. Gps: 51.811329, -4.748970

Photograph 5 Dormouse nest in tube No.222, 24 September 2019, Gps: 51.812399, -4.747793

Photograph 6 Dormouse nest in tube No.496, 25 September, Gps: 51.815994, -4.730582

Photograph 7 a) & b) Dormouse nest in nest tube 509, 25 September 2019. Gps: 51.816397, -4.728842

Photograph 8 a) & b) Dormouse nest in tube No. 510, 25 September 2019 Gps 51.816323, -4.728675

Photograph 9 Dormouse nest in tube No.205, 22 October Gps: 51.811278, -4.748872

Photograph 10 Dormouse nest now used by wood mouse tube No.220, 22 October. Gps: 51.812664, -4.748333

Photograph 11 Dormouse nest in tube No.509, 23 October 2019, now occupied by 5 x wood mice. Gps: 51.816397, -4.728842

Photograph 12 a) & b) Dormouse nest in tube No.510, 23 October 2019 Gps: 51.818842, -4.729025

Photograph 13 a) & b) Dormouse nest in tube No.757, 22 October 2019. Gps: 51.811247, -4.747193

Photograph 14 a) & b) Dormouse nest in tube No. 782 22 October 2019 Gps: 51.812686, -4.742866

Photograph 15 Dormouse nest in tube No.69, 12 December 2019. Gps 51.816810, -4.730539

Photograph 16 Dormouse nest possibly taken over by wood mouse, tube No.200, 21 November. Gps 51.811471, -4.747580

Photograph 17 Dormouse nest in tube No. 510, 12 December 2019 (left in situ) Gps: 51.816297, -4.728726

Photograph 18 Dormouse nest in tube No. 753, 12 December 2019 (left in situ) Gps: 51.812013, -4.745136

Photograph 19 Dormouse nest in tube No. 757, 12 December 2019 (left in situ) Gps: 51.810205, -4.748539.

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 8.7 Riparian Mammal Survey Report

A40PRC-ARP-EBD-SWI-RP-LE-0009

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Contents

1 Introduction

1.1.1 Ove Arup and Partners Ltd (Arup) was commissioned by Welsh Government to undertake ecological surveys in relation to the A40 Penblewin to Redstone Cross Improvements.

1.1.2 At the time of the instruction there were three scheme options, one to the south of the existing A40 and two to the north. The two to the north shared the same central alignment but one had a staggered junction north of Redstone Cross and the other featured a T-Junction. The central alignments of these scheme options are shown in Figure 1

1.1.3 This report sets out the methodology, results and conclusions of a reptile survey carried out in suitable habitat along these scheme options, north and south of the existing A40 during 2019.

1.2 Background

1.2.1 The presence of habitat suitable for reptiles was established during a Phase 1 Habitat Survey undertaken in July 2017. Common lizard Zootoca vivipara was also found at the western end of the adjacent A40 Llanddewi Velfry to Penblewin Improvements[1].

1.3 Survey Objectives

1.3.1 The main objective of the reptile survey was to determine the presence or likely absence of reptile species within the survey area. If present, further objectives would then be set to determine the distribution and likely population size class of reptile species within the survey area.

1.4 Legislation

1.4.1 All UK native reptile species (adder Vipera berus, grass snake Natrix helvetica, smooth snake Coronella austriaca, common lizard, slow-worm Anguis fragilis and sand lizard Lacerta agilis) are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) against deliberate or intentional killing, injuring and unlicensed trade.

[1] Welsh Government (2019) A40 Llanddewi Velfrey to Penblewin Improvements Environmental Statement Chapter 8 Nature Conservation. https://gov.wales/sites/default/files/publications/2019-08/a40-llanddewi-velfrey-to-penblewin-environmental-statement-volume-1-july-2019.pdf

This legislation applies to all life stages of these species.

1.4.2 The sand lizard Lacerta agilis and smooth snake Coronella austriaca receive additional legislation as a result of their status as European Protected Species (EPS) and are therefore fully protected under Schedule 2 of the Conservation of Habitats and Species Regulations 2017 (as amended). However, sand lizard and smooth snake are very restricted in their distribution and not expected to be found in the study area.

1.4.3 Slow-worm, sand lizard, common lizard, grass snake and adder are also listed as priority species of principle importance for the conservation of biodiversity in response to Section 7 of the Environment Act (Wales) 2016. This legislation places duties on public bodies in Wales to conserve and enhance biodiversity in the exercise of their functions, including the consideration of the resilience of ecosystems in terms of their diversity, connectivity, adaptability, scale and condition.

2 Methodology

2.1 Desk Study

2.1.1 A data search was obtained from the West Wales Biodiversity Information Centre (WWBIC)[2]on 11th June 2019. The data search included all historic records of protected and/or notable species including reptile species within a two-kilometre radius of the scheme and the northern option.

2.1.2 The previous Environmental Statement for the A40 Llanddewi Velfry to Penblewin Improvements1 was also reviewed for data relevant to reptiles.

2.2 Field Surveys

Survey Area

2.2.1 Field surveys were carried out within a 50m buffer of the centrelines of the scheme options. The survey area is shown on Figure 1.

Habitat Suitability Assessment

2.2.2 Areas of suitable reptile habitat were identified using information obtained from the initial Phase 1 Habitat survey undertaken in July 2017 and the surveys to update these results over spring and summer 2019, and from aerial photography.

2.2.3 Common reptile species including slow worm, common lizard and grass snake are found in habitats such as unimproved, thick, tussocky grassland, woodland edges and scrub. They particularly favour areas where there is a mosaic of different habitats and structures to provide them with a diversity of invertebrate prey, as well as suitable basking locations. Areas of more open habitat on banks with a south-facing aspect which get direct sunlight, provide suitable basking spots[3].

2.2.4 Fourteen areas were identified as having potential to support reptile populations, as shown on Figure 1. These predominantly included open grassy margins alongside hedgerow field boundaries and woodland

[2] https://www.wwbic.org.uk/ with data supplied 11th June 2019
[3] Edgar, P., Foster, J., and Baker., J. (2010) Reptile Habitat Management Handbook. Amphibian and Reptile Conservation, Bournemouth

edges.

Presence / Likely Absence Survey

2.2.5 A seven-visit reptile survey was carried out in accordance with standard best practice guidance[4]. The methodology involves the placement of artificial refugia within suitable reptile habitat. The refugia used comprised pieces of roofing felt measuring approximately 1m x 0.5m with a placement density of at least 10 refugia per hectare.

2.2.6 Tablet devices were used to record the position of refugia and to collect data during the seven survey visits in order to improve efficiency and mapping precision. A total of 220 refugia were installed on the 22nd and 27th August 2019. Deployment was completed at least six days prior to survey commencement, to allow the refugia to bed in and for any reptile populations to habituate to them. Seven visits were carried out in September 2019 by suitably qualified ecologists, with at least 48 hours between each visit. The refugia were collected in on the last visit on 26th September.

2.2.7 All survey visits were made in suitable weather conditions, within a temperature range of between 9°C and 18°C (weather conditions for each survey visit are provided in Appendix A). In addition, any pre-existing suitable artificial or natural refugia on site were also checked as part of the survey.

2.2.8 Each refugia was lifted carefully to search for any reptile species. If present, details of the reptile species, sex, age class and condition were recorded against the refugia number using the tablet devices. Additional signs of reptile presence such as sloughed skins were also recorded where evident and any live animals observed away from refugia were also recorded.

2.3 Limitations and Assumptions

2.3.1 The findings presented in this report represent those at the time of the surveys and reporting, and data collected from available sources.

2.3.2 There were no limitations with regard to the timing of the survey visits; all visits were spaced out through the month of September, one of the

[4] Froglife. (1999). Reptile Survey: An Introduction to Planning, Conducting and Interpreting Surveys for Snake and Lizard Conservation. Froglife Advice Sheet 10. Halesworth: Froglife.

optimal months for reptile survey when conditions are cooler for better chances of reptile detection4.

2.3.3 The refugia were removed from Areas 9 and 14 after the third visit due to disturbance by cattle within these fields. Given the lack of results in the first three visits in these areas, and the absence of reptiles in other areas of similar habitat it is considered that reptiles are also likely absent from Areas 9 and 14. Furthermore, the regular disturbance and poaching of the habitat by cattle further reduces the likelihood of reptiles being present.

2.3.4 Damage to mats by cows was also an issue elsewhere, particularly in Area 3 where approximately one third of the mats were damaged and had to be relocated, replaced or removed over the course of the seven visits.

2.3.5 Despite these limitations, the overall survey effort is considered to still be sufficient enough to be confident that the results reflect the presence / absence of the target reptile species within the study area.

3 Results

3.1 Desk Study

3.1.1 WWBIC provided four records of reptiles within two kilometres of the scheme options. A record of an adult female slow-worm was provided from 2018, located approximately 1.1km south of the southern Scheme option in a garden in Narberth town centre. The other three records, all from 2006, were provided at a one-kilometre grid square resolution only (overlapping with the eastern-most end of the Scheme options) but comprised records of slow-worm, grass snake and common lizard.

3.1.2 A population of common lizard was recorded within the western areas of the adjacent A40 Llanddewi Velfry to Penblewin Improvement1, although only in relatively small numbers with a maximum count of three individuals including juveniles.

3.2 Field Surveys

Habitat Suitability Assessment

3.2.1 The habitat suitability assessment identified fourteen areas of suitable reptile habitat, in which to carry out the seven-visit presence / absence survey. These are described in Table 1. Fields apparently regularly used for cattle grazing were avoided where possible.

Table 1 Habitat descriptions of survey areas

Area	Description	NGR
1	Poor semi-improved grassland along the hedgerow field boundaries. This field is only occasionally grazed by cattle.	SN 10663 16174
2	South-facing poor semi-improved grassland field, along hedgerow field boundaries. Occasionally grazed by sheep.	SN 10773 16247
3	South-facing improved grassland field, along hedgerow and woodland edge field boundaries. Occasionally grazed by cattle.	SN 10691 16073
4	South-facing poor semi-improved grassland field, along hedgerow and woodland edge. Regularly and heavily grazed by cattle.	SN 10858 16089
5	South-facing poor semi-improved grassland field, along hedgerow. Occasionally grazed by sheep.	SN 10852 16315
6	Poor semi-improved un-grazed grassland, along hedgerow boundary.	SN 10941 16098
7	Marginal un-grazed grassland habitat between woodland edge and poor semi-improved field.	SN 11041 16169
8	Along a hedgerow and woodland edge which enclose a marshy grassland field. Occasionally grazed by cattle.	SN 11175 16247
9	Along a woodland edge within a marshy grassland field. Grazed by cattle.	SN 11290 16385
10	Grassy margin between a hedgerow and farm access track, undisturbed by cattle.	SN 11242 16675
11	Along a hedgerow bordering a south-facing, un-grazed improved grassland field.	SN 11613 16668
12	Along a woodland edge within a poor semi-improved grassland field. Occasionally grazed by sheep / cattle.	SN 11583 16507
13	Along hedgerow field boundaries enclosing south-facing, un-grazed improved and poor semi-improved grassland fields.	SN 11803 16676

Presence / Likely Absence Survey

3.2.2 No reptiles were found in any of the 14 survey areas on any of the reptile survey visits. The only animal recorded using the refugia during the survey was a common frog Rana temporaria in Area 14 under mat 16 on 5th September 2019.

3.2.3 During a visit to the survey area to install static bat detectors on 23rd April 2019 an ecologist sighted an adult female common lizard. The lizard was basking on the grass verge of a layby on the existing A40, adjacent to Area 13 at National Grid Reference: SN 11599 16662, see Photograph 1. Despite survey effort in this area in autumn 2019, no further observations were made.

4 Conclusions

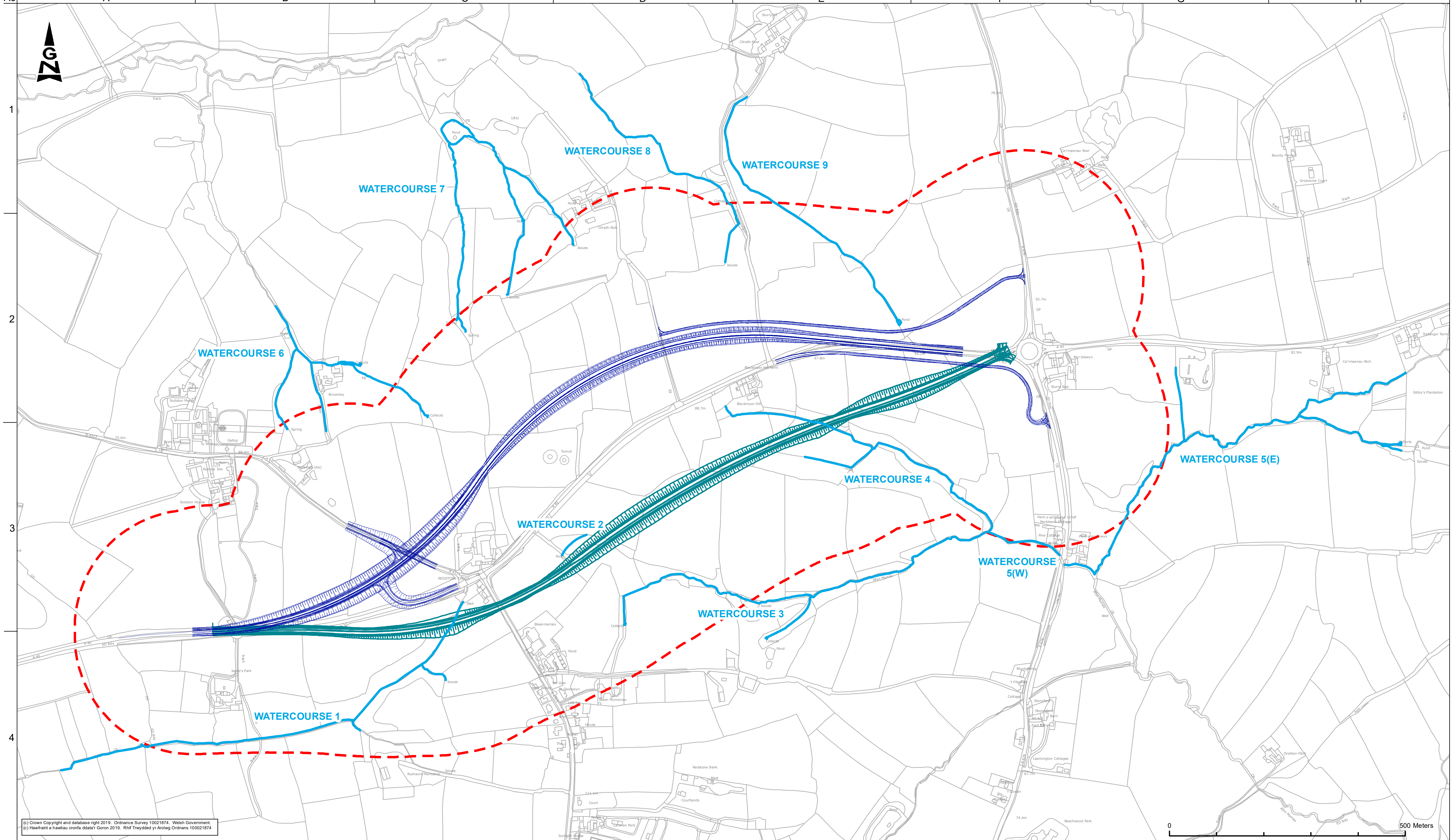
4.1.1 Despite the fact no reptiles were found during the presence / likely absence survey, the presence of common lizard in the general area has been confirmed through the incidental sighting in April and through the positive field survey records of this species to the east of the Penblewin roundabout during the baseline surveys of the adjacent land.

4.1.2 Due to the use of most of the survey area (within 50m of the centrelines of the route options) for cattle production, and the subsequent poaching of the majority of field boundaries and woodland edges, suitable reptile habitat was scarce and where present, was sub-optimal. This is likely to be the reason for the very low number of common lizards detected.

4.1.3 The WWBIC data search provided records of grass snake and slow worm within two kilometres of the scheme options. The extensive network of hedgerows and watercourses throughout this area of Pembrokeshire provides good connectivity for these other common reptile species and whilst they may only be present in low population densities their presence within the survey cannot be ruled out.

4.1.4 A complete assessment of the impacts on reptile species will be carried out for the scheme as part of an environmental impact assessment, the results of which will be presented in the Environmental Statement together with appropriate mitigation and compensation measures as required.

Figures



LEGEND

- 250 METRE BUFFER SURVEY AREA
- PROPOSED SCHEME (SOUTHERN OPTION)
- PROPOSED SCHEME (NORTHERN OPTIONS)
- WATERCOURSES SURVEYED

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction	None
Maintenance / Cleaning	None
Use	None
Decommissioning / Demolition	None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	16/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

ARCADIS
MOTT MACDONALD

Delivery Team
ARUP
RICHARDS MOOREHEAD & LAING LTD
PLANNING | LANDSCAPE | ENVIRONMENT

Drawing Title
FIGURE 1
RIPARIAN MAMMAL SURVEY LOCATIONS

Suitability
S3 | FIT FOR REVIEW AND COMMENT

Scale at A3
1:7,500

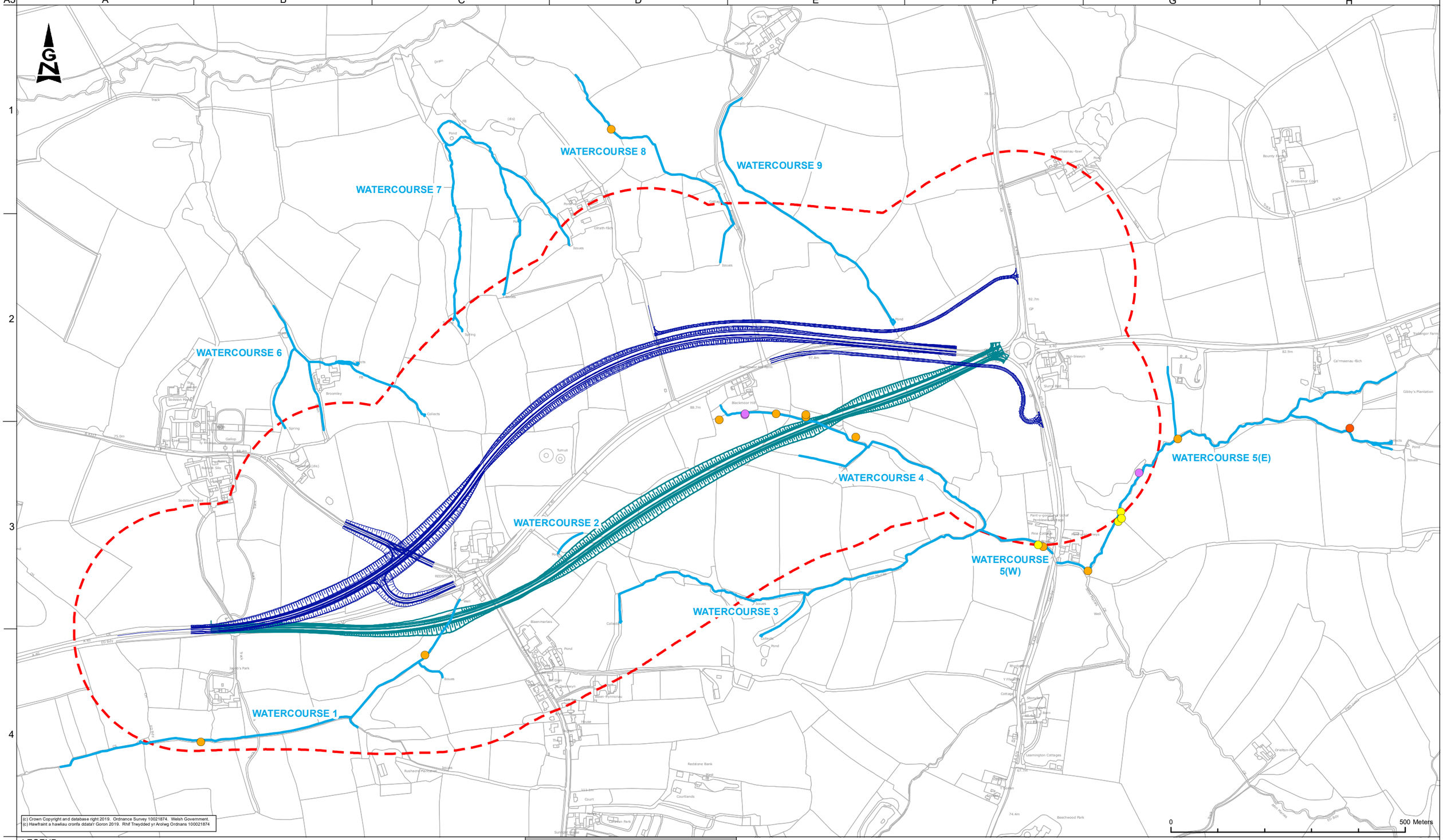
Rev	By	Chkd	Appd	Auth
P01	AC	CJ	PC	GD
Date	16/01/20	16/01/20	16/01/20	16/01/20

Name
A40PRC - ARP - EBD - SWI - DR - LE - 0014

Project | Originator | Volume | Location | Type | Role | Number

A3 | A | B | C | D | E | F | G | H

1 | 2 | 3 | 4



LEGEND

- 250 METRE BUFFER SURVEY AREA
- PROPOSED SCHEME (SOUTHERN OPTION)
- PROPOSED SCHEME (NORTHERN OPTIONS)
- WATERCOURSES SURVEYED

OTTER SIGNS

- HOLT
- LAY-UP
- SPRAINT (FRESH)
- SPRAINT (OLD)

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None
Maintenance / Cleaning
None
Use
None
Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	16/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS | MOTT MACDONALD | ARUP | RICHARDS

Drawing Title
FIGURE 2
RIPARIAN MAMMAL SURVEY RESULTS

Suitability
S3 | FIT FOR REVIEW AND COMMENT

Scale at A3 1:7,500

Rev	By	Chkd	Appd	Auth
P01	AC	CJ	PC	GD
	Date 16/01/20	Date 16/01/20	Date 16/01/20	Date 16/01/20

Name
A40PRC - ARP - EBD - SWI - DR - LE - 0015
Project | Originator | Volume | Location | Type | Role | Number

Photographs

Photograph 1 Adult female common lizard recorded on 23rd April 2019 in Area 13 (during bat static detector survey visit).

Appendix A Survey Timing and Weather Conditions

Survey Timing and Weather Conditions

Table A 1 Survey timings and weather conditions during the presence / likely absence surveys.

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
Area 1							
1	02 / 09 / 2019	14:27-14:44	18	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	13:49-14:07	16	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	10:29-10:45	14	3	NW	20%	Sunny
4	13 / 09 / 2019	10:56-11:15	16	3	NE	20%	Clouds and sun
5	19 / 09 / 2019	10:25-10:53	16	3	SE	5%	Sunny
6	23 / 09 / 2019	10:04-10:20	16	4	S	95%	Cloudy, wind increasing
7	26 / 09 / 2019	09:42-10:14	16	5	SW	50%	Sun / showers, paused work during rain
Area 2							
1	02 / 09 / 2019	14:44-14:55	18	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	14:09-14:15	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	10:45-10:47	14	3	NW	20%	Sunny
4	13 / 09 / 2019	11:27-11:40	16	3	NE	20%	Clouds and sun
5	19 / 09 / 2019	10:55-11:06	17	3	SE	5%	Sunny
6	23 / 09 / 2019	10:21-10:35	16	4	S	95%	Cloudy, wind increasing
7	26 / 09 / 2019	10:14-10:29	16	5	SW	50%	Cloudy
Area 3							
1	02 / 09 / 2019	13:36-14:07	15	4	SW	60%	Dry and cloudy

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
2	05 / 09 / 2019	12:00-12:11	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	15:04-15:05	16	3	W	20%	Sun and cloud
4	13 / 09 / 2019	10:34-10:44	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:35-13:37	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:53-09:53	16	4	S	95%	Cloudy
7	26 / 09 / 2019	13:16-13:18	17	4	SW	50%	Sunny
Area 4							
1	02 / 09 / 2019	13:23-13:34	15	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	11:47-11:57	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:51-15:02	17	2	W	20%	Sunny
4	13 / 09 / 2019	10:30-10:31	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:39-13:39	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:40-09:51	16	4	S	95%	Cloudy
7	26 / 09 / 2019	13:19-13:34	17	4	SW	50%	Sunny
Area 5							
1	02 / 09 / 2019	14:56-15:07	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	14:20-14:32	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	10:47-10:55	14	3	NW	20%	Sunny
4	13 / 09 / 2019	11:16-11:22	16	3	NE	20%	Cloudy and sun
5	19 / 09 / 2019	11:07-11:16	17	3	SE	5%	Sunny
6	23 / 09 / 2019	10:36-10:41	16	4	S	95%	Mostly cloudy, some sun. Increasing wind
7	26 / 09 / 2019	10:32-10:41	16	5	SW	50%	Sunny

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
Area 6							
1	02 / 09 / 2019	12:18-12:25	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:36-11:39	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:34-14:44	17	2	W	20%	Sunny
4	13 / 09 / 2019	10:21-10:25	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:25-13:30	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:33-09:37	16	4	S	95%	Cloudy
7	26 / 09 / 2019	13:02-13:09	17	4	SW	50%	Sunny
Area 7							
1	02 / 09 / 2019	12:16-12:18	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:33-11:35	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:29-14:34	17	2	W	20%	Cloudy
4	13 / 09 / 2019	10:16-10:20	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:20-13:24	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:29-09:32	16	4	S	95%	Cloudy
7	26 / 09 / 2019	12:57-13:01	16	4	SW	50%	Sunny
Area 8							
1	02 / 09 / 2019	12:03-12:10	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:19-11:28	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:13-14:23	17	2	W	20%	Sun and cloud
4	13 / 09 / 2019	10:02-10:10	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:07-13:17	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:19-09:24	16	4	S	95%	Hazy clouds, getting brighter

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
7	26 / 09 / 2019	12:43-12:54	16	4	SW	50%	Cloudy
Area 9							
1	02 / 09 / 2019	11:41-11:53	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:00-11:03	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	13:57-14:11	17	2	W	20%	Sun and cloud
Mats removed from Area 10 during third visit due to cattle							
Area 10							
1	02 / 09 / 2019	15:19-15:20	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	14:42-14:45	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	11:08-11:12	15	3	NW	20%	Cloudy
4	13 / 09 / 2019	11:44-11:46	16	3	NE	20%	Sunny
5	19 / 09 / 2019	11:24-11:27	17	3	SE	5%	Sunny
6	23 / 09 / 2019	10:50-10:51	16	4	S	95%	Mostly cloudy but some sun. Increasing wind
7	26 / 09 / 2019	10:48-10:53	16	5	SW	50%	Sunny
Area 11							
1	02 / 09 / 2019	15:35-15:40	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	14:54-15:00	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	11:18-11:28	15	3	NW	20%	Sunny
4	13 / 09 / 2019	11:58-12:10	17	3	NE	20%	Sunny
5	19 / 09 / 2019	11:36-11:43	17	3	SE	5%	Sunny
6	23 / 09 / 2019	11:01-11:08	16	4	S	95%	Mostly cloudy but some sun. Increasing wind
7	26 / 09 / 2019	11:05-11:14	16	4	SW	50%	Sunny
Area 12							

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
1	02 / 09 / 2019	11:17-11:19	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	13:38-13:40	16	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	13:43-13:50	16	3	NW	20%	Cloudy
4	13 / 09 / 2019	09:36-09:39	13	2	N	20%	Sun but trees shading
5	19 / 09 / 2019	12:45-12:51	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:09-09:11	16	4	S	95%	Cloudy, after short rain
7	26 / 09 / 2019	14:02-14:06	16	4	SW	50%	Sun / showers, paused work during rain
Area 13							
1	02 / 09 / 2019	15:57-16:14	18	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	15:14-15:29	17	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	11:42-12:00	15	3	NW	20%	Sunny
4	13 / 09 / 2019	12:20-12:40	17	3	NE	20%	Sunny
5	19 / 09 / 2019	12:18-12:34	18	3	SE	5%	Sunny
6	23 / 09 / 2019	11:21-11:35	16	4	S	95%	Cloudy and windy
7	26 / 09 / 2019	11:26-11:47	16	4	SW	50%	Sunny
Area 14							
1	02 / 09 / 2019	10:38-10:50	16	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	10:24-10:48	14	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	13:11-13:16	16	3	NW	20%	Sunny
Mats removed from Area 16 during third visit due to cattle							

A40 Penblewin to Redstone Cross Improvements

OVE ARUP & PARTNERS LTD

Breeding Bird Survey; 2019

Final

VERSION 3

15 October 2019

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Contents

Figures

Executive Summary

BiOME Consulting Ltd was commissioned by Ove Arup & Partners Ltd in April 2019 to complete a breeding bird survey including barn owl *Tyto alba* survey and associated reporting, in relation to the proposed upgrade of a section of the A40 between Penblewin and Redstone Cross. At the time of the surveys, two route alignments were under consideration (the northern and southern route alignments).

Field surveys broadly followed the territory mapping of Common Bird Census (CBC) methodology albeit with a reduced number of visits (three). Territory maps of legally protected species/species of conservation concern were compiled at the conclusion of the CBC surveys.

A dedicated barn owl survey was completed, which included all areas within 250m of the proposed northern and southern route alignments. This survey involved the identification and inspection of buildings/structures and trees to identify the presence/likely absence of breeding/roosting barn owls, and the assessment of habitat suitability for foraging barn owl.

Within the northern alignment CBC survey area territories of five species of conservation concern were identified; with territories of seven species of conservation concern within the southern alignment survey area. No territories of Schedule 1 species were present within either the northern or southern alignment survey areas.

No signs of barn owl presence were identified within any building/structure within the survey area during the dedicated survey and no trees with the potential to support breeding barn owl were identified. However, suitable foraging habitat was present on either side of both potential route alignments at a number of locations, along with potential commuting routes. A live barn owl was observed along with a dead (potentially the same) barn owl which was very likely a result of vehicle collision, during other surveys to inform the proposed scheme. Consequently, mitigation measures will need to be employed to minimise the risk of barn owl mortality associated with the chosen alignment.

1. Introduction

BiOME Consulting Ltd was commissioned by Ove Arup & Partners Ltd in April 2019 to complete a breeding bird survey, including barn owl *Tyto alba* survey and associated reporting, in relation to the proposed upgrade of section of the A40 between Penblewin and Redstone Cross (**Figure 1**).

At the time of the surveys, two route alignments were under consideration (the northern and southern route alignments). This report presents results in relation to both options.

Nomenclature within this report follows the British (English) vernacular name within the British Ornithologists' Union British list[1].

1 BOU (2015). *The British List; The official list of bird species recorded in Britain* [online] available at: https://www.bou.org.uk/british-list/category-a-b-c-species/

2. Methodology

2.1. Breeding Bird Survey

2.1.1. Common Bird Census Survey

Field surveys broadly followed the 'territory mapping' or Common Bird Census (CBC) methodology[2,3] albeit with a reduced number of visits (three). CBC territory mapping is the most accurate practical way to determine the numbers and distribution of breeding birds where a high level of detail is required. Essentially, the method involves mapping all birds seen or heard during walkover visits to the site, paying particular attention to behaviour which indicates breeding (e.g. singing or carrying nesting material or food). By combining the results of all visits, it is possible to determine the species present on the site and derive an indication of the numbers of breeding territories within the survey area.

Two transect routes were determined (**Figures 2.1** and **2.2**) with the objective of encompassing a range of habitats, with a focus on those habitats with the greatest potential to support species of conservation concern and/or legally protected species. For this project this included field boundaries, marshy grassland, woodland, waterbodies and scrub. The total length of the northern transect route was 3.6km and the southern transect route was 3.2km. Three approximately evenly-spaced survey visits were completed between April and mid-June 2019.

Surveys, which included areas within ca.50m of the northern (**Figure 2.1**) and southern (**Figure 2.2**) potential alignments, commenced within one hour after sunrise and were completed by noon. The start point of surveys was alternated between visits to ensure all parts of the survey area received adequate coverage during peak periods of bird activity. The surveyor followed the pre-defined transect route and logged all bird observations on field maps using standard BTO coding, paying particular attention to behaviour which indicated breeding. However, observations of birds outside the survey area were also logged when seen.

2 Bibby, C.J., Hill, D.A., Burgess, N.D. and Mustoe, S. (2000) *Bird Census Techniques*. 2nd Edition. Academic Press: London

3 Marchant, J. H. (1983) *BTO Common Birds Census Instructions*. BTO, Tring.

2.1.2. Territory Mapping

Species observed within suitable breeding habitat were considered to represent breeding birds if a nest, eggs or young were located, if they were observed displaying or singing, if adults were observed carry food/faecal sacks or were observed in territory disputes. In addition, birds recorded in the same location on at least two visits were also considered to represent breeding birds.

Territory mapping was completed in relation to the following species, henceforth referred to as 'Target Species'.

- Species included on the Red and Amber lists of Birds of Conservation Concern in Wales (BoCCW) [3, 4].
- The Environment (Wales) Act 2016 Section 7 Priority Species (S7PS).
- Schedule 1 species, of the Wildlife and Countryside Act 1981 (as amended).

2.2. Barn Owl Surveys

A barn owl survey adhering to the methodology described within Shawyer (2011)[5] was completed.

The objectives of this survey were to:

- Document barn owl presence/likely absence.
- If present, determine barn owl distribution and abundance.
- Identify potential road traffic accidence 'blackspots'.

To achieve these objectives, the surveys outlined below were completed.

Surveys included all areas within 250m of the proposed northern (**Figure 2.1**) and southern (**Figure 2.2**) route alignments.

4 Pritchard, R. (ed.). (2016). Birds in Wales. Birds of Conservation Concern in Wales 3: the population status of birds in Wales

5 Shawyer, C.R (2011). Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment. Developing Best Practice in Survey and Reporting. IEEM, Winchester.

2.2.1. Field Survey

A walkover survey was completed during daylight to identify features of potential value to barn owls. Prior to the completion of this survey aerial imagery and OS maps were reviewed.

Features identified as of potential value to barn owls were inspected in detail to determine if they offer a Potential Nest Site (PNS) for barn owls.

PNS typically include:

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

During surveys of the above PNS, Active Roost Sites (ARS) were also recorded. An ARS is defined as a feature within which breeding does not occur, but where a bird is seen or heard regularly or its current or recent presence (within the last 12 months) can be recognised by signs of thick, chalky-white, streaky droppings, usually accompanied by pellets and moulted feathers.

All habitats within the survey area was assessed to determine which, on the basis of their appearance and structure, offered Potential Foraging or Commuting

Habitat (PFH). Barn owls can utilise a variety of different habitat types, but the majority of prime foraging habitat in mainland Britain is provided by fields of rough-grassland and young plantations, and in particular by rough-grassland corridors along watercourses, roadsides, arable field margins, woodland edge and occasionally along woodland rides.

All habitats within the survey area were allocated to one of the categories detailed within **Table 1**.

Table 1. Defining potential foraging or commuting habitat for barn owls[5]

Habitat Type	Habitat Quality	Description
1	Optimal	Optimum habitat for field voles *Microtus agrestis* (for breeding, foraging and shelter) and are of the highest value to barn owls. Usually permanent, unimproved or semi-improved grassland, rank and heterogeneous in appearance, often of mixed height, with fully or partly collapsed dead grass stems (straw) often dominating the leaf sward. The grassland possesses a high abundance of raised tussocks per unit area (typically 4-40 m-2) coupled with a compacted basal litter layer or 'thatch' of straw, at least 30 mm deep. Usually receive no real management or anything other than periodic light grazing by farm animals. Long-term set-aside grassland and unmanaged fields, wasteland, ditches, riverbanks, field margins and road verges are the most common examples of this habitat type. When viewed in the wider landscape, Type 1 Habitats can usually be recognised, particularly in the autumn, winter and early spring, by their golden or green/brown appearance.
2	Sub-optimal	Of intermediate and often transient value to barn owls. This type of improved or semi-improved grassland is characterised by having a homogeneous, more even-height sward, sometimes displaying some lush and emerging tussock structure but little sign of a litter layer or 'thatch'. It can sometimes constitute a mature clover/grass ley and usually receives some level of farm management such as occasional fertilization, annual topping or light grazing. When seen in the wider landscape Type 2 Habitats normally have a more uniform, dark green appearance, than Type 1 Habitats.
3	Poor	Type 3 Habitats offer very poor habitat for field voles and most other small mammals and as such are of low value to barn owls. These improved grasslands are characterised by having a homogeneous sward, which is often kept short throughout much of the year, no tussock structure and are devoid of any litter layer at their base. They are usually mown closely for hay or silage, heavily grazed by sheep, horses or cattle or used for public amenity. They normally display a uniform bright green appearance when viewed in the wider landscape. Acid grasslands and those overgrown with scrub which can restrict barn owls from hunting, also fall into this habitat category.

Habitat Type	Habitat Quality	Description
Other	Little or no value	Non-grassland habitats, such as arable fields and mature woodland are generally of little or no value as a permanent foraging resource to barn owls. Arable fields containing cereals, rapeseed, or other food crops do not provide suitable habitat for field voles, although at certain times of the year, such as during harvest, they can, for short periods, expose wood mice *Apodemus sylvaticus* and temporarily attract barn owls. Prior to harvest, however, arable crops are largely impenetrable to foraging barn owls because of the stiff nature of the crop and high density of planting. For the purpose of the survey, arable fields without grass margins and woodlands (except those possessing wide grass rides or young plantations) are, therefore, considered unsuitable.

2.2.2. Defining a Road Traffic Accident Blackspot (TAB)

For linear projects, the bisection of prime foraging habitat (optimal and sub-optimal (**Table 1**)) by a newly proposed major route will predispose this location as a future traffic accident 'blackspot' for barn owls. Following the completion of field surveys, the potential presence of TABs was assessed.

2.2.3. Incidental Observations

A variety of other ecological surveys have been completed in relation to the proposed development. Surveyors logged all sighting of barn owl during these surveys, details of which are provided within this report.

2.3. Surveyors

CBC surveys were undertaken by Martyn Owen MCIEEM, Adam Cross ACIEEM and Stuart Thomas MCIEEM, all of whom are experienced consultant ornithologists.

Barn owl surveys were completed by Martyn Owen and Stuart Thomas; both hold Natural Resources Wales Schedule 1 survey licences in relation to barn owl.

2.4. Survey Details

Detail in relation to survey dates and weather are provided within **Table 2** and **Table 3**.

Table 2. CBC survey details

Survey Visit	Date	Lead Surveyor	Weather
Northern Alignment			
1	25/04/2019	Martyn Owen	Temp (°C): 10-11 Cloud cover (octets): 6-8 Wind (Beaufort)/Direction: 1-2 S Precipitation: Inf. light showers
2	14/05/2019	Adam Cross	Temp (°C): 9 Cloud cover (octets): 0/8 Wind (Beaufort)/Direction: 1 W Precipitation: Nil
3	20/06/2019	Martyn Owen	Temp (°C): 11-15 Cloud cover (octets): 3-6 Wind (Beaufort)/Direction: 0-1 W Precipitation: Nil
Southern Alignment			
1	26/04/2019	Stuart Thomas	Temp (°C): 9 Cloud cover (octets): 7 Wind (Beaufort)/Direction: 1 S Precipitation: Nil
2	15/05/2019	Adam Cross	Temp (°C): 9 Cloud cover (octets): 0/8 Wind (Beaufort)/Direction: 1 E Precipitation: E
3	19/06/2019	Martyn Owen	Temp (°C): 10-14 Cloud cover (octets): 3-4 Wind (Beaufort)/Direction: 1 W Precipitation: Nil

Table 3 Barn owl survey details

Survey Visit	Date	Surveyors	Weather
Northern & Southern Alignment			
1	05/08/2019	Martyn Owen / Stuart Thomas	Temp (°C): 19-21 Cloud cover (octets): 6-8 Wind (Beaufort): 2-3 SW Precipitation: Nil
2	06/08/2019	Martyn Owen / Stuart Thomas	Temp (°C): 18-20 Cloud cover (octets): 3-8 Wind (Beaufort): 3-4 SW Precipitation: Inf. light showers
3	07/08/2019	Martyn Owen / Stuart Thomas	Temp (°C): 19-24 Cloud cover (octets): 3-8 Wind (Beaufort): 2-3 W Precipitation: Nil

2.5. Limitations

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

The breeding bird transect routes did not include the entirety of all potential breeding bird habitat on site, given the size of the site and the uniform nature of much of the survey area. The number of breeding bird territories reported on site may therefore be an under-estimation. No attempt has been made to extrapolate the number of territories present outside of the transect survey area, given the number of variables associated with breeding, e.g. territory size and habitat quality. However, the transect route is likely to provide a fair representation of the bird population within the survey area.

Three CBC survey visits were completed. Whilst this does not conform to the requirements of a full CBC survey (eight-ten visits), it is deemed adequate in this instance to provide an appropriate indication of the breeding bird assemblage and numbers of pairs within the survey area.

During territory mapping, birds recorded in the same location on at least two visits were considered to represent breeding birds. Including birds recorded only on one date would have likely led to the overestimation of breeding numbers due to the potential inclusion of passage migrants. This may have led to some pairs which did breed being excluded during territory mapping, although such instances would likely be rare, and not compromise the overall conclusions of this report.

The locations of territories on **Figure 3** should be viewed as approximate, with the locations shown indicating a location within the territory of a breeding pair, rather than a nest location.

Complete access to all buildings with the potential to support barn owls within the survey area was achieved with the exception of one derelict cottage at Location 2 (**Figure 4.1/4.2**), which was considered unsafe. The wider farm complex contained numerous buildings with potential to support barn owls, although no evidence of presence was encountered. The external inspection of the derelict cottage did not identify any signs, and it was also possible to assess some of the interior from doorways/windows. Given the absence of barn owl signs in the wider farm complex and around the cottage exterior/viewable interior, it is considered unlikely that barn owl used this building in any way.

3. Results

3.1. Common Bird Census Surveys

The CBC results are presented below, separately for the northern and southern route alignments.

3.1.1. Northern Alignment

Within the northern alignment transect survey area territories of five Target Species were identified. Details are provided within **Table 4** and territory locations are shown on **Figure 3.1**.

Table 4. Northern alignment breeding bird survey results – Target Species

Species	Status	Number of Territories
Long-tailed tit *Aegithalos caudatus*	BoCCW Amber	2
Willow warbler *Phylloscopus trochilus*	BoCCW Red	1
Whitethroat *Sylvia communis*	BoCCW Red S7PS	1
Song thrush *Turdus philomelos*	S7PS	4
Linnet *Linaria cannabina*	S7PS	2

Table 5 provides a summary of the non-breeding Target Species and all other species observed across the survey period during surveys of the northern alignment.

Table 5. Northern alignment breeding bird survey results – non-breeding Target Species and other species

Species	Comments
Red kite *Milvus milvus*	Logged in flight over the survey area
Buzzard *Buteo buteo*	Confirmed breeder
Lesser black-backed gull *Larus fuscus*	Logged in flight over the survey area
Herring gull *Larus argentatus*	Logged in flight over the survey area
Woodpigeon *Columba palumbus*	Confirmed breeder
Collared dove *Streptopelia decaocto*	Confirmed breeder
Magpie *Pica pica*	Confirmed breeder
Jackdaw *Corvus monedula*	Confirmed breeder
Rook *Corvus frugilegus*	Confirmed breeder

Species	Comments
Carrion crow *Corvus corone*	Confirmed breeder
Blue tit *Cyanistes caeruleus*	Confirmed breeder
Great tit *Parus major*	Confirmed breeder
Swallow *Hirundo rustica*	Confirmed breeder
Chiffchaff *Phylloscopus collybita*	Confirmed breeder
Blackcap *Sylvia atricapilla*	Confirmed breeder
Wren *Troglodytes troglodytes*	Confirmed breeder
Blackbird *Turdus merula*	Confirmed breeder
Mistle thrush *Turdus viscivorus*	Logged in flight over the survey area
Robin *Erithacus rubecula*	Confirmed breeder
Grey wagtail *Motacilla cinerea*	Logged in flight over the survey area
Chaffinch *Fringilla coelebs*	Confirmed breeder
Bullfinch *Pyrrhula pyrrhula*	Observed on a single occasion (one bird)
Goldfinch *Carduelis carduelis*	Confirmed breeder

3.1.2. Southern Alignment

Within the southern alignment transect survey area territories of seven Target Species were identified. Details are provided within **Table 6** and territory locations are shown on **Figure 3.2**.

Table 6. Southern alignment breeding bird survey results – Target Species

Species	Status	Number of Territories
Long-tailed tit	BoCCW Amber	1
Goldcrest *Regulus regulus*	BoCCW Amber	1
Willow warbler	BoCCW Red	4
Song thrush	S7PS	6
Spotted flycatcher *Muscicapa striata*	BoCCW Red S7PS	1
House sparrow *Passer domesticus*	BoCCW Amber S7PS	3
Greenfinch *Chloris chloris*	BoCCW Amber	1

Table 7 provides a summary of the non-breeding Target Species and all other species observed across the survey period during surveys of the northern alignment.

Table 7. Southern alignment breeding bird survey results – non-breeding Target Species and other species

Species	Comments
Sparrowhawk *Accipiter nisus*	Logged in flight on 19/06/2019
Buzzard	Logged in flight over the survey area
Lesser black-backed gull	Logged in flight over the survey area
Herring gull	Logged in flight over the survey area
Feral Pigeon Columba livia	Logged in flight over the survey area
Woodpigeon	Probable breeder
Great spotted woodpecker *Dendrocopos major*	Possible breeder
Magpie	Possible breeder
Jay *Garrulus glandarius*	Logged in flight over the survey area
Jackdaw	Possible breeder
Rook	Confirmed breeder
Carrion crow	Foraging within fields and in flight. No evidence of breeding within survey area.
Raven *Corvus corax*	Logged in flight over the survey area
Blue tit	Confirmed breeder
Great tit	Confirmed breeder
Swallow	Logged in flight over the survey area
House martin *Delichon urbicum*	Logged in flight over the survey area
Chiffchaff	Confirmed breeder
Blackcap	Confirmed breeder
Nuthatch *Sitta europaea*	Confirmed breeder
Treecreeper *Certhia familiaris*	Probable breeder
Wren	Confirmed breeder
Blackbird	Confirmed breeder
Robin	Confirmed breeder
Chaffinch	Confirmed breeder
Goldfinch	Logged in flight over the survey area

3.2. Barn Owl Surveys

3.2.1. Buildings/Structures

Eleven buildings/structures were identified within the survey area (**Figures 4.1** (northern alignment) and **4.2** (southern alignment)), details of which are provided within **Table 8**. No evidence of barn owl was identified.

Table 8. Barn owl survey results – buildings/structures

Reference	Approx. Distance/Direction from Northern Alignment (Figure 4.1)	Approx. Distance/Direction from Northern Alignment (Figure 4.2)	Notes	Status
1	230m/N	(>250m/N)	Two-storey old stone barn used for donkeys/storage on ground floor and storage on 1st floor. No current potential barn owl access to 1st floor. Access to ground floor; no signs of occupancy. Also, single storey open-fronted shed used for storage. Anecdotally (landowner *pers comm.*), barn owl present three years ago in barn (breeding status unknown).	PNS. No signs of occupancy.
2	20m/W	20m/W	Farm seemingly largely not currently operational. Complex comprised large tin shed, two storey hay barn, cow sheds (stone), derelict cottage (immediately adjacent to A40). Unable to internally inspect derelict cottage due to health and safety concerns (see **Section 2.5**), although it was possible to make some observations through windows/doors. No signs.	PNS. No signs of occupancy.
3	220m/S	(>250m/S)	No buildings offering potential barn owl nesting/roosting opportunities.	No PNS

Reference	Approx. Distance/Direction from Northern Alignment (Figure 4.1)	Approx. Distance/Direction from Northern Alignment (Figure 4.2)	Notes	Status
4	230m/N	(>250m/N)	Single storey shed with wooden walls and tin roof.	PNS. No signs of occupancy.
5	70m/S	120m/N	Residential property with numerous outbuildings. Resident owns a barn owl and has seen wild barn owl near property in past, though not for over six months. High disturbance levels.	No PNS
6	50m/S	200m/N	Single storey, small (c.8m x 4m) tin shed, with potential barn owl access above door and potential nest site within diesel tank.	PNS. No signs of occupancy.
7	150m/S	130m/S	Small farm with two outbuildings. A modern brick shed and a tin barn with hay bales inside.	PNS. No signs of occupancy.
8	240m/N	(>250m/N)	Small stable complex, including horse stables and sheds for hay storage (open fronted). All sheds of modern construction and subject to high levels of disturbance.	PNS. No signs of occupancy.

Reference	Approx. Distance/Direction from Northern Alignment (Figure 4.1)	Approx. Distance/Direction from Northern Alignment (Figure 4.2)	Notes	Status
9	200m/N	200m/N	Large farm complex which is largely outside survey area.	No PNS
10	240m/N	(>250m/N)	No buildings offering barn owl potential.	No PNS
11	30m/S	50m/N	Numerous outbuildings/barns with barn owl access and potential nest sites.	PNS. No signs of occupancy.
12	(>250m/S)	30m/S	No buildings offering barn owl potential.	No PNS

3.2.2. Trees

All trees within the northern and southern alignment survey areas were assessed to determine the presence/absence of PNS. No trees offering PNS were identified and no evidence of barn owl was encountered.

3.2.3. Potential Foraging/Commuting Habitat

Potential Foraging or Commuting Habitat was mapped, the results of this survey are shown on **Figure 4.1** (northern alignment) and **4.2** (southern alignment) and summarised in **Table 9**.

Table 9. Barn owl survey results – PFH assessment

Habitat Type	Area within Northern Alignment Survey Area	Area within Northern Alignment Survey Area
Optimal	10.94Ha	14.08Ha
Sub-optimal	28.21Ha	21.68Ha
Poor	84.82Ha	62.81Ha

3.2.4. Road Traffic Accident Blackspots

As illustrated on **Figures 4.1/4.2** suitable foraging habitat was present immediately on either side of both potential route alignments at a number of locations. Furthermore, mature hedgerows were present which could offer commuting routes from suitable foraging habitat further distant from the proposed routes for barn owl between foraging areas.

3.2.5. Incidental Observations

A dead barn owl was found on the southern verge of the A40, 190m east of Redstone Cross junction at a point where two gateways lie on opposite sides of the existing road during a survey visit on 3 July 2019 (barn owl sighting 1, **Figures 4.1/4.2)**. Taking into account the location of discovery, this was very likely a victim of vehicle collision.

A barn owl was present during afternoon within fields to the north of Redstone Cross during a survey visit in June (barn owl sighting 2, **Figures 4.1/4.2)**.

3.2.6. Conclusions

No signs of barn owl were present within any building within the survey area and no trees with the potential to support breeding barn owl were identified. However,

suitable foraging habitat was present on either side of both potential route alignments at a number of locations (**Figures 4.1** and **4.2**), along with potential commuting routes. A live barn owl was observed along with a dead (potentially the same) barn owl which was very likely a result of vehicle collision.

Consequently, mitigation measures will need to be employed to minimise the risk of barn owl mortality associated with the chosen alignment.

4. Summary

A breeding bird survey, including barn owl survey, in relation to the proposed upgrade of section of the A40 between Penblewin and Redstone Cross was completed during summer 2019. At the time of the surveys, two route alignments were under consideration (the northern and southern route alignments).

Field surveys broadly followed the territory mapping of CBC methodology albeit with a reduced number of visits (three). Territory maps were compiled at the conclusion of the CBC surveys.

The dedicated barn owl survey included all areas within 250m of the proposed northern and southern route alignments. This survey involved the identification and inspection of buildings/structures and trees to identify the presence/likely absence of breeding/roosting barn owls, and the assessment of habitat suitability for foraging barn owl.

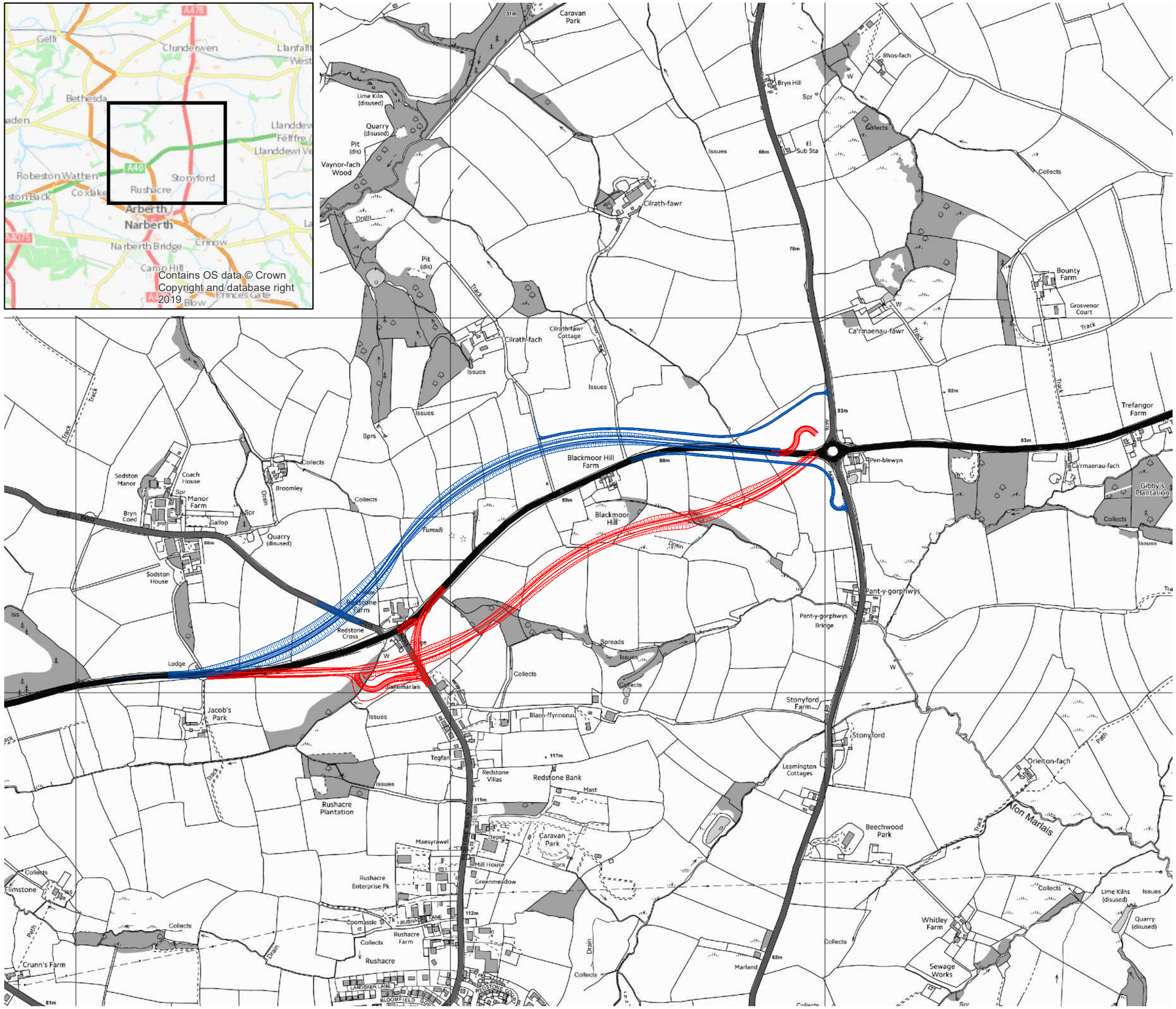
Within the northern alignment CBC survey area territories of five species of conservation concern were identified; long-tailed tit (two), willow warbler (one), whitethroat (one), song thrush (four) and linnet (two).

Within the southern alignment CBC survey area seven territories of species of conservation concern were identified; long-tailed tit (one), goldcrest (one), willow warbler (four), song thrush (six), spotted flycatcher (one), house sparrow (three) and greenfinch (one).

No territories of any Schedule 1 species were present within either the northern or southern alignment survey areas.

No signs of barn owl were present within any building/structure within the survey area and no trees with the potential to support breeding barn owl were identified. However, suitable foraging habitat was present on either side of both potential route alignments at a number of locations (**Figures 4.1/4.2**), along with potential commuting routes. A live barn owl was observed along with a dead (potentially the same) barn owl (**Figures 4.1/4.2)** which was very likely a result of vehicle collision. Consequently, mitigation measures will need to be employed to minimise the risk of barn owl mortality associated with the chosen alignment.

Figures



A40 Penblewin to Redstone Cross Improvements

Fig 1: Breeding Bird Survey Report: 2019
Site Location

Key

- Proposed Alignment (Northern
- Proposed Alignment (Southern

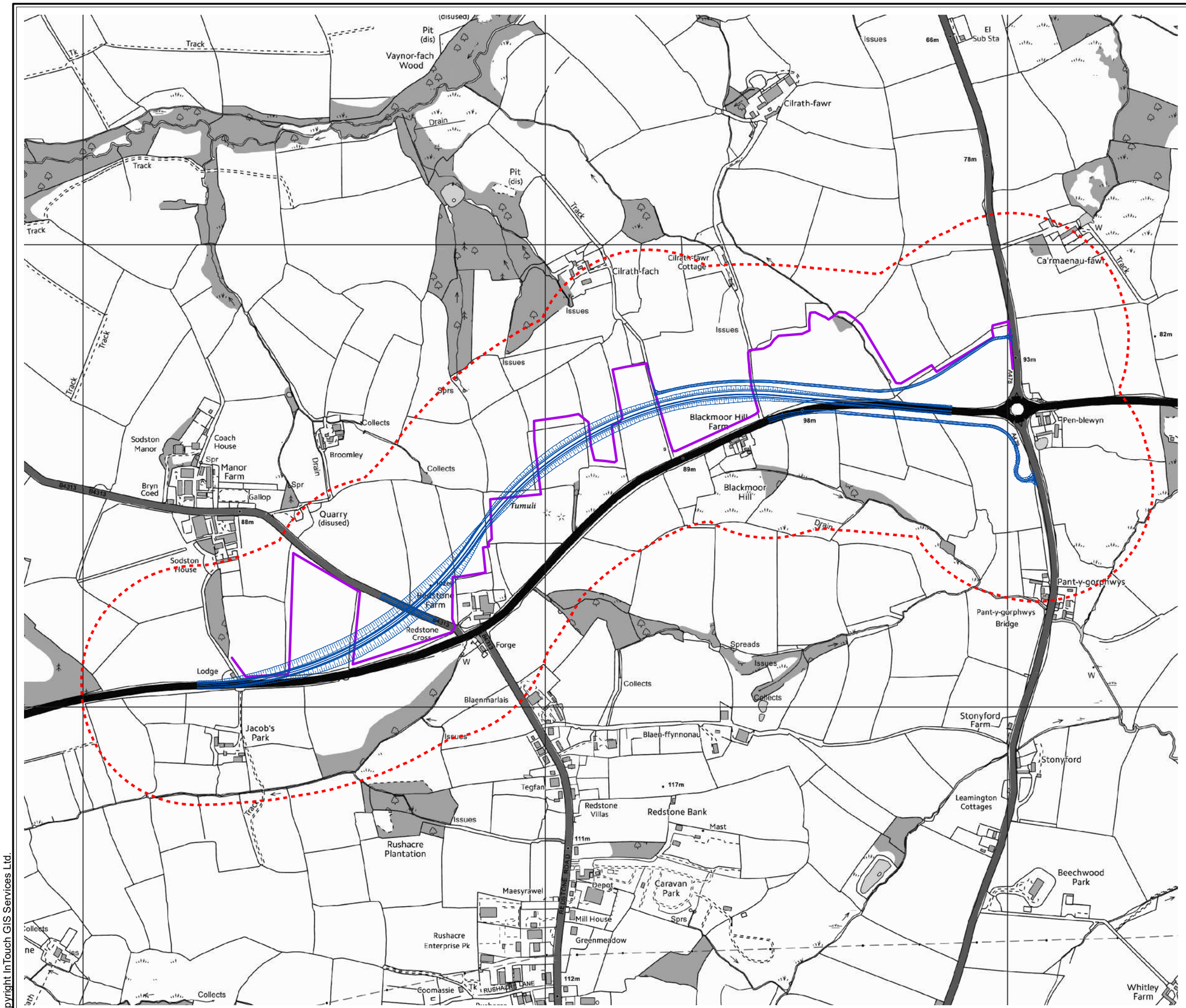
N

Kilometres
0 0.1 0.2 0.3 0.4 0.5

ARUP

SCALE 1:10,000 @ A3	*PROJECT CODE*
CONTENT MO	*DRAWN* JG
CHECKED RM	*DATE* 04/11/2019

BiOME CONSULTING



A40 Penblewin to Redstone Cross Improvements

Fig 2.1: Breeding Bird Survey Report: 2019 Breeding Bird Survey Transect Route And Barn Owl Survey Area - Northern Alignment

Key

- Proposed Alignment (Northern
- Breeding Bird Transect Route - Northern Alignment
- 250m buffer - Barn Owl Survey

N

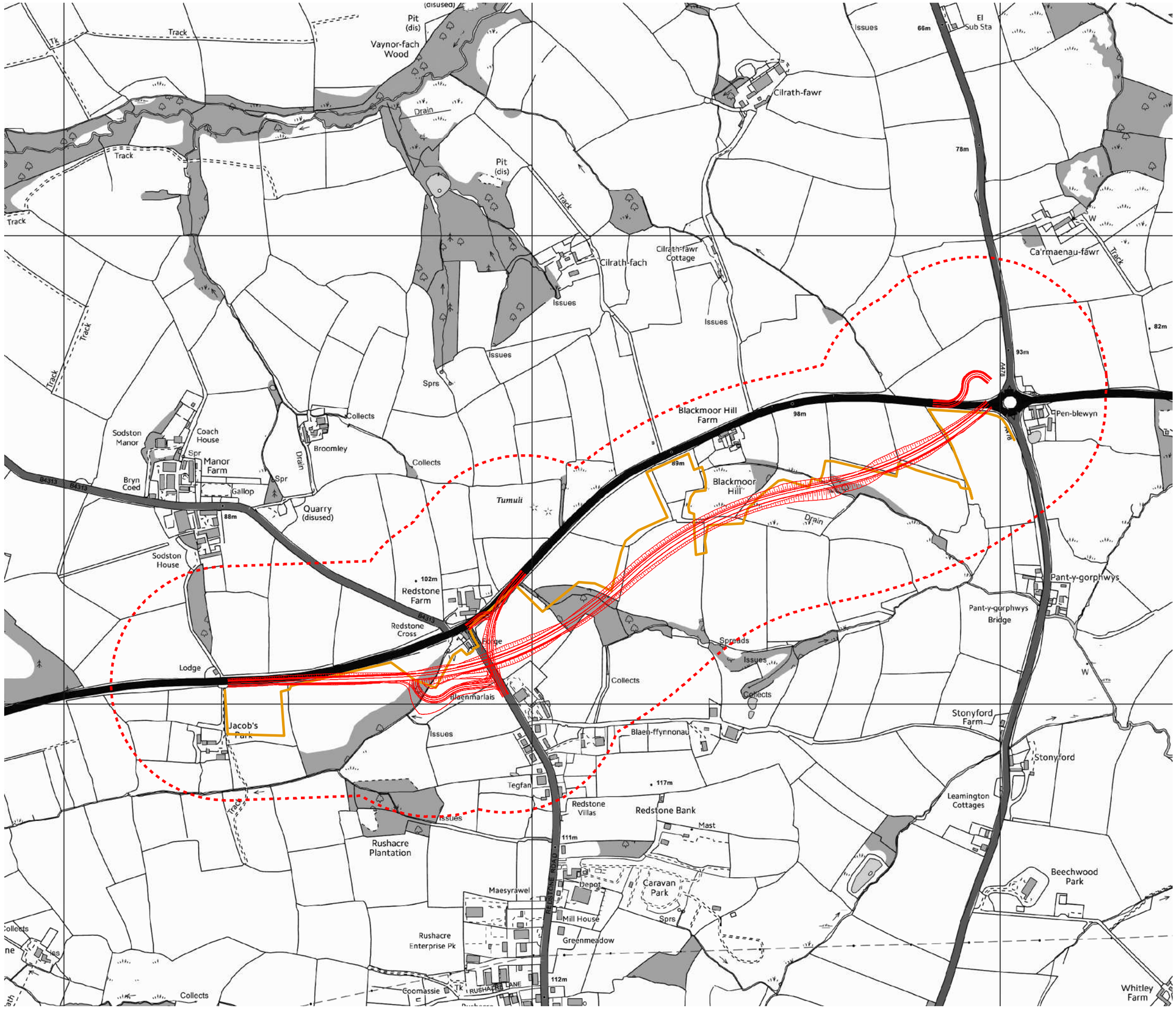
Kilometres

0 0.1 0.2 0.3 0.4 0.5

ARUP

SCALE 1:8,000 @ A3	*PROJECT CODE*
CONTENT MO	*DRAWN* JG
CHECKED RM	*DATE* 04/11/2019

BiOME CONSULTING



A40 Penblewin to Redstone Cross Improvements

Fig 2.2: Breeding Bird Survey Report: 2019 Breeding Bird Survey Transect Route And Barn Owl Survey Area - Southern Alignment

Key

- Proposed Alignment (Southern
- Breeding Bird Transect Route - Southern Alignment
- 250m buffer - Barn Owl Survey

N

Kilometres

0 0.1 0.2 0.3 0.4 0.5

ARUP

SCALE 1:8,000 @ A3	*PROJECT CODE*
CONTENT MO	*DRAWN* JG
CHECKED RM	*DATE* 04/11/2019

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A40 Penblewin to Redstone Cross Improvements

Fig 3.1: Breeding Bird Survey Report: 2019 Breeding Bird Territory Map - Northern Alignment

Key

Birds of Conservation Concern (Wales)

- Red List
- Amber List
- Environment (Wales) Act 2016; Section 7 Species
- Proposed Alignment (Northern
- Northern Transect Route

N

Kilometres

0 0.1 0.2 0.3 0.4 0.5

ARUP

SCALE 1:8,000 @ A3	*PROJECT CODE*
CONTENT MO	*DRAWN* JG
CHECKED RM	*DATE* 05/11/2019

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A40 Penblewin to Redstone Cross Improvements

Fig 3.2: Breeding Bird Survey Report: 2019 Breeding Bird Territory Map - Southern Alignment

Key

Birds of Conservation Concern (Wales)

- Red List
- Amber List
- Environment (Wales) Act 2016; Section 7 Species
- Proposed Alignment (Southern
- Southern Transect Route

N

Kilometres

0 0.1 0.2 0.3 0.4 0.5

ARUP

SCALE 1:8,000 @ A3	*PROJECT CODE*
CONTENT MO	*DRAWN* JG
CHECKED RM	*DATE* 04/11/2019

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A40 Penblewin to Redstone Cross Improvements

Fig 4.1: Breeding Bird Survey Report: 2019 Barn Owl Survey Results - Northern Alignment

Key

- Barn Owl Sightings

Buildings (Potential Nest Sites)

- Potential Nest Site
- No Potential

Barn Owl Habitats

- Optimal Foraging Habitat
- Sub-optimal Foraging Habitat
- Poor Foraging Habitat
- Proposed Alignment (Northern
- 250m buffer - Barn Owl Survey

N

Kilometres

0 0.1 0.2 0.3 0.4 0.5

ARUP

SCALE 1:8,000 @ A3	*PROJECT CODE*
CONTENT MO	*DRAWN* JG
CHECKED RM	*DATE* 04/11/2019

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A40 Penblewin to Redstone Cross Improvements

Fig 4.2: Breeding Bird Survey Report: 2019 Barn Owl Survey Results - Southern Alignment

Key

- Barn Owl Sightings

Buildings (Potential Nest Sites)

- Potential Nest Site
- No Potential

Barn Owl Habitats

- Optimal Foraging Habitat
- Sub-optimal Foraging Habitat
- Poor Foraging Habitat
- Proposed Alignment (Southern
- 250m buffer - Barn Owl Survey

N

Kilometres

0 0.1 0.2 0.3 0.4 0.5

ARUP

SCALE 1:8,000 @ A3	*PROJECT CODE*
CONTENT MO	*DRAWN* JG
CHECKED RM	*DATE* 04/11/2019

BiOME CONSULTING

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 8.9 Reptile Survey Report

A40PRC-ARP-EBD-SWI-RP-LE-0006

P01 | S3

30/01/20

Contents

Tables

Photographs

1 Introduction

1.1.1 Ove Arup and Partners Ltd (Arup) was commissioned by Welsh Government to undertake ecological surveys in relation to the A40 Penblewin to Redstone Cross Improvements.

1.1.2 At the time of the instruction there were three scheme options, one to the south of the existing A40 and two to the north. The two to the north shared the same central alignment but one had a staggered junction north of Redstone Cross and the other featured a T-Junction. The central alignments of these scheme options are shown in Figure 1 below.

1.1.3 This report sets out the methodology, results and conclusions of a reptile survey carried out in suitable habitat along these scheme options north and south of the existing A40 during 2019.

1.2 Background

1.2.1 The presence of habitat suitable for reptiles was established during a Phase 1 Habitat Survey undertaken in July 2017. Common lizard Zootoca vivipara was also found at the western end of the adjacent A40 Llanddewi Velfry to Penblewin Improvements[1].

1.3 Survey Objectives

1.3.1 The main objective of the reptile survey was to determine the presence or likely absence of reptile species within the survey area. If present, further objectives would then be set to determine the distribution and likely population size class of reptile species within the survey area.

1.4 Legislation

1.4.1 All UK native reptile species (adder Vipera berus, grass snake Natrix helvetica, smooth snake Coronella austriaca, common lizard, slow-worm Anguis fragilis and sand lizard Lacerta agilis) are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) against deliberate or intentional killing, injuring and unlicensed trade.

[1] Welsh Government (2019) A40 Llanddewi Velfrey to Penblewin Improvements Environmental Statement Chapter 8 Nature Conservation. https://gov.wales/sites/default/files/publications/2019-08/a40-llanddewi-velfrey-to-penblewin-environmental-statement-volume-1-july-2019.pdf

This legislation applies to all life stages of these species.

1.4.2 The sand lizard Lacerta agilis and smooth snake Coronella austriaca receive additional legislation as a result of their status as European Protected Species (EPS) and are therefore fully protected under Schedule 2 of the Conservation of Habitats and Species Regulations 2017 (as amended). However, sand lizard and smooth snake are very restricted in their distribution and not expected to be found in the study area.

1.4.3 Slow-worm, sand lizard, common lizard, grass snake and adder are also listed as priority species of principle importance for the conservation of biodiversity in response to Section 7 of the Environment Act (Wales) 2016. This legislation places duties on public bodies in Wales to conserve and enhance biodiversity in the exercise of their functions, including the consideration of the resilience of ecosystems in terms of their diversity, connectivity, adaptability, scale and condition.

2 Methodology

2.1 Desk Study

2.1.1 A data search was obtained from the West Wales Biodiversity Information Centre (WWBIC)[2]on 11th June 2019. The data search included all historic records of protected and/or notable species including reptile species within a two-kilometre radius of the scheme and the northern option.

2.1.2 The previous Environmental Statement for the A40 Llanddewi Velfry to Penblewin Improvements1 was also reviewed for data relevant to reptiles.

2.2 Field Surveys

Survey Area

2.2.1 Field surveys were carried out within a 50m buffer of the centrelines of the scheme options. The survey area is shown on Figure 1.

Habitat Suitability Assessment

2.2.2 Areas of suitable reptile habitat were identified using information obtained from the initial Phase 1 Habitat survey undertaken in July 2017 and the surveys to update these results over spring and summer 2019, and from aerial photography.

2.2.3 Common reptile species including slow worm, common lizard and grass snake are found in habitats such as unimproved, thick, tussocky grassland, woodland edges and scrub. They particularly favour areas where there is a mosaic of different habitats and structures to provide them with a diversity of invertebrate prey, as well as suitable basking locations. Areas of more open habitat on banks with a south-facing aspect which get direct sunlight, provide suitable basking spots[3].

2.2.4 Fourteen areas were identified as having potential to support reptile populations, as shown on Figure 1. These predominantly included open grassy margins alongside hedgerow field boundaries and woodland

[2] https://www.wwbic.org.uk/ with data supplied 11th June 2019
[3] Edgar, P., Foster, J., and Baker., J. (2010) Reptile Habitat Management Handbook. Amphibian and Reptile Conservation, Bournemouth

edges.

Presence / Likely Absence Survey

2.2.5 A seven-visit reptile survey was carried out in accordance with standard best practice guidance[4]. The methodology involves the placement of artificial refugia within suitable reptile habitat. The refugia used comprised pieces of roofing felt measuring approximately 1m x 0.5m with a placement density of at least 10 refugia per hectare.

2.2.6 Tablet devices were used to record the position of refugia and to collect data during the seven survey visits in order to improve efficiency and mapping precision. A total of 220 refugia were installed on the 22nd and 27th August 2019. Deployment was completed at least six days prior to survey commencement, to allow the refugia to bed in and for any reptile populations to habituate to them. Seven visits were carried out in September 2019 by suitably qualified ecologists, with at least 48 hours between each visit. The refugia were collected in on the last visit on 26th September.

2.2.7 All survey visits were made in suitable weather conditions, within a temperature range of between 9°C and 18°C (weather conditions for each survey visit are provided in Appendix A). In addition, any pre-existing suitable artificial or natural refugia on site were also checked as part of the survey.

2.2.8 Each refugia was lifted carefully to search for any reptile species. If present, details of the reptile species, sex, age class and condition were recorded against the refugia number using the tablet devices. Additional signs of reptile presence such as sloughed skins were also recorded where evident and any live animals observed away from refugia were also recorded.

2.3 Limitations and Assumptions

2.3.1 The findings presented in this report represent those at the time of the surveys and reporting, and data collected from available sources.

2.3.2 There were no limitations with regard to the timing of the survey visits; all visits were spaced out through the month of September, one of the

[4] Froglife. (1999). Reptile Survey: An Introduction to Planning, Conducting and Interpreting Surveys for Snake and Lizard Conservation. Froglife Advice Sheet 10. Halesworth: Froglife.

optimal months for reptile survey when conditions are cooler for better chances of reptile detection4.

2.3.3 The refugia were removed from Areas 9 and 14 after the third visit due to disturbance by cattle within these fields. Given the lack of results in the first three visits in these areas, and the absence of reptiles in other areas of similar habitat it is considered that reptiles are also likely absent from Areas 9 and 14. Furthermore, the regular disturbance and poaching of the habitat by cattle further reduces the likelihood of reptiles being present.

2.3.4 Damage to mats by cows was also an issue elsewhere, particularly in Area 3 where approximately one third of the mats were damaged and had to be relocated, replaced or removed over the course of the seven visits.

2.3.5 Despite these limitations, the overall survey effort is considered to still be sufficient enough to be confident that the results reflect the presence / absence of the target reptile species within the study area.

3 Results

3.1 Desk Study

3.1.1 WWBIC provided four records of reptiles within two kilometres of the scheme options. A record of an adult female slow-worm was provided from 2018, located approximately 1.1km south of the southern Scheme option in a garden in Narberth town centre. The other three records, all from 2006, were provided at a one-kilometre grid square resolution only (overlapping with the eastern-most end of the Scheme options) but comprised records of slow-worm, grass snake and common lizard.

3.1.2 A population of common lizard was recorded within the western areas of the adjacent A40 Llanddewi Velfry to Penblewin Improvement1, although only in relatively small numbers with a maximum count of three individuals including juveniles.

3.2 Field Surveys

Habitat Suitability Assessment

3.2.1 The habitat suitability assessment identified fourteen areas of suitable reptile habitat, in which to carry out the seven-visit presence / absence survey. These are described in Table 1. Fields apparently regularly used for cattle grazing were avoided where possible.

Table 1 Habitat descriptions of survey areas

Area	Description	NGR
1	Poor semi-improved grassland along the hedgerow field boundaries. This field is only occasionally grazed by cattle.	SN 10663 16174
2	South-facing poor semi-improved grassland field, along hedgerow field boundaries. Occasionally grazed by sheep.	SN 10773 16247
3	South-facing improved grassland field, along hedgerow and woodland edge field boundaries. Occasionally grazed by cattle.	SN 10691 16073
4	South-facing poor semi-improved grassland field, along hedgerow and woodland edge. Regularly and heavily grazed by cattle.	SN 10858 16089
5	South-facing poor semi-improved grassland field, along hedgerow. Occasionally grazed by sheep.	SN 10852 16315
6	Poor semi-improved un-grazed grassland, along hedgerow boundary.	SN 10941 16098
7	Marginal un-grazed grassland habitat between woodland edge and poor semi-improved field.	SN 11041 16169
8	Along a hedgerow and woodland edge which enclose a marshy grassland field. Occasionally grazed by cattle.	SN 11175 16247
9	Along a woodland edge within a marshy grassland field. Grazed by cattle.	SN 11290 16385
10	Grassy margin between a hedgerow and farm access track, undisturbed by cattle.	SN 11242 16675
11	Along a hedgerow bordering a south-facing, un-grazed improved grassland field.	SN 11613 16668
12	Along a woodland edge within a poor semi-improved grassland field. Occasionally grazed by sheep / cattle.	SN 11583 16507
13	Along hedgerow field boundaries enclosing south-facing, un-grazed improved and poor semi-improved grassland fields.	SN 11803 16676

Presence / Likely Absence Survey

3.2.2 No reptiles were found in any of the 14 survey areas on any of the reptile survey visits. The only animal recorded using the refugia during the survey was a common frog Rana temporaria in Area 14 under mat 16 on 5th September 2019.

3.2.3 During a visit to the survey area to install static bat detectors on 23rd April 2019 an ecologist sighted an adult female common lizard. The lizard was basking on the grass verge of a layby on the existing A40, adjacent to Area 13 at National Grid Reference: SN 11599 16662, see Photograph 1. Despite survey effort in this area in autumn 2019, no further observations were made.

4 Conclusions

4.1.1 Despite the fact no reptiles were found during the presence / likely absence survey, the presence of common lizard in the general area has been confirmed through the incidental sighting in April and through the positive field survey records of this species to the east of the Penblewin roundabout during the baseline surveys of the adjacent scheme (see Photograph 1 below).

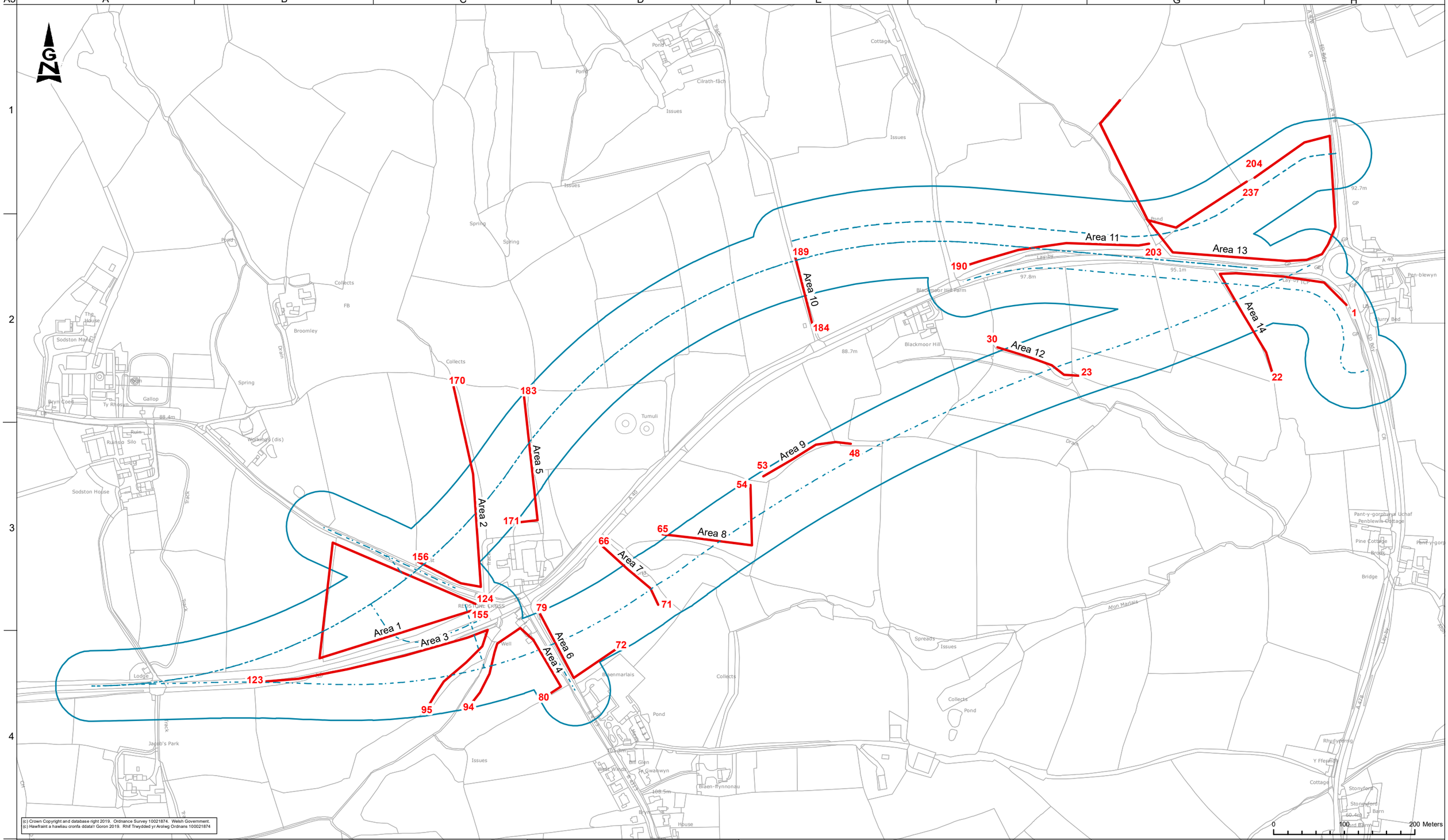
4.1.2 Due to the use of most of the survey area (within 50m of the centrelines of the route options) for cattle production, and the subsequent poaching of the majority of field boundaries and woodland edges, suitable reptile habitat was scarce and where present, was sub-optimal. This is likely to be the reason for the very low number of common lizards detected.

4.1.3 The WWBIC data search provided records of grass snake and slow worm within two kilometres of the scheme options. The extensive network of hedgerows and watercourses throughout this area of Pembrokeshire provides good connectivity for these other common reptile species and whilst they may only be present in low population densities their presence within the survey cannot be ruled out.

4.1.4 A complete assessment of the impacts on reptile species will be carried out for the scheme as part of an environmental impact assessment, the results of which will be presented in the Environmental Statement together with appropriate mitigation and compensation measures as required.

Figures

Figure 1 Reptile survey areas



LEGEND

- PROPOSED ROUTE CENTRELINES
- CENTRELINE 50 METRE BUFFER
- REPTILE SURVEY AREAS AND REFUGIA NUMBERS

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	17/01/20	FIRST ISSUE	AC	CJ	PC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS PARTNERSHIP LTD

Drawing Title
FIGURE 1
REPTILE SURVEY AREAS

Suitability
S3 | FIT FOR REVIEW AND COMMENT

Scale at A3
1:5,000

Rev	By	Chkd	Appd	Auth
P01	AC	CJ	PC	GD
	Date 17/01/20	Date 17/01/20	Date 17/01/20	Date 17/01/20

Name
A40PRC - ARP - EBD - SWI - DR - LE - 0001
Project | Originator | Volume | Location | Type | Role | Number

Photographs

Photograph 1 Adult female common lizard recorded on 23rd April 2019 in Area 13 (during bat static detector survey visit).

Appendix A Survey Timing and Weather Conditions

A1 Survey Timing and Weather Conditions

Survey timings and weather conditions during the presence / likely absence surveys.

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
Area 1							
1	02 / 09 / 2019	14:27-14:44	18	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	13:49-14:07	16	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	10:29-10:45	14	3	NW	20%	Sunny
4	13 / 09 / 2019	10:56-11:15	16	3	NE	20%	Clouds and sun
5	19 / 09 / 2019	10:25-10:53	16	3	SE	5%	Sunny
6	23 / 09 / 2019	10:04-10:20	16	4	S	95%	Cloudy, wind increasing
7	26 / 09 / 2019	09:42-10:14	16	5	SW	50%	Sun / showers, paused work during rain
Area 2							
1	02 / 09 / 2019	14:44-14:55	18	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	14:09-14:15	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	10:45-10:47	14	3	NW	20%	Sunny
4	13 / 09 / 2019	11:27-11:40	16	3	NE	20%	Clouds and sun
5	19 / 09 / 2019	10:55-11:06	17	3	SE	5%	Sunny
6	23 / 09 / 2019	10:21-10:35	16	4	S	95%	Cloudy, wind increasing
7	26 / 09 / 2019	10:14-10:29	16	5	SW	50%	Cloudy
Area 3							

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
1	02 / 09 / 2019	13:36-14:07	15	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	12:00-12:11	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	15:04-15:05	16	3	W	20%	Sun and cloud
4	13 / 09 / 2019	10:34-10:44	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:35-13:37	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:53-09:53	16	4	S	95%	Cloudy
7	26 / 09 / 2019	13:16-13:18	17	4	SW	50%	Sunny
Area 4							
1	02 / 09 / 2019	13:23-13:34	15	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	11:47-11:57	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:51-15:02	17	2	W	20%	Sunny
4	13 / 09 / 2019	10:30-10:31	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:39-13:39	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:40-09:51	16	4	S	95%	Cloudy
7	26 / 09 / 2019	13:19-13:34	17	4	SW	50%	Sunny
Area 5							
1	02 / 09 / 2019	14:56-15:07	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	14:20-14:32	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	10:47-10:55	14	3	NW	20%	Sunny
4	13 / 09 / 2019	11:16-11:22	16	3	NE	20%	Cloudy and sun
5	19 / 09 / 2019	11:07-11:16	17	3	SE	5%	Sunny
6	23 / 09 / 2019	10:36-10:41	16	4	S	95%	Mostly cloudy, some sun. Increasing wind

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
7	26 / 09 / 2019	10:32-10:41	16	5	SW	50%	Sunny
Area 6							
1	02 / 09 / 2019	12:18-12:25	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:36-11:39	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:34-14:44	17	2	W	20%	Sunny
4	13 / 09 / 2019	10:21-10:25	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:25-13:30	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:33-09:37	16	4	S	95%	Cloudy
7	26 / 09 / 2019	13:02-13:09	17	4	SW	50%	Sunny
Area 7							
1	02 / 09 / 2019	12:16-12:18	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:33-11:35	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:29-14:34	17	2	W	20%	Cloudy
4	13 / 09 / 2019	10:16-10:20	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:20-13:24	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:29-09:32	16	4	S	95%	Cloudy
7	26 / 09 / 2019	12:57-13:01	16	4	SW	50%	Sunny
Area 8							
1	02 / 09 / 2019	12:03-12:10	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:19-11:28	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	14:13-14:23	17	2	W	20%	Sun and cloud
4	13 / 09 / 2019	10:02-10:10	16	3	NE	20%	Sunny
5	19 / 09 / 2019	13:07-13:17	18	3	SE	5%	Sunny

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
6	23 / 09 / 2019	09:19-09:24	16	4	S	95%	Hazy clouds, getting brighter
7	26 / 09 / 2019	12:43-12:54	16	4	SW	50%	Cloudy
Area 9							
1	02 / 09 / 2019	11:41-11:53	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	11:00-11:03	15	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	13:57-14:11	17	2	W	20%	Sun and cloud
Mats removed from Area 10 during third visit due to cattle							
Area 10							
1	02 / 09 / 2019	15:19-15:20	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	14:42-14:45	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	11:08-11:12	15	3	NW	20%	Cloudy
4	13 / 09 / 2019	11:44-11:46	16	3	NE	20%	Sunny
5	19 / 09 / 2019	11:24-11:27	17	3	SE	5%	Sunny
6	23 / 09 / 2019	10:50-10:51	16	4	S	95%	Mostly cloudy but some sun. Increasing wind
7	26 / 09 / 2019	10:48-10:53	16	5	SW	50%	Sunny
Area 11							
1	02 / 09 / 2019	15:35-15:40	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	14:54-15:00	16	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	11:18-11:28	15	3	NW	20%	Sunny
4	13 / 09 / 2019	11:58-12:10	17	3	NE	20%	Sunny
5	19 / 09 / 2019	11:36-11:43	17	3	SE	5%	Sunny
6	23 / 09 / 2019	11:01-11:08	16	4	S	95%	Mostly cloudy but some sun. Increasing wind

Visit No.	Date	Time	Temp. (oC)	Wind		Avg. Cloud Cover	Conditions
				Speed (Beaufort)	Direction		
7	26 / 09 / 2019	11:05-11:14	16	4	SW	50%	Sunny
Area 12							
1	02 / 09 / 2019	11:17-11:19	17	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	13:38-13:40	16	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	13:43-13:50	16	3	NW	20%	Cloudy
4	13 / 09 / 2019	09:36-09:39	13	2	N	20%	Sun but trees shading
5	19 / 09 / 2019	12:45-12:51	18	3	SE	5%	Sunny
6	23 / 09 / 2019	09:09-09:11	16	4	S	95%	Cloudy, after short rain
7	26 / 09 / 2019	14:02-14:06	16	4	SW	50%	Sun / showers, paused work during rain
Area 13							
1	02 / 09 / 2019	15:57-16:14	18	4	SW	60%	Dry and cloudy
2	05 / 09 / 2019	15:14-15:29	17	3	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	11:42-12:00	15	3	NW	20%	Sunny
4	13 / 09 / 2019	12:20-12:40	17	3	NE	20%	Sunny
5	19 / 09 / 2019	12:18-12:34	18	3	SE	5%	Sunny
6	23 / 09 / 2019	11:21-11:35	16	4	S	95%	Cloudy and windy
7	26 / 09 / 2019	11:26-11:47	16	4	SW	50%	Sunny
Area 14							
1	02 / 09 / 2019	10:38-10:50	16	4	W	60%	Dry and cloudy
2	05 / 09 / 2019	10:24-10:48	14	4	NW	40%	Mix of sun and cloud, windy
3	10 / 09 / 2019	13:11-13:16	16	3	NW	20%	Sunny
Mats removed from Area 16 during third visit due to cattle							

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 8.10 CONFIDENTIAL Badger Survey Report

A40PRC-ARP-EBD-SWI-RP-LE-0004

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30/01/20

DUE TO THE CONFIDENTIAL NATURE OF THE CONTENTS, THE BADGER SURVEY REPORT HAS NOT BEEN INCLUDED WITHIN THIS VERSION OF THE ENVIRONMENTAL STATEMENT.

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Welsh Government

A40 Penblewin to Redstone Cross Improvements

Statement to Inform an Appropriate Assessment

A40PRC-ARP-EBD-SWI-RP-LE-0012

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Contents

Appendices (included at end of document)

Tables

1 Introduction

1.1 Context

1.1.1 In December 2004, the Welsh Government announced the outcome of the A40 West of St Clears study into the consideration of both single carriageway and dual carriageway improvements to the A40 between St Clears and Haverfordwest. This study came about as a result of a number of previous reports that all concluded that the A40 needed improvement.

1.1.2 In January 2019, the Welsh Government appointed Ove Arup & Partners Ltd (Arup) to develop the design of the proposed A40 Penblewin to Redstone Cross Improvements up to publication of draft Orders. An environmental statement for the adjacent A40 Llanddewi Velfrey to Penblewin Improvements was produced by Arup and published in July 2019.[1]

1.2 Project history

1.2.1 In December 2004, the Minister announced the publication of his Addendum to the 2002 Trunk Road Forward Programme (TRFP) and this included two major single carriageway improvement schemes for the A40 west of St Clears. The improvements would use the 2+1 configuration allowing overtaking on the two-lane direction, with overtaking prohibited in the one lane direction and would be delivered in the following phases:

a) A40 Penblewin - Slebech Park
b) A40 Llanddewi Velfrey - Penblewin.

1.2.2 The first of these projects, Penblewin - Slebech Park, was completed in March 2011.

1.2.3 In July 2013, Edwina Hart AM CStJ MBE, Minister for Economy, Science and Transport, published a written statement outlining her priorities for Transport. The statement included the following: "*Improving the A40 has been identified as a priority by the Haven*

[1] Welsh Government (2019) A40 Llanddewi Velfrey to Penblewin Improvements Environmental Statement Chapter 8 Nature Conservation. https://gov.wales/sites/default/files/publications/2019-08/a40-llanddewi-velfrey-to-penblewin-environmental-statement-volume-1-july-2019.pdf

Waterway Enterprise Zone Board and I intend to undertake further development of previously proposed improvements."

1.2.4 On 12 November 2014, in providing an update on the closure of the Murco Refinery in Milford Haven, the Minister made an oral Statement in Plenary: "*In terms of transport links, I have instructed my officials to accelerate to the fullest extent possible the programme for delivering improvements at Llanddewi Velfrey."*

1.2.5 In June 2015, in a written statement on the A40 Improvement Study, the Minister noted *"It is my intention to progress delivery of the A40 Llanddewi Velfrey to Penblewin scheme as soon as possible…"*

1.2.6 The publication of draft Orders and the Environmental Statement was completed in July 2019 for the A40 Llanddewi Velfrey to Penblewin Improvements (adjacent scheme).

1.2.7 In 2017, attendees at the Public Information Exhibition for the A40 Llanddewi Velfrey to Penblewin Improvements, expressed their support for improvements to Redstone Cross.

1.2.8 In August 2018, the Cabinet Secretary for Economy and Transport, Ken Skates AM, confirmed in writing to the Senior Coroner in response to the inquest into the death of a driver joining the A40 at Redstone Cross1, that investigations would be commenced to look at improving junction safety and providing more safe overtaking opportunities along the length of the A40, which includes improvements at Redstone Cross.

1.2.9 In January 2019, Arup (supported by RML), began investigating the problems and developed potential effective solutions to address the transport related problems along the A40 between Penblewin Roundabout and Redstone Cross for the Welsh Government.

1.2.10 The publication of draft Orders and the Environmental Statement is planned for summer 2020 for this scheme.

1.3 The problems

1.3.1 Consultation with key stakeholders, including the Local Authority, Welsh Government Departments and the Regional Transport Planner has identified the following problems:

a) The A40 mainline and Redstone Cross Junction is substandard.

c) Limited overtaking opportunities lead to poor journey time reliability and driver frustration.

d) Occasional convoys of heavy goods vehicles from the ferry ports and slow moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.

e) Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.

f) There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road Scheme objectives.

g) A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.

h) A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on private car for inter-urban connections.

1.4 Scheme Objectives

1.4.1 A number of transport planning objectives have been developed iteratively during previous development work and engagement on the A40 project, aiming to address one or more of the identified problems. During the early stages of Key Stage 3 the problems and objectives were refreshed during a focused workshop event with key stakeholders to take into account the WelTAG 2017 guidance and Well-being of Future Generations (Wales) Act well-being goals. The Scheme objectives are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To reduce the number and severity of collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

1.5 Purpose of this report

1.5.1 This report has been prepared to provide initial information to the Welsh Ministers ("the Competent Authority") on the implications of the Scheme on European Sites, as required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended). This report covers Stage 1 Screening and Stage 2 Appropriate Assessment as set out in LA 115 Habitats Regulations Assessment (Highways England, 2019).

1.6 Requirements of the Habitats Regulations

1.6.1 The Habitats Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna provides legal protection for habitats and species of European importance. The Directive is transposed into UK law by the Conservation of Habitats and Species Regulations 2017 (hereafter referred to as the 'Habitats Regulations'). Before deciding to undertake or give authorisation for a plan or project the Welsh Government as a determining body and competent authority, must consider under the requirements of Regulation 63 whether the plan or project —

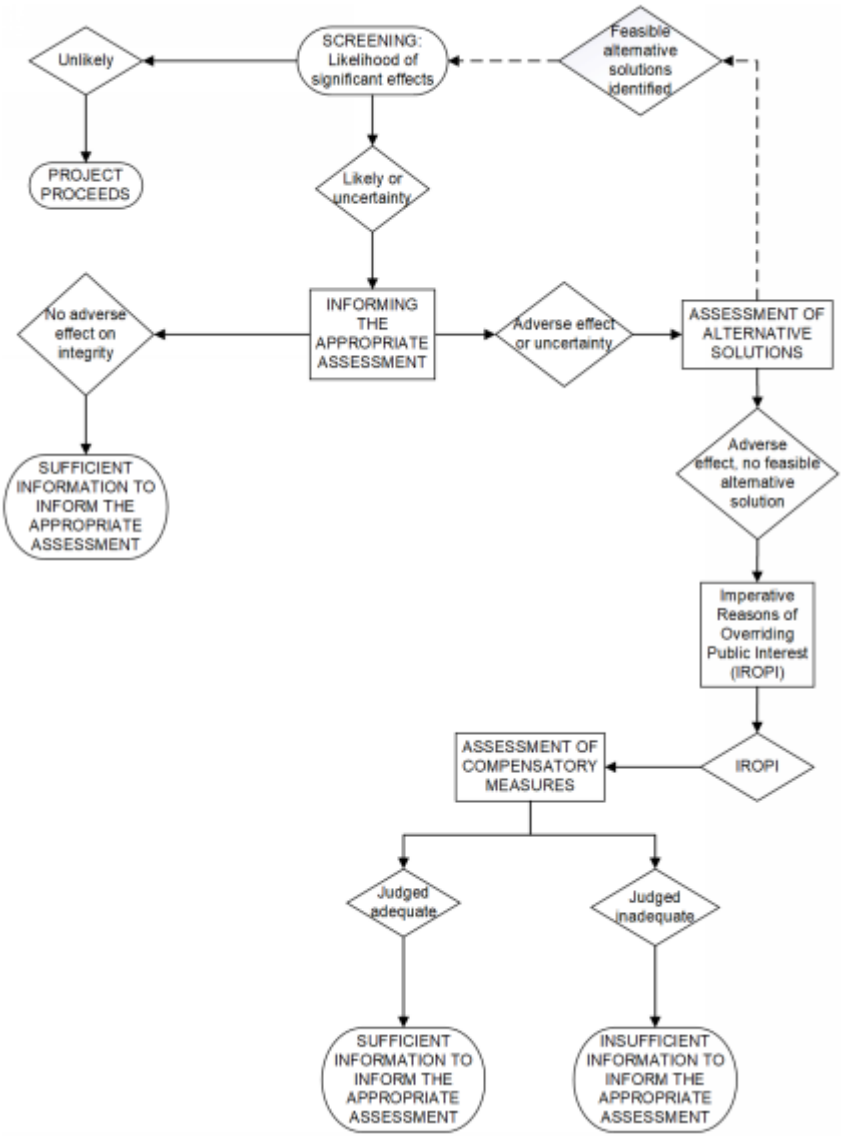
a) is likely to have a significant effect on a European site (either alone or in combination with other plans or projects), and

b) is not directly connected with or necessary to the management of that site;

1.6.2 Where there is a Likely Significant Effect (LSE), (or such an effect cannot be discounted) and the plan or project is not connected with or necessary to the management of the site then the competent authority must make an 'appropriate assessment' of the implications for that site

in view of its conservation objectives. An overview of the HRA process is shown below.

Figure 2.3 Generic HRA process



Extract 1 Figure 2.3 of DMRB LA115.

1.6.3 In the light of the conclusions of the assessment, the competent authority may agree to the plan or project only after having ascertained that the project will not, alone or in-combination with other plans and projects, adversely affect the integrity of the European site. The only exceptions are where there are no alternatives and there are imperative reasons of overriding public interest, in which case compensatory measures must be adopted if the Scheme is to proceed.

1.7 Policy and Guidance

1.7.1 The consideration of the Scheme, as described in Section 2 below, in relation to the Habitats Regulations has been informed by a range of guidance and policy documents including:

a) Design Manual for Road and Bridges (DMRB) LA 115 Habitats Regulations assessment (Highways England, 2019);

b) The Habitats Regulations Handbook (Tyldesley & Chapman, 2013), and subsequent updates; and

c) Assessing Projects under the Habitats Directive: Guidance for Competent Authorities (Tyldesley D. , 2011).

1.7.2 The assessment has also been informed by a review of all relevant case law including recent European Court rulings.

1.8 Experience of the Authors of this Report

1.8.1 This report has been authored by Joseph Shepherdson and Victoria Newlove of Arup. In addition, the report has been checked and reviewed by Pete Wells and approved by Neil Harwood for issue by Arup.

1.8.2 Joseph Shepherdson BSc (Hons), MRSB, Grad CIEEM, is a professional ecologist with over six years of experience in ecological research and consultancy. He is a specialist in ornithology and has published his work in animal behaviour. Joseph led on the Strategic Ecological Mitigation Plan for the Liverpool Waters Development in 2019, this role required Joseph to coordinate with Statutory bodies to produce an overarching mitigation plan for the entire scheme.

1.8.3 Victoria Newlove BA (Hons), MSc, CBiol, ACIEEM is a senior ecologist with nine years of experience, including roles in the consultancy and conservation sectors. She has been responsible for project management and co-ordination of ecological inputs on a range of development projects. She is experienced in detailed ecological reporting and assessment, including HRA Screening and Appropriate Assessment, protected species licence applications and Ecological Impact Assessment (EcIA).

1.8.4 Pete Wells BSc (Hons), MSc, CEnv, MCIEEM is a professional

ecologist with 20 years of experience in project management, ecological surveys, assessment and the design of mitigation strategies. He is a specialist in ecology and mammal behaviour with experience in both environmental consultancies and statutory bodies and has specialised in undertaking Habitats Regulations Assessments. He was the lead author of the Strategic Habitats Regulations Assessment for the M4 Corridor Around Newport Plan in 2014,the Statement to Inform an Appropriate Assessment for the A487 New Dyfi Bridge Scheme in 2017, and the Statement to Inform an Appropriate Assessment for the A40 Llanddewi Velfry to Penblewin Scheme in 2019, for which he was also an expert witness at the Local Public Inquiry in March 2020.

1.8.5 Neil Harwood BA (Hons), MSc, CEnv, MCIEEM is a professional ecologist and leader of Arup's ecology business, with over 20 years of consultancy experience in the UK and Australia. He specialises in projects involving birds, bats, green infrastructure design and biodiversity net gain and is a member of CIEEM's Professional Standards Committee. He regularly holds lead roles on strategic-level environmental assessments and large-scale, multi-national infrastructure projects in particular. He also has considerable experience in working on plans and projects that may affect Natura 2000 sites and has produced, reviewed and/or approved Habitats Regulations Assessments for a number of projects and plans, including the New M4 Magor to Castleton project.

1.9 Abbreviations

1.9.1 The following abbreviations are used in this report.

Abbreviation	Expanded terms
ARN	Affected Road Network
CIRIA	Construction Industry Research and Information Association
cSAC	Candidate Special Area of Conservation
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
GWDTE	Groundwater dependant terrestrial ecosystems
GIS	Geographical Information System
HRA	Habitats Regulations assessment
LDP	Local Development Plan
NMUs	Non-Motorised Users
SWTRA	South Wales Trunk Roads Agency
NRW	Natural Resources Wales
PEU	Plainly Established and Uncontroversial
PPG	Pollution Prevention Guidelines
pSPA	Proposed Special Protection Area
RTP	Regional Transport Plan
SAC	Special Area of Conservation
SIAA	Statement to Inform an Appropriate Assessment
SPA	Special Protection Area
TLSE	Test of Likely Significant Effect
TPOs	Transport Planning Objectives
UDP	Unitary Development Plan
WelTAG	Welsh Transport Appraisal Guidance

2 Scheme Description

2.1 Detailed Description

2.1.1 The proposal is to update a 1.76km length of the A40, from the junction with Jacobs Park to the west and Redstone Cross to the Penblewin Roundabout to a modern standard three lane carriageway, with two lanes in one direction and one lane in the opposite direction, separated by a 1m wide hatched strip. The overtaking provision will alternate so that both eastbound and westbound traffic can overtake.

2.1.2 Four options for this section of the A40 were shortlisted. Each option was assessed in terms of performance in addressing the problems, balanced with their likely economic, social and environmental impacts. Following a detailed WelTAG study and public and stakeholder engagement, Option 2B was determined to be the best solution. This option addresses the problems, achieves the objectives and performs best against the majority of cultural, social and economic appraisal criteria. Option 2B has also been recognised as the preferred solution during public and stakeholder engagement that has been undertaken to date.[2]

2.1.3 The Scheme would commence approximately 550 metres west of Redstone Cross (Chainage (Ch) 0+000.), where the existing A40 passes Sodston Lodge. The Scheme would leave the line of the existing A40 at Sodston Lodge and draw gradually to the south. At approximately Ch.0+400, the road would cross a small wooded watercourse on an embankment up to 4 metres high. It would then begin to descend on a gentle gradient for about 1km, entering a cutting up to 7 metres deep through the Redstone ridge at Ch.0+500. To the north side of the Scheme would be properties at Redstone Cross and to the south the Blaen Marlais Care Home. The B4313 Redstone Road would cross the A40 on a proposed bridge at Ch.0+570 and then join the detrunked A40 on the east side of Redstone Cross. The detrunked existing A40 road would be a local road extending from Redstone Cross to Penblewin roundabout.

2.1.4 From Ch.0+570 to Ch.0+800, the Scheme would transition from cutting to embankment and continue the gentle left-hand curve to cross a small watercourse and woodland at around Ch.0+800. The embankment

[2] Welsh Government Consultation Document, A40 Penblewin to Redstone Cross Improvements, 26 July 2019.

would continue eastwards, crossing a further two minor watercourses, with the Scheme entering a shallow right-hand bend that would continue to Ch.1+450. At Ch.1+400, the embankment would cease and the Scheme would continue east in a cutting up to 8m deep as it commences the climb towards Penblewin Roundabout at Ch.1+760, which is roughly at ground level.

2.1.5 A plan of the Scheme is shown on Figure 1.

2.2 Distance from European Sites

2.2.1 In accordance with the requirements of LA 115, the following European Sites are included within the considerations of this assessment:

a) Afonydd Cleddau / Cleddau Rivers SAC - 1.2km west of the Scheme;

b) Pembrokeshire Marine / Sir Benfro Forol SAC - 4.5km west of the Scheme;

c) Pembrokeshire Bat Sites and Bosherston Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC - 7.9 km southwest of the Scheme;

d) Limestone Coast of South West Wales / Afordir Calchfaen de Orllewin Cymru SAC - 17.4 km to the west of the Scheme; and

e) North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC - 18.8 km to the west of the Scheme.

2.3 Physical Land Take of the Scheme

2.3.1 The Scheme would be approximately 1.8km in length and would have a permanent land take of 13.6ha. Of this, approximately 12.8ha would be agricultural land of which approximately 3.8ha* is Grade 3a quality i.e. the best and most versatile agricultural land. Four agricultural businesses would be affected to varying degrees both during construction and following completion of the Scheme. Approximately 0.8ha of land would be required temporarily to undertake construction works and temporary traffic management operations. These areas would be occupied for a period of around 18 months before being returned to their original usage and handed back to the owners. There are no buildings directly affected by the Scheme although some are in close proximity to where works may take place.

2.3.2 The Scheme will not result in land take from any statutory designated sites.

2.4 Key Stages and Phasing

2.4.1 This section details the main construction activities that are expected to take place during enabling works and construction of the proposed Scheme.

2.4.2 For the purpose of this Statement assumptions have been made regarding the construction activities to be undertaken, based upon the Project Team's experience. It is not anticipated that these assumptions will differ from the final construction activities determined at the detailed design phase. However, if construction activities at detailed design differ significantly from the assumptions made, this document will need to be updated to reflect the changes.

2.4.3 Detailed design and construction works are considered likely to commence in 2021 and will be implemented and opened to the public in 2022.

2.4.4 The construction activities for the Scheme would be typical of a major road scheme and consist of the following:

a) Advance/preparatory works likely to be undertaken prior to construction.
b) Site establishment, fencing erected and vegetation clearance.
c) Main site accesses would be established where the proposed road corridor meets existing roads.
d) Bulk earthworks - excavations and construction of embankments and construction of highway drainage.
e) Construction of structures including, underpasses, bridge and culverts.
f) Mainline, side road and tie-in pavement works.
g) Installation of street furniture, such as traffic signs and street lighting.
h) Landscaping and planting of soft estate.

2.5 Resources Required for Construction

2.5.1 A variety of different materials would be required for the construction

phase of the Scheme. The Scheme would be designed to prevent, where possible, the generation of waste materials and the import of construction materials by reusing or recycling the available existing materials along the Scheme.

2.5.2 Where possible, site won materials would be reused for the earthworks; however, some materials would be unsuitable for reuse and other materials cannot be sourced on site and would need to be imported.

2.5.3 A summary of the predicted material resources use is presented in Table 1.

Table 1 Predicted material resource use required for construction

Project Activity	Material assets required for the project	Estimate quantities of material assets required	Additional information on material assets
Earthworks	Topsoil	Some 9,000 m³*	Sourced from site
	General fill for embankments – primary or secondary / recycled materials	133,000m³ *	Sourced from site and local suppliers
	Capping	8,000m³ *	Sourced from local suppliers
Installation of pavement	Type 1 subbase	10,000m³*	Sourced from local suppliers
	Base, binder, and surface course. Primary or Secondary / Recycled materials	16,000m³*	Sourced from local suppliers
Structures	Concrete	TBC	Local batching plants
Installation of manufactured products	Drainage, kerbs, trees, traffic signs, lighting etc.	Various quantities relative to road length and necessary safety measures	To be established local/national suppliers
* Please note that these figures are based on estimates made at the current preliminary design stage.			

2.6 Waste Produced during Construction

2.6.1 It is proposed that all materials/arisings from construction would be reused on site in accordance with the waste management hierarchy defined within the waste framework directive. There may be some waste associated with the works which cannot be reused on site. Table 2 provides a summary of waste arisings

Table 2 Summary of waste arisings

Project Activity	Waste arisings from the project	Estimate quantities of waste arisings	Additional information on waste arisings
Site clearance	Vegetation, surface strip, kerbs, trees, traffic signs, lighting etc.	Quantities not available at this stage.	Likely to be a combination of locally recycled, disposal at an inert or non-hazardous landfill site.
Earthworks	Excess Topsoil	Nil	All excavated topsoil to be reused in earthworks and landscaping
	Surplus excavated material (acceptable and unacceptable materials)	Nil	It is assumed that all site won materials are suitable for reuse.
Removal of pavement	Surface planings	At tie-ins, quantities not available at this stage	Road planings would be subject to the waste management hierarchy and reused where possible.
Installation of manufactured products	No significant waste arisings.	No significant waste arisings.	
Operation of the road	No significant waste arisings.	No significant waste arisings.	

2.7 Emissions

Construction

2.7.1 The scheme has the potential to generate dust during the construction phase. Dust-generating activities would occur along the length of the Scheme and include: earthworks to create attenuation ponds, embankments and cuttings and construction of the proposed new section of road, see **Air Quality** (ES Volume 1, Chapter 13). Mitigation outlined in the Construction Environmental Management Plan (CEMP) is designed to reduce the impact of construction dust on any nearby sensitive receptors. There are no sensitive ecological receptors; habitats or flora which are rated as high sensitivity, medium sensitivity or low sensitivity to dust in accordance with the Institute of Air Quality Management Guidance[3], within 50m of the dust generating construction activity. Any construction related dust impact is therefore

[3] Holman *et al* (2014). *IAQM Guidance on the assessment of dust from demolition and construction,* Institute of Air Quality Management, London. www.iaqm/wp-content /uploads/guidance/dust_assessment.pdf.

considered to be negligible.

2.7.2 The air quality assessment for the scheme, see **Air Quality** (ES Volume 1, ES Chapter 13), was carried out in accordance with previous DMRB guidance[4] as it was undertaken prior to the publication of the new DMRB LA 105 Air Quality[5]. The previous guidance only requires sensitive designated habitats that are internationally or nationally protected within 200m of the affected road network to be used as receptors in the assessment. The new DMRB guidance requires sensitive designated habitats and species within 200m of the affected road network to be included in the air quality assessment. It defines designated habitats as internationally designated sites, nationally designated sites, local nature reserves, local wildlife sites, nature improvement areas, ancient woodland and veteran trees. There are no such designated habitats, as defined by either the previous or new DMRB guidance, or any known species which are sensitive to air quality impacts, within 200m of the scheme. The air quality assessment for the construction stage, which was based on road traffic modelling, did not identify any significant changes in traffic anywhere on the ARN. Therefore, it did not identify any significant changes in air quality anywhere on the ARN, including within 200m of any sensitive designated habitats or species.

Operation

2.7.3 The air quality assessment for the operational stage of the scheme, see **Air Quality** (ES Volume 1, Chapter 13), was also based on road traffic modelling and did not identify any significant changes in traffic, nor significant changes in air quality anywhere on the ARN, including within 200m of a sensitive designated habitat (as defined by either the previous or new DMRB guidance). No air quality impacts on sensitive habitats or species were identified.

2.8 Excavation Requirements during Construction

2.8.1 Various locations along the length of the Scheme will require minor excavations into the existing ground as part of the construction works. However, there are three main areas of cutting required along the proposed Scheme, as summarised in Table 3 below and as can be seen on the General arrangement figures within the Environmental

[4] Previous DMRB Air Quality Guidance includes: HA 207/07, IAN 170/12, IAN 174/13, IAN 175/13, part of IAN 185/15.
[5] Highways England (2019) DMRB LA 105 Air Quality.

Statement.

Table 3 Summary of main excavations

Cutting Reference	Approximate Chainage	Approximate Length	Approximate Depth	Material Description
Cutting 1	0+000 to 0+350	350m	3.0m	Haverford Beds Formation
Cutting 2	0+500 to 0+740	240m	6.0m	Slade and Redhill Formation
Cutting 3	1+490 to 1+780	290m	6.0m	Slade and Redhill Formation

2.8.2 Excavations for the cuttings detailed above are likely to encounter weathered rock. Ground investigation within the Haverford Beds indicate this formation to increase in strength and quality with depth. However, the Slade and Redhill formation was reported to be fractured to a significant depth.

2.8.3 The materials excavated from the cuttings are expected to be predominantly granular in nature, although this is likely to easily break down under compaction to form an acceptable fill for construction of embankments.

2.8.4 Excavations are likely to be achievable by digging and ripping with standard excavation and earth moving equipment. It is anticipated that there will be no need for blasting of rock due to the fractured nature of the rock that has typically been recorded.

2.8.5 Where the existing groundwater table is anticipated to be within the cutting depth, toe drains are likely to be provided to maintain groundwater levels below the base of the cutting. Crest drain are likely to be constructed where surface water may run towards the crest of the cutting slopes to limit flow and potential erosion of the excavated face.

2.8.6 The construction of the cuttings could result in the removal of any potential underlying mineral resources. The construction of the cuttings may also require groundwater control measures; such as a groundwater control system at the base of the excavation. This may lead to the reduction in water entering local catchment areas of surface water courses; having an impact on the local hydrology.

2.8.7 The proposed western cutting (mainline chainage 0+220 to 0+380) may remove and / or limit access to both identified mineral resources. The

central cutting (mainline chainage 0+500 to 0+700) may remove and / or limit access to minerals considered to be of regional importance (aggregates). However, considering the mineral resources pertain to strata and areas that are much larger than the areas of the proposed cuttings, access to the vast majority of these resources would not be significantly affected.

2.9 Transportation Requirements during Construction

2.9.1 Materials required for the construction of the Scheme (including concrete, steel and pavement materials) will be sourced from appropriate suppliers within the local/regional area. These will be required to be transported to the Scheme via the local road network. Materials will be stored on site at designated site compounds. Frequency of movements will vary depending on site activity being undertaken. The main site accesses would be located at the Scheme junction locations at either end of the Scheme.

2.9.2 If removal of waste materials from site is required, the locations for the disposal of these materials are likely to include a combination of local recycling facilities and disposal at an inert or non-hazardous landfill site. It is anticipated that a local recycling facility would be favoured. Transportation of these materials would be via the local road network.

2.9.3 Transportation of excavated material across the Scheme (refer to Section 2.8) will be along haul roads that will follow the Scheme alignment and within the Scheme boundary. The Scheme earthwork movements will be planned so that fill required for embankments will generally be transported from adjacent cuttings to minimise transportation movements and material handling.

3 European Sites Potentially Affected by the Scheme

3.1.1 LA 115 sets out the following criteria for the identification of potential effects on European Sites. The Site:

a) is within 2km of a European Site or functionally linked land;

b) is within 30km of any SAC, cSAC, pSAC, where bats are one of the qualifying interests;

c) crosses or lies adjacent to, upstream of, or downstream of, a watercourse which is designated in part or wholly as a European Site;

d) has a potential hydrological or hydrogeological linkage to a European Site containing a groundwater dependant terrestrial ecosystem (GWDTE) which triggers assessment in accordance with LA 113 Road Drainage and the Water Environment; or

e) has an Affected Road Network (ARN) which triggers the criteria for assessment of European Sites within HA 207/07 Air Quality.

3.1.2 For the purposes of the HRA, where the established risk to GWDTE is assessed to be above negligible, further assessment in accordance with LA 113 would be required. An assessment of impacts on the water environment in relation to GWDTE and the Cleddau Rivers SAC was carried out in accordance with LA 113 and is set out in **Road Drainage and Water Environment** (ES Volume 1, Chapter 7).

3.1.3 Additional European sites should be subject to screening where the existence of ecological connectivity between projects and European sites is identified beyond the screening criteria.

3.1.4 Of the SACs identified, three are designated for bat species and the remaining two are designated for otter *Lutra lutra* and are hydrologically connected to the Scheme via watercourses. There are no Ramsar sites or SPAs within 2km of the Scheme.

3.1.5 The European Sites, their features and the distance of the sites from the Scheme are shown in Table 4 below with locations shown on Figure 2. The conservation objectives for these sites were reviewed from the Core Management Plans[6] available on the NRW website.

[6] https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/find-protected-areas-of-land-and-seas/designated-sites/?lang=en. Accessed during 2017.

Table 4 European Sites within 30km of the Scheme

Site	Distance	Qualifying Features
Afonydd Cleddau / Cleddau Rivers SAC	1.2km north-west	Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batracion* vegetation
		Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior
		Active raised bogs
		Brook lamprey *Lampetra planeri*
		River lamprey *Lampetra fluviatilis*
		Sea lamprey *Petromyzon marinus*
		Bullhead *Cottus gobio*
		European otter *Lutra lutra*
Pembrokeshire Marine / Sir Benfro Forol SAC	4.5km south-west	Estuaries
		Large shallow inlets and bays
		Reefs
		Sandbanks which are slightly covered by sea water all the time
		Mudflats and sandflats not covered by sea water at low tide
		Coastal lagoons
		Atlantic salt meadows *Glauco-Puccinellietalia maritimae*
		Submerged or partially submerged sea caves
		Grey seal *Halichoerus grypus*
		Shore dock *Rumex rupestris*
		Sea lamprey
		River lamprey

Site	Distance	Qualifying Features
		Allis shad *Alosa alosa*
		Twaite shad *Alosa fallax*
		European otter
Pembrokeshire Bat Sites and Bosherston Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	7.9km south-west	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.
		Greater horseshoe bat *Rhinolophus ferrumequinum*
		Lesser horseshoe bat *Rhinolophus hipposideros*
		European otter
Limestone Coast of South West Wales / Afordir Calchfaen de Orllewin Cymru SAC	17.4km South-west	Vegetated sea cliffs of the Atlantic and Baltic Coasts
		Fixed coastal dunes with herbaceous vegetation (‘grey dunes’)
		European dry heaths
		Semi-natural dry grasslands and scrubland facies on calcareous substrates *Festuco-Brometalia*
		Caves not open to the public
		Submerged or partially submerged sea caves
		Greater horseshoe bat
		Early gentian *Gentianella anglica*
		Petalwort *Petalophyllum ralfsii*
North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC	18.8km north	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
		Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
		Barbastelle bat *Barbastella barbastellus*

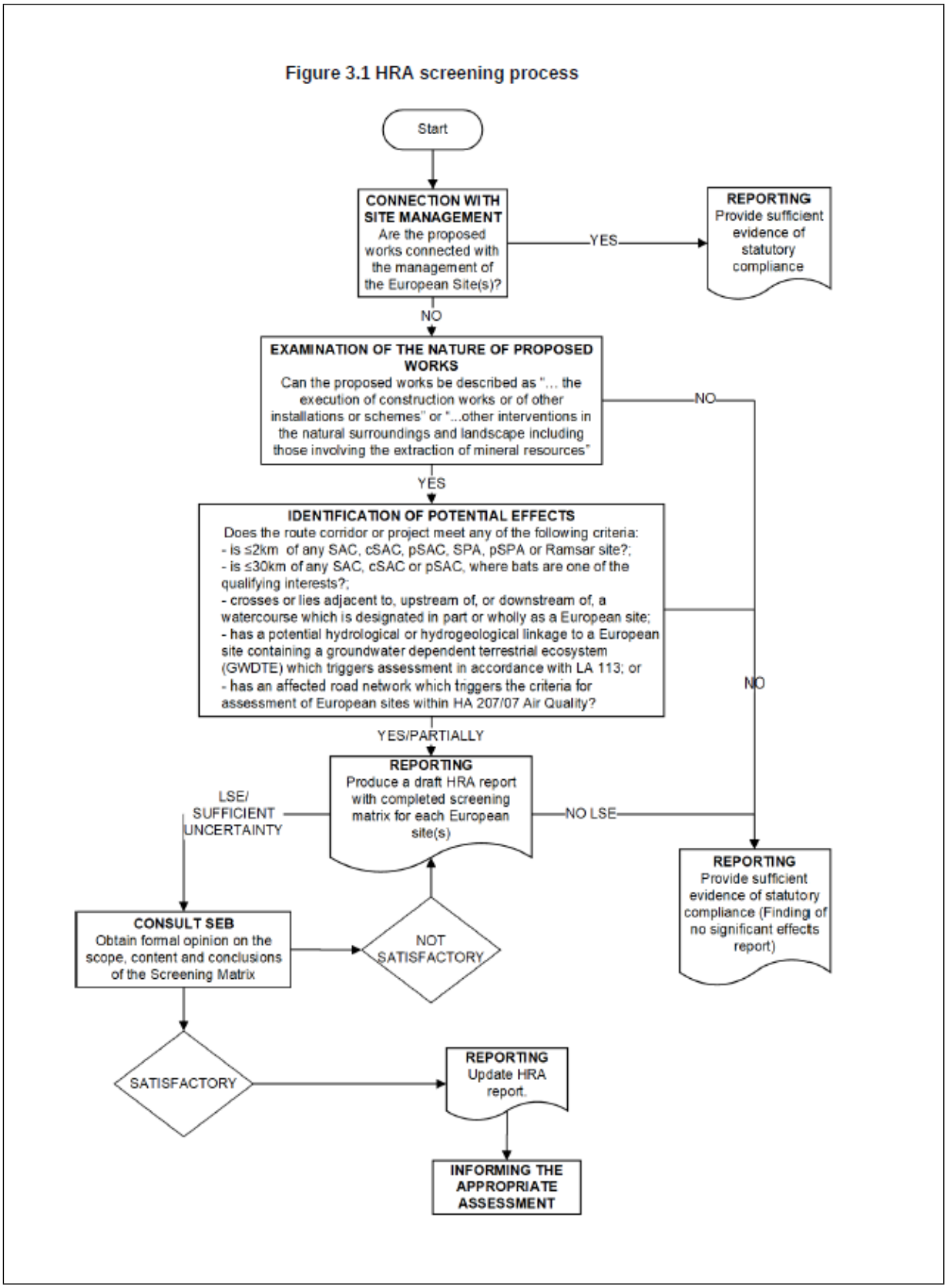
4 Assessment Methodology and Assumptions

4.1 HRA Methodology

4.1.1 All plans and projects should identify any potential impacts on European Sites early in the plan-making process and then seek to alter the plan or project to avoid them or introduce mitigation measures to the point where no significant effects remain. The 'Competent Authority' (Welsh Government) shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of a European site or sites in accordance with the requirements of the Habitats Regulations (Regulation 63(5)). Regulation 63(3) requires the Competent Authority to consult with the Statutory Nature Conservation Body (Natural Resources Wales) and have regard to any representations made by that body.

4.1.2 European Sites include SACs, candidate SACs, Offshore Marine SACs and SPAs. However, it is government policy in England and Wales to also include Wetlands of International Importance (Ramsar sites), potential SPAs and possible Ramsar sites as European Sites.

4.1.3 The HRA process for highway schemes follows the guidance set out in DMRB LA 115 HRA. The initial stage of the HRA comprises the screening process stage (i.e. consideration of likely significant effects), which is reported in the HRA report. If likely significant effects are anticipated, the second stage, or Appropriate Assessment stage (consideration of effects in relation to the conservation objectives) is carried out. Extract 2 overleaf shows an overview of the HRA screening process as provided within the DMRB LA 115 HRA.



Extract 2 Flow diagram showing the HRA Screening process taken from DMRB LA 115 HRA

4.2 Assessment Methodology

4.2.1 This section provides the applicable methodologies and assumptions for the consideration of the Scheme with regard to the requirements of the Habitats Regulations.

4.2.2 The assessment process has been based on that set out in DMRB LA 115 HRA and the Habitats Regulations Handbook (Tyldesley & Chapman, 2013) (as updated) and taking account of relevant caselaw. The consideration of the Scheme was undertaken in the following step by step process.

Understanding European Site features and conservation objectives

4.2.3 Conservation objectives of each interest feature of each European Site potentially affected were acquired and examined. In Wales, conservation objectives are considered to consist of the vision and performance indicators stated in the relevant Core Management Plan available from Natural Resources Wales website. For each of the sites, the relevant qualifying interests were also collated and examined.

Identification of plans or projects considered for in-combination effects

4.2.4 It is a requirement of the Habitat Regulations to examine the potential for a plan or project to have a significant effect either alone or in combination with other plans and projects. It is therefore necessary to identify those other plans and projects which may give rise to in-combination effects with the Scheme.

4.2.5 If significant effects are identified from the Scheme alone, the in-combination assessment may not be required until the Appropriate Assessment stage.

4.2.6 To inform this process, plans and projects which have a spatial context and contain plans or proposals most likely to have in-combination effects, will be identified from the following locations:

a) Welsh Government - strategies, plans and guidance;
b) Local Authority/National Plan Authorities - LDP/UDP;
c) Statutory Environment Bodies - Management Plans;
d) Joint Transport Plan for South West Wales 2015-2020;

e) Pembrokeshire County Council Local Development Plan (LDP) Planning Pembrokeshire's Future (up to 2021) (adopted in 2013 and currently subject to review).

4.2.7 In addition to the in-combination effects of other plans and projects, other elements considered with this assessment include:

a) Developments and other projects which are currently under construction; and

b) Proposed developments which are currently under consideration with the local planning authority or other determining bodies.

4.2.8 When considering in-combination effects in the assessments for each site, the potential impact of the measure on the feature is the key consideration. A plan or project could have an effect on water quality which can alter the nutrient balance on a site/feature without being a significant effect, but such an effect could still be significant when considered in-combination with air quality impacts resulting from another plan or project.

Identification of the potential impacts of the Scheme

4.2.9 The construction and operation of the Scheme has the potential to give rise to the following impacts on European Sites:

a) Habitat loss and/or fragmentation (including foraging areas) including interruption of flight lines and restrictions to species movements;

b) Loss of resting/roosting sites;

c) Air quality emissions and changes to atmospheric deposition;

d) Changes in water quality and quantity;

e) Changes in hydrological conditions;

f) Changes to structure/composition of the habitat;

g) Noise and vibration disturbance to species;

h) Visual and lighting disturbance to species;

i) Physical restrictions to the movement of species; and

j) Mortality or injury of species as a result of collision with moving vehicles.

4.2.10 This list has formed the basis for considering the potential for effects on the European Sites on the basis of identifying the sources or impacts and the pathways that could link those sources to the features of the site (receptors).

4.2.11 The consideration of the potential for impacts has also been informed by the conservation objectives for the features of the European Sites identified, specifically those conservation objectives whose achievement could be compromised by the predicted impacts. In particular, details of the vulnerability of features to particular potentially influencing factors (such as the vulnerability of certain habitats to increases in nitrogen deposition) were used to identify the likelihood of impacts affecting features of the sites.

Consideration of the significance of the potential effects

4.2.12 The significance of the potential effects was assessed taking into account plainly established uncontroversial standard construction industry practices that are require by current UK legislation.

4.2.13 The assessment of the likelihood of significant effects has been made of the Scheme on its own and in-combination with other plans and projects.

4.3 The Use of Professional Judgement

4.3.1 Professional judgement was used in the carrying out of this work where specific guidance was not available, and in the interpretation of results. Where there was insufficient information regarding the likelihood of qualifying interests being present, or of the risk of impacts, the assessment used the precautionary principle to inform the judgement. The precautionary principle has been applied to ensure that any assessment errs on the side of caution, without being overly cautious. This principle means that the conservation objectives should prevail where there is uncertainty or that harmful effects will be assumed in the absence of evidence to the contrary.

4.3.2 In the assessment professional judgement has been applied using the following criteria, as often insufficient information about the elements and interests is available:

a) The vulnerability/sensitivity of the receiving environment/features of interest;

b) When the risk of effects is likely to occur (e.g. construction and/or operation);

c) The likely geographical extent of the effects; and

d) Likelihood of significant effects (e.g. those above negligible in magnitude) occurring based on previous experience with similar elements, where available.

5 Baseline Information

5.1.1 The area of the proposed Scheme comprises rural agricultural areas predominantly used for cattle grazing. Wooded stream corridors, small woodlands and mature hedgerows separate fields and provide a highly connected landscape.

5.2 Watercourses

5.2.1 A desk study of freely available mapping and aerial imagery has identified the following surface water features in the study area, the features are shown on Surface Water Features (ES Volume 2, Figure 7.1):

a) There are multiple **unnamed tributaries of Longford Brook** to the north of the A40. The Longford Brook catchment is to the north of the ridgeline, with the closest unnamed tributary shown on OS mapping 40m to the north of the Scheme at chainage 1+600. From west to east, these watercourses are labelled 1, 2, 3, 10 and 11.

b) **Unnamed tributaries of the Afon Marlais** are within the 500m study area; labelled in Volume 2, Figure 7.1. From site visit observations, Tributary ID8 could be described as a drainage ditch, and 9 and 7 are streams. As shown in Volume 2, Figure 7.2, the Afon Marlais catchment forms the southern side of the ridgeline, with the majority of the Scheme being in this area. As confirmed on the Lle: Welsh Government Geo-Portal, the Afon Marlais main river starts at the A478, 550m to the south west of the crossing point.

c) **Unnamed tributaries of Narbeth Brook.** As shown in Volume 2, Figure 7.2, the Narberth Brook catchment lies to the west of the Afon Marlais catchment. The western edge of the Scheme from chainage 0+600 is within this catchment. Narberth Brook itself and the associated Cleddau Rivers SAC and SSSI designations are located 1.5km downstream from the Scheme. Watercourses are shown on OS mapping in Volume 2, Figure 7.1 to rise 20m south of the existing A40 at Redstone Farm and would be crossed by the Scheme. These are considered as ephemeral streams which would flow during wetter periods. Watercourse ID6 was observed to have very low flows during dry periods immediately south of the well visible on OS mapping to the west of Redstone Cross, but is a fast flowing shingle bottomed woodland streams further south towards Watercourse ID4.

5.3 Otters

5.3.1 Details of the methodology of the surveys undertaken is provided in Nature Conservation (ES Volume, Chapter 8)[7].

Desk Study

5.3.2 Ten records of otter were provided by the West Wales Biological Information Centre within 2km of the site, three of which were from within the last ten years. The closest record within the last ten years was located approximately 150m east of Redstone Cross junction. There have been no otter casualties recorded from the existing A40 within the extent of the Scheme.

Field Surveys

5.3.3 Evidence of otters was recorded on six of the nine watercourses surveyed. Signs recorded include spraints, lay-up sites and footprints, these locations are shown on Figure 3. No breeding sites were found to be present within 250m of the site. Otter are therefore assumed to have the potential to be present on all watercourses within the study area.

5.3.4 The otter population present within the study area is considered likely to be part of or contribute to the population designated as part of the Cleddau Rivers SAC and Pembrokeshire Marine SAC.

5.4 Barbastelle Bat and Horseshoe Bat Species

5.4.1 Details of the methodology of the surveys undertaken is provided in Chapter 8 of the Environmental Statement for the Scheme.[7]

Desk Study Records

5.4.2 Records of bat species were obtained from WWBIC in June 2019 for the area within two kilometres of the centreline of the scheme. Records of bat roosts were obtained for the area within 5km of the centreline of the scheme. The WWBIC data search returned records of all three Annex II species.

[7] Arup (2020) A40 Penblewin to Redstone Cross Improvements Environmental Statement.

5.4.3 Four of the roost records were of greater horseshoe bat, and two of the roost records were of lesser horseshoe bat, all over 4.5km away from the scheme. A record of a greater horseshoe bat roost was provided by NRW in November 2019 with its response to the scoping report[8]. The record is located approximately 400m away, to the northwest of the scheme near Sodston Manor Farm, and comprises a roost used by up to 8 greater horseshoe bats. No records of roosting barbastelle were returned with the data search.

5.4.4 The roost of greater horseshoe bats identified by NRW is very likely to be associated with the SAC population of greater horseshoe bats located at the Slebech Park roost located to the west of the Scheme.

Field Surveys

Roost Surveys

5.4.5 Thirteen buildings/properties were surveyed for bats during 2019 by external inspection. Eight of these were found to have low, moderate or high bat roost potential and were therefore subject to dusk emergence and /or dawn re-entry surveys. The purpose of the dusk emergence and /or dawn re-entry surveys is to confirm the presence or likely absence of a bat roost. Roosts of common bat species were found in five of the buildings surveyed but none of the buildings surveyed were found to be used by roosting horseshoe or barbastelle bat species.

5.4.6 Ground level tree assessments carried out on all trees within 50m of the centreline of the scheme alignments under consideration at the time of the surveys identified 91 trees with suitability for roosting bats (either low, moderate or high suitability). Following aerial tree climbing inspections carried out in 2019, there were eight trees with moderate or high suitability. These were subject to dusk emergence or dawn re-entry surveys. None of the trees surveyed were found to be used by roosting horseshoe species or barbastelle bats.

Walked Activity

5.4.7 The locations of bat registrations recorded during Walked Activity Transects during 2019 are shown on Figures 4-10 of the bat survey report.[9] Two greater horseshoe bats were recorded during the May transect survey (on the northern transect).

[8] Letter from Natural Resources Wales (NRW) in response to A40 Scoping Report. Dated 07 November 2019.
[9] Welsh Government (2020) A40 Penblewin to Redstone Cross Improvements ES Appendix 8.4 Bat Roost & Transect Survey Report.

5.4.8 Lesser horseshoe and barbastelle bats were not recorded during the walked activity transects undertaken during 2019.

Static Activity Monitoring

5.4.9 The locations sampled during 2019 are shown on Figures 1 to 7 of the passive bat monitoring report **Bat Activity Survey Report** (ES Volume 3, ES Appendix 8.5)[10]. Of the three bat species which are features of nearby SACs, greater horseshoe bat was the most frequently recorded species.

5.4.10 Low numbers of lesser horseshoe bat were recorded at a location south-east of the Redstone Cross junction, consisting of a single pass in April and a single pass in October. Two lesser horseshoe passes were also recorded at a location north-west of Redstone Cross junction in September. Barbastelle bat was recorded at a location south-east of Redstone Cross junction, in April only, consisting of a single pass.

5.4.11 The static detector located within the woodland corridor at Ch0+800 recorded the highest level of activity by greater horseshoe across the 2019 survey period. The locations of these registrations are shown on Figures 18-25.

The average bat activity indices at the locations are shown in Table 5-

[10] Welsh Government (2020) A40 Penblewin to Redstone Cross Improvements ES Appendix 8.5 Bat Activity Survey Report.

5.4.12 Table 8 below. These show the average number of bat passes (equivalent) per night (Bat Activity Index (BAI)) for each 5-night monitoring session in 2019. The number of files (sound clips) recorded by the detectors each night was taken as a proxy value to the number of bat passes. These were combined for each recording session and then divided by five (i.e. the number of nights recording) to calculate the BAI.

5.4.13 Comparison of the BAIs for the individual species compared to that for all species combined shows that the SAC species represent a very small component of the bat activity within the vicinity of the Scheme.

5.4.14 Note that monitoring was not undertaken in August due to user error[10]. Further details on the limitations and methodology for the surveys is provided in **Nature Conservation** (ES Volume 1, Chapter 8) and its appendices.

Table 5 Bat Activity Indices for all bat species recorded in 2019

Location number	1	2	3	4	5	6
April	329.8	79.4	-	200.8	106.8	-
May	12.4	18.8	242.2	27.0	18.6	21.6
June	1.6	-	385.2	68.4	24.0	0.6
July	5.6	7.2	80.4	14.2	-	55.4
August	-	-	-	-	-	-
September	274.2	73.8	576.0	-	31.8	1.8
October	37.8	8.6	46.4	9.6	129.4	6.4
Average	110.2	37.6	266.0	64.0	62.1	17.2

Table 6 Bat Activity Indices for barbastelle recorded in 2019

Location number	1	2	3	4	5	6
April	0	0	0	0.2	0	0
May	0	0	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
August	-	-	-	-	-	-
September	0	0	0	0	0	0
October	0	0	0	0	0	0
Average	0	0	0	0.03	0	0

Table 7 Bat Activity Indices for greater horseshoe bat recorded in 2019

Location number	1	2	3	4	5	6
April	0	0.6	-	0	0.2	-
May	0	0.2	0.6	0.2	1.6	0
June	0	-	0.2	0.8	1.4	0.6
July	0	0	0	0.8	0	0
August	-	-	-	-	-	-
September	1.0	0.8	1.0	0	0	0.2
October	0.8	0	0	0	0	0
Average	0.30	0.32	0.36	0.30	0.53	0.16

Table 8 Bat Activity Indices for lesser horseshoe bat recorded in 2019

Location number	1	2	3	4	5	6
April	0	0	0	0	0.2	0
May	0	0	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
August	-	-	-	-	-	-
September	0	0	0	0	0	0
October	0	0	0	0	0.2	0
Average	0	0	0	0	0.07	0

5.4.15 The lesser horseshoe bats recorded may be foraging from the Slebech Park roost, which forms part of the Pembrokeshire Bat Sites and Bosherston Lakes SAC, located approximately 7.9km west of the Scheme. The greater horseshoe bats recorded are highly likely to have come from the roost identified by NRW 400m to the northwest of the Scheme and are assumed to be crossing the existing A40 corridor using natural 'hop-overs' formed by mature trees. The identified roost was used by a maximum of eight greater horseshoe bats, however only one building out of a farm and school complex were included within the surveys and planning application. As such it is considered likely that a larger more significant roost may be present within the Sodston area.

5.4.16 However, it is highly likely that this roost contributes to the population at Slebech Park, which is part of the SAC. It is unlikely that the greater horseshoe bats present within the study area are from the Limestone Coast of South West Wales SAC due to the distance of this site from the study area (17.4km south west), although they are highly likely to be from roosts which contribute to the SAC populations.

5.4.17 The barbastelle bats present within the study area are unlikely to be from North Pembrokeshire Woodlands SAC due to the distance of this site from the study area (18.8km north west), although they are highly likely to be from roosts which contribute to the SAC populations.

Summary of Key Foraging and Commuting areas for Bats

5.4.18 A review of the combined bat activity survey results has identified four linear habitat features within the footprint of the scheme which are considered key foraging and commuting features for bats, in particular those used by qualifying species of the SACs. These four key features

are listed below together with the survey results which qualify them as such:

a) Ch 0+800: the woodland corridor to the east of Redstone Cross junction (Static Location 5) - where the highest level of activity of greater horseshoe bat was recorded [BAI 0.53] and the only location where lesser horseshoe bat was recorded [BAI 0.07] across all months of the static monitoring surveys;

b) Ch 1+120: the belt of woodland with mature trees along the remnants of an old hedge bank (Static Location 3) – the location with the second highest level of greater horseshoe bat activity was recorded [BAI 0.36], this location also had the highest BAI for all species across all months [BAI 266.0], this location was also recorded as a hotspot for foraging *Myotis* sp and *Nyctalus* sp. during the walked activity transect surveys;

c) Ch 1+350: woodland corridor with a small stream to the southeast of Blackmoor Hill Farm (Static Location 2) – third highest level of greater horseshoe bat activity recorded [BAI 0.32]; and

d) Ch 0+920 a mature hedgerow which runs north-south (Static Location 4) - the only location where barbastelle was recorded [BAI 0.03] during the passive monitoring surveys, greater horseshoe activity here was also relatively high [BAI 0.30].

6 Consideration of the Significance of Potential Effects – Screening Stage

6.1 Test of Likely Significant Effect (TLSE)

6.1.1 Table 9 below sets out the initial Test of Likely Significance of Effects occurring as a result of the implementation of the Scheme prior to the identification and design of mitigation. Further details of the assessment in the form of matrix worksheets for those sites scoped into the assessment are provided in Appendix A.

6.1.2 The TLSE is made in light of the conservation objectives for each of the sites and features in the following sections.

6.1.3 As stated above, consideration of the TSLE has only included Plainly established uncontroversial standard working practices within the construction industry that are required by current UK Laws and Regulations.

6.1.4 Construction would be carried out in accordance with guidance outlined within Construction Industry Research and Information Association (CIRIA) best practice guidance.

Table 9 Test of Likely Significant Effects During Construction and Operation

Site	Distance	Qualifying Features	Pathway	Potential Effects	Significant
Afonydd Cleddau / Cleddau Rivers SAC	1.2km	Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batracion* vegetation	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and plant abundance.	Potential for **significant** effect in the absence of mitigation
		Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	No pathway – feature separated by sufficient distance.	This site was scoped out of the GWDTE assessment as it is more than 1km from the Scheme and 2km from where the Scheme crosses the nearest tributary	Not significant
		Active raised bogs	No pathway – feature separated by sufficient distance.	This site was scoped out of the GWDTE assessment as it is more than 1km from the Scheme and 2km from where the Scheme crosses the nearest tributary	Not significant
		Sea lamprey	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation
		Brook lamprey	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation

Site	Distance	Qualifying Features	Pathway	Potential Effects	Significant
		River lamprey	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation
		Bullhead	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation
		European otter	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on prey abundance.	Potential for **significant** effect in the absence of mitigation
			Potential for otters to cross the Scheme moving between catchments.	Risk of death or injury as a result of collision with vehicles. Habitat fragmentation.	**Significant** effect in the absence of mitigation.
Pembrokeshire Marine / Sir Benfro Forol SAC	4.5km	Estuaries	No pathway – feature separated by sufficient distance.	None	N/A
		Large shallow inlets and bays	No pathway – feature separated by sufficient distance.	None	N/A
		Reefs	No pathway – feature separated by sufficient distance.	None	N/A
		Sandbanks which are slightly covered by sea water all the time	No pathway – feature separated by sufficient distance.	None	N/A

Site	Distance	Qualifying Features	Pathway	Potential Effects	Significant
		Mudflats and sandflats not covered by sea water at low tide	No pathway – feature separated by sufficient distance.	None	N/A
		Coastal lagoons	No pathway – feature separated by sufficient distance.	None	N/A
		Atlantic salt meadows *Glauco-Puccinellietalia maritimae*	No pathway – feature separated by sufficient distance.	None	N/A
		Submerged or partially submerged sea caves	No pathway – feature separated by sufficient distance.	None	N/A
		Grey seal *Halichoerus grypus*	No pathway – feature separated by sufficient distance.	None	N/A
		Shore dock *Rumex rupestris*	No pathway – feature separated by sufficient distance.	None	N/A
		Sea lamprey	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation
		River lamprey	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation
		Allis shad *Alosa alosa*	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation

Site	Distance	Qualifying Features	Pathway	Potential Effects	Significant
		Twaite shad *Alosa fallax*	Potential for pollution and sediment laden run-off to enter designated areas via watercourses.	Reduction in water quality and effects on survival and breeding success.	Potential for **significant** effect in the absence of mitigation
		European otter	Potential for otters to cross the Scheme moving between catchments.	Risk of death or injury as a result of collision with vehicles Habitat fragmentation	**Significant** effect in the absence of mitigation.
Pembrokeshire Bat Sites and Bosherston Lakes / Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	7.9km	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	No pathway – feature separated by sufficient distance.	None	N/A
		Greater horseshoe bat	Potential for greater horseshoe bats to cross the Scheme.	Risk of death or injury as a result of collision with vehicles. Habitat fragmentation.	**Significant** effect in the absence of mitigation.
		Lesser horseshoe bat	Potential for lesser horseshoe bats to cross the Scheme.	Risk of death or injury as a result of collision with vehicles. Habitat fragmentation.	**Significant** effect in the absence of mitigation.
		European otter	No pathway – feature separated by sufficient distance approximately 25km from Bosherston.Lakes component, where the otter feature is located.	None	N/A
Limestone Coast of South	17.4km	Vegetated sea cliffs of the Atlantic and Baltic coasts	No pathway – feature separated by sufficient distance.	None	N/A

Site	Distance	Qualifying Features	Pathway	Potential Effects	Significant
West Wales / Afordir Calchfaen de Orllewin Cymru SAC		Fixed coastal dunes with herbaceous vegetation (grey dunes)	No pathway – feature separated by sufficient distance.	None	N/A
		European dry heaths	No pathway – feature separated by sufficient distance.	None	N/A
		Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (important orchid sites)	No pathway – feature separated by sufficient distance.	None	N/A
		Caves not open to the public	No pathway – feature separated by sufficient distance.	None	N/A
		Submerged or partially submerged sea caves	No pathway – feature separated by sufficient distance.	None	N/A
		Greater horseshoe bat	Potential for greater horseshoe bats to cross the Scheme.	Risk of death or injury as a result of collision with vehicles. Habitat fragmentation.	**Significant** effect in the absence of mitigation
		Early gentian	No pathway – feature separated by sufficient distance.	None	N/A
		Petalwort	No pathway – feature separated by sufficient distance.	None	N/A
North Pembrokeshire Woodlands /	18.8km	Old sessile oak woods with Ilex and Blechnum in the British Isles	No pathway – feature separated by sufficient distance.	None	N/A

Site	Distance	Qualifying Features	Pathway	Potential Effects	Significant
Coedydd Gogledd Sir Benfro SAC		Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	No pathway – feature separated by sufficient distance.	None	N/A
		Barbastelle	Potential for barbastelle bats to cross the Scheme.	Risk of death or injury as a result of collision with vehicles. Habitat fragmentation.	**Significant** effect in the absence of mitigation

7 Appropriate Assessment

7.1 Cleddau Rivers SAC

Watercourse and fish features

Conservation objectives

7.1.1 The status of the watercourse is a major determinant of favourable conservation status of other features of this site. The watercourse will be considered to be in favourable status when:

a) The capacity for the habitats in the SAC to support each feature at near-natural population levels, as determined by predominantly unmodified ecological and hydromorphological processes and characteristics, should be maintained as far as possible, or restored where necessary.

b) The ecological status of the water environment should be sufficient to maintain a stable or increasing population of each feature. This will include elements of water quantity and quality, physical habitat and community composition and structure. It is anticipated that in most instances these limits will concur with the standards used by the Review of Consents process.

c) Flow regime, water quality and physical habitat should be maintained in, or restored as far as possible to, a near-natural state, in order to support the coherence of ecosystem structure and function across the whole area of the SAC.

d) All known breeding, spawning and nursery sites of species features should be maintained as suitable habitat as far as possible, except where natural processes cause them to change.

e) Flows, water quality, substrate quality and quantity at fish spawning sites and nursery areas will not be depleted by abstraction, discharges, engineering or gravel extraction activities or other impacts to the extent that these sites are damaged or destroyed.

f) The river planform and profile should be predominantly unmodified. Physical modifications having an adverse effect on the integrity of the SAC, including, but not limited to, revetments on active alluvial river banks using stone, concrete or waste materials, unsustainable extraction of gravel, addition or release of excessive quantities of fine sediment, will be avoided.

g) River SSSI features should be in favourable condition.

h) Artificial factors impacting on the capability of each species feature to occupy the full extent of its natural range should be

modified where necessary to allow passage, eg. weirs, bridge sills, acoustic barriers. The reservoir dams on the Syfynwy are excluded.

i) Natural factors such as waterfalls, which may limit the natural range of a species feature or dispersal between naturally isolated populations, should not be modified.

j) Flows during the normal migration periods of sea and river lamprey will not be depleted by abstraction to the extent that passage upstream to spawning sites is hindered.

k) Water Quality targets follow those in the revised Common Standards Monitoring Guidance for Rivers (JNCC 2016).

l) Potential sources of pollution not addressed in the review of consents, such as contaminated land, will be considered in assessing plans and projects.

m) Levels of suspended solids will be agreed by NRW for each Water Framework Directive water body in the Afonydd Cleddau SAC. Measures including, but not limited to, the control of suspended sediment generated by agriculture, forestry and engineering works, will be taken to maintain suspended solids below these levels.

Assessment of Effects

7.1.2 The stream to the west of Redstone Cross is a tributary of the Narberth Brook which flows into the Cleddau River SAC, see **ES Volume 2 Figures 7.1 and 7.2**. The SAC is approximately 2 km downstream of where the Scheme crosses this tributary at Ch 0+400.

7.1.3 The construction of the Scheme has the potential to give rise to the release of sediment laden run-off and pollutants into the watercourses that are crossed by the Scheme. Where this to occur in those that flow into the SAC system this could give rise to effects on the water course habitat feature and thereby also the fish features which may also be present. Taking in to account he requirements of conservation objectives l) and m) above, it is clear that in the absence of mitigation, these are likely to result in adverse effects on the integrity of these features.

7.1.4 The Highways England Water Risk Assessment Tool (HEWRAT) model was used to consider the operational impact of the Scheme. This found in the absence of mitigation measure that there were potential for operational effects on water quality within surface water systems resulting from heavy metals, see **Road Drainage and Water Environment** (ES Volume 1, Chapter 7). These effects are also

considered likely to give rise adverse effects on the integrity of the watercourse habitat and fish species features.

7.1.5 **Road Drainage and Water Environment** (ES Volume 1, Chapter 7) assesses the impact of the scheme on the ground water environment of the Cleddau Rivers SAC which lies approximately 1.2 km at its closest point to the north of the Scheme although this found no likely effects.

Mitigation Measures – Design Mitigation

7.1.6 The design philosophy of the carriageway drainage includes a series of measures to ensure that flood risk is not increased in the vicinity of the Scheme and to ensure that soluble and suspended pollutants in carriageway runoff are reduced to acceptable levels prior to discharge to groundwater or local watercourses. This is considered to be an improvement in comparison to the run-off from the existing A40, which is believed to discharge directly to local watercourses with no treatment or attenuation. These measures are described in the paragraphs below and described in detail in the **Drainage Strategy Report** (ES Volume 3, Appendix 7.3)[11].

7.1.7 Where possible, highway runoff would be infiltrated into the ground using attenuation/ infiltration basins. If infiltration is not an option due to ground conditions the proposed surface water discharge is to be attenuated to a Greenfield Runoff Rate (GRR) of 5.2 l/s/ha for all events up to a 100 year return period with an allowance for climate change.

7.1.8 Surface water from the new approach road from the de-trunked A40 to the Penblewin Roundabout is proposed to be drained via conventional kerbs and gullies whilst combined surface water/ groundwater filter drains will take the flows from the cuttings.

7.1.9 Where the Scheme crosses watercourses, flows would be maintained within their catchment through culverts where possible. These culverts would be designed in accordance with the requirements of the DMRB HA107/04, CIRIA Report C689. This states culverts in urban areas and villages should be designed for 1 in 100 years and agricultural land of high value should be to 1 in 50 years. Where the catchment area draining to the cross-drainage culvert is not readily defined, the minimum culvert diameter would be 1200mm in accordance with the

[11] Document number: A40PRC-ARP-HDG-SWI-RP-D-0001

DMRB.

7.1.10 A positive drainage system would be provided for the Scheme which would ensure that there is no surface water flooding for a 1 in 5-year return period event. This design standard is in accordance with DMRB which includes an allowance for climate change.

7.1.11 Peak flows have been increased by 30% to account for the effects of climate change, as agreed with Pembrokeshire County Council as Lead Local Flood Authority in a face to face meeting held on 7/8/19. Follow up correspondence is provided in **Drainage Strategy Report** (ES Volume 3 Appendix 7.3).

7.1.12 In cuttings, the surface runoff would be drained to filter drains in the verge. Lined cut-off ditches at the top of cuttings and unlined cut-off ditches at bottom of embankments will intercept natural runoff. If the natural topography falls away from the road alignment, cut off ditches will not generally be provided other than to mitigate local flooding risk. Any existing land drains encountered would be intercepted and diverted to cut-off ditches.

7.1.13 Attenuation/infiltration basins would be designed to ensure that groundwater would not impede their performance.

Mitigation Measures – Construction Mitigation

7.1.14 Any construction activity proposed within the vicinity of watercourses will be strictly carried out in accordance with the detailed Ground and Surface Water Management Plan (GSWMP) that will be implemented prior to and during construction. These plans will follow legislation and best practice standards as outlined in the outline GSWMP and outline Pollution Prevention and Control Management Plan set out in Section 6 and Section 7 of the **Pre-CEMP** (ES Volume 3, Appendix 2.2) respectively.

Residual Assessment

7.1.15 The mitigation measures outlined above are considered adequate to reduce the scale of effects of the construction and operation of the Scheme to levels that would not adversely affect the integrity of the Cleddau Rivers SAC alone.

7.1.16 The only in-combination project identified for the Scheme is the

adjacent A40 Llandewi Velfry to Penblewin Improvements. Equivalent mitigation measures to ensure the protection of surface waters were included within that scheme and it is likely that they would be constructed simultaneously.

7.1.17 Pollutions would be limited to discrete point locations which could be easily contained with the measures outlined above. Furthermore, it would be unlikely for two such incidents to occur at the same time even if both schemes were constructed at the same time.

7.1.18 With regard to sediment laden surface water run-off, there is the potential for this to occur during any significant heavy rainfall event during the construction process. However, the pollution and sediment control measures that will be included within the CEMP will ensure that sediments are not released in to watercourses.

7.1.19 Therefore, it is concluded that the construction and operation of the Scheme in-combination with other projects would not give rise to adverse effects on the integrity of the watercourse and fish features of the Cleddau Rivers SAC.

Otter

Conservation objectives for Otter

7.1.20 The otter feature of the Cleddau Rivers SAC will be considered to be in favourable conservation status, where all of the following conditions are satisfied:

a) The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

b) The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

c) The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

d) The otter must be able to breed and recruit successfully in the SAC. The size of breeding territories may vary depending on prey abundance.

e) Otter food sources must be sufficient for maintenance of the population.

f) The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

g) No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

Assessment of Effects

7.1.21 The screening test identified the potential for significant effects on otter due to the effects of pollution, sediment run-off and the risk of collision with vehicles. Evidence of otter was recorded within the study area and it is considered likely that they use watercourses within the study area to move between catchment areas. This is supported by the field surveys as otter were recorded in six out of nine of the surveyed watercourses.

7.1.22 The effects of pollution and sediment run-off have been assessed for the watercourse and fish species in the sections above.

7.1.23 The existing road is likely to form a potential barrier or risk for otters moving between catchment areas, in particular where there are watercourses within culverts under the road. However, no otter casualties have been reported within the local area.

7.1.24 The proposed Scheme will in effect create a second barrier for the majority of its length with the exception of the area of the Penblewin roundabout where it is on the line of the existing road.

7.1.25 Therefore, in light of Conservation Objective F above, it is considered that, in the absence of mitigation, the proposed Scheme will have an adverse effect on the integrity of the Cleddau Rivers SAC.

Mitigation Measures – Design Mitigation

<u>Crossing structures</u>

7.1.26 Mitigation structures to allow the safe passage of otters have been provided on all 5 watercourses crossed by the Scheme, as set out in Table 10 below, as otter are assumed to utilise all watercourses within the study area. Three of the culverts that carry watercourses under the Scheme include a dry ledge above the flood level (Ch 0+420, Ch 0+850

and Ch 1+380). The dry ledges will be 0.5m wide. At the remaining two watercourses crossings, the most westerly watercourse (Jacobs Park Ch 0+010) and the most easterly (to west of Penblewin roundabout Ch 1+680), the vertical alignment of the scheme is very close to ground level as it is where the ends of the scheme tie-in to the existing A40. At these locations it is not possible to provide an underpass large enough to accommodate a dry ledge above the flood level for otter, therefore separate pipe culverts have been provided above the flood level or as high as possible, to provide a dry underpass for otter at times of flood.

Table 10 List of structures providing mitigation for otter crossing the scheme (west to east).

Chainage	Location	Type	Purpose	Easting	Northing	Dimensions	Length
0+010	Jacobs Park	Pipe + Manhole culvert	Dry underpass above flood level / as high as possible. Otter, badger*	210359	216050	0.6m diameter	28m
0+420	SW of Redstone Cross	Reinforced concrete underpasses (x2)	Watercourse Bats, otters, badger Dormouse	210790	216064	2m headroom x 3m wide box culverts 0.5m wide ledge above flood level for mammals 0.5m x 0.5m dormouse bridge	54m long (under mainline) 52m long (under side road)
0+820	Blaenmarlais Wildlife Crossing E of Redstone Cross	reinforced concrete underpass	Bats, Dormouse, Badger Suitable for otters using the wet woodland corridor	211150	216221	2m headroom by 3m wide box culvert	38.5m long
0+850	E of Redstone Cross	Box culvert	Watercourse Otter	211165	216235	1.5m x 1.5m box culvert 0.5m wide ledge above flood level for mammals	38.5m
1+150	Along strip of woodland SW of Blackmoor Hill Farm	Reinforced concrete underpass	Bats, Badger Dormouse	211403	216402	2m headroom x 3m wide box culvert 0.5m x 0.5m dormouse bridge	45m long
1+380	Blackmoor Hill Farm Underpass (E of Blackmoor Hill Farm)	Reinforced concrete underpass	Watercourse Farm underpass for cattle Bats, Otter, Badger Dormouse	211621	216466	5.3m headroom x 3m wide box culvert 0.5m wide ledge above flood level for mammals 0.5m x 0.5m dormouse bridge	51m long
1+680	Southwest of Penblewin roundabout	Pipe + Manhole Crossing	Dry underpass above flood level / as high as possible. Otter, Badger	211904	216585	0.6m diameter	30m

*where a crossing structure is suitable for badgers it is assumed it is also suitable for Section 7 mammals and other wildlife.

Mammal Fencing

7.1.27 Mammal fencing consistent with that used on the adjacent Robeston Wathen Improvements to the west will be incorporated along the entire length of the scheme. The fencing, which will be 1.6m high without any crank on the top, will prevent otters from accessing the carriageway and also guide them to the wildlife crossings. The fencing will tie-in to the wing walls of underpasses and culverts and to the parapets of the green bridge. See **Environmental Masterplan** for the location of the fencing.

Mitigation Measures – Construction Mitigation

7.1.28 During the construction of the Scheme, a number of mitigation measures will be implemented to prevent disturbance to otters. These include:

a) Pre-construction surveys will be required to make sure there are no new otter breeding sites or resting places in the footprint of the scheme prior to vegetation clearance activities commencing. A mitigation licence from NRW will be required for the loss of otter resting sites within the construction footprint.

b) Where possible there will be no night working undertaken during the construction of the Scheme. Where this is not possible, any task lighting will be arranged such that there is no light spill on to adjacent vegetation, including riparian corridors.

c) Areas of retained habitats suitable for use by otter will be protected throughout the construction period to avoid damage and degradation in accordance with the habitat protection measures detailed in the **Pre-CEMP** (ES Volume 3, Appendix 2.2).

d) Any construction activity proposed within the vicinity of watercourses will be strictly carried out in accordance with the detailed Ground and Surface Water Management Plan (GSWMP) that will be implemented prior to and during construction. These plans will follow legislation and best practice standards as outlined in the outline GSWMP and outline Pollution Prevention and Control Management Plan set out in Section 6 and Section 7 of the **Pre-CEMP** (ES Volume 3, Appendix 2.2).

e) Any temporary excavations which need to be left overnight will be covered over, or a means of escape provided to avoid harm to otters which might otherwise become trapped.

f) Supervision by an Ecological Clerk of Works (ECoW) of vegetation clearance and the installation of any relevant ecological mitigation incorporated within the Scheme design.

Residual Assessment

7.1.29 With the inclusion of the mitigation measures outlined above, it is concluded that the proposed Scheme is unlikely to give rise to an adverse effect on the integrity of the Cleddau Rivers SAC alone.

7.1.30 The Llanddewi Velfry to Penblewin Improvements Scheme identified similar effects on otters as this Scheme, both from construction and operation. That scheme also included mitigation measures in common with those outlined above.

7.1.31 The in-combination effects of the two schemes would be limited to the potential for effects from construction, both in terms of water quality/prey availability and disturbance, due to the inclusion of mammal fencing and appropriate culverts and ledges to allow otter passage during all flow conditions.

7.1.32 The effects of the construction of both projects on water quality and fish species is considered under the watercourse feature above.

7.1.33 Construction of the schemes has the potential to cause disturbance to a limited number of resting places which are infrequently used by otter. No natal holts have been recorded within the vicinity of the Scheme. Furthermore, the restrictions included within the mitigation in terms of limitations to night working and lighting will ensure that disturbance to otters is avoided or minimised during the construction of the Scheme.

7.1.34 It is therefore concluded that the proposed Scheme is not likely to give rise to adverse effects on the otter population of the Cleddau Rivers SAC either alone or in-combination with other projects.

7.2 Pembrokeshire Marine / Sir Benfro Forol SAC

Fish Species

Conservation Objectives

7.2.1 The fish populations which are features of the SAC will be considered to be in favourable condition when:

a) The population is maintaining itself on a long-term basis as a viable component of its natural habitat;

b) The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future;

c) The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing.

Assessment of Effects

7.2.2 The stream to the west of Redstone Cross is a tributary of the Narberth Brook which flows into the Eastern Cleddau (part of the Cleddau Rivers SAC), see **ES Volume 2, Figures 7.1 and 7.2**. The SAC is approximately 2 km downstream of where the Scheme crosses this tributary at Ch 0+400. The Eastern Cleddau is included in the Pembrokeshire Marine SAC downstream of Blackpool Mill, approximately 4.5km from the Scheme.

7.2.3 The construction of the Scheme has the potential to give rise to the release of sediment laden run-off and pollutants in to the watercourses that are crossed by the Scheme. Where this to occur in those that flow in to the SAC system this could give rise to effects on the fish populations which may be present and are features of the SAC. Taking in to account he requirements of conservation objectives, it is clear that in the absence of mitigation, these are likely to result in adverse effects on the integrity of these features.

7.2.4 The Highways England Water Risk Assessment Tool (HEWRAT) model was used to consider the operational impact of the Scheme. This found in the absence of mitigation measure that there were potential for operational effects on water quality within surface water systems resulting from heavy metals, see **Road Drainage and Water Environment** (ES Volume 1, ES Chapter 7). These effects are also considered likely to give rise adverse effects on the integrity of the watercourse habitat and fish species features.

7.2.5 **Road Drainage and Water Environment** (ES Volume 1, ES Chapter 7) assesses the impact of the scheme on the ground water environment of the Pembrokeshire Marine SAC which lies approximately 1.2 km at its closest point to the north of the Scheme although this found no likely effects.

Mitigation Measures

7.2.6 The mitigation measures for fish species are set out in relation to the watercourse and fish populations within the Cleddau Rivers SAC above.

Residual Assessment

7.2.7 The mitigation measures outlined above are considered adequate to reduce the scale of effects of the construction and operation of the Scheme to levels that would not adversely affect the integrity of the Pembrokeshire Marine SAC alone.

7.2.8 The only in-combination project identified for the Scheme is the adjacent A40 Llandewi Velfry to Penblewin Improvements. Equivalent mitigation measures to ensure the protection of surface waters were included within that scheme and it is likely that they would be constructed simultaneously.

7.2.9 Pollutions would be limited to discrete point locations which could be easily contained with the measures outlined above. Furthermore, it would be unlikely for two such incidents to occur at the same time even if both schemes were constructed at the same time.

7.2.10 With regard to sediment laden surface water run-off, there is the potential for this to occur during any significant heavy rainfall event during the construction process. However, the pollution and sediment control measures that will be included within the CEMP will ensure that sediments are not released in to watercourses.

7.2.11 Therefore, it is concluded that the construction and operation of the Scheme in-combination with other projects would not give rise to adverse effects on the integrity of the fish features of the Pembrokeshire Marine SAC.

Otter Population

7.2.12 The otter feature of the Pembrokeshire Marine / Sir Benfro Forol SAC will be considered to be in favourable conservation status, where all of the following conditions are satisfied:

a) The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements are

population size, structure, production, and condition of the species within the site.

b) Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression.

c) The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

d) Their range within the SAC and adjacent inter-connected areas is not constrained or hindered.

e) There are appropriate and sufficient food resources within the SAC and beyond.

f) The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing.

g) The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include;

   i. Distribution.
   ii. Extent.
   iii. Structure.
   iv. Function and quality of habitat.
   v. Prey availability and quality.

7.2.13 As part of this objective it should be noted that:

a) The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term.

b) The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term.

c) Contamination of potential prey species should be below concentrations potentially harmful to their physiological health.

d) Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour.

e) There are sufficient sources within the SAC and beyond of high-quality freshwater for drinking and bathing.

7.2.14 In the Milford Haven waterways complex, inputs of nutrients and contaminants to the water column and sediments derived from human

activity must remain at or below levels at the time the site became a candidate SAC. As part of this objective, it should be noted that otter populations should be increasing.

Assessment of Effects

7.2.15 The screening test identified the potential for significant effects on otter due to the risk of collision with vehicles. Although otters do not appear to be present within the study area on a regular basis, it is considered likely that they use watercourses within the study area to move between catchment areas. This is supported by the field surveys as otter were recorded in six out of nine of the surveyed watercourses.

7.2.16 The existing road is likely to form a potential barrier or risk for otters moving between catchment areas, in particular where there are watercourses within culverts under the road. However, no otter casualties have been reported within the local area.

7.2.17 The proposed Scheme will in effect create a second barrier for the majority of its length with the exception of the area of the Penblewin roundabout where it is on the line of the existing road.

7.2.18 Therefore, in light of Conservation Objective D above, it is considered that, in the absence of mitigation, the proposed Scheme will have an adverse effect on the integrity of the Pembrokeshire Marine / Sir Benfro Forol SAC.

Mitigation Measures

7.2.19 See mitigation measures for otter outlined above under (Cleddau Rivers SAC).

Residual Assessment

7.2.20 With the inclusion of the mitigation measures outlined above, it is concluded that the proposed Scheme is unlikely to give rise to an adverse effect on the integrity of the Pembrokeshire Marine / Sir Benfro Forol SAC alone. The in-combination assessment for this feature would be the same as for the otter feature of the Cleddau River SAC.

7.2.21 It is therefore concluded that the proposed Scheme is not likely to give rise to adverse effects on the integrity of the otter population of the Pembrokeshire Marine/Sir Befro Forol SAC either alone or in-

combination with other projects.

7.3 Pembrokeshire Bats Sites and Bosherston Lakes SAC

Greater Horseshoe Bat

7.3.1 The greater horseshoe bat feature of this SAC is considered to be in favourable condition when:

a) The greater horseshoe bat population will be capable of maintaining itself on a long-term basis as a viable component of its natural habitats.

b) The natural range of greater horseshoe bats will neither be reduced nor will be likely to be reduced for the foreseeable future.

c) There will be sufficient habitat to maintain its populations on a long-term basis.

d) At least three SSSI maternity roosts will be occupied annually by adult greater horseshoe bats and their young:

   i. Stackpole Courtyard Flats and Walled Garden SSSI

   ii. Slebech Stable Yard Loft, Cellars and Tunnels SSSI

   iii. Felin Llwyngwair SSSI

e) Carew Castle SSSI will continue to be used as an intermediate greater horseshoe bat roost, during the spring and autumn, as a male summer roost and an autumn/spring mating roost.

f) The greater horseshoe bat population at the component SSSI's will be stable or increasing.

g) There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.

h) All factors affecting the achievement of these conditions are under control.

7.3.2 The Core Management Plan also sets out performance indicators with the conservation objectives including the following for the availability of bat fly-ways and feeding areas:

a) 7-16km - Only a small part of this area is likely to be used for foraging, but flight routes may lead further, connecting to other roost sites. Maintenance of pronounced habitat links through the area will be important. Some of the most pronounced areas of extensive hedgerows (particularly higher overgrown ones), scrub and wet woodland - especially surrounding pasture and wet ground will be important to the bats.

Assessment of Effects

7.3.3 The proposed Scheme crosses a number of linear features where greater horseshoe bat passes have been recorded. The highest levels of activity were recorded within the woodland at Ch0+800. Further details on the survey results are provided in Section 5 above and within **Nature Conservation** (ES Volume 1, Chapter 8).

7.3.4 The construction of the proposed Scheme will result in the loss of 14.74ha grazing pasture (measured from the Phase 1 Habitat survey results within the proposed Scheme fenceline), which is a very small amount compared to the area of land within the 7-16km zone around the Slebach Stableyard roost (8,027,088.4ha), a large proportion of which comprises similar grazing pasture. However the area affected by the Scheme is much closer to a potential maternity roost at Sodston.

7.3.5 However, the proposed Scheme has the potential to limit the range of greater horseshoe bats by the interruption of flight lines. The width of the Scheme is such that horseshoe bats are likely to either drop to road height whilst crossing, risking collision with vehicles, or would be deterred from crossing altogether, resulting in a contraction of their range.

7.3.6 Therefore, in light of Conservation Objective b) above, it is considered that in the absence of mitigation, the proposed Scheme will have an adverse effect on the integrity of the greater horseshoe bat feature of this SAC.

Mitigation Measures – Design Mitigation

<u>Crossing Structures</u>

7.3.7 A total four culvert crossing structures have been designed to allow bats to safely cross from one side of the scheme to the other, see Table 11 below for a summary of the crossings for bats.

Table 11 Summary of crossing structures designed for bats

Chainage	Location	Dimensions
Ch 0+420	Woodland and stream SW of Redstone Cross	Reinforced concrete underpasses (x2) 2m headroom x 3m wide 54m long (under mainline) 52m long (under side road)
Ch 0+820	Woodland to E of Redstone Cross	Reinforced concrete underpass 2m headroom by 3m wide 38.5m long
Ch 1+150	Along strip of woodland SW of Blackmoor Hill Farm	Reinforced concrete underpass 2m headroom x 3m wide, 45m long
Ch 1+380	Woodland and stream, E of Blackmoor Hill Farm	Reinforced concrete underpass 5.3m headroom x 3m wide 51m long

7.3.8 Three of these crossings have been placed along three of the four key foraging and commuting hotspots identified through the baseline surveys, see 5.4.18; the underpass at Ch 0+820, underpass at Ch 1+150 and underpass at Ch 1+380. The fourth crossing designed for bats is the pair of two reinforced concrete underpasses at Ch 0+420 southwest of Redstone Cross (underneath the mainline and side road). Despite not being identified as one of the four hotspots it was found to support foraging and commuting bats including greater horseshoe [BAI 0.16].

7.3.9 The fourth key foraging and commuting area identified through the baseline surveys not covered by a crossing structure; the hedgerow which runs north south at Ch 0+900 (Static Location 4) will be completely removed to accommodate the scheme. In its place, either side of the scheme will be native species planting which will run east-west along the new highway boundaries which will guide commuting bats either west towards the green bridge at Ch 0+820, or east to the underpass at Ch 1+150, see **Environment Masterplan** (ES Volume 3, Appendix 2.7).

Underpasses

7.3.10 Each underpass is at least 2m high and 3m wide to ensure they are of sufficient size to provide effective mitigation for bats including greater horseshoe bat. Previous studies on the effectiveness of crossing structures focusing on greater horseshoe bats on the adjacent A40 Penblewin to Slebech Park Improvement, where the culvert size was 1.8m in diameter or higher found that a small proportion of greater horseshoe bats still choose to fly over the road during monitoring

surveys in the first five years of operation[12]. For culvert sizes 1.8m in diameter or higher, the study found that between 86% and 97% of greater horseshoe bat passes recorded were using the structure. The remainder were flying over the road.

7.3.11 The four underpasses designed for bats within the Scheme are at least 2m headroom x 3m wide therefore it is expected they will be taken up as effective commuting routes for bats including greater horseshoe bats with a greater effectiveness.

Lighting

7.3.12 It is only proposed to provide illumination on the Penblewin roundabout and its approaches, with the approach lighting distance equal to the peak traffic queuing distance, which is approximately to the back of the splitter island. This represents a reduction in the extent of lighting compared to the existing A40 where the lighting extends approximately 60m back from the roundabout.

7.3.13 The existing vegetation around the roundabout and approaches will be significantly affected during the construction of the Scheme. Further consideration of the exact locations of lighting columns in relation to areas of proposed landscaping should be undertaken during the detailed design stage.

7.3.14 No road illumination is proposed at Redstone Cross Junction, which has west facing access/egress only, or anywhere else along the scheme. The existing street lighting on Redstone Road north of the Blaenmarlais Care home will be removed along with that on the existing A40 corridor at Redstone Cross Junction. The amount of street lighting within the vicinity of the Scheme will therefore be significantly reduced.

7.3.15 The lighting on the Penblewin roundabout approaches will be designed in accordance with advice in the BCT and Institute of Lighting Professionals (ILP) guidance on Bats and artificial lighting in the UK[13], and will ensure that light spill on to adjacent areas of vegetation is avoided or minimised in accordance with the guidance.

[12] Davies J. G. (2019) *Effectiveness of mitigation of the impacts of a new road on horseshoe bats Rhinolophus ferrumequinum in Wales*, UK. Conservation Evidence Vol 16, pages 17-23. ISSN 1758-2067.
[13] BCT, ILP (2018) *Guidance Note 08/18: Bats and artificial lighting in the UK Bats and the Built Environment series*. Bat Conservation Trust and Institute of Lighting Professionals.

Mitigation Measures - Construction Mitigation

7.3.16 During the construction of the Scheme, a number of mitigation measures will be implemented to ensure that bats are not prevented from crossing the construction area or disturbed whilst foraging. These include:

a) Pre-construction surveys, if more than two years have elapsed since the surveys to inform this assessment, to ensure all active flight routes have been identified.

b) The key commuting and foraging routes for bats crossing the scheme, see 5.4.18 (to be updated by pre-construction surveys) will be retained for as long as possible in the works programme to minimise the duration of severance of these features.

c) Temporary reconnection of these routes will be implemented during construction using dead hedging (such as a line of branches set within barrels or a line of herras fencing panels/similar with hessian/netlon fencing stretched across them to provide a solid structure along which bats can commute), to allow bats to continue using these routes where possible. These will be positioned before dusk each day during the period between April and October (exact timing to be informed by weather conditions) to reconnect severed features until such time as the crossing structures are installed.

d) Where possible construction activities should be limited to daylight hours, with no works within 1hr of sunset or sunrise. Any temporary construction stage task lighting required within the bat activity season (May to October inclusive) must ensure there is no light spill on either roosts or potential commuting routes. A buffer zone where there is no artificial illumination or glare will need to be agreed at the licensing stage and adhered to during construction.

e) Supervision by an ECoW of vegetation clearance and the installation of any relevant ecological mitigation incorporated within the Scheme design.

Residual Assessment

7.3.17 Due to the vertical alignment of the Scheme it has not been possible to include culverts of at least 3m height inline with the recommendations of the Best Practice Guidelines for Transport Infrastructure [14] apart from the farm underpass at Ch1+380. However, all the culverts have a cross-sectional area in excess of 5.35m^2, a size which was found to greatly increase the uptake of culverts by bats on the nearby A40

[14] Berthinussen A, Altringham J (2015). WC1060 Development of a cost effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure. DEFRA Science and Research Projects.

Robeston Wathen Improvements Scheme[15].

7.3.18 The Best Practice Guidelines for Transport Infrastructure also recommends culverts of approximately 6m in height be used for woodland edge flying species, however it should also be noted that bats crossing a road over 5m above the road surface would be deemed to have crossed safely[16].

7.3.19 Research has also found the majority of bat species will use structures with much smaller dimensions as reporting in Limpens, Twisk, & Veenbaas (2005)[17], including species such as barbastelle bat, whiskered bat (*Myotis mystacinus*) and Brandt's bat (*Myotis brandtii*) which are woodland edge species.

7.3.20 Table 5 of Limpens, Twisk, & Veenbaas reports all of the species recorded on the Scheme with the exception of noctule and serotine, have been found to use tunnels 4m wide by 4m high and bridges over water with a minimum height of 2m. Whilst larger culverts up to 6m height may increase the certainty of being used by bats, the practicality and cost of including such large structures within a Scheme is limited and potentially unneccessary if smaller structures have been found to be effective elsewhere within the United Kingdom and Europe.

7.3.21 Therefore, although the mitigation design does not include culverts of 6m in height as recommended by the Best Practice Guidelines for transport infrastructure, there is evidence that the culverts proposed within the revised mitigation design will be of sufficient size to be effective in providing safe crossing points for all bat species, and particularly the two horseshoe bat species.

7.3.22 Therefore, with the inclusion of the mitigation measures outlined above, it is concluded that the proposed Scheme alone is unlikely to give rise to an adverse effect on the integrity of the Pembrokeshire Bat Sites and Bosherston Lakes SAC in relation to the greater horseshoe bat feature.

7.3.23 Both the A40 Llanddewi Velfry to Penblewin Improvements and the proposed Scheme have the potential to give rise to effects on the greater

[15] Davies, J. (2019). Effectiveness of mitigation of the impacts of a new road on horseshoe bats Rhinolophus ferrumequinum in Wales, UK. Conservation Evidence 16, 17 – 23.
[16] Berthinussen A, Altringham J (2012). Do Bat Gantries and Underpasses Help Bats Cross Roads Safely? PLoS ONE 7(6): e38775. https://doi.org/10.1371/journal.pone.0038775
[17] Limpens, H., Twisk, P., & Veenbaas, G. (2005). Bats and Road Construction. Delft, The Netherlands: Rijkswaterstaat.

horseshoe bat feature of this European Site although neither would be likely to give rise to adverse effects on the integrity of the feature and site alone.

7.3.24 Both projects include appropriate proportionate mitigation measures both to provide safe crossing structures and to avoid and reduce the effects of habitat severance and disturbance during construction. Whilst there is the potential that mitigation measures may not be completely effective, the two projects in-combination would not be likely to prevent the European Site from achieving its conservation objectives, in part due to the distance separating the projects from the European Site.

7.3.25 It is therefore concluded that the proposed Scheme is not likely to give rise to adverse effects on the integrity of the greater horseshoe bat feature or the Pembrokeshire Bat Sites and Bosherston Lakes SAC either alone or in-combination with other projects.

Lesser Horseshoe Bat

7.3.26 The lesser horseshoe bat feature of this SAC is considered to be in favourable condition when:

a) The lesser horseshoe bat population will be capable of maintaining itself on a long-term basis as a viable component of its natural habitats.

b) The natural range of lesser horseshoe bats will be neither being reduced nor will be likely to be reduced for the foreseeable future, and

c) There will be sufficient habitat to maintain its populations on a long-term basis.

d) At least four SSSI maternity roosts will be occupied annually by adult lesser horseshoe bats and their young:

   i. Beech Cottage, Waterwynch SSSI,

   ii. Orielton Stable Block and Cellars SSSI,

   iii. Park House Outbuildings SSSI,

   iv. Stackpole Courtyard Flats and Walled Garden SSSI

e) The lesser horseshoe bat population at the component SSSI's will be stable or increasing.

f) There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including

continuous networks of sheltered, broadleaved woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.

g) All factors affecting the achievement of these conditions are under control.

7.3.27 Lesser horseshoe bat is not listed as key species within the Slebech Park Stable Yard Loft, Cellers and Tunnels SSSI component of the SAC. It is included as a species of importance but not the main focus of management or monitoring. However, the performance indicators include reference to winter hibernation roosting by lesser horseshoe bats within the Slebech Stable Yard Loft, Cellers and Tunnels SSSI.

7.3.28 The performance indicators also set limits for the availability of bat fly-ways and feeding areas out with the designated areas of the SAC up to a distance of 7km from the roost sites.

Assessment of Effects

7.3.29 Two passes of lesser horseshoe bat were recorded within the woodland block at Ch0+800.

7.3.30 The Scheme is located in excess of 7km from the Slebach Stable Yard and therefore the severing of flight routes is not considered to affect the performance indicators in relation to the Slebech component of the SAC.

7.3.31 However, bats hibernating within the Slebech roost are likely to include bats from a number of different summer roosts within the vicinity, but outwith the SAC designated area. The maintenance of these supporting populations will be important in maintaining the numbers of bats hibernating within the SAC component.

7.3.32 The proposed Scheme has the potential to limit the range of lesser horseshoe bats from supporting roosts by the interruption of flight lines. The width of the Scheme is such that horseshoe bats are likely to either drop to road height whilst crossing, risking collision with vehicles, or would be deterred from crossing altogether, resulting in a contraction of their range.

7.3.33 Therefore, in light of the conservation objectives above, it is considered that in the absence of mitigation, the proposed Scheme will have an adverse effect on the integrity of the lesser horseshoe bat feature of this

SAC.

Mitigation Measures

7.3.34 The mitigation measures outlined above for greater horseshoe bats also apply to the lesser horseshoe bat feature.

Residual Assessment

7.3.35 As with the residual assessment for greater horseshoe bat above, with the inclusion of the mitigation measures outlined above, it is concluded that the proposed Scheme alone is unlikely to give rise to an adverse effect on the integrity of the Pembrokeshire Bat Sites and Bosherston Lakes SAC in relation to the lesser horseshoe bat feature.

7.3.36 Both the A40 Llanddewi Velfry to Penblewin Improvements and the proposed Scheme have the potential to give rise to effects on the lesser horseshoe bat feature of this European Site although neither would be likely to give rise to adverse effects on the integrity of the feature and site alone.

7.3.37 Both projects include appropriate proportionate mitigation measures both to provide safe crossing structures and to avoid and reduce the effects of habitat severance and disturbance during construction. Whilst there is the potential that mitigation measures may not be completely effective, the two projects in-combination would not be likely to prevent the European Site from achieving its conservation objectives, in part due to the distance separating the projects from the European Site.

7.3.38 It is therefore concluded that the proposed Scheme is not likely to give rise to adverse effects on the integrity of the lesser horseshoe bat feature or the Pembrokeshire Bat Sites and Bosherston Lakes SAC either alone or in-combination with other projects.

7.4 Limestone Coast of South West Wales SAC

7.4.1 The greater horseshoe bat feature of the Limestone Coast of South West Wales SAC is considered to be in favourable condition when:

a) Greater horseshoe bats will continue to utilise known caves roosts undisturbed by the public.

b) Distinctive droppings indicate presence at any time of year but largest numbers of bats are likely to be found in the period November to March.

c) The peak winter population in the main Castlemartin Cave is equivalent to approximately 20% of the Pembrokeshire Bat Sites and Bosherston lakes SAC greater horseshoe bat population.

d) The greater horseshoe bat population within the caves being monitored is stable or increasing.

e) Natural processes such as rock falls will be tolerated but other factors affecting the achievement of these conditions are under control.

Assessment of Effects

7.4.2 The greater horseshoe bat interest within this SAC is the use of certain caves along the coast line as hibernation sites by bats from the Pembrokeshire Bat Sites and Bosherston Lakes SAC. The effects of the proposed Scheme on this latter site has been assessed in section 7.3 above.

7.4.3 The potential for effects on the greater horseshoe bat feature of the Limestone Coast of South Wales SAC comes from the risk of severing flight routes which may be used to move between different roost sites, and the potential risks of mortality from bats flying across the operational road. However, as the proposed Scheme is located to the north east of all the key roost sites within both the Limestone Coast of South West Wales SAC and the Pembrokeshire Bat Sites and Bosherston Lakes SAC, the risk of these effects being discernible within the SAC populations is unlikely as described in section 7.3 above.

7.4.4 However, in the absence of mitigation, the risk remains and therefore, adverse effects could occur.

Mitigation Measures

7.4.5 The mitigation measures are the same as described in section 7.3 above.

Residual Effects

7.4.6 As with the residual assessment for greater horseshoe bat as a feature of the Pembrokeshire Bat Sites and Bosherston Lakes SAC above, with

the inclusion of the mitigation measures outlined above, it is concluded that the proposed Scheme is unlikely to give rise to an adverse effect on the integrity of the Limestone Coast of South West Wales SAC in relation to the greater horseshoe bat feature. The in-combination assessment for this feature would be the same as for the greater horseshoe bat feature of the Pembrokeshire Bat Sites and Bosherston Lakes SAC.

7.4.7 It is therefore concluded that the proposed Scheme is not likely to give rise to adverse effects on the integrity of the greater horseshoe bat population of the Limestone Coast of South West Wales SAC either alone or in-combination with other projects.

7.5 North Pembrokeshire Woodlands SAC

7.5.1 The barbastelle bat feature of the North Pembrokeshire Woodlands SAC is considered to be in favourable condition when:

a) There will be no loss of ancient semi-natural woodland at the site.

b) Canopy gaps will be present throughout the site, with two or more young trees growing in each.

c) Canopy cover will be 50-90% throughout the site (except in Hawthorn fields).

d) A well-developed shrub layer with holly will be present throughout the woodland, to provide a favourable micro-climate for roosting barbastelle bats.

e) A minimum of 4 trees per hectare will be allowed to die standing, will not be removed or cut down. These will be distributed across the site and will include trees with splits, fallen, leaning trees and hollow trees.

f) Ivy will be allowed to grow on trees throughout the site, to provide roosting opportunities.

g) There will be no overall loss of open water.

h) There will be no increase in disturbance (e.g. paths or rides) near any of the roosting sites.

i) No roosting sites will be lost as a result of human intervention.

j) Barbastelle bat passes will be detected on at least four out of six transects between 25 July and 7 September.

k) There will be contiguous suitable foraging habitat within a 16km radius around Pengelli Forest, including wooded stream valleys, low and overgrown hedgerows, scrub, overgrown pastures, bracken stands and woodland (which can include conifer plantations).

l) Roosts outside the SSSI boundary will be left undisturbed, with no woodland management within 50m of a barbastelle roost, and no clearance of the shrub layer. Over-mature trees in any of the woodlands within 2km of Pengelli should be left undisturbed except where they pose a risk to public safety, in which case minimal trees surgery can be permitted.

m) All factors affecting the achievement of the foregoing conditions will be under control.

Assessment of Effects

7.5.2 Barbastelle bats were only recorded on one occasion during the 2019 surveys, consisting of a single pass in April 2019. The survey results show that this species only uses areas within the vicinity of the proposed Scheme on an infrequent basis. Although separated by a considerable distance from the SAC designated area (c. 18.8km), there are records of barbastelle from areas closer to the proposed Scheme, and it is therefore not possible to confirm that there is no link between barbastelle bats recorded and the SAC designated population.

7.5.3 Barbastelle bats are considered to be vulnerable to collision with vehicles as casualties have been recorded (Catherine Bickmore Associates, 2003), although they have stronger echolocation calls and are less likely to fly at low heights over open areas.

7.5.4 Given the behavioural characteristics of the species concerned and the very low levels of activity recorded on the site, it is considered very unlikely that barbastelle bats would be affected, either in terms of the severing of flight routes or collision with vehicles, at a population level.

7.5.5 Conservation Objective 11 relates to the availability of foraging habitat within 16km; however, as the proposed Scheme is over 18km from the SAC boundary, the ability of the feature to meet its conservation objectives is not affected.

7.5.6 Whilst there is potential for the barbastelle bats recorded within the study area to be associated with the North Pembrokeshire Woodlands SAC, the significant distance between the Scheme and this site means

that the proposed Scheme alone is not likely to have a discernible effect on the population with the SAC. This would also apply to the A40 Llanddewi Velfry to Penblewin Improvements (the in-combination project).

7.5.7 Therefore, it can be concluded that the proposed Scheme is unlikely to give rise to adverse effects on the integrity of the barbastelle bat feature of the North Pembrokeshire Woodlands SAC either alone or in-combination with other projects. Furthermore, the mitigation measures included within the Scheme for bats in the form of culverts at key features will provide safe crossing points for bat species including barbastelle.

8 Monitoring

8.1 Pre-Construction Monitoring

8.1.1 Monitoring in the form of pre-construction surveys will be undertaken to provide up to date information on the presence of otters, horseshoe bat species and barbastelle bat.

8.1.2 Otter surveys would be undertaken on two occasions within the preceding six months prior to the start of construction. All watercourses within 100m of the proposed Scheme, along with any associated construction areas, will be searched for signs of otter activity and potential resting places. Other areas of habitats such as woodlands and dense scrub will also be searched for the presence of potential natal holts.

8.1.3 Pre-construction surveys for bats, should delays occur, will comprise the following elements:

a) Inspections and emergence/re-entry surveys of trees within 50m;
b) Static activity monitoring of the identified flight routes and other linear features intersected by the Scheme;
c) Walked transects along the alignment of the proposed Scheme.

8.2 Monitoring during Construction

8.2.1 During the construction phase, monitoring will be undertaken to record animals passing through the construction areas. This will be undertaken using trail cameras to monitor the movement of otters along water courses, and through a combination of static and walked activity transects. Infra-red camera monitoring will also be undertaken at the key flight line locations that have been identified. The full details of monitoring including frequency and monitoring effort will be discussed and agreed with NRW prior to the commencement of construction through the production of an Ecological Compliance Audit Scheme.

8.3 Post Construction Monitoring

8.3.1 Monitoring will be undertaken for five years post-construction, with any requirement beyond this, subject to agreement with the relevant statutory environmental bodies. The monitoring will include:

a) Monitoring of the condition of the mitigation measures on an annual basis.

b) Monitoring the effective use of underpasses by otters.

c) Monitoring the effective use of underpasses by bat species, with particular regard to horseshoe species.

8.4 Criteria for Effectiveness

8.4.1 The mitigation measures will be considered to be effective and therefore to have successfully fulfilled their function when the following draft criteria, which are based on published literature, are met:

a) 80% of lesser horseshoe, greater horseshoe or barbastelle bats recorded crossing the scheme at the four mitigation structures use those structures to cross the Scheme safely. This would be where 80% of bats recorded use the structure instead of flying over the road or cross the road at a height in excess of 5m above the road surface[18].

b) Lesser and greater horseshoe bats continue to be recorded during activity surveys to both the north and south of the Scheme.

c) Otters are recorded using underpasses.

d) No otter casualties as a result of road traffic accidents are recorded on the Scheme.

8.4.2 If these criteria are not met within any of the monitoring years post construction, the mitigation will be reviewed in consultation with NRW to agree any remedial action or alterations to the mitigation to improve its effectiveness.

8.4.3 Monitoring criteria will be discussed and agreed with NRW during the detailed design stage prior to construction.

8.5 Reporting

8.5.1 The results of the monitoring will be reported to NRW and other relevant statutory environmental bodies on an annual basis through the Ecological Compliance Audit and Monitoring Reports. In addition, the

[18] In accordance with Berthinussen & Altringham (2015) Development of a Cost-Effective Method for Monitoring the Effectiveness of Mitigation for Bats Crossing Linear Transport Infrastructure WC1060 Appendix G which states ['*Mitigation structures are considered to be effective when bats are commuting across the scheme in similar numbers before and after construction, and at least 90% of crossing bats are using the structure to cross safely'*.]

scope of the monitoring, methods and results will be discussed through further engagement with the Environmental Liaison Group during and post construction.

9 Consultation

9.1.1 Regulation 63(3) of the Habitats Regulations requires the competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which requires appropriate assessment to "consult the appropriate nature conservation body and have regard to any representations made by that body within such reasonable time as the authority specify."

9.1.2 The Scheme has been developed through an iterative process, and has been subject to assessment of impacts on European sites. An Appropriate Assessment Screening Report was prepared for the transportation study (DMRB Key Stage 2) for the Scheme; the screening exercise involved a detailed assessment of the potential impacts of various route options for the Scheme on European sites, and several options were ruled out due to their potential for significant impacts on European sites.

9.1.3 During the development of the Scheme regular Environmental Liaison Group meetings have been held with various stakeholders, including the Welsh Government and Statutory Environmental Bodies (SEB) including NRW and Pembrokeshire Council, to discuss the development of the Scheme design and the progress of surveys and assessment of effects.

10 Conclusion

10.1.1 The Habitat Regulations requires answers to the following four questions (a to d), based on the information presented, when concluding a SIAA. These are addressed in turn here, in relation to the sites that were considered in the Appropriate Assessment.

a) Is the proposal directly connected with or necessary to site management for nature conservation?

10.1.2 The proposed Scheme is neither connected with nor necessary to the management of the European Sites being considered.

b) Is the proposal likely to have a significant effect on the features of the site of European Importance, alone or in combination with other plans and projects?

10.1.3 The screening exercise identified that the proposed Scheme had the potential to give rise to significant effects on watercourses and the populations of fish they support, lesser horseshoe bats, greater horseshoes, barbastelle bats and otters, which are the qualifying features of the European Sites being considered. The likely significant effects of the Scheme are listed in Section 6 and are discussed in detail in Section 7.

c) What are the implications of the effects of the proposal on the sites' conservation objectives and will it delay or interrupt progress towards achieving the objectives?

10.1.4 It has been concluded that, assuming the implementation of the various mitigation measures outlined in Section 7 of this document, the proposed Scheme would not affect progress towards the achievement of any of the objectives for qualifying features of European Sites.

d) Can it be ascertained that the proposal will not adversely affect the integrity of the sites beyond reasonable scientific doubt?

10.1.5 Whether the Scheme would have an adverse effect on the integrity of the sites has been determined by assessing whether the Scheme would affect the achievement of one or more of the relevant conservation objectives set for the European Sites considered in the Appropriate Assessment. This has been limited to those conservation objectives which are likely to be affected by the Scheme. The assessment

concluded that the residual effects of the Scheme would not affect the achievement of any of the conservation objectives set for the five Special Areas of Conservation considered.

10.1.6 Best professional judgement was used to answer these questions, supported by the information outlined in this SIAA. As the answer to all of these questions is 'no', it is considered that the Scheme would not adversely affect the integrity of any of the sites.

10.1.7 Therefore, for the purposes of Regulation 63 of the Conservation of Habitats and Species Regulations 2017, it is concluded that there would not be an adverse effect on the integrity of the European Sites considered in this assessment.

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Appendix A: Screening Matrices

A1 Afonydd Cleddau / Cleddau Rivers SAC

Project Name:	A40 Penblewin to Redstone Cross	
European Site under consideration:	Afonydd Cleddau / Cleddau Rivers SAC	
Date:	Author:	Verified
1 June 2020	Victoria Newlove	Pete Wells
Description of Project		
Size and scale (road type and probable traffic volume)	A 1.76km length of the A40 Trunk Road would be improved with two lanes provided in one direction, to allow overtaking, and one lane provided in the opposite direction. The overtaking provision will alternate so that both eastbound and westbound traffic can overtake. The Penblewin to Redstone Cross section of the A40 has no intermediate junctions (other than a few minor property accesses) and has relatively low traffic flows, slightly in excess of 10,000 Annual Average Daily Traffic (AADT).	
Land take	The approximate area of the Scheme footprint is13.6ha, which includes all land required for the Scheme to be constructed operated and maintained. No land take is required from any European Site.	
Distance from the European Site or key features of the site (from edge of the project assessment corridor)	The SAC is located approximately 1.2km from the Scheme at its closest point and is hydrologically connected via water courses.	
Resource requirements (from the European Site or from areas in proximity to the site, where of relevance to consideration of impacts)	All materials required for the construction of the Scheme (including concrete, steel and imported fill/topsoil) will be sourced from appropriate suppliers within the local/regional area. These will not be sourced from within or near to European Site. The suppliers of materials will be determined during the detailed design stage.	
Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution)	Emissions in terms of highways drainage and air quality emissions are largely unchanged. There is the potential for sediment run-off during construction in the event of heavy rainfall and flood events however this will be avoided using PEU measures.	
Excavation requirements (e.g. impacts of local hydrogeology)	Approximately 880m of the Scheme are within cutting and will require significant excavation. The construction of the proposed attenuation ponds will generally require shallow excavations, with a maximum depth of 5.4 metres from the current ground level to the base of the pond invert level. The proposed overbridge is also anticipated to	

	require shallow excavations to facilitate shallow foundations. Mobilisation of silts during excavation, work on the river banks or by surface water runoff from bare areas, could result in washing of sediment into watercourses and cause siltation within any riverbed gravels.
Transportation requirements	This information is not available at this stage
Duration of construction and operation	Detailed design and construction works are considered likely to commence in 2021 and would continue for around 12 months. Maintenance and aftercare of the environmental aspects of the Scheme remain the responsibility of the Contractor for five years after the completion of construction.
Other	Not applicable
Description of avoidance and/or mitigation measures Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on:	
Nature of proposals	Pollution prevention measures including sediment management.
Location	Within the construction areas.
Evidence for effectiveness	Plainly established good construction practice as recommended by organisations such as CIRIA and the Environment Agency/Natural Resources Wales.
Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations)	Implementation of an agreed CEMP.
Characteristics of European Site A brief description of the European Site should be produced, including information on:	
Name of European Site and its EU code	Afonydd Cleddau / Cleddau Rivers SAC UK0030074
Location and distance of the European Site from the proposed works	The closest point of the Cleddau Rivers SAC is located approximately 1.2km to the west of the Scheme. This is the Longford Brook tributary of the Easter Cleddau.
European Site size	730.55ha
Key features of the European Site including the primary reasons for selection and any other qualifying interests	The SAC is designated for the following features: • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batracion* vegetation • Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior • Active raised bogs • Brook lamprey • River lamprey

	• Sea lamprey • Bullhead • European otter
Vulnerability of the European Site – any information available from the standard data forms on potential effect pathways	The Cleddau Rivers are vulnerable to diffuse pollution and siltation arising from agricultural land practices.
European Site conservation objectives – where these are readily available	A summary of the conservation objectives for this site is provided in Appendix B.
Assessment Criteria Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the European Site.	
Impacts are considered to be the potential for polluted or sediment laden run-off to enter the water course and effect water quality, with consequential effects on habitats and species. The potential for otter mortality as a result of collision with vehicles is also considered as otters are likely to use streams crossed by the Scheme to move between catchments.	
Initial Assessment The key characteristics of the site and the details of the European Site should be considered in identifying potential impacts. Describe any likely changes to the site arising as a result of:	
Reduction of habitat area	There is no direct impact on habitats within the SAC. There is the potential for pollution and/or sediment run-off entering the Longford Brook
Disturbance to key species	No impacts predicted.
Habitat or species fragmentation	Potential for impacts on otter populations through severing of dispersal corridors.
Reduction in species density	Potential for impacts on otter populations through collision with vehicles.
Changes in key indicators of conservation value (water quality, etc)	There is the potential for pollution and/or sediment run-off entering the Longford Brook however this will be controlled by implementation of pollution control measures and planning of works to reduce risk of sediment release during flood events.
Climate change	No impacts predicted.
Describe any likely impacts on the European Site as a whole in terms of:	
Interference with the key relationships that define the structure of the site	No impacts are predicted.
Interference with key relationships that define the function of the site	There is the potential for pollution and/or sediment run-off entering the Longford Brook however this will be controlled by implementation of pollution

	control measures and planning of works to reduce risk of sediment release during flood events.
Indicate the significance as a result of the identification of impacts set out above in terms of:	
Reduction of habitat area	Potentially significant.
Disturbance to key species	Not significant.
Habitat or species fragmentation	Potentially significant.
Loss	Potentially significant.
Fragmentation	Not significant.
Disruption	Not significant.
Disturbance	Not significant.
Change to key elements of the site (e.g. water quality, hydrological regime etc)	Not significant.
Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.	
Potential for significant effects on otter populations from collisions with vehicles and severance of dispersal corridors.	
Outcome of screening stage (delete as appropriate).	Likely to be Significant Effects.
Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence).	This document will be share with NRW.

A2 Pembrokeshire Bat Sites and Bosherston Lakes SAC

Project Name:	A40 Penblewin to Redstone Cross	
European Site under consideration:	Pembrokeshire Bat Sites and Bosherston Lakes SAC	
Date:	Author:	Verified
1 June 2020	Victoria Newlove	Pete Wells
Description of Project		
Size and scale (road type and probable traffic volume)	A 1.76km length of the A40 Trunk Road would be improved with two lanes provided in one direction, to allow overtaking, and one lane provided in the opposite direction. The overtaking provision will alternate so that both eastbound and westbound traffic can overtake. The Penblewin to Redstone Cross section of the A40 has no intermediate junctions (other than a few minor property accesses) and has relatively low traffic flows, slightly in excess of 10,000 Annual Average Daily Traffic (AADT).	
Land-take	The approximate area of the scheme footprint is 13.6ha, which includes all land required for the Scheme to be constructed operated and maintained.	
Distance from the European Site or key features of the site (from edge of the project assessment corridor)	The SAC is located approximately 7.9km from the Scheme at its closest point. This is the Slebech Park roost.	
Resource requirements (from the European Site or from areas in proximity to the site, where of relevance to consideration of impacts)	All materials required for the construction of the Scheme (including concrete, steel and imported fill/topsoil) will be sourced from appropriate suppliers within the local/regional area. These will not be sourced from within or near to European Site. The suppliers of materials will be determined during the detailed design stage.	
Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution)	Emissions in terms of highways drainage and air quality emissions are largely unchanged. There is the potential for sediment run-off during construction in the event of heavy rainfall and flood events however this will be avoided using PEU measures.	
Excavation requirements (e.g. impacts of local hydrogeology)	Approximately 880m of the Scheme are within cutting and will require significant excavation. The construction of the proposed attenuation ponds will generally require shallow excavations, with a maximum depth of 5.4 metres from the current ground level to the base of the pond invert level. The proposed overbridge is also anticipated to require	

	shallow excavations to facilitate shallow foundations. Mobilisation of silts during excavation, work on the river banks or by surface water runoff from bare areas, could result in washing of sediment into watercourses and cause siltation within any riverbed gravels.
Transportation requirements	This information is not available at this stage
Duration of construction, operation,	Detailed design and construction works are considered likely to commence in 2021 and would continue for around 12 months. Maintenance and aftercare of the environmental aspects of the Scheme remain the responsibility of the Contractor for five years after the completion of construction.
Other	Not applicable
Description of avoidance and/or mitigation measures Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on:	
Nature of proposals	Pollution prevention measures including sediment management.
Location	Within the construction areas.
Evidence for effectiveness	Plainly established good construction practice as recommended by organisations such as CIRIA and the Environment Agency/Natural Resources Wales.
Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations)	Implementation of an agreed CEMP.
Characteristics of European Site A brief description of the European Site should be produced, including information on:	
Name of European Site and its EU code	Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston UK0014793
Location and distance of the European Site from the proposed works	The closest part of the European site to the proposed works is the Slebech Park roost site, located 7.9km to the west.
European Site size	121.26ha
Key features of the European Site including the primary reasons for selection and any other qualifying interests	The SAC is designated for the following features: • Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. • Greater horseshoe bat • Lesser horseshoe bat • European otter
Vulnerability of the European Site – any	The lake feature is vulnerable to the effects of diffuse pollution and water quality issues. The

information available from the standard data forms on potential effect pathways	species features are vulnerable to the loss of foraging habitat, fragmentation of habitat and the risk of injury from collision with vehicles.
European Site conservation objectives – where these are readily available	A summary of the conservation objectives for this site is provided in Appendix B.
Assessment Criteria Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the European Site.	
The construction and operation of the new road have the potential to cause the fragmentation of habitats and severe flight lines used by the horseshoe bat species. Once operational there is a risk that bats trying to cross the scheme may be killed or injured through collision with vehicles. Within SAC otters are a feature of the Bosherston Lakes Component with is approximately 25km from the Scheme. This feature is therefore not likely to be affected.	
Initial Assessment The key characteristics of the site and the details of the European Site should be considered in identifying potential impacts. Describe any likely changes to the site arising as a result of:	
Reduction of habitat area	No impacts predicted
Disturbance to key species	No impacts predicted – roost sites located sufficiently way from Scheme to avoid disturbance.
Habitat or species fragmentation	Potential impact from the severance of flightlines and widening of existing crossing points.
Reduction in species density	Potential impact from collision with vehicles.
Changes in key indicators of conservation value (water quality, etc)	No impacts predicted.
Climate change	No impacts predicted.
Describe any likely impacts on the European Site as a whole in terms of:	
Interference with the key relationships that define the structure of the site	No impacts are predicted.
Interference with key relationships that define the function of the site	No impacts are predicted.
Indicate the significance as a result of the identification of impacts set out above in terms of	
Reduction of habitat area	Not significant.
Disturbance to key species	Not significant.
Habitat or species fragmentation	Potentially significant
Loss	Potentially significant
Fragmentation	Potentially significant

Disruption	Not significant
Disturbance	Not significant
Change to key elements of the site (e.g. water quality, hydrological regime etc)	Not significant
Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.	
Potential for the severance of flightlines and the death/injury of horseshoe bats trying to cross the scheme.	
Outcome of screening stage (delete as appropriate).	Likely to be Significant Effects.
Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence).	This document will be share with NRW.

A3 Limestone Coasts of South West Wales SAC

Project Name:	A40 Penblewin to Redstone Cross	
European Site under consideration:	Limestone Coasts of South West Wales SAC	
Date:	Author:	Verified
1 June 2020	Victoria Newlove	Pete Wells
Description of Project		
Size and scale (road type and probable traffic volume)	A 1.76km length of the A40 Trunk Road would be improved with two lanes provided in one direction, to allow overtaking, and one lane provided in the opposite direction. The overtaking provision will alternate so that both eastbound and westbound traffic can overtake. The Penblewin to Redstone Cross section of the A40 has no intermediate junctions (other than a few minor property accesses) and has relatively low traffic flows, slightly in excess of 10,000 Annual Average Daily Traffic (AADT).	
Land-take	The approximate area of the scheme footprint is 13.6ha which includes all land required for the Scheme to be constructed operated and maintained.	
Distance from the European Site or key features of the site (from edge of the project assessment corridor)	The SAC is located approximately 17.4km from the Scheme at its closest point.	
Resource requirements (from the European Site or from areas in proximity to the site, where of relevance to consideration of impacts)	All materials required for the construction of the Scheme (including concrete, steel and imported fill/topsoil) will be sourced from appropriate suppliers within the local/regional area. These will not be sourced from within or near to European Site. The suppliers of materials will be determined during the detailed design stage.	
Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution)	Emissions in terms of highways drainage and air quality emissions are largely unchanged. There is the potential for sediment run-off during construction in the event of heavy rainfall and flood events however this will be avoided using PEU measures.	
Excavation requirements (e.g. impacts of local hydrogeology)	Approximately 880m of the Scheme are within cutting and will require significant excavation. The construction of the proposed attenuation ponds will generally require shallow excavations, with a maximum depth of 5.4 metres from the current ground level to the base of the pond invert level. The proposed overbridge is also anticipated to require	

	shallow excavations to facilitate shallow foundations. Mobilisation of silts during excavation, work on the river banks or by surface water runoff from bare areas, could result in washing of sediment into watercourses and cause siltation within any riverbed gravels.
Transportation requirements	This information is not available at this stage
Duration of construction, operation,	Detailed design and construction works are considered likely to commence in 2021 and would continue for around 12 months. Maintenance and aftercare of the environmental aspects of the Scheme remain the responsibility of the Contractor for five years after the completion of construction.
Other	Not applicable.
Description of avoidance and/or mitigation measures Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on:	
Nature of proposals	Pollution prevention measures including sediment management.
Location	Within the construction areas.
Evidence for effectiveness	Plainly established good construction practice as recommended by organisations such as CIRIA and the Environment Agency/Natural Resources Wales.
Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations)	Implementation of an agreed CEMP.
Characteristics of European Site A brief description of the European Site should be produced, including information on:	
Name of European Site and its EU code	Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC UK0014787
Location and distance of the European Site from the proposed works	The closest part of the European site to the proposed works located 17.4km to the south west.
European Site size	1,583.86ha
Key features of the European Site including the primary reasons for selection and any other qualifying interests	The SAC is designated for the following features: • Vegetated sea cliffs of the Atlantic and Baltic coasts • Fixed coastal dunes with herbaceous vegetation (grey dunes) • European dry heaths • Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (important orchid sites)

	• Caves not open to the public • Submerged or partially submerged sea caves • Greater horseshoe bat • Early gentian • Petalwort
Vulnerability of the European Site – any information available from the standard data forms on potential effect pathways	The habitat and plant features are vulnerable to the effects of diffuse pollution and land management practices. Greater horseshoe bats are vulnerable to the loss of foraging habitat, fragmentation of habitat and the risk of injury from collision with vehicles.
European Site conservation objectives – where these are readily available	A summary of the conservation objectives for this site is provided in Appendix B.
Assessment Criteria Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the European Site.	
The construction and operation of the new road have the potential to cause the fragmentation of habitats and severe flight lines used by the horseshoe bat species. Once operational there is a risk that bats trying to cross the scheme may be killed or injured through collision with vehicles. The habitats and plant features are unlikely to be affected due to the separate distance.	
Initial Assessment The key characteristics of the site and the details of the European Site should be considered in identifying potential impacts. Describe any likely changes to the site arising as a result of:	
Reduction of habitat area	
Disturbance to key species	No impacts predicted – roost sites located sufficiently way from Scheme to avoid disturbance.
Habitat or species fragmentation	Potential impact from the severance of flightlines and widening of existing crossing points.
Reduction in species density	Potential for impacts on otter populations through severing of dispersal corridors
Changes in key indicators of conservation value (water quality, etc)	No impacts predicted.
Climate change	No impacts predicted.
Describe any likely impacts on the European Site as a whole in terms of	
Interference with the key relationships that define the structure of the site	No impacts are predicted.
Interference with key relationships that define the function of the site	No impacts are predicted.
Indicate the significance as a result of the identification of impacts set out above in terms of:	
Reduction of habitat area	Not significant

Disturbance to key species	Not significant
Habitat or species fragmentation	Potentially significant
Loss	Potentially significant
Fragmentation	Potentially significant
Disruption	Not significant
Disturbance	Not significant
Change to key elements of the site (e.g. water quality, hydrological regime etc)	Not significant
Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.	
Potential for significant effects on greater horseshoe bat populations from collisions with vehicles and habitat severance.	
Outcome of screening stage (delete as appropriate).	Likely to be Significant Effects.
Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence).	This document will be share with NRW.

A4 North Pembrokeshire Woodlands SAC

Project Name:	A40 Penblewin to Redstone Cross	
European Site under consideration:	North Pembrokeshire Woodlands SAC	
Date:	Author:	Verified
1 June 2020	Victoria Newlove	Pete Wells
Description of Project		
Size and scale (road type and probable traffic volume)	A 1.76km length of the A40 Trunk Road would be improved with two lanes provided in one direction, to allow overtaking, and one lane provided in the opposite direction. The overtaking provision will alternate so that both eastbound and westbound traffic can overtake. The Penblewin to Redstone Cross section of the A40 has no intermediate junctions (other than a few minor property accesses) and has relatively low traffic flows, slightly in excess of 10,000 Annual Average Daily Traffic (AADT).	
Land-take	The approximate area of the scheme footprint is 13.6ha, which includes all land required for the Scheme to be constructed operated and maintained.	
Distance from the European Site or key features of the site (from edge of the project assessment corridor)	The SAC is located approximately 18.8km from the Scheme at its closest point.	
Resource requirements (from the European Site or from areas in proximity to the site, where of relevance to consideration of impacts)	All materials required for the construction of the Scheme (including concrete, steel and imported fill/topsoil) will be sourced from appropriate suppliers within the local/regional area. These will not be sourced from within or near to European Site. The suppliers of materials will be determined during the detailed design stage.	
Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution)	Emissions in terms of highways drainage and air quality emissions are largely unchanged. There is the potential for sediment run-off during construction in the event of heavy rainfall and flood events however this will be avoided using PEU measures.	
Excavation requirements (e.g. impacts of local hydrogeology)	Approximately 880m of the Scheme are within cutting and will require significant excavation. The construction of the proposed attenuation ponds will generally require shallow excavations, with a maximum depth of 5.4 metres from the current ground level to the base of the pond invert level. The proposed overbridge is also anticipated to require shallow excavations to facilitate shallow foundations. Mobilisation of silts during excavation,	

	work on the river banks or by surface water runoff from bare areas, could result in washing of sediment into watercourses and cause siltation within any riverbed gravels.
Transportation requirements	This information is not available at this stage
Duration of construction, operation,	Detailed design and construction works are considered likely to commence in 2021 and would continue for around 12 months. Maintenance and aftercare of the environmental aspects of the Scheme remain the responsibility of the Contractor for five years after the completion of construction.
Other	Not applicable
Description of avoidance and/or mitigation measures Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on:	
Nature of proposals	Pollution prevention measures including sediment management.
Location	Within the construction areas.
Evidence for effectiveness	Plainly established good construction practice as recommended by organisations such as CIRIA and the Environment Agency/Natural Resources Wales.
Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations)	Implementation of an agreed CEMP.
Characteristics of European Site A brief description of the European Site should be produced, including information on:	
Name of European Site and its EU code	North Pembrokeshire Woodlands / Coedydd Gogledd Sir Benfro SAC UK0030227
Location and distance of the European Site from the proposed works	The closest part of the European site to the proposed works is 18.8km to the north.
European Site size	313.8ha
Key features of the European Site including the primary reasons for selection and any other qualifying interests	The SAC is designated for the following features: • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* • Barbastelle
Vulnerability of the European Site – any information available from the standard data	The habitat features are vulnerable to the effects of diffuse pollution and management practices such as high grazing levels. Barbastelle bats are vulnerable to the loss of foraging habitat, fragmentation of

forms on potential effect pathways	habitat and the risk of injury from collision with vehicles.
European Site conservation objectives – where these are readily available	A summary of the conservation objectives are included in Appendix B.
Assessment Criteria Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the European Site.	
The construction and operation of the new road have the potential to cause the fragmentation of habitats and severe flight lines used by the horseshoe bat species. Once operational there is a risk that bats trying to cross the scheme may be killed or injured through collision with vehicles. The habitats and plant features are unlikely to be affected due to the separate distance.	
Initial Assessment The key characteristics of the site and the details of the European Site should be considered in identifying potential impacts. Describe any likely changes to the site arising as a result of:	
Reduction of habitat area	No impacts predicted.
Disturbance to key species	No impacts predicted – roost sites located sufficiently way from Scheme to avoid disturbance.
Habitat or species fragmentation	Potential impact from the severance of flightlines and widening of existing crossing points.
Reduction in species density	Potential impact from the severance of flightlines and widening of existing crossing points.
Changes in key indicators of conservation value (water quality, etc)	No impacts predicted.
Climate change	No impacts predicted.
Describe any likely impacts on the European Site as a whole in terms of:	
Interference with the key relationships that define the structure of the site	No impacts are predicted.
Interference with key relationships that define the function of the site	No impacts are predicted.
Indicate the significance as a result of the identification of impacts set out above in terms of:	
Reduction of habitat area	Not significant.
Disturbance to key species	Not significant.
Habitat or species fragmentation	Potentially significant.
Loss	Potentially significant.
Fragmentation	Potentially significant.
Disruption	Not significant.
Disturbance	Not significant.

Change to key elements of the site (e.g. water quality, hydrological regime etc)	Not significant.
Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known.	
Potential for significant effects on barbastelle bat populations from collisions with vehicles.	
Outcome of screening stage (delete as appropriate).	Likely to be Significant Effects.
Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence).	This document will be share with NRW.

Appendix B: Conservation Objectives

The following conservation objectives have been reproduced from the Core Management Plans available on the Natural Resources Wales website.

B1 Afonydd Cleddau / Cleddau Rivers SAC

B1.1 Conservation Objective for the watercourse

B1.1.1 The capacity for the habitats in the SAC to support each feature at near-natural population levels, as determined by predominantly unmodified ecological and hydromorphological processes and characteristics, should be maintained as far as possible, or restored where necessary.

B1.1.2 The ecological status of the water environment should be sufficient to maintain a stable or increasing population of each feature. This will include elements of water quantity and quality, physical habitat and community composition and structure. It is anticipated that in most instances these limits will concur with the standards used by the Review of Consents process.

B1.1.3 Flow regime, water quality and physical habitat should be maintained in, or restored as far as possible to, a near-natural state, in order to support the coherence of ecosystem structure and function across the whole area of the SAC.

B1.1.4 All known breeding, spawning and nursery sites of species features should be maintained as suitable habitat as far as possible, except where natural processes cause them to change.

B1.1.5 Flows, water quality, substrate quality and quantity at fish spawning sites and nursery areas will not be depleted by abstraction, discharges, engineering or gravel extraction activities or other impacts to the extent that these sites are damaged or destroyed.

B1.1.6 The river planform and profile should be predominantly unmodified. Physical modifications having an adverse effect on the integrity of the SAC, including, but not limited to, revetments on active alluvial river banks using stone, concrete or waste materials, unsustainable extraction of gravel, addition or release of excessive quantities of fine sediment, will be avoided.

B1.1.7 River SSSI features should be in favourable condition.

B1.1.8 Artificial factors impacting on the capability of each species feature to occupy the full extent of its natural range should be modified here necessary to allow passage, eg. weirs, bridge sills, acoustic barriers. The reservoir dams on the Syfynwy are excluded.

B1.1.9 Natural factors such as waterfalls, which may limit the natural range of a species feature or dispersal between naturally isolated populations, should not be modified.

B1.1.10 Flows during the normal migration periods of sea and river lamprey will not be depleted by abstraction to the extent that passage upstream to spawning sites is hindered.

B1.1.11 Levels of nutrients, in particular phosphate, will be agreed between EA and CCW for each Water Framework Directive water body in the Cleddau SAC, and measures taken to maintain nutrients below these levels. It is anticipated that these limits will concur with the standards used by the Review of Consents process.

B1.1.12 Levels of all other water quality parameters that could affect the distribution and abundance of all species will be agreed between EA and CCW for each Water Framework Directive water body in the Cleddau SAC, and measures taken to maintain pollution below these levels. It is anticipated that these limits will concur with the standards used by the Review of Consents process. Potential sources of pollution not addressed in the Review of Consents, such as contaminated land, will be considered in assessing plans and projects.

B1.1.13 Potential sources of pollution not addressed in the review of consents, such as contaminated land, will be considered in assessing plans and projects.

B1.1.14 Levels of suspended solids will be agreed between EA and CCW for each Water Framework Directive water body in the Usk SAC. Measures including, but not limited to, the control of suspended sediment generated by agriculture, forestry and engineering works, will be taken to maintain suspended solids below these levels.

B1.2 Conservation Objective for the sea lamprey

B1.2.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The conservation objective for the watercourse as defined above is met.

d) The population of the feature in the SAC must be stable or increasing over the long term.

e) The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

i. The natural range is taken to mean those reaches where predominantly suitable habitat for each life stage exists over the long term.

ii. Suitable habitat is defined in terms of near-natural hydrological and geomorphological processes and forms e.g. suitable flows to allow upstream migration, depth of water and substrate type at spawning sites, and ecosystem structure and functions e.g. food supply.

iii. Suitable habitat need not be present throughout the SAC but where present must be secured for the foreseeable future.

f) Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

g) The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

B1.3 Conservation Objective for the brook lamprey

B1.3.1 The vision for the feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The conservation objective for the watercourse as defined above is met

h) The population of the feature in the SAC must be stable or increasing over the long term.

i. The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

ii. The natural range is taken to mean those reaches where predominantly suitable habitat for each life stage exists over the long term.

iii. Suitable habitat is defined in terms of near-natural hydrological and geomorphological processes and forms e.g. suitable flows to allow upstream migration, depth of water and substrate type at spawning sites, and ecosystem structure and functions e.g. food supply.

iv. Suitable habitat need not be present throughout the SAC but where present must be secured for the foreseeable future.

i) Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

j) The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

B1.4 Conservation Objective for the bullhead

B1.4.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The conservation objective for the watercourse as defined above must be met

k) The population of the feature in the SAC must be stable or increasing over the long term.

l) The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

   i. The natural range is taken to mean those reaches where predominantly suitable habitat for each life stage exists over the long term.

   ii. Suitable habitat is defined in terms of near-natural hydrological and geomorphological processes and forms e.g. suitable flows to allow upstream migration, depth of water and substrate type at spawning sites, and ecosystem structure and functions e.g. food supply.

   iii. Suitable habitat need not be present throughout the SAC but where present must be secured for the foreseeable future.

m) Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs.

n) The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.

B1.5 Conservation Objective for the European Otter

B1.5.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC.

o) The SAC will have sufficient habitat, including riparian trees and vegetation and wetlands, to support the otter population in the long term.

p) The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future.

q) The otter must be able to breed and recruit successfully in the SAC. The size of breeding territories may vary depending on prey abundance.

r) Otter food sources must be sufficient for maintenance of the population.

s) The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.

t) No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.

B1.6 Conservation Objective for the water courses of plain to montane levels habitat

B1.6.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The conservation objective for the watercourse as defined above must be met.

u) The natural range of the plant communities represented within this feature should be stable or increasing in the SAC.

i. The natural range is taken to mean those reaches where predominantly suitable habitat exists over the long term.

ii. Suitable habitat and associated plant communities may vary from reach to reach.

iii. Suitable habitat is defined in terms of near-natural hydrological and geomorphological processes and forms eg. depth and stability of flow, stability of bed substrate, and ecosystem structure and functions eg. nutrient levels, shade.

iv. Suitable habitat for the feature need not be present throughout the SAC but where present must be secured for the foreseeable future, except where natural processes cause it to decline in extent.

b) The area covered by the feature within its natural range in the SAC should be stable or increasing.

v) The conservation status of the feature's typical species should be favourable condition. The typical species are defined with reference to the species composition of the appropriate JNCC river vegetation type for the particular river reach, unless differing from this type due to natural variability when other typical species may be defined as appropriate.

B1.7 Conservation Objective for the alluvial forests habitat

B1.7.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The canopy is dominated by single stands of alder *Alnus glutinosa* or willow *Salix spp*. In alluvial woods with free draining soils there may be ash or oak in the canopy, but in the wetter alluvial woodlands ash *Fraxinus excelsior* is more likely to be limited to areas of relatively drier ground.

w) The structure of alluvial woodland is recognised as being dynamic therefore the presence of over mature trees is desirable but not essential.

x) The river itself should be dynamic to allow for areas of outwash and deposition that trees can regenerate on.

y) Lying or standing deadwood (> 20cm diameter and > 1m length) is present at all sites.

z) The feature should support alluvial ground flora including two of the following:

i. meadowsweet *Filipendula ulmaria*;
ii. yellow flag Iris *pseudacorus*;
iii. nettle *Urtica dioica*;
iv. common reed *Phragmities austrailis*;
v. greater tussock sedge *Carex paniculata*;
vi. opposite-leaved golden saxifrage *Chrysosplenium oppositifolium;*
vii. rushes *Juncus* spp.;
viii. tufted hair-grass *Deschampsia cespitosa;*
ix. hemlock water-dropwort *Onanthe crocata*; and
x. wild angelica *Angelica sylvestris*.

B1.8 Conservation objectives for the active raised bog habitat

B1.8.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) On the mire expanse there are at least 3 of *Calluna vulgaris*, *Erica tetralix, Eriophorum angustifolium, E.vaginatum & Trichophorum cespitosum constant*, with a combined cover not exceeding 80%

aa) No single species > 50% cover

bb) At least one of *Andromeda polifolia, Drosera rotundifolia, Empetrum nigrum, Narthecium ossifragum and Vaccinium oxycoccos* occurs at least frequently

cc) On the mire expanse only there are at least 2 of the following spp. constant, with a combined cover > 20%: *Sphagnum capillifolium, S. magellanicum, S. papillosum, S. tenellum*

dd) No reduction in extent of microtopographic features (e.g. bog pools).

B2 Pembrokeshire Marine / Sir Benfro Forol SAC

B2.1.1 To achieve favourable conservation status all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve favourable conservation status.

B2.2 Habitat Features

a) Sandbanks which are slightly covered by seawater all the time

b) Estuaries

c) Mudflats and sandflats not covered by seawater at low tide

d) Coastal lagoons

e) Large shallow inlets and bays

f) Reefs

g) Submerged or partially submerged sea caves

h) Atlantic salt meadows

B2.3 Range

B2.3.1 The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing.

B2.3.2 For the **inlets and bays** feature these include;

a) The embayment of St. Brides Bay

b) The ria of Milford Haven

c) Peripheral embayments and inlets

B2.3.3 For the coastal lagoons feature this is subject to the requirements for maintenance of the artificial impoundment structure and maintenance of the lagoons for the original purpose or subsequent purpose that pre-dates classification of the site.

B2.4 Structure and function

B2.4.1 The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded. Important elements include;

a) geology,
b) sedimentology,
c) geomorphology,
d) hydrography and meteorology,
e) water and sediment chemistry,
f) biological interactions.

B2.4.2 This includes a need for:

B2.4.3 Nutrient levels in the water column and sediments to be:

a) at or below existing statutory guideline concentrations
b) within ranges that are not potentially detrimental to the long term maintenance of the features species populations, their abundance and range.

B2.4.4 Contaminant levels in the water column and sediments derived from human activity to be:

a) at or below existing statutory guideline concentrations
b) below levels that would potentially result in increase in contaminant concentrations within sediments or biota
c) below levels potentially detrimental to the long-term maintenance of the feature species populations, their abundance or range.

Restoration and recovery

B2.4.5 As part of this objective it should be noted that; the Milford Haven waterway complex would benefit from restorative action, for example through the removal of non-natural beach material, and the removal, replacement or improved maintenance of rock filled gabions. There is also need for some restoration of the populations of several typical species of the Milford Haven waterway complex that are severely depleted with respect to historical levels as a consequence primarily of human exploitation.

B2.4.6 In the Milford Haven waterways complex inputs of nutrients and contaminants to the water column and sediments derived from human activity must remain at or below levels at the time the site became a candidate SAC.

B2.4.7 For the lagoons feature this is subject to the requirements for maintenance of the artificial impoundment structures of coastal lagoons and maintenance of the lagoons for their original purpose or subsequent purpose that pre-dates classification of the site.

B2.5 Typical Species

B2.5.1 The presence, abundance, condition and diversity of typical species is such that habitat quality is not degraded. Important elements include:

a) species richness,

b) population structure and dynamics,

c) physiological health,

d) reproductive capacity,

e) recruitment,

f) mobility,

g) range.

B2.5.2 As part of this objective it should be noted that:

a) populations of typical species subject to existing commercial fisheries need to be at an abundance equal to or greater than that required to achieve maximum sustainable yield and secure in the long term

b) the management and control of activities or operations likely to adversely affect the habitat feature is appropriate for maintaining it in favourable condition and is secure in the long term.

Restoration and recovery

B2.5.3 For the inlets and bays features this includes the need for some restoration of the populations of several typical species which are severely depleted with respect to historical levels as a consequence primarily of human exploitation.

B2.5.4 In the Milford Haven waterways complex inputs of nutrients and contaminants to the water column and sediments derived from human activity must remain at or below levels at the time the site became a candidate SAC.

B2.6 Species Features

a) Grey Seal *Halichoeurus grypus*

b) Otter *Lutra lutra*

c) Allis shad *Alosa alosa*

d) Twaite shad *Alosa fallax*

e) River lamprey *Lampetra fluviatilis*

f) Sea lamprey *Petromyzon marinus*

g) Shore dock *Rumex rupestris*

B2.7 Populations

B2.7.1 The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements include:

a) population size

b) structure, production

c) condition of the species within the site.

B2.7.2 As part of this objective it should be noted that for **otter and grey seal;**

a) Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression

B2.7.3 For **grey seal and otter**, populations should not be reduced as a consequence of human activity.

B2.8 Range

B2.8.1 The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future.

B2.8.2 As part of this objective it should be noted that for **otter and grey seal:**

a) Their range within the SAC and adjacent inter-connected areas is not constrained or hindered

b) There are appropriate and sufficient food resources within the SAC and beyond

c) The sites and amount of supporting habitat used by these species are accessible

d) and their extent and quality is stable or increasing

B2.9 Supporting habitats and species

B2.9.1 The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include;

a) distribution

b) extent

c) structure

d) function and quality of habitat

e) prey availability and quality.

B2.9.2 As part of this objective it should be noted that;

a) The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term.

b) The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term.

c) Contamination of potential prey species should be below concentrations potentially harmful to their physiological health. Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour

d) For otter there are sufficient sources within the SAC and beyond of high quality freshwater for drinking and bathing.

Restoration and recovery

B2.9.3 In the **Milford Haven waterways complex** inputs of nutrients and contaminants to the water column and sediments derived from human activity must remain at or below levels at the time the site became a candidate SAC.

B2.9.4 As part of this objective it should be noted that for the **otter,** populations should be increasing.

B3 Pembrokeshire Bat Sites and Bosherston Lakes SAC

B3.1 Conservation objectives for the hard oligo-mesotrophic waters habitat

B3.1.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) Submerged Chara beds (mainly *Chara hispida* in places up to a metre long) will form the predominant submerged macrophyte vegetation throughout most of Central and Western Arms and Central Lake of Bosherston Lakes (unit 1a) and may be present in the Eastern Arm (unit 1b).

b) Chara will occur at more than 50% frequency along regular surveillance transects within the Western and Central arms.

c) Chara species (not necessarily hispida) will be present in other embayments and pools, including the Eastern Arm of Bosherston Lakes (unit 1b) and pools in the Mere Pool Valley (unit 1d).

d) The Western and Central Arms are spring-fed, so nutrient levels here remain low. One of the main nutrients (phosphorous) will reach no more than 25 micrograms per litre in regular sampling areas. Nitrogen levels in the water will be low (less than 1 milligram per litre) and declining or stable.

e) The Western Arm, Central Arm and Central Lake water will be fairly clear, but well vegetated with submerged and marginal plants. In natural openings (e.g. over springs) within otherwise dense Chara beds, a sechii disk will be viewable on the lakebed.

f) Water depth will vary from about 3.5m OD (winter maximum) to about 0.5m or less in places in summer.

g) Fringing the Chara beds, are beds of white water lilies Nymphaea alba. They will remain fairly abundant in the Western and Central Arms, with smaller populations in Central Lake.

h) Reed and swamp and fringing burr-reed will be restricted to shallow zones – covering not more than 10 % of the site.

i) All factors affecting the achievement of these conditions are under control.

B3.2 Conservation Objective for the greater horseshoe bat

B3.2.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The greater horseshoe bat population will be capable of maintaining itself on a long-term basis as a viable component of its natural habitats.

b) The natural range of greater horseshoe bats will neither be reduced nor will be likely to be reduced for the foreseeable future, and • There will be sufficient habitat to maintain its populations on a long-term basis.

c) At least three SSSI maternity roosts will be occupied annually by adult greater horseshoe bats and their young:

   i. Stackpole Courtyard Flats and Walled Garden SSSI
   ii. Slebech Stable Yard Loft, Cellars and Tunnels SSSI
   iii. Felin Llwyngwair SSSI

d) Carew Castle SSSI will continue to be used as an intermediate greater horseshoe bat roost, during the spring and autumn, as a male summer roost and an autumn/spring mating roost.

e) The greater horseshoe bat population at the component SSSI's will be stable or increasing.

f) There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.

g) All factors affecting the achievement of these conditions are under control.

B3.3 Conservation Objective for the lesser horseshoe bat

B3.3.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The Lesser horseshoe bat population will be capable of maintaining itself on a long-term basis as a viable component of its natural habitats.

b) The natural range of lesser horseshoe bats will be neither being reduced nor will be likely to be reduced for the foreseeable future, and

c) There will be sufficient habitat to maintain its populations on a long-term basis.

d) At least four SSSI maternity roosts will be occupied annually by adult lesser horseshoe bats and their young:

   i. Beech Cottage, Waterwynch SSSI,
   ii. Orielton Stable Block and Cellars SSSI,
   iii. Park House Outbuildings SSSI,
   iv. Stackpole Courtyard Flats and Walled Garden SSSI

e) The lesser horseshoe bat population at the component SSSI's will be stable or increasing.

f) There will be a sufficiently large area of suitable habitat surrounding these roosts to support the bat population, including continuous networks of sheltered, broadleaved woodland, tree lines and hedgerows connecting the various types of roosts with areas of insect-rich grassland and open water.

g) All factors affecting the achievement of these conditions are under control.

B3.4 Conservation Objective for the European otter

B3.4.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The Otter population will be capable of maintaining itself on a long-term basis as a viable component of its natural habitats.

b) The natural range of otters will neither be reduced nor will be likely to be reduced for the foreseeable future, and

c) There will be sufficient habitat to maintain its populations on a long-term basis.

d) The otter population will be stable or increasing.

e) There will be a sufficiently large area of suitable habitat to support an otter breeding population, including:

   i. Open water with sufficient food resources (notably eels and other fish species) and

ii. a continuous network of undisturbed sheltered resting places along the lake shoreline – including swamp, broadleaved woodland and calcareous scrub.

f) All factors affecting the achievement of these conditions are under control.

B4 Limestone Coast of South West Wales SAC

B4.1 Conservation Objective for the vegetated sea cliffs habitat

B4.1.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

B4.1.2 Cliff and crevice vegetation continues to form a very open cover of deep-rooted crevice dwelling species forming a narrow band along the steep cliff edges. On their seaward edges the cliff and crevice communities grade into the supralittoral lichen zone. Landwards they meet the maritime grassland and thereophyte communities which themselves intermingle with the maritime heaths. Both golden samphire and rock sea lavenders are typically associated with crevices and ledges and continue to be generally widespread where open and exposed conditions prevail.

B4.1.3 The maritime grasslands range from short open swards with occasional areas of bare ground to taller, more closed swards where Red Fescue (*Festuca rubra*) forms tussocks and “mattresses”. The more strongly maritime influenced grassland communities on this site, for the most part, occur on the exposed south and south westerly facing slopes.

B4.1.4 Elsewhere, in less exposed situations the grasslands show less maritime influence with species such as Cowslips (*Primula veris*) and Bluebells (*Hyacinthoides non-scripta*) occurring. The grasslands also support important populations of typical invertebrates such as ants and butterflies as well as insects associated with open soils, grass roots or dung such as various cranefly and beetle larvae.

B4.1.5 Maritime heath occurs in exposed locations as stands of low, wind-pruned heath dominated by heather (*Calluna vulgaris*) and bell heather (*Erica cinerea*). Species such as spring squill (*Scilla verna*), milkworts (*Polygala spp*.) pale dog violet (*Viola lactea*) and sedges (*Carex spp*.) are present in stands. This gives way to gorse-dominated dry heath (feature 3) in more sheltered areas.

a) Cliff and crevice vegetation occurs naturally on suitably exposed rocky ledges and crevices throughout the site. The variety of vegetation types reflecting the degree of exposure to maritime influences - including communities with thrift, rock and golden samphires, sea lavenders, sea-beet and sea plantain.

b) Maritime Grassland occupies approximately 15% of the total site area.

c) The following plants are common in the maritime grassland: thrift Armeria maritima; spring squill Scilla verna and sea plantain Plantago maritime.

d) Maritime Heathland occupies approximately 10% of the total site area.

e) The following plants are common in the maritime heathland: heather Calluna vulgaris; bell heather Erica cinerea and spring squill Scilla verna.

f) Populations of nationally rare and nationally scarce vascular and lower plant species, associated with cliff-crevice, maritime grassland and related calcareous grassland swards are maintained.

g) Competitive species indicative of under-grazing, particularly cocksfoot Dactylis glomerata, tor grass Brachypodium pinnatum, bracken Pteridium aquilinum and western gorse Ulex gallii are kept in check.

h) Non-native plants such as Hottentot fig Carpobotus edulis are absent or rare.

B4.2 Conservation objectives for the fixed dunes habitat

B4.2.1 The dune complex at Broomhill Burrows, Broadhaven South and Barafundle Bay will demonstrate a fairly complete sequence from fore dunes fringed on the seaward edge by narrow bands of mobile dune, through to fixed dune grassland. There will be small blow-out patches of bare sand and foredune and strandline. Elsewhere in the SAC, the perched dunes (such as at Stackpole Warren) may not show this zonation from fore dune to fixed dune but should none-the-less have some blowouts and areas of bare sand.

a) Fixed dunes occupy approximately 20% of the total site area.

b) The following plants will be common in a short, open sward: Asperula cyanchica,Carlina vulgaris, Euphrasia spp., Gentianella amarella, Linum catharticum, Lotus corniculatus, Pilosella officinarum, Plantago coronopus, Sedum acre, Thymus polytrichus, Viola spp., Anacamptis pyramidalis.

c) Distinct patches of open, lichen-rich turf, supporting Fulgensia fulgens on Trichosporum moss will occur in several mapped locations in management units 2a, 2b, 3b and 3c.

d) Alien species will be absent, and other negative indicator species (such as bracken Pteridium aquilinum) will be under control in fixed dune grassland.

e) Sea Buckthorn Hippophae rhamnoides will be absent from all dunes systems within the SAC.

B4.3 Conservation objectives for the dry heath habitat

B4.3.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The current extent of Dry heath will be maintained.

b) Dry heath will occupy areas of the site where heathland extends beyond the zone of maritime influence.

c) As a result dry heath may lack the species characteristic of maritime heath.

d) Much of the dry heath will have a short and open structure.

e) The dry heaths will support typical species such as the dark green fritillary (Argynnis aglaja) and the silver studded blue butterfly, Plebeius argus.

B4.4 Conservation objectives for the semi-natural dry grassland and scrub facies habitat

B4.4.1 This feature is to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) / Dry grasslands and scrublands on chalk or limestone will be referable to the NVC communities Festuca – Avenula grassland (CG2) and Festuca – Hieracium – Thymus grasslands (CG7)

b) The communities making up this feature will cover at least 14 ha within Castlemartin Cliffs and Dunes SSSI) and 10 ha within Stackpole and Stackpole Quay to Trewent Point SSSI, and 18 ha within the Gower Coast SSSI (which also includes NVC community CG1) occurring as small patches along coastal cliff-tops,

among the fixed dune grasslands, mainly on shallow soils overlying areas of limestone bedrock.

c) The feature will support a range of typical plant and invertebrate species.

B4.5 Conservation objectives for the caves not open to the public habitat

B4.5.1 These caves continue to be primarily of importance as bat hibernacula and roost sites. Their performance indicators are expressed in terms of their suitability as bat hibernacula/roost sites. The performance indicators are those given in Wilkinson, K. (2006). Monitoring report: Greater horseshoe bats of the Limestone Coast of South West Wales SAC. CCW Internal document. Choughs continue to breed high in the roofs of several caves.

a) There is minimal disturbance to the caves by the public;

b) The caves remain suitable as bat roost/hibernation sites;

c) Caves utilised by breeding choughs remain undisturbed for choughs;

d) The geological interest of the caves will be unconcealed;

e) Natural processes such as small rock falls will be tolerated.

B4.6 Conservation objectives for the submerged or partially submerged sea caves

B4.6.1 These features are cross-boundary features between the Limestone Coast SAC and the Pembrokeshire Marine SAC. Other than prevention of human disturbance to both the caves themselves and any species which may be using them (mainly bats and grey seals), there is little management required or indeed possible for this feature.

a) There should be minimal disturbance to the caves and they should remain closed to the public.

b) The caves should remain suitable as bat roost/hibernation sites

c) The caves used by grey seal should remain free of human disturbance

d) The geological interest of the caves will be unconcealed

e) Natural processes such as small rock falls will be tolerated

f) The affects of tidal activity in partially submerged caves should have a minimal effect on the internal environment of the cave (where the cave is a bat roost).

B4.7 Conservation objectives for the greater horseshoe bat

B4.7.1 Greater horseshoe bats will continue to utilise known caves roosts undisturbed by the public.

B4.7.2 Distinctive droppings indicate presence at any time of year but largest numbers of bats are likely to be found in the period November to March.

B4.7.3 The peak winter population in the main Castlemartin Cave is equivalent to approximately 20% of the Pembrokeshire Bat Sites and Bosherston lakes SAC greater horseshoe bat population.

B4.7.4 The greater horseshoe bat population within the caves being monitored is stable or increasing.

B4.7.5 Natural processes such as rock falls will be tolerated but other factors affecting the achievement of these conditions are under control.

B4.8 Conservation objectives for the petalwort

B4.8.1 *Petalophyllum ralfsii* will continue to be found at two SSSI sand dune systems within the SAC, (Broomhill Burrows & Brownslade Burrows). The Brownslade Burrows population will occur patchily at high densities in successionally young, open vegetation in damp, dune slacks.

a) *P. ralfsii* has a continued presence at Broomhill Burrows SSSI.

b) *P.ralfsii* occurs at high densities in suitable dune slacks at Brownslade Burrows SSSI.

c) At both sites there are areas of open, damp, calcareous dune slacks with patches of suitable and optimal habitat present.

d) Suitable dune slacks have patches of bare ground that is being colonised by jelly lichens (*Collema spp*.) and Barbula mosses.

e) Brownslade Burrows continues to be winter grazed by cattle and sheep, which is helping to maintain the short sward and open conditions required by *P. ralfsii*.

B4.9 Conservation objectives for the early gentian

B4.9.1 The feature will be present at Stackpole in management unit 3d.

B4.9.2 Dune gentians with three or fewer internodes and a long terminal internode, which contributes between 40-100% of the height of the stem (corresponding to the current definition/description of Early gentian *Gentianella anglica*) occur within at least 4 open dry dune slacks on Stackpole Warren and in other open, herb-rich calcareous grassland areas.

B4.9.3 Further survey/research will confirm that these forms are definitely separable from Gentianella amarelle.

B4.10 Conservation objectives for the marsh fritillary butterfly

B4.10.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) A healthy metapopulation of marsh fritillary butterflies is present within Castlemartin Cliffs and Dunes SSSI component of the SAC, extending over some 5km along the coast.

b) The population is maintaining itself and, although perhaps cyclically affected by a parasitic wasp, it is secure within at least two core areas and occasionally is also found breeding outside the SAC boundary on in-land areas of Castlemartin Range.

c) There is sufficient suitable and good condition habitat to support the meta-population of the butterfly which is dependent here on mainly herb-rich coastal limestone grassland, with large patches/swathes of the caterpillar's main food-plant, devil's bit scabious Succisa pratensis bordered by coastal heath and scrub.

d) The sward will vary in height so that there are short 'lawn' areas for the caterpillars to sun themselves on (including numerous yellow ant Lasius flavus hills) and taller tussocky, or open sparse bracken areas to provide shelter.

B5 North Pembrokeshire Woodlands

B5.1 Conservation objectives for the old sessile oak woods habitat

B5.1.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) The majority of the SAC will be covered by oak woodland.

b) There will be no measurable, permanent loss of semi-natural woodland.

c) The trees will be locally native, with a dominance of oak in the canopy, and include ash and rowan.

d) No more than 5% of the canopy forming trees will consist of non-native species.

e) Each woodland will include trees of a wide range of age classes, including veteran trees.

f) Between 10-25% of the woodland area will comprise a dynamic, shifting pattern of gaps: in the long-term, most of these will be created by natural processes.

g) There will be sufficient natural regeneration to replace the canopy in these gaps over time.

h) There will be abundant dead and dying trees with holes and hollows, rot columns, torn off limbs and rotten branches. Dead wood, both standing and fallen, will be retained to provide habitats for other species, and will represent at least 10% (by volume) of the total timber.

i) Veteran trees will be favoured during any silvicultural management because they support a wide variety of species, including lichens.

j) Old forest lichen species will be found throughout the site, especially on well-lit trees around woodland edges and glades.

k) Invasive alien species, such as rhododendron, laurel and Japanese knotweed, will eventually be eradicated from the site, or restricted to very low cover.

l) There will be a well-developed shrub layer throughout the SAC, including hazel and holly.

m) The field layer will be diverse and include broad-buckler fern, greater wood-rush, bluebell, honeysuckle, wood-sorrel, dog's-

mercury, opposite-leaved golden-saxifrage, bilberry, bracken, bramble and violets.

n) The woodlands will support populations of butterflies, birds and mammals.

o) All factors affecting the achievement of the foregoing conditions will be under control.

B5.2 Conservation objectives for the alluvial forests habitat

B5.2.1 The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:

a) At least 2% of the SAC will be covered by alluvial woodland.

b) The canopy will consist of locally native trees, with an overall dominance of alder. At least 90% of the canopy trees will be wet woodland species. There will be no non-native trees present in the canopy.

c) In the long-term, each woodland will include trees of a broad range of age classes, including saplings and veteran trees.

d) At any given time, around 30% of the woodland area will consist of a dynamic, shifting pattern of canopy gaps, maintained by natural processes.

e) There will be sufficient natural regeneration in the gaps (from seed or vegetative) to replace the canopy, 90% of which will be alder or willow.

f) There will be abundant dead and dying trees with holes and hollows, rot columns, torn off limbs and rotten branches. Dead wood, both standing and fallen, will be retained to provide habitats for other species, and will represent at least 10% (by volume) of the total timber.

g) There will be no evidence of alder disease.

h) Veteran trees will be favoured during any silvicultural management because they support a wide variety of species, including lichens. Old forest lichen species will be found throughout the sites, especially on well-lit trees around woodland edges and glades.

i) Invasive alien species, such as rhododendron, laurel and Japanese knotweed, will be eradicated from the site, or subject to a control programme of eradication.

j) The field layer will be diverse and dominated by alluvial species. Indicators of drying out (bramble) and over-grazing (creeping buttercup) will be scarce.

k) All factors affecting the achievement of the foregoing conditions will be under control.

B5.3 Conservation objectives for the barbastelle bat

B5.3.1 The vision for this feature is for it to be in favourable conservation status, where all of the following conditions are satisfied:

a) There will be no loss of ancient semi-natural woodland at the site.

b) Canopy gaps will be present throughout the site, with two or more young trees growing in each.

c) Canopy cover will be 50-90% throughout the site (except in Hawthorn fields).

d) A well-developed shrub layer with holly will be present throughout the woodland, to provide a favourable micro-climate for roosting barbastelles.

e) A minimum of 4 trees per hectare will be allowed to die standing, will not be removed or cut down. These will be distributed across the site and will include trees with splits, fallen, leaning trees and hollow trees.

f) Ivy will be allowed to grow on trees throughout the site, to provide roosting opportunities.

g) There will be no overall loss of open water.

h) There will be no increase in disturbance (eg paths or rides) near any of the roosting sites.

i) No roosting sites will be lost as a result of human intervention.

j) Barbastelle bat passes will be detected on at least 4 out of 6 transects between 25 July and 7 September.

k) There will be contiguous suitable foraging habitat within a 16km radius around Pengelli Forest, including wooded stream valleys, low and overgrown hedgerows, scrub, overgrown pastures, bracken stands and woodland (which can include conifer plantations).

l) Roosts outside the SSSI boundary will be left undisturbed, with no woodland management within 50m of a barbastelle roost, and no clearance of the shrub layer. Over-mature trees in any of the woodlands within 2km of Pengelli should be left undisturbed except

where they pose a risk to public safety, in which case minimal trees surgery can be permitted.

m) All factors affecting the achievement of the foregoing conditions will be under control.

Appendix C: 2019 Static Monitoring Data

C1.1 April 2019 Results – Bat Activity Index (BAI)

Location	Barbastelle	Serotine	*Myotis* sp.	Leisler's bat	Noctule	*Nyctalus* sp.	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle	Pipistrelle sp.	Long-eared sp.	Greater horseshoe	Lesser horseshoe	All species BAI	Latitude	Longitude
1	0	0	15.8	0	9.6	0	0	10.2	285	1.8	7.4	0	0	329.8	51.81588	-4.729862
2	0	0	6.6	0	11.8	0	0	8.6	48.2	2.6	1	0.6	0	79.4	51.81478	-4.73375
4	0.2	0	12.2	0	27.8	0	0	21.8	134	2.4	2.4	0	0	200.8	51.81287	-4.739304
5	0	0	3	0	6.8	0	0	8.8	84.4	3.4	0	0.2	0.2	106.8	51.81216	-4.740773
7	0	0	0.8	0	8.6	0.2	0	3.4	20.4	0.4	0	0.4	0	34	51.81653	-4.73592
8	0	0	4.6	0	3.4	0	0.8	46.2	408.2	21.2	0	1.4	0	485.8	51.8154	-4.741057
9	0	0.2	4	0.8	12.4	0	0.8	31.8	111.4	11.8	0	0.6	0	173.8	51.81456	-4.742634
10	0	0	5.6	0	6.4	0	0	7.8	381.8	3.8	0.4	0.4	0	406.2	51.81364	-4.744119
11	0	0	1.2	0	3.6	0	0	13.2	227.8	8	0	2.4	0	256.2	51.81202	-4.746202
12	0	0	1	0	2.2	0	0	10	27	1.2	0	0.6	0	42	51.81116	-4.748243

C1.2 May 2019 Results - BAI

Location	Barbastelle	Serotine	*Myotis* sp.	Leisler's bat	Noctule	*Nyctalus* sp.	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle	Pipistrelle sp.	Long-eared sp.	Greater horseshoe	Lesser horseshoe	All species BAI	Latitude	Longitude
1	0	0	3.4	0	0.6	0	0	0.6	7.4	0	0.4	0	0	12.4	51.81588	-4.729862
2	0	0	1	0	11.2	0	0	2	4.2	0	0	0.4	0	18.8	51.81478	-4.73375
3	0	0	5	0	9.2	0.8	0	18.8	180.2	27.2	1.2	0.6	0	242.2	51.81384	-4.736863
4	0	0.4	1.4	0.2	5	0	0	5	9.2	0.8	4.8	0.2	0	27	51.81287	-4.739304
5	0	0	1.2	0	4.2	0	0	2.6	7.4	0.8	0.8	1.6	0	18.6	51.81216	-4.740773
6	0	0	0	0	1.6	0.2	0	14.2	5	0.8	0	0	0	21.6	51.81076	-4.745108
7	0	0	0.2	0	2.2	0	0	0.6	2.4	0	0	0	0	5.4	51.81653	-4.73592
8	0	0	0	0	0.8	0	0	23	51.4	2.4	0	0	0	77.6	51.8154	-4.741057
9	0	0	0.8	0	2.8	0.8	0	9.2	37.6	1.2	0	0.8	0	52.4	51.81456	-4.742634
10	0	0	2.6	0	4.8	1.6	0	3	17.4	0.2	1	0	0	29	51.81364	-4.7444119
11	0	0	0.6	0	1	0	0	1.8	36.8	0.2	0	0.2	0	40.6	51.81202	-4.746202
12	0	0	0.4	0	1.2	0	0	0.4	1.4	0.2	0.2	0	0	3.8	51.81116	-4.748243

C1.3 June 2019 Results - BAI

Location	Barbastelle	Serotine	*Myotis* sp.	Leisler's bat	Noctule	*Nyctalus* sp.	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle	Pipistrelle sp.	Long-eared sp.	Greater horseshoe	Lesser horseshoe	All species BAI	Latitude	Longitude
1	0	0	0	0	0	0	0	0.2	1.4	0	0	0	0	1.6	51.81588	-4.729862
3	0	0	2	0	4.4	0	0	31.2	332	15.4	0	0.2	0	385.2	51.81384	-4.736863
4	0	0	3.8	0	18.4	0	0	6	36.8	1.4	1.2	0.8	0	68.4	51.81287	-4.739304
5	0	0	0.2	0	15.8	0	0	1.4	4.8	0.4	0	1.4	0	24	51.81216	-4.740773
6	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0.6	51.81076	-4.745108
7	0	0	0.4	0	31.4	0	0	1.6	2.4	1.4	0.6	0.4	0	38.2	51.81653	-4.73592
8	0	0	3.4	0	1.2	0	0	14	380.2	9.6	0	0.4	0	408.8	51.8154	-4.741057
9	0	0	1.2	0	4.6	0.2	0.4	94.4	196.4	30.8	0	0.4	0	328.2	51.81456	-4.742634
10	0	0	0.4	0.2	8	0	0	15.8	64.6	1.6	0	0.4	0	91	51.81364	-4.744119
12	0	0	2	0	35	0.2	0	10.2	16.8	0.8	0.2	2.4	0	67.4	51.81116	-4.748243

C1.4 July 2019 Results - BAI

Location	Barbastelle	Serotine	*Myotis* sp.	Leisler's bat	Noctule	*Nyctalus* sp.	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle	Pipistrelle sp.	Long-eared sp.	Greater horseshoe	Lesser horseshoe	All species BAI	Latitude	Longitude
1	0	0	0.2	0	0	0	0	2.8	0.4	2.2	0	0	0	5.6	51.81588	-4.729862
2	0	0	0	0	1.8	0	0	0.2	5.2	0	0	0	0	7.2	51.81478	-4.73375
3	0	0	0	0	2.2	0	0	20.2	53.8	4	0.2	0	0	80.4	51.81384	-4.736863
4	0	0	0	0	1.4	0	0	0.4	12.4	0	0	0	0	14.2	51.81287	-4.739304
6	0	0	1.2	0	3.4	0	0	22	22.6	5.8	0	0.4	0	55.4	51.81076	-4.745108
7	0	0	1	0	31.2	0.2	0.2	2	8	1.6	0.6	0.6	0	45.2	51.81653	-4.73592
9	0	0	9.6	0	8.2	0	0	58.2	633.2	45.6	0.4	0.2	0	755.4	51.81456	-4.742634
10	0	0	2.6	0	5.2	0	0	25	242.6	6.6	0.2	0.6	0	282.8	51.81364	-4.744119
12	0	0	14.6	0	1.4	0	0	16.8	70.4	9.2	0.8	0.4	0	113.6	51.81202	-4.746202

C1.5 September 2019 Results - BAI

Location	Barbastelle	Serotine	*Myotis* sp.	Leisler's bat	Noctule	*Nyctalus* sp.	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle	Pipistrelle sp.	Long-eared sp.	Greater horseshoe	Lesser horseshoe	All species BAI	Latitude	Longitude
1	0	0	21.2	0.2	30.2	0	0	9.8	207.8	3.6	0.4	1	0	274.2	51.81588	-4.729862
2	0	0	0.6	0	3.4	0.2	0	9.2	58.8	1	0	0.8	0	73.8	51.81478	-4.73375
3	0	0	6.2	0	2.4	0.4	0	76.6	457.4	31.6	0.8	1	0	576	51.81384	-4.736863
5	0	0	1.8	0	1.2	0.4	0	1.8	27	0	0	0	0	31.8	51.81216	-4.740773
6	0	0	0.4	0	0	0	0	0	1.2	0	0	0.2	0	1.8	51.81076	-4.745108
11	0	0	4	0	0.6	0	0	20.6	169.8	25	0	1	0	221	51.81202	-4.746202
12	0	0	0	0	0	0	0	0.2	1.2	0	0	0	0.4	1.8	51.81116	-4.748243

C1.6 October 2019 Results - BAI

Location	Barbastelle	Serotine	*Myotis* sp.	Leisler's bat	Noctule	*Nyctalus* sp.	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle	Pipistrelle sp.	Long-eared sp.	Greater horseshoe	Lesser horseshoe	All species BAI	Latitude	Longitude
1	0	0	3.6	0	2.6	0	0	2.8	26.2	0	1.8	0.8	0	37.8	51.81588	-4.729862
2	0	0	0.4	0	2.2	0	0	0.8	5.2	0	0	0	0	8.6	51.81478	-4.73375
3	0	0	2.8	0	0.8	0	0	1	41.6	0.2	0	0	0	46.4	51.81384	-4.736863
4	0	0	0.2	0	1.4	0	0	1	7	0	0	0	0	9.6	51.81287	-4.739304
5	0	0	0.6	0.2	3	0	0	1	124	0.4	0	0	0.2	129.4	51.81216	-4.740773
6	0	0	0.2	0	0.8	0	0	1.6	3.8	0	0	0	0	6.4	51.81076	-4.745108
9	0	0	1	0	0.6	0	0	1.2	135.8	0.4	0	0	0	139	51.81456	-4.742634
11	0	0	2.6	0	0.2	0	0	1.6	110.2	2	0	0	0	116.6	51.81202	-4.746202
12	0	0	2.8	0	0.6	0	0	1.2	5.8	0	0	0.2	0	10.6	51.81116	-4.748243

Appendix D: Figures

Appendix E: Dates and Times of Bat Passess

Month	Location No.	Date	Time of registration	Species	Sunset time	Sunrise time	Time of registration after sunset	Time of registration before sunrise	Equipment	latitude	longitude
April	8	17/04/2019	00:10	RHIFER	20:17	06:21	03:53	06:10	WA SM4	51.8154	-4.741057
April	9	17/04/2019	00:12	RHIFER	20:17	06:21	03:54	06:08	WA SM4	51.81456	-4.742634
April	11	16/04/2019	21:30	RHIFER	20:17	06:21	01:13	08:50	WA SM4	51.81202	-4.746202
April	8	18/04/2019	04:06	RHIFER	20:19	06:19	07:46	02:13	WA SM4	51.8154	-4.741057
April	8	18/04/2019	03:26	RHIFER	20:19	06:19	07:07	02:52	WA SM4	51.8154	-4.741057
April	2	18/04/2019	02:38	RHIFER	20:19	06:19	06:19	03:40	WA SM4	51.81478	-4.73375
April	5	17/04/2019	22:48	RHIHIP	20:19	06:19	02:28	07:31	WA SM4	51.81216	-4.740773
April	8	19/04/2019	00:09	RHIFER	20:21	06:17	03:48	06:07	WA SM4	51.8154	-4.741057
April	11	19/04/2019	03:09	RHIFER	20:21	06:17	06:48	03:07	WA SM4	51.81202	-4.746202
April	11	19/04/2019	01:55	RHIFER	20:21	06:17	05:34	04:21	WA SM4	51.81202	-4.746202
April	11	19/04/2019	01:42	RHIFER	20:21	06:17	05:21	04:34	WA SM4	51.81202	-4.746202
April	12	19/04/2019	01:13	RHIFER	20:21	06:17	04:52	05:03	WA SM4	51.81116	-4.748243
April	2	19/04/2019	02:59	RHIFER	20:21	06:17	06:38	03:17	WA SM4	51.81478	-4.73375
April	2	19/04/2019	00:09	RHIFER	20:21	06:17	03:48	06:07	WA SM4	51.81478	-4.73375
April	4	18/04/2019	20:48	BARBAR	20:21	06:17	00:27	09:28	WA SM4	51.81287	-4.739304
April	5	19/04/2019	02:32	RHIFER	20:21	06:17	06:11	03:45	WA SM4	51.81216	-4.740773
April	7	20/04/2019	00:21	RHIFER	20:22	06:14	03:58	05:53	WA SM4	51.81653	-4.73592
April	8	20/04/2019	05:12	RHIFER	20:22	06:14	08:49	01:02	WA SM4	51.8154	-4.741057
April	9	19/04/2019	22:48	RHIFER	20:22	06:14	02:25	07:26	WA SM4	51.81456	-4.742634
April	10	20/04/2019	05:30	RHIFER	20:22	06:14	09:07	00:44	WA SM4	51.81364	-4.744119
April	11	20/04/2019	04:17	RHIFER	20:22	06:14	07:54	01:57	WA SM4	51.81202	-4.746202
April	11	20/04/2019	04:19	RHIFER	20:22	06:14	07:56	01:55	WA SM4	51.81202	-4.746202

April	11	19/04/2019	22:08	RHIFER	20:22	06:14	01:45	08:06	WA SM4	51.81202	-4.746202
April	11	19/04/2019	23:54	RHIFER	20:22	06:14	03:32	06:20	WA SM4	51.81202	-4.746202
April	11	20/04/2019	05:18	RHIFER	20:22	06:14	08:55	00:56	WA SM4	51.81202	-4.746202
April	11	20/04/2019	03:14	RHIFER	20:22	06:14	06:51	03:00	WA SM4	51.81202	-4.746202
April	11	20/04/2019	05:08	RHIFER	20:22	06:14	08:45	01:06	WA SM4	51.81202	-4.746202
April	8	20/04/2019	21:02	RHIFER	20:24	06:12	00:38	09:10	WA SM4	51.8154	-4.741057
April	8	21/04/2019	03:17	RHIFER	20:24	06:12	06:53	02:55	WA SM4	51.8154	-4.741057
April	9	21/04/2019	03:19	RHIFER	20:24	06:12	06:55	02:53	WA SM4	51.81456	-4.742634
April	11	21/04/2019	00:42	RHIFER	20:24	06:12	04:18	05:30	WA SM4	51.81202	-4.746202
April	12	20/04/2019	23:45	RHIFER	20:24	06:12	03:20	06:27	WA SM4	51.81116	-4.748243
April	12	20/04/2019	21:04	RHIFER	20:24	06:12	00:40	09:08	WA SM4	51.81116	-4.748243
April	8	21/04/2019	21:31	RHIFER	20:26	06:10	01:05	08:39	WA SM4	51.8154	-4.741057
April	8	21/04/2019	21:32	RHIFER	20:26	06:10	01:06	08:38	WA SM4	51.8154	-4.741057
April	8	22/04/2019	02:13	RHIFER	20:26	06:10	05:46	03:57	WA SM4	51.8154	-4.741057
April	11	21/04/2019	23:13	RHIFER	20:26	06:10	02:47	06:56	WA SM4	51.81202	-4.746202
April	11	21/04/2019	22:43	RHIFER	20:26	06:10	02:17	07:27	WA SM4	51.81202	-4.746202
April	11	21/04/2019	22:26	RHIFER	20:26	06:10	02:00	07:44	WA SM4	51.81202	-4.746202
April	11	22/04/2019	00:04	RHIFER	20:26	06:10	03:38	06:05	WA SM4	51.81202	-4.746202
April	7	22/04/2019	23:18	RHIFER	20:27	06:08	02:50	06:49	WA SM4	51.81653	-4.73592
April	8	23/04/2019	05:37	RHIFER	20:27	06:08	09:09	00:31	WA SM4	51.8154	-4.741057
April	10	23/04/2019	00:28	RHIFER	20:27	06:08	04:00	05:40	WA SM4	51.81364	-4.744119
April	2	22/04/2019	21:48	RHIFER	20:27	06:08	01:20	08:19	WA SM4	51.81478	-4.73375
May	3	03/05/2019	22:43	RHIFER	20:46	05:46	01:56	07:03	WA SM4	51.81384	-4.736863
May	3	03/05/2019	22:25	RHIFER	20:46	05:46	01:39	07:20	WA SM4	51.81384	-4.736863
May	9	03/05/2019	22:27	RHIFER	20:46	05:46	01:41	07:19	WA SM2	51.81456	-4.742634

May	9	03/05/2019	22:44	RHIFER	20:46	05:46	01:58	07:01	WA SM2	51.81456	-4.742634
May	9	03/05/2019	22:27	RHIFER	20:46	05:46	01:41	07:19	WA SM2	51.81456	-4.742634
May	9	03/05/2019	22:44	RHIFER	20:46	05:46	01:58	07:01	WA SM2	51.81456	-4.742634
May	3	06/05/2019	22:02	RHIFER	20:51	05:41	01:11	07:38	WA SM4	51.81384	-4.736863
May	11	06/05/2019	21:50	RHIFER	20:51	05:41	00:59	07:50	WA SM4	51.81202	-4.746202
May	4	07/05/2019	00:13	RHIFER	20:51	05:41	03:22	05:27	WA SM4	51.81287	-4.739304
May	5	06/05/2019	22:07	RHIFER	20:51	05:41	01:16	07:33	WA SM4	51.81216	-4.740773
May	2	07/05/2019	22:10	RHIFER	20:52	05:39	01:18	07:28	WA SM4	51.81478	-4.73375
May	5	07/05/2019	21:30	RHIFER	20:52	05:39	00:37	08:09	WA SM4	51.81216	-4.740773
May	5	07/05/2019	21:32	RHIFER	20:52	05:39	00:39	08:06	WA SM4	51.81216	-4.740773
May	5	07/05/2019	21:33	RHIFER	20:52	05:39	00:40	08:06	WA SM4	51.81216	-4.740773
May	5	07/05/2019	21:33	RHIFER	20:52	05:39	00:40	08:05	WA SM4	51.81216	-4.740773
May	5	07/05/2019	21:32	RHIFER	20:52	05:39	00:40	08:06	WA SM4	51.81216	-4.740773
May	5	07/05/2019	21:32	RHIFER	20:52	05:39	00:39	08:06	WA SM4	51.81216	-4.740773
May	5	07/05/2019	21:33	RHIFER	20:52	05:39	00:41	08:05	WA SM4	51.81216	-4.740773
May	2	09/05/2019	04:21	RHIFER	20:54	05:37	07:27	01:15	WA SM4	51.81478	-4.73375
June	4	08/06/2019	22:43	RHIFER	21:34	05:01	01:08	06:18	WA SM4	51.81287	-4.739304
June	5	08/06/2019	22:34	RHIFER	21:34	05:01	00:59	06:27	WA SM4	51.81216	-4.740773
June	5	09/06/2019	00:07	RHIFER	21:34	05:01	02:32	04:54	WA SM4	51.81216	-4.740773
June	5	09/06/2019	03:25	RHIFER	21:34	05:01	05:50	01:36	WA SM4	51.81216	-4.740773
June	6	09/06/2019	03:13	RHIFER	21:34	05:01	05:39	01:47	WA SM2	51.81076	-4.745108
June	10	08/06/2019	22:40	RHIFER	21:34	05:01	01:06	06:20	WA SM2	51.81364	-4.744119
June	12	09/06/2019	01:10	RHIFER	21:34	05:01	03:35	03:51	WA SM4	51.81116	-4.748243
June	12	09/06/2019	02:57	RHIFER	21:34	05:01	05:22	02:04	WA SM4	51.81116	-4.748243
June	12	09/06/2019	03:35	RHIFER	21:34	05:01	06:01	01:25	WA SM4	51.81116	-4.748243

June	3	09/06/2019	22:39	RHIFER	21:35	05:01	01:03	06:22	WA SM4	51.81384	-4.736863
June	4	09/06/2019	23:54	RHIFER	21:35	05:01	02:19	05:06	WA SM4	51.81287	-4.739304
June	4	10/06/2019	01:16	RHIFER	21:35	05:01	03:40	03:44	WA SM4	51.81287	-4.739304
June	5	09/06/2019	23:57	RHIFER	21:35	05:01	02:21	05:03	WA SM4	51.81216	-4.740773
June	5	10/06/2019	01:34	RHIFER	21:35	05:01	03:58	03:26	WA SM4	51.81216	-4.740773
June	5	10/06/2019	03:31	RHIFER	21:35	05:01	05:56	01:29	WA SM4	51.81216	-4.740773
June	6	10/06/2019	03:33	RHIFER	21:35	05:01	05:58	01:27	WA SM2	51.81076	-4.745108
June	6	09/06/2019	22:33	RHIFER	21:35	05:01	00:58	06:27	WA SM2	51.81076	-4.745108
June	7	09/06/2019	22:38	RHIFER	21:35	05:01	01:03	06:22	WA SM4	51.81653	-4.73592
June	7	10/06/2019	01:54	RHIFER	21:35	05:01	04:19	03:06	WA SM4	51.81653	-4.73592
June	9	10/06/2019	01:55	RHIFER	21:35	05:01	04:19	03:06	WA SM4	51.81456	-4.742634
June	9	10/06/2019	01:15	RHIFER	21:35	05:01	03:40	03:45	WA SM4	51.81456	-4.742634
June	12	09/06/2019	22:38	RHIFER	21:35	05:01	01:03	06:22	WA SM4	51.81116	-4.748243
June	12	10/06/2019	02:11	RHIFER	21:35	05:01	04:36	02:49	WA SM4	51.81116	-4.748243
June	12	10/06/2019	03:40	RHIFER	21:35	05:01	06:05	01:20	WA SM4	51.81116	-4.748243
June	12	10/06/2019	03:47	RHIFER	21:35	05:01	06:11	01:13	WA SM4	51.81116	-4.748243
June	4	10/06/2019	23:46	RHIFER	21:36	05:00	02:10	05:13	WA SM4	51.81287	-4.739304
June	5	11/06/2019	03:33	RHIFER	21:36	05:00	05:57	01:27	WA SM4	51.81216	-4.740773
June	12	10/06/2019	22:33	RHIFER	21:36	05:00	00:56	06:27	WA SM4	51.81116	-4.748243
June	10	11/06/2019	22:36	RHIFER	21:36	05:00	00:59	06:24	WA SM2	51.81364	-4.744119
June	12	11/06/2019	22:13	RHIFER	21:36	05:00	00:36	06:47	WA SM4	51.81116	-4.748243
June	12	11/06/2019	22:24	RHIFER	21:36	05:00	00:47	06:35	WA SM4	51.81116	-4.748243
June	12	11/06/2019	22:32	RHIFER	21:36	05:00	00:55	06:28	WA SM4	51.81116	-4.748243
June	12	12/06/2019	22:38	RHIFER	21:37	05:00	01:00	06:21	WA SM4	51.81116	-4.748243
June	12	14/06/2019	22:33	RHIFER	21:38	04:59	00:54	06:26	WA SM4	51.81116	-4.748243

June	12	14/06/2019	22:37	RHIFER	21:38	04:59	00:58	06:22	WA SM4	51.81116	-4.748243
June	9	16/06/2019	00:53	RHIFER	21:39	04:59	03:14	04:06	WA SM4	51.81456	-4.742634
June	9	15/06/2019	22:46	RHIFER	21:39	04:59	01:06	06:13	WA SM4	51.81456	-4.742634
June	12	16/06/2019	03:48	RHIFER	21:39	04:59	06:08	01:11	WA SM4	51.81116	-4.748243
June	12	16/06/2019	04:12	RHIFER	21:39	04:59	06:33	00:46	WA SM4	51.81116	-4.748243
June	12	15/06/2019	22:32	RHIFER	21:39	04:59	00:53	06:26	WA SM4	51.81116	-4.748243
June	3	17/06/2019	22:42	RHIFER	21:40	04:59	01:02	06:16	WA SM4	51.81384	-4.736863
June	7	17/06/2019	22:38	RHIFER	21:40	04:59	00:58	06:20	WA SM4	51.81653	-4.73592
June	12	17/06/2019	22:41	RHIFER	21:40	04:59	01:00	06:18	WA SM4	51.81116	-4.748243
June	12	17/06/2019	22:41	RHIFER	21:40	04:59	01:01	06:17	WA SM4	51.81116	-4.748243
June	12	18/06/2019	03:45	RHIFER	21:40	04:59	06:05	01:13	WA SM4	51.81116	-4.748243
June	12	18/06/2019	03:49	RHIFER	21:40	04:59	06:09	01:09	WA SM4	51.81116	-4.748243
June	12	18/06/2019	03:53	RHIFER	21:40	04:59	06:12	01:06	WA SM4	51.81116	-4.748243
June	12	18/06/2019	03:54	RHIFER	21:40	04:59	06:13	01:05	WA SM4	51.81116	-4.748243
June	12	18/06/2019	03:55	RHIFER	21:40	04:59	06:14	01:04	WA SM4	51.81116	-4.748243
June	12	18/06/2019	04:02	RHIFER	21:40	04:59	06:22	00:56	WA SM4	51.81116	-4.748243
June	12	18/06/2019	04:04	RHIFER	21:40	04:59	06:24	00:54	WA SM4	51.81116	-4.748243
June	12	17/06/2019	22:36	RHIFER	21:40	04:59	00:56	06:22	WA SM4	51.81116	-4.748243
June	8	20/06/2019	03:31	RHIFER	21:40	04:59	05:50	01:27	WA SM2	51.8154	-4.741057
June	8	22/06/2019	03:30	RHIFER	21:41	04:59	05:49	01:28	WA SM2	51.8154	-4.741057
July	6	27/07/2019	01:13	RHIFER	21:17	05:31	03:56	04:17	WA SM4	51.81076	-4.745108
July	11	26/07/2019	23:28	RHIFER	21:17	05:31	02:10	06:02	WA SM2	51.81202	-4.746202
July	9	28/07/2019	02:40	RHIFER	21:16	05:33	05:23	02:52	WA SM4	51.81456	-4.742634
July	7	28/07/2019	23:10	RHIFER	21:14	05:34	01:55	06:24	WA SM4	51.81653	-4.73592
July	7	28/07/2019	23:10	RHIFER	21:14	05:34	01:56	06:23	WA SM4	51.81653	-4.73592

July	7	28/07/2019	23:16	RHIFER	21:14	05:34	02:02	06:17	WA SM4	51.81653	-4.73592
July	10	28/07/2019	23:43	RHIFER	21:14	05:34	02:28	05:51	WA SM4	51.81364	-4.744119
July	10	29/07/2019	04:22	RHIFER	21:14	05:34	07:07	01:12	WA SM4	51.81364	-4.744119
July	11	29/07/2019	04:23	RHIFER	21:14	05:34	07:08	01:11	WA SM2	51.81202	-4.746202
July	6	31/07/2019	04:20	RHIFER	21:11	05:37	07:08	01:17	WA SM4	51.81076	-4.745108
July	6	31/07/2019	23:26	RHIFER	21:10	05:39	02:16	06:12	WA SM4	51.81076	-4.745108
July	6	31/07/2019	23:19	RHIFER	21:10	05:39	02:09	06:19	WA SM4	51.81076	-4.745108
July	10	01/08/2019	04:29	RHIFER	21:10	05:39	07:19	01:09	WA SM4	51.81364	-4.744119
September	3	18/09/2019	20:36	RHIFER	19:27	06:57	01:09	10:21	WA SM2	51.81384	-4.736863
September	11	18/09/2019	20:34	RHIFER	19:27	06:57	01:07	10:22	WA SM2	51.81202	-4.746202
September	11	19/09/2019	01:00	RHIFER	19:27	06:57	05:33	05:56	WA SM2	51.81202	-4.746202
September	11	19/09/2019	01:00	RHIFER	19:27	06:57	05:33	05:57	WA SM2	51.81202	-4.746202
September	1	18/09/2019	21:42	RHIFER	19:27	06:57	02:15	09:15	WA SM4	51.81588	-4.729862
September	1	18/09/2019	20:25	RHIFER	19:27	06:57	00:58	10:32	WA SM4	51.81588	-4.729862
September	6	19/09/2019	20:59	RHIFER	19:24	06:59	01:35	09:59	WA SM2	51.81076	-4.745108
September	1	19/09/2019	23:28	RHIFER	19:24	06:59	04:03	07:31	WA SM4	51.81588	-4.729862
September	1	19/09/2019	20:37	RHIFER	19:24	06:59	01:12	10:22	WA SM4	51.81588	-4.729862
September	2	20/09/2019	23:59	RHIFER	19:22	07:01	04:36	07:01	WA SM4	51.81478	-4.73375
September	2	21/09/2019	01:05	RHIFER	19:22	07:01	05:43	05:55	WA SM4	51.81478	-4.73375
September	2	21/09/2019	01:06	RHIFER	19:22	07:01	05:43	05:54	WA SM4	51.81478	-4.73375
September	2	21/09/2019	01:06	RHIFER	19:22	07:01	05:43	05:54	WA SM4	51.81478	-4.73375
September	3	20/09/2019	20:42	RHIFER	19:22	07:01	01:20	10:18	WA SM2	51.81384	-4.736863
September	3	20/09/2019	21:26	RHIFER	19:22	07:01	02:03	09:34	WA SM2	51.81384	-4.736863
September	1	21/09/2019	00:02	RHIFER	19:22	07:01	04:39	06:58	WA SM4	51.81588	-4.729862
September	3	22/09/2019	19:53	RHIFER	19:17	07:04	00:35	11:11	WA SM2	51.81384	-4.736863

September	3	23/09/2019	01:47	RHIFER	19:17	07:04	06:29	05:17	WA SM2	51.81384	-4.736863
September	11	22/09/2019	20:13	RHIFER	19:17	07:04	00:55	10:50	WA SM2	51.81202	-4.746202
September	11	22/09/2019	21:59	RHIFER	19:17	07:04	02:41	09:05	WA SM2	51.81202	-4.746202
September	12	22/09/2019	23:55	RHIHIP	19:17	07:04	04:37	07:08	WA SM2	51.81116	-4.748243
September	12	22/09/2019	23:55	RHIHIP	19:17	07:04	04:37	07:08	WA SM2	51.81116	-4.748243
October	1	22/10/2019	19:22	RHIFER	18:11	07:54	01:11	12:32	WA SM4	51.81588	-4.729862
October	1	22/10/2019	19:22	RHIFER	18:11	07:54	01:10	12:32	WA SM4	51.81588	-4.729862
October	1	22/10/2019	19:20	RHIFER	18:11	07:54	01:09	12:34	WA SM4	51.81588	-4.729862
October	1	22/10/2019	19:21	RHIFER	18:11	07:54	01:10	12:33	WA SM4	51.81588	-4.729862
October	12	22/10/2019	19:07	RHIFER	18:11	07:54	00:56	12:47	WA SM4	51.81116	-4.748243
October	5	24/10/2019	20:57	RHIHIP	18:07	07:58	02:49	11:01	WA SM4	51.81216	-4.740773

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 9.1 LANDMAP Evaluation

A40PRC-RML-ELS-SWI-RP-L-0901

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29/05/20

Appendix 9.1 Contents

National Landscape Character Areas

Table 1 Taf and Cleddau Vales (NLCA)

Taf and Cleddau Vales (NLCA 44)
Key Characteristics • Ordovician shales, mudstones and sandstones underlie much of the area with intrusions of Cambrian igneous rocks forming craggy summits (tors) in the west. An outcrop of later, Devonian Old Red Sandstone forms the boundary with Carboniferous Coal Measures to the south. • Undulating topography with harder rocks forming hilly areas. • Steep, often wooded, small glacial melt-water valleys with fast rivers and streams, generally running from north to south – particularly notable around Maesprior. • A predominantly rural, settled, agricultural landscape, with a mix of fields of pasture, cereals and hay meadows. Higher land is of a heathy character. • Fields are mainly medium sized, bounded by a regular pattern of hedgerows, hedgerow trees and hedgebanks. • Small blocks of broadleaved woodland and mixed or coniferous plantations are located on slopes. Watercourses are often fringed by oak-dominated woodlands. • The East and West Cleddau rivers are nationally and internationally recognised as important wildlife habitats. Both support populations of otter and submerged water crowfoot. • A range of archaeological features is scattered across the landscape, with clusters of prehistoric ritual and funerary monuments occupying prominent positions. • Narbeth, St Clears and Whitsand are the principal towns. Settlement elsewhere is dispersed, with hamlets and small villages in valleys. • The main A477 and A40 trunk roads cross this otherwise overwhelmingly peaceful, rolling countryside.
Summary Description The area is a broad, undulating, agricultural, lowland, generally sloping southwards and forming the rural hinterland to the settlements and more populous areas that lie outside its confines to the south-west and south-east. It is dissected by numerous small, deeply cut minor river valleys, often with wooded sides. It is crossed by main road and rail routes, notably the South Wales to Ireland routes to nearby Fishguard. The area forms the inland setting to the more established visitor destinations in Pembrokeshire Coast National Park. The area is predominantly enclosed with well kept, mature hedgerows and narrow lanes. A historic cultural division, the Landsker Line, runs across part of the area. To its north are Welsh place names and traditions amidst a more marginal farmland, while to the south names are Anglicised, amidst a gentler, improved farmland of dairying, root crop and cereal production.

https://naturalresources.wales/evidence-and-data/maps/nlca/?lang=en

Table 2 NLCA - Milford Haven (NLCA)

Milford Haven (NLCA 48)
Key characteristics: • Complex geology - The geological history of the landscape is complex, with a mixture of Ordovocian, Silurian, Devonian and Carboniferous rocks and mudstones. A band of uplifted igneous lava and tuff is exposed to the north of Milford Haven. • Large Ria - The deep water of Milford Haven was initially formed along a fault line, widened by glacial meltwater flows. Post-glacial sea level rise flooded the valley to form today's extensive ria landscape. • Estuaries extending inland - The ria extends many miles inland to include the long, twisting Daugleddau estuaries, including the Eastern and Western Cleddau tidal rivers with their very sheltered conditions but strong tidal currents, and extensive lengths of salt marsh and mud banks. • Coastal and intertidal species and habitats - are of international and national importance. Species-rich salt marshes and sheltered muddy inter-tidal areas are abundant, including many 'pills' (small muddy creeks), some man-made. • Mixed fields and hedgerows – a rolling lowland agricultural landscape with a mosaic of mixed fields bounded by hedgerows. • Mixed and conifer plantations fringe the upper ria and estuaries – with frequent copses and riparian (riverside) woodlands found on slopes throughout. Ancient semi- • natural sessile oak woodlands are also among the area's valued habitats. • Historic port defences - A number of archaeological features are present, from Iron Age forts to significant and well-preserved, 19th century naval fortifications, including the Royal Dockyard at Pembroke. • Towns and villages - The area is served by the towns of Haverfordwest, Milford Haven and Pembroke. Elsewhere, villages and hamlets are dispersed along roads, their intersections or at former landing places for cross-Haven ferries. • Industry by the lower ria - Oil refineries and their jetties, and a power station dominate the coastal landscape at the mouth of the Haven. • Tranquil rural upper ria and estuaries – contrasting to the lower ria, the upper ria and estuaries and their surrounding woodland and farmland are intimate and rural • Renowned scenic qualities - The upper ria and estuaries have long been admired for its scenic qualities, with the Haven being mentioned in Shakespeare's Cymbeline.
Summary Description Fortress Haven, defended for millennia by prehistoric promontory forts, Mediaeval castles and massive Palmerston forts, is a drowned river valley or ria, providing an immense expanse of deep-water anchorage for today's oil-carrying super tankers. It is a naturally strategic place, with outer headlands and cliffs ideal for defensive installations. Today it conveys the sense of being both industrially of supra-importance, and of a maritime playground for sailors and yachtsmen. Its role as an important military bastion did not cease until after the Second World War. The area is served by the towns of Haverfordwest, Milford Haven and Pembroke, whose existence and character relate closely to the ria. Elsewhere, villages and hamlets are dispersed along roads, their intersections or at former landing places for cross-Haven ferries. The prominent industry at Pembroke Dock and Milford Haven, with oil refineries and their jetties dominating the coastal landscape at the mouth of the Haven, contrasts remarkably with the intimate and rural landscapes of the inland ria or Daugleddau, and its surrounding woodland slopes and farmland. The modern industrial leviathans also coexist with areas that are of international and national nature conservation interests. The Daugleddau estuaries and the Cleddau river basins form part of the Pembrokeshire Coast National Park.

https://naturalresources.wales/evidence-and-data/maps/nlca/?lang=en

LANDMAP Cultural Landscape Aspect Areas

Table 3 Rural Carmarthenshire (CL)

Rural Carmarthenshire (CRMRT-CL-061)		
Condition: Unassessed	**Value:** High	**Rarity:** Commonplace
Overall Evaluation: High High for the varying topography of each of the areas being emblematic of the beauties of the countryside, and for the survival of its principal cultural activity of farming.		
Summary Description Multi-faceted appearance but largely homogenous cultural use in the form of farming. The county of Carmarthenshire is so large, and indeed so topographically, culturally and socially diverse as between its various components, that it is not possible within resources to characterise all its cultural features other than those which have a special resonance. However, on the basis that historically, and currently, the principal cultural activity is farming, and recognising that the landscape changes from coastal flats to rugged and inaccessible high points riven by mountain river and stream valleys with undulating landscapes of soothing attractiveness, this catch-all designation appears to be appropriate.		

landmap-maps.naturalresources.wales/CRMRTCL061

Table 4 Haven tributaries (CL)

Haven tributaries (PMBRK-CL-002)		
Condition: Good	**Value:** Outstanding	**Rarity:** Rare
Overall Evaluation: Outstanding As a national park, as an historic landscape and as a significant leisure/pleasure area. In terms of cultural effect, the designation is of outstanding importance as the combination of statutory powers, concepts and influence have done much to change the perceptions of Pembrokeshire. The designation is recognition of the generally accepted understanding that Pembrokeshire, not only the National Park, is a truly beautiful and lovely part of Wales.		
Summary Description The areas on the banks of the western and eastern Cleddau, the Carew and the Cresswell, and the rivers themselves. This area includes traces of the county"s small-scale coal mining industry as well as historic agricultural landscapes including landed houses, farms and cottages set in distinctive field patterns. The area includes Carew castle and tide-mill (the only working example in Britain); the castle hosts holiday and term-time activities for children.		

landmap-maps.naturalresources.wales/PMBRKCL002

Table 5 Railway system (CL)

Railway system (PMBRK-CL-009)		
Condition: Poor	**Value:** High	**Rarity:** Representative
Overall Evaluation: High High rather than Outstanding in that although there are Brunel connections, it is understood that there is little in the way of historic engineering works or cultural "story" associated with these lines.		
Summary Description A railway system, made up of lines of different dates, most of which have been downgraded in the course of the twentieth century.		

landmap-maps.naturalresources.wales/PMBRKCL009

Table 6 Lowlands (CL)

Lowlands (PMBRK-CL-196)		
Condition: Fair	**Value:** High	**Rarity:** Commonplace
Overall Evaluation: High Experiencing cultural change as the economics of rural land use are influencing the types of crops grown, the size of actual farms and other human geography. Although individual settlements within this area might not score highly in this respect, this the area that effectively defines Pembrokeshire, the one which travellers through and from Ireland see, and which preserves many of the distinctive features of Medieval settlement.		
Summary Description The lowland part of Pembrokeshire, characterised by rich farmland, English speaking communities, residential and commercial expansion. The settlement patterns are historically rich, and the area also includes the Landsker castles as well as more modern defensive structures around Milford Haven.		

landmap-maps.naturalresources.wales/PMBRKCL196

Table 7 Bluestone, Oakwood, Folly Farm (CL)

Bluestone, Oakwood, Folly Farm (PMBRK-CL-589)		
Condition: Good	**Value:** Outstanding	**Rarity:** Representative
Overall Evaluation: Outstanding At present, these attractions have been rated as outstanding with an improving trend. This has been done after much thought and reflects the significance of the attractions in terms of "popular" culture. Oakwood is one of the most visible tourist success stories in Wales. It has developed from a small-scale family operation to a major business. It makes a significant contribution to the economy of the area. A similar trend is visible at Folly Farm. Folly Farm has been run by the Williams family as a Welsh working farm for over 50yrs. In 1988 the farm diversified and the gates were opened to the public, and it became Wales premier farm attraction.		
Summary Description Oakwood and Folly farm are the most visible tourist success stories in Wales.		

landmap-maps.naturalresources.wales/PMBRKCL589

Table 8 Castlemartin Training Area and Pembrokeshire Airfields (CL)

MOD sites and airfields (PMBRK-CL-819)		
Condition: Fair	**Value:** High	**Rarity:** Representative
Overall Evaluation: High The military presence is an factor in Pembrokeshire's history. Significant because of clearly defined areas of land, transient population, archaeological riches, and wider-spread economic impact.		
Summary Description Former and present defensive sites; Castlemartin is the largest single element in the Army Training Estate Pembrokeshire ATE P, used by regular and territorial Army and Cadet forces, other services, some overseas forces, and (uniquely in the UK) by armoured units for direct-fire live gunnery exercises, with both on-land impact areas and a large offshore safety area. During non-firing periods there is public access to the coastal path. The airfields include Brawdy, now Cawdor (army) barracks, Templeton (now an army Dry Training Area) and St David's, acquired by the National Park and managed for nature conservation and quiet enjoyment. The 2002 National Eisteddfod was held here.		

landmap-maps.naturalresources.wales/PMBRKCL819

Table 9 Narberth (CL)

Narberth (PMBRK-CL-829)		
Condition: Good	**Value:** High	**Rarity:** Rare
Overall Evaluation: High Flourishing tourist destination. There is a danger that because of Narberth's success at re-inventing itself that the pressure for new development could actually change the character that has given its present cultural significance. It personifies a "middle class" settlement.		
Summary Description Narberth has undergone a cultural transformation in the last thirty years from a small market centre serving a small restricted area to become a significant tourist centre gaining a wide reputation as a place for quality visitor experience. With its variety of art, craft and coffee shops Narberth has become an ideal tourist centre for both wet and dry weather conditions. It has also become known as the "capital" of the Landsker Borderlands. This has been largely due to the efforts of SPARC (South Pembrokeshire Partnership for action with Rural Communities) a locally based, non-government organisation that works with and within the community.		

landmap-maps.naturalresources.wales/PMBRKCL829

Table 10 Principal roads (CL)

Principal roads (PMBRK-CL-977)		
Condition: Good	**Value:** High	**Rarity:** Commonplace
Overall Evaluation: High Improvements to the A40 infrastructure will potentially help to create an economic corridor which is considered essential to the regeneration of the area's economy and employment base, and in overcoming its peripheral location. The A40 trunk road links St Clear, Haverfordwest and Fishguard, and is the main transport artery in Pembrokeshire. The 60 million pounds improvement plan for the A40 trunk road could result in the regeneration of peripheral locations. There are concerns from organisations such as Friends of the Earth, that spending 60 million pounds upgrading or dualling the A40 would only encourage more traffic, more car dependency and more global warming emissions.		
Summary Description The A40 trunk road links St Clear, Haverfordwest and Fishguard. The A40, along with the A477 are part of the Trans-European Road Network (TERN) because of the importance of their strategic linking of Ireland, the UK, and Europe. Proposals for improving the A40 are included in the Joint Unitary Development Plan for Pembrokeshire 2000 - 2016 prepared by Pembrokeshire County Council and the Pembrokeshire Coast National Park Authority. The A40/M4 corridor and links between the M4 and the Pembrokeshire ports are designated in the Welsh Office's "Priority for Trunk Road Improvement".		

landmap-maps.naturalresources.wales/PMBRKCL977

LANDMAP Geological Landscape Aspect Areas

Table 11 Coxlake (GL)

Coxlake (PMBRK-GL-193)		
Condition: Good	**Value:** Moderate	**Rarity/Uniqueness:** Low
Overall Evaluation: Moderate No regionally significant sites/ landforms noted during present survey and geology/ geomorphology considered to be typical of feature/ process and is either widespread, better exposed elsewhere or not currently known to be exceptional.		
Summary Description Area of terrain significantly lower than the Robeston Wathen and Narberth massifs to the W and E, but still rising to around 40m, albeit relatively gently, above river valleys to S and N. Underlain by Silurian mudrocks with some glacial clay (Quaternary: Pleistocene).		

landmap-maps.naturalresources.wales/PMBRKGL193

Table 12 Longford – Stoneyford (GL)

Longford - Stoneyford (PMBRK-GL-194)		
Condition: Good	**Value:** Low	**Rarity/Uniqueness:** Moderate
Overall Evaluation: Moderate No regionally significant sites/ landforms noted during present survey and geology/ geomorphology considered to be typical of feature/ process and is either widespread, better exposed elsewhere or not currently known to be exceptional.		
Summary Description Forms an apron, locally terrace-like, with relatively gentle slopes around the N, E and S sides of the Narberth - Llanddewi Velfrey massif and a broad basin in the Whitley Farm area at the western end of Lampeter Vale. Includes glacial sands and gravels (Quaternary: Pleistocene) in the N and presumed to include similar deposits in the S (where the area is likely to represent the continuation of the feature / deposit of the Tygywn and Gorse wen areas on the S side of the Vale). Some bedrock exposure may be present locally also.		

landmap-maps.naturalresources.wales/PMBRKGL194

Table 13 Narberth – Llanddewi Velfrey (GL)

Longford - Stoneyford (PMBRK-GL-194)		
Condition: Good	**Value:** High	**Rarity/Uniqueness:** High
Overall Evaluation: Moderate Includes nationally important proposed geological SSSI at Pengawse Hill (Ordovician stratigraphy).		
Summary Description Prominent block with steep scarp surrounding the N, W and SW of Lampeter Vale and formed of Ordovician and Silurian slates, the latter with thin sandstone bands, Dissected by steep-side cwms, most prominently on the N side of the Vale where a sub-plateau feature at around 135-145 m is present in the Llandewi Velfrey area. Scarp also present on the W side of the ridge, W of Narberth.		

landmap-maps.naturalresources.wales/PMBRKGL195

LANDMAP Historic Landscape Aspect Areas

Table 14 Pont-y-Fenni, Whitland Abbey (HL)

Pont-y-Fenni, Whitland Abbey (CRMRT-HL-40346)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High This area scores highly in most categories but its potential and rarity scores are moderate. It is a typical example of a Carmarthenshire agricultural landscape.	
Summary Description Medium to large irregular pasture fields, areas of strip field remnants to the SE around St Clears and areas of woodland. The settlement pattern is one of dispersed farmsteads and cottages. A large solar farm has been installed to the northwest of Whitland. Most significant archaeological element(s): Whitland Abbey, Llangan church and cropmarks, Roman Road.	

landmap-maps.naturalresources.wales/CRMRTHL40346

Table 15 Lampeter Vale (HL)

Lampeter Vale (CRMRT-HL-40353)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High This area scores highly in most categories but its potential and rarity scores are moderate. It is a good example of a Carmarthenshire agricultural landscape occupying the floor of a river valley.	
Summary Description An area mainly along the valley floor of the Afon Taf, including large regular pasture fields and a settlement pattern of dispersed farmsteads and cottages. Most significant archaeological element(s): Medieval and post medieval field systems, Roman road, Bronze Age ritual monuments.	

landmap-maps.naturalresources.wales/CRMRTHL40353

Table 16 Penbontbren (HL)

Penbontbren (CRMRT-HL-40354)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High This area scores highly in most categories but its potential and rarity scores are moderate. It is a good example of a Carmarthenshire agricultural landscape occupying the floor of a small river valley.	
Summary Description Valley floor of the Afon Taf from Login to Llanfallteg bridge encompassing some regular field enclosures and areas of woodland, with a settlement pattern of dispersed farmsteads. Most significant archaeological element(s): post medieval settlement.	

landmap-maps.naturalresources.wales/CRMRTHL40354

Table 17 Henllanfallteg (HL)

Henllanfallteg (CRMRT-HL-42460)	
Condition: Poor	**Value:** High
Overall Evaluation: High This area scores highly in most categories but its potential and rarity scores are moderate. It is a typical example of a Carmarthenshire agricultural landscape.	
Summary Description Dispersed farms, including some large holdings, in a landscape of small fields and scattered woodland. There are now several individual wind turbines on farms in this area. Most significant archaeological element(s): Extant buildings - churches, chapels, mills, etc, Iron Age defended hillforts, Prehistoric funerary and ritual sites.	

landmap-maps.naturalresources.wales/CRMRTHL42460

Table 18 Eastern Cleddau (HL)

Eastern Cleddau (CRMRT-HL-42471)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High This area scores highly in most categories but its potential and rarity scores are moderate. It is a good example of a Carmarthenshire agricultural landscape occupying the floor of a river valley. Most of this area lies within Pembrokeshire.	
Summary Description Floodplain characterised by large fields. There are no settlements. It is not an important routeway though it is crossed by several roads and a railway. Most significant archaeological element(s): Bridges, Undated earthworks.	

landmap-maps.naturalresources.wales/CRMRTHL42471

Table 19 Llandissilio (HL)

Llandissilio (CRMRT-HL-42472)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High This area scores highly in most categories but its potential and rarity scores are moderate. It is a typical example of a Carmarthenshire agricultural landscape.	
Summary Description Village of Llandissilio and dispersed farms, including some large holdings, in a landscape of small fields and scattered woodland. Most significant archaeological element(s): Extant buildings - churches, chapels, mills, etc, Deserted rural settlements, Iron Age forts.	

landmap-maps.naturalresources.wales/CRMRTHL42472

Table 20 Clynderwen (HL)

Clynderwen (CRMRT-HL-42473)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High This area scores highly in most categories but its potential and rarity scores are moderate. It is a typical example of a Carmarthenshire agricultural landscape.	
Summary Description Village of Clynderwen, with a main road and railway line and a Roman road, and dispersed farms, including some large holdings, in a landscape of medium-sized fairly regular fields and scattered woodland. Most significant archaeological element(s): Extant buildings - churches, chapels, mills, etc, Iron Age forts, Roman road.	

landmap-maps.naturalresources.wales/CRMRTHL42473

Table 21 Lampeter Velfrey (HL)

Lampeter Velfrey (PMBRK-HL-40349)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High Well-preserved character of the post-medieval fieldscape and the presence of potentially significant prehistoric remains.	
Summary Description Lowland hills and valleys. It lies partly in Carmarthenshire. The area is characterised by medium-sized, irregular fields, with some deciduous woodland particularly in the many stream and river valleys. Settlement is mainly dispersed, but there is a small nucleation, at Lampeter Velfrey, of mainly 19th-20th century housing, with a 19th century chapel and a school. Settlement otherwise comprises dispersed farms, both large and small, and mainly informal. There is a medieval church, and a motte castle, at Lampeter Velfrey, and nearby is a group of Neolithic monuments. Recorded archaeology otherwise mainly comprises prehistoric burnt mounds, and post-medieval cottages and quarries. There are some Scheduled Ancient Monuments in the area. Summary of the most significant archaeological elements: prehistoric funerary and ritual monuments, medieval and post-medieval settlement.	

landmap-maps.naturalresources.wales/PMBRKHL40349

Table 22 Lampeter Vale (HL)

Lampeter Vale (PMBRK-HL-40353)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High Well-preserved fieldscape exhibiting evidence of multi-period activity spanning the Bronze Age through to the late post-medieval period.	
Summary Description Lowland hills and valleys. It lies partly in Carmarthenshire. The area is characterised by large regular fields. A wide river valley crosses the area (the Afon Marlais) and there are also many ponds and lakes, and a sewage works. The A40 trunk road, and two railway lines, also cross the area. There is little settlement, and it is dispersed, comprising small and large informal farms, and some post-medieval cottages. The area contains much recorded archaeology including a Scheduled bronze age round barrow, a Scheduled medieval/post-medieval house site, a Roman road, two iron age defended enclosures, further bronze age round barrows and a possible standing stone, a possible burnt mound, medieval ridge-and-furrow and field systems, and from the post-medieval period, a mill, lodges and bridges. Summary of the most significant archaeological elements: Roman road, prehistoric funerary and ritual monuments, medieval settlement.	

landmap-maps.naturalresources.wales/PMBRKHL40353

Table 23 Eastern Cleddau (HL)

Eastern Cleddau (PMBRK-HL-42471)	
Condition: Unassessed	**Value:** Moderate
Overall Evaluation: Moderate Although the historic character of the area appears to have been largely retained, its potential is limited.	
Summary Description Floodplain of Eastern Cleddau and further upstream, where it is narrower, the valley sides. The river here partly represents the county boundary between Pembrokeshire and Carmarthenshire. The area is characterised by large fields, both regular and irregular. There is some woodland, some of which is coniferous on the steeper valley sides. Settlement is dispersed, comprising a few irregular farms, both large and small. There are also a few dispersed cottages. However, the area also includes the lower part of Llawhaden village, which is a Conservation Area and is represented by a medieval landmark church (listed), a scheduled bridge, and 19th century houses and cottages, some of which are listed. The southern end of the area is crossed by the A40 trunk road and a main railway line. Recorded archaeology includes the medieval church, with an Early Christian Monument, bridges, least and place-names. Summary of the most significant archaeological elements: bridges, the church, undated earthworks.	

landmap-maps.naturalresources.wales/PMBRKHL42471

Table 24 Llandissilio (HL)

Llandissilio (PMBRK-HL-42472)	
Condition: Unassessed	**Value:** High
Overall Evaluation: High Apparent survival of a late Neolithic ritual landscape. However, further work is required to substantiate this interpretation. There is also evidence of Bronze Age ritual activity and later prehistoric settlement, as well as an early medieval ecclesiastical presence.	
Summary Description A lowland plateau, characterised by medium-large irregular enclosures, intersected by river valleys including the Eastern Cleddau. There is some woodland, especially on the valley sides, but scattered elsewhere. The area is crossed by a number of modern roads, including the A478 trunk road, and by two railway lines. Settlement is mainly dispersed and includes large and small farms, both informal and in line. Some of the holdings are large. There is also a nucleation at Llandissilio, which has origins as settlement around a listed medieval church, but is mainly represented by 19th-20th century roadside ribbon development. There is further 19th-20th century housing, especially along the A478. There are a number of disused quarries and gravel pits. Other landscape elements include 19th religious buildings, a school, a modern caravan park and a fish farm. Scheduled monuments comprise bronze age round barrows, an iron age defended settlement and a possible medieval defended site. Other recorded archaeology includes further bronze age round barrows and an iron age defended settlement, a prehistoric enclosure; a Roman road, the medieval church, with important Early Christian Monument, and a ruined medieval church. Summary of the most significant archaeological elements: iron age forts and deserted rural settlements, standing post-medieval buildings including churches, chapels and mills.	

landmap-maps.naturalresources.wales/PMBRKHL42472

Table 25 Clynderwen (HL)

Clynderwen (PMBRK-HL-42473)	
Condition: Unassessed	**Value:** Moderate
Overall Evaluation: Moderate Although the fieldscape and dispersed settlement pattern shown on the early editions of the OS survives largely intact, the archaeological resource is limited. The Iron Age enclosure sites do, however, offer some potential.	
Summary Description Lowland plateau, partly lying in Carmarthenshire. It is characterised by large regular fields, intersected by river valleys including the Eastern Cleddau. There is some woodland, especially on the valley sides, but scattered elsewhere. The area is crossed by a number of modern roads, including the A478 trunk road, and by a railway line. Settlement is mainly dispersed and includes large and small farms, both informal and in line, and some dispersed cottages. Some of the holdings are large. There is also a nucleation at Clynderwen which has 19th century origins as a settlement around the railway station. It is mainly represented by 19th-20th century roadside ribbon development but includes commercial buildings, a school and 19th century religious buildings. There are a number of listed Buildings including, outside the village, estate lodges. Recorded archaeology includes a scheduled bronze age round barrow group, a scheduled iron age defended enclosure, other prehistoric funerary and ritual sites; Roman road including scheduled stretches, a rebuilt medieval church with an Early Christian Monument, and a medieval church. Summary of the most significant archaeological elements: prehistoric monuments, Roman road and standing post-medieval buildings including churches, chapels and mills.	

landmap-maps.naturalresources.wales/PMBRKHL42473

Table 26 Toch (HL)

Toch (PMBRK-HL-43905)	
Condition: Good	**Value:** Moderate
Overall Evaluation: Moderate Reasonably well-preserved condition of the post-medieval regular fieldscape and settlement pattern in this area. The archaeological record is relatively modest in scope, although there is potential for evidence of prehistoric or Romano-British settlement activity to be identifed in the vicinity of Cottleys Farm.	
Summary Description HLC 331 Toch Most significant archaeological element(s): Bronze age finds, Undated earthwork. Toch historic landscape character area lies across a low, rounded ridge that achieves heights of over 80m above sea level. The A40 runs along the crest of the ridge and bisects this area. Dispersed farms and fields characterise this area. Farmhouses are mostly 19th century in date, stone-built with slate roofs, and in the Georgian vernacular tradition - i.e. symmetrical positioning of windows, chimneys etc. Older farm buildings consist of one or two ranges, again stone-built with slate roofs. High Toch farmhouse, and a nearby milepost, are Grade II listed. Large modern agricultural buildings attached to some of the farms are a feature of the landscape. Other dwellings, in addition to the farmhouses, comprise dispersed 19th century houses alongside the A40. Fields vary in size, but most approximate to a rectangular shape. Boundaries are earth banks topped with hedges. Most of the hedges are in good condition, but a significant number are becoming overgrown and support small trees, and a small number are derelict and are replaced by wire fences. The overgrown hedges in conjunction with scrubby woodland on some steep slopes and in hollows lend a wooded aspect to parts of the area. Agricultural land-use is improved pasture with a little arable. Archaeological sites do not characterise this area, and consist of bronze age find spots and an undated earthwork. The definition of this area is not good. Many of its historic landscape components are also found in neighbouring areas. Generally, however, to the south the landscape consists of woodland and estate farms and parkland, whilst elsewhere the field patterns, settlement pattern and buildings are slightly different. Conservation priorities - Most of the components of the historic landscape are in good condition. However, the condition of the field boundaries should be monitored to ensure no further deterioration occurs.	

landmap-maps.naturalresources.wales/PMBRKHL43905

Table 27 Canaston and Minwear Woods (HL)

Canaston and Minwear Woods (PMBRK-HL-43906)	
Condition: Good	**Value:** Outstanding
Overall Evaluation: Outstanding Two counts: 1/The long established character of this area as a heavily wooded landscape, which has remained intact in spite of intrusion by modern coniferous plantation 2/ the remarkable diversity and importance of the archaeological resource within this area, including three Iron Age hillforts, an outstanding example of a late medieval fortified house (Castell Coch), a substantial 15th-17th century farmstead complex (The Sisters' House), an historically important early 17th century iron furnace and forge site in Canaston Wood, and Blackpool Mill, an impressive early 19th century water mill.	
Summary Description HLC 330 Canaston and Minwear Woods Most significant archaeological element(s): 3 Iron Age forts, Early iron furnace, Castell Coch. This historic landscape area lies across the north and south valley sides and surrounding hills of the upper reaches of the Milford Haven waterway. The overriding component of this landscape is woodland. Deciduous woodland cloaks the lower slopes along the banks of the Milford Haven waterway, or Eastern Cleddau as it should be termed in these upper reaches, and parts of the northern valley side, but commercial 20th century coniferous plantations dominate this area. Open areas are few, and consist of a few fields, such as those on the valley floor close to Blackpool Bridge. Included in this area are the water pumping station at Canaston Bridge; Canaston Bridge itself which is Grade II listed; Blackpool Mill, a Grade II* listed four storey, five bay Georgian structure, now a popular tourist attraction; Blackpool Mill Bridge, a Grade II* listed single-arched stone built structure; Castell Coch, a medieval defended house, deserted and ruinous; and the Sisters" House, an early modern farmstead with a massive stone barn, now all ruinous. As well as tourist facilities at Blackpool Mill there are woodland walks and picnic places. In addition to the archaeological sites of Castell Coch and the Sisters" House there are three iron age hillforts, limekilns on the shore of the waterway, and the sites of an iron furnace and iron forge. The latter two sites are of great importance - Mynne's furnace in Canaston Wood remains the only known blast furnace from this crucial period in the development of the Welsh iron working industry, and woodland in the 17th century and 18th century was managed specifically to produce charcoal for the furnace and forge. This is very distinct historic landscape area, and contrasts sharply with the surrounding landscape of fields, farms and parkland.	

landmap-maps.naturalresources.wales/PMBRKHL43906

Table 28 Amroth (HL)

Amroth (PMBRK-HL-46162)	
Condition: Fair	**Value:** High
Overall Evaluation: High Diverse, multi-period scope of the archaeological record, with evidence of Neolithic/Bronze Age ritual/funerary activity, several Iron Age defended enclosures, the rare survival of a Romano-British villa site located within an earlier earthwork enclosure at Trelissey, several medieval churches (Amroth, Ludchurch, Mounton and Newton North) and moated sites, and a number of important post-medieval gentry houses with Grade II listed gardens and landscaped parks (Colby Lodge, Merrixton and Kilgetty).	
Summary Description Amroth is spread out over an incised coastal plateau. All field types are represented, but the majority are medium-sized and regular. There is a fair amount of deciduous woodland, particularly within the numerous, mainly steep-sided valleys that cross the area, and there is also some planted mixed woodland. Pockets of moorland also exist on the higher ground. Settlement is in the main dispersed, but a number of nucleations are also present. These are mainly post-medieval in origin, many having developed in the 19th century in response to the rising, local coal industry. All farm types and housing types are represented, including gentry houses. A number of modern roads, including the A477 trunk road, cross the area, as well as a railway line which is still in use. The area is also characterised by tourist facilities, including caravan parks, which are concentrated towards the coast. There are a very large number of archaeological sites, from all periods, and many listed buildings. Many Listed Buildings. Scheduled Ancient Monuments comprise a prehistoric burnt mound, two iron age defended enclosures, a medieval fortified manor house and fishpond, a medieval church, a post-medieval iron forge, and disused coal workings. In addition, a number of medieval churches and castles are present. The area also includes three Registered Parks and Gardens (Colby Lodge, Kilgetty and Merrixton). Summary of the most significant archaeological elements: iron age defended enclosures, medieval churches and castles, post-medieval buildings, landscapes and sites.	

landmap-maps.naturalresources.wales/PMBRKHL46162

Table 29 Newhouse (HL)

Newhouse (PMBRK-HL-46164)	
Condition: Good	**Value:** High
Overall Evaluation: High Diverse, multi-period scope of the archaeological resource, distinguished particularly by the survival of two important prehistoric ritual/funerary complexes at Newhouse Barrows and Crug Swyllt, W of Tavernspite, both of which offer considerable potential for further investigation.	
Summary Description Occupying a flat lowland ridge. It comprises medium-large regular enclosures, some of which, particularly towards the east, may be relict medieval strip fields. Very little woodland is present, although there are a number of planted shelter belts at the west end which are associated with a gentry house. The area is crossed by a modern road, which was formerly a turnpike and features a listed milestone. Characteristic of this area is the lack of modern development. Settlement is dispersed, slight and scattered, and is mainly represented by small informal farms. Little other settlement is present, although two former parsonages are listed buildings, and there is a gentry house, with a lodge. A caravan park is also present. The area is rich in prehistoric monuments including a bronze age barrow cemetery (part-scheduled), another scheduled round barrow, a standing stone and a scheduled iron age defended settlement. Recorded archaeology is otherwise restricted to post-medieval buildings, documented sites and a disused quarry. Summary of the most significant archaeological elements: prehistoric funerary and ritual sites, iron age hillforts, post-medieval buildings and other structures. There are a number of individual wind turbines within this aspect area.	

landmap-maps.naturalresources.wales/PMBRKHL46164

Table 30 Templeton Strip Fields (HL)

Templeton Strip Fields (PMBRK-HL-46166)	
Condition: Fair	**Value:** High
Overall Evaluation: High Remarkable survival of the fossilised medieval strip field system surrounding the village of Templeton, one of the best preserved examples of its type in southern Pembrokeshire, and the diverse, multi-period scope of the archaeological record, including an Iron Age hillfort and medieval ringwork castle, as well as the earliest Baptist chapel in Pembrokeshire at Molleston, together with its unusual, Grade II listed formal garden.	
Summary Description Representing a fossilised system of medieval strip fields that surround the village of Templeton. They constitute almost the entire area, but there is a little deciduous woodland and a planted shelter belt at the east end. The area is also characterised by modern roads, and a railway line that is still in use. Settlement is dispersed, and limited to a few informal farms, both large and small, a few of them being attached to gentry houses. There is little other settlement. However, a few dwellings lie beside the former turnpike that runs along the southern edge of the area, and the area also includes some of the 20th century housing on the northern edge of Templeton village. There is also a caravan park. The listed 19th century Baptist chapel at Molleston is associated with a Registered Park and Garden. A motte castle associated with the medieval settlement at Templeton is scheduled, as is an iron age defended enclosure. Other recorded archaeology is limited to built heritage, a holy well and disused quarries. Summary of the most significant archaeological elements: iron age fort, medieval earthwork castle, post-medieval buildings and structures.	

landmap-maps.naturalresources.wales/PMBRKHL46166

Table 31 Templeton (HL)

Templeton (PMBRK-HL-46167)	
Condition: Fair	**Value:** High
Overall Evaluation: High Remarkably well preserved example of a nucleated, planned settlement of medieval date, documented as a borough in the late 13th century. The street plan of the medieval settlement, comprising a series of elongated, narrow plots evenly distributed on either side of an axial N-S main street, has been justifiably described as 'a good example of Norman linear planning'.	
Summary Description Village of Templeton, which is a small nucleation with presumed medieval origins. It has a distinctive morphology, apparently comprising a row of tofts either side of an axial main street, and occupies a landscape of relict strip fields (which belong to another aspect area). However the 19th century church appears not to have medieval origins, while most development is 19th-20th century being represented by detached, semi-detached and terraced housing, with a few 20th century cul-de-sacs. There is also a small caravan park. Listed buildings are restricted to a garden wall, and there are no Scheduled Ancient Monuments. A railway line, which is still in use, defines the eastern edge of the area. An evaluation excavation undertaken within the village by DAT in 2010 uncovered what appeared to be a Bronze Age ring ditch, as well as evidence of a possible medieval stone-walled building and possible medieval boundary ditches. Recorded archaeology is limited to built heritage. Summary of the most significant archaeological elements: Bronze Age ring ditch, medieval boundary ditches, post-medieval buildings and structures.	

landmap-maps.naturalresources.wales/PMBRKHL46167

Table 32 Narberth Mountain (HL)

Narberth Mountain (PMBRK-HL-46168)	
Condition: Fair	**Value:** High
Overall Evaluation: High Well-preserved, coherent nature of the fieldscape and settlement pattern and the diverse, multi-period scope of the archaeological record with evidence of Bronze Age burnt mounds, Iron Age defended enclosures and the rare survival of the extensive earthworks of a 17th century formal garden at The Grove.	
Summary Description Occupying the gentle north-facing slope of a lowland ridge. Fields are mainly medium-large, regular enclosures which probably date to the 18th or 19th century. Woodland is restricted to the sides of a few stream valleys, and there are further small, scrubby patches. Settlement is dispersed and is mainly represented by small, informal farms, but there has also been some 19th-20th century domestic development along the A478 trunk road, which runs through the area. There are no listed buildings. Recorded archaeology is more-or-less restricted to a scheduled iron age defended enclosure; however possible burnt mounds, a possible iron age defended enclosure, and disused quarries are also present. Summary of the most significant archaeological elements: iron age hillfort, post-medieval quarries, possible sites.	

landmap-maps.naturalresources.wales/PMBRKHL46168

Table 33 Templeton Airfield (HL)

Templeton Airfield (PMBRK-HL-46169)	
Condition: Poor	**Value:** Moderate
Overall Evaluation: Moderate Lack of landscape coherence (most of the structures associated with the Second World War airfield have disappeared) and the limited scope of the archaeological record.	
Summary Description Disused Second World War airfield. Much of the land has reverted to scrub and moor. The airfield runways and roadways can still be traced, but no military buildings now survive. Standing buildings in the area are limited to two dwellings lying alongside the road that forms the southern edge of the area. There is no other settlement, but the area does include some medium-sized, regular fields on its east side. There are no Scheduled Ancient Monuments or listed buildings. Recorded archaeology is restricted to a documented round barrow and a possible chambered tomb, a disused quarry and other documented sites. Summary of the most significant archaeological elements: documentary records of prehistoric sites.	

landmap-maps.naturalresources.wales/PMBRKHL46169

Table 34 Wiston – Llawhaden (HL)

Wiston - Llawhaden (PMBRK-HL-46204)	
Condition: Fair	**Value:** Outstanding
Overall Evaluation: Outstanding Remarkable diversity and multi-period scope of the archaeological resource in this area, particularly distinguished by the widespread distribution of Iron Age defended sites (a remarkable number of which have been excavated), the survival of significant evidence of medieval occupation (including an outstanding example of a motte and bailey castle at Wiston and the impressive bishops palace at Llawhaden) and the survival of a number of Grade II listed gentry houses.	
Summary Description Occupying an open lowland plateau. All field types are represented, but are mainly medium-sized and regular, with some narrower fields that may represent relict medieval strip fields. In general, the area is characterised by a lack of woodland although there are some dispersed wooded pockets, and some coniferous plantation. Settlement is in the main dispersed, but there are nucleations at Wiston, Llawhaden, and Clarbeston Road. Wiston and Llawhaden both have origins as medieval boroughs, around substantial, medieval masonry castles (both scheduled), but show no evidence of planned layouts. Wiston, which is a Conservation Area, is a loose cluster of 18th-20th century dwellings including a gentry farm, but also includes a listed, landmark medieval parish church. A Roman fort just to the north of Wiston village was excavated by DAT in 2013, marking an important advance in our understanding of the Roman penetration of southwest Wales. The fort was dated to c.AD74 and used until c.AD100. A settlement developed by aroun AD150 and this seems to have been occupied into the 3rd century AD, possibly into the 4th century AD. A Roman road has also been identified in association with the fort and a possible Romano-British farmstead just to the south of the fort. Llawhaden is more developed but is largely 19th-20th century, with a significant 20th century housing element. It is also a Conservation Area and includes a number of listed buildings and a scheduled medieval chapel. Clarbeston Road, in contrast, has origins in the 19th century having developed around a railway station, and the building stock is all 19th-20th century. The railway line forms the northern boundary of the area while the A40 trunk road bisects the southern part. All farm types and housing types are represented within the area, including a number of gentry houses, but there are no other listed buildings.	

landmap-maps.naturalresources.wales/PMBRKHL46204

Table 35 Robeston Wathen (HL)

Robeston Wathen (PMBRK-HL-46205)	
Condition: Fair	**Value:** Moderate
Overall Evaluation: Moderate Well-preserved but by no means unique post-medieval fieldscape and associated nucleated settlement offering some potential for further research, particularly with regard to the prehistoric landscape.	
Summary Description Village of Robeston Wathen and its medieval open field system. It is a landscape of medium-sized, fairly regular enclosures co-axial on, and crossed by, the A40 trunk road. Those enclosures around the village of Robeston Wathen, have demonstrable origins as medieval strip fields, while field morphology in the remainder of the area suggests similar origins. Stands of deciduous trees, particularly in the valleys, lend the area a wooded aspect. The village of Robeston Wathen has medieval origins around a listed, landmark medieval parish church. However, development is largely 19th-20th century but it does include a listed, 18th century gentry house. The A40 formerly ran through the heart of the village, but now runs just to the south, following the construction of a new bypass during the second decade of the 21st century. The area also includes the northern outskirts of the town of Narberth and its 20th century roadside ribbon development, some 20th century infrastructure, a sports fields and a caravan park. There is some further, dispersed settlement, confined to a few large informal farms, and scattered 19th-C20th century roadside development. Recorded archaeology comprises possible bronze age standing stones, iron age defended enclosures, one of which is scheduled, the medieval church, post-medieval buildings, and disused quarries and limekilns. Summary of the most significant archaeological elements: iron age forts, post-medieval buildings.	

landmap-maps.naturalresources.wales/PMBRKHL46205

Table 36 Llanddewi Velfrey (HL)

Llanddewi Velfrey (PMBRK-HL-46206)	
Condition: Fair	**Value:** High
Overall Evaluation: High Diversity of its archaeological remains and built heritage, including two substantial Iron Age defended enclosures, a well-preserved Georgian gentry house (Panteg) and an important Grade II Listed garden (Blackaldern).	
Summary Description Lowland hills and valleys. It comprises all field types, but they are mainly medium-sized and regular. Stands of woodland, particularly in the valleys, lend the area a wooded aspect, while the steep slopes at east end of area are cloaked in deciduous woodland. The area is crossed by a number of major roads including the A40 trunk road, including a portion of the Robeston Wathen bypass at the western end of the aspect area. A former turnpike road marks the southern edge of the aspect area. The main railway line to Pembroke Dock runs through the area and remains in use. Settlement is in the main dispersed but there are a number of small nucleations. Crinow is an informal, loose cluster of dwellings, mainly 19th-20th century in date, around a listed, rebuilt medieval parish church. A scheduled medieval earthwork castle lies nearby. Llanmill is a cluster of buildings, again mainly 19th century, around a mill. Llanddewi Velfrey developed along the line of the A40 during the 19th century and is a straggling settlement of development and commercial buildings, mainly roadside, from the 19th-20th century. Princes Gate is similarly 19th-20th century, and developed around a toll-gate on the turnpike road. All farm types and housing types are represented, including a number of gentry houses one of which, Blackaldern, is both listed and a Registered Park and Garden. Another gentry house site, Henllan, is also surrounded by a designed landscape. There is further, scattered domestic development, which is mainly 19th-20th century and confined to roadsides. Caravan parks, a crematorium, and sewage works, form the 20th century, are prominent landscape features. Other listed buildings include further medieval churches, 19th century chapels, and milestones alongside the turnpike road. There are number of Scheduled Ancient Monuments including a bronze age round barrow group, iron age defended enclosures.	

landmap-maps.naturalresources.wales/PMBRKHL46206

Table 37 Narberth (HL)

Narberth (PMBRK-HL-46207)	
Condition: Fair	**Value:** High
Overall Evaluation: High Survival of the historic core of Narberth, representing a particularly well-preserved example of an early to mid-19th Century market town with important earlier components surviving (specifically Narberth Castle) and which has retained its historic character in spite of late 20th century housing development on its periphery.	
Summary Description This is a large nucleation, with origins as a medieval borough based on a castle. The castle, whose masonry ruins are scheduled, occupies a prominent position on a spur overlooking the town, opposite the listed, medieval parish church. There is little evidence that the medieval settlement was planned. It appears instead that it developed informally along the road, now the A478 trunk road, that runs through the town. However, post-medieval development appears more planned, based around a market square which now features a handsome early 19th century town hall. Narberth's development mainly belongs to the 19th century and is concentrated alongside the roads leading into the town. It is generally of good quality, with fine terraced housing in the vernacular tradition, and commercial properties including a coaching inn. Many of these buildings are listed. Twentieth century development is represented by infill and ribbon development, including a number of housing estates and closes. There are also schools, a sports fields, a caravan park and other infrastructure on the periphery of the area. The historic core of the town is a Conservation Area. Recorded archaeology is mainly confined to buildings, and there are no other Scheduled Ancient Monuments. Summary of the most significant archaeological elements: medieval castle and church, post-medieval buildings.	

landmap-maps.naturalresources.wales/PMBRKHL46207

Table 38 Walton East (HL)

Walton East (PMBRK-HL-46208)	
Condition: Fair	**Value:** Outstanding
Overall Evaluation: Outstanding Richness and diversity of the archaeological record, which potentially includes evidence of prehistoric ritual activity of national importance.	
Summary Description Walton East is a very large aspect area (46.39 sq km), essentially comprising an open lowland plateau. There is some woodland, including fairly extensive coniferous plantations, but in general the area is an open treeless landscape and the stream valleys that cross the area are similarly not wooded. All field types are represented, but they are mainly medium-sized and regular. There has been some loss of hedges in the exposed areas. A number of major roads cross the area including the A40 trunk road, and the B4329, in addition to two railway lines. Settlement is in the main dispersed but there is a nucleation at Walton East, which is an informal, loose cluster of houses, mainly 19th-20th century in date, around a rebuilt medieval parish church. There are small hamlets at Rudbaxton and Bletherston, both clustered around listed medieval parish churches, the former also featuring a scheduled motte castle. The hamlet at Clarbeston also lies around a listed, landmark medieval parish church, which has been rebuilt. All farm types and housing types are represented, farms ranging from small vernacular holdings to large Georgian farms. There are also a number of gentry houses, some with listed buildings and designed landscapes, for example Scolton Manor, which is a listed building and a Registered Park and Garden, and is now a museum. Other scattered domestic development is mainly 19th-20th century and confined to roadsides. Modern features include extensive gravel workings, and a sewage works. There are a very large number of archaeological sites, from all periods. Scheduled Ancient Monuments are represented by a prehistoric pit circle, a bronze age round barrow, two large, landmark iron age defended enclosures and two smaller enclosures, and a further medieval motte. Other recorded archaeology also includes a round barrow group, other iron age defended enclosures, medieval chapel sites and mills.	

landmap-maps.naturalresources.wales/PMBRKHL46208

Table 39 Oakwood (HL)

Oakwood (PMBRK-HL-46223)	
Condition: Good	**Value:** Low
Overall Evaluation: Low Relative paucity of the archaeological record and the limited scope for further archaeological investigation.	
Summary Description An amusement park established in the 1980s and the adjacent Bluestone Holiday Village, established by 2008. Oakwood is a designed landscape with planted woodland, shelter belts and a lake; there are also large regular fields leading east up to the A378 trunk road. Development and infrastructure includes rollercoaster rides and other attractions. The park was established over a landscape of fields, which included some disused quarries, but pre-1980 features are limited to a couple of 20th century commercial buildings on the A378. Bluestone is also a designed landscape and includes a large number of holiday cottages, the Blue Lagoon holiday complex and swimming facility gathered around an artificial lake. The remains of a medieval church have been preserved within the area of the development.	

landmap-maps.naturalresources.wales/PMBRKHL46223

Table 40 Drim Wood (HL)

Drim Wood (PMBRK-HL-46224)	
Condition: Good	**Value:** Moderate
Overall Evaluation: Moderate Relatively modest scope of the archaeological record. However, there is potential for further investigation of the Iron Age defended enclosure at Holgan Camp; there is potential for improvement of visitor access and on-site information relating to this site.	
Summary Description 20th Century coniferous plantation, lying on the steep western slopes of the Eastern Cleddau. It is not enclosed but there a few old field boundaries are present. The forestry is crossed by modern trackways. A minor road follows the foot of the slope, along which a very small amount of 19th-20th Century ribbon development occurs at the north end of the area, including a chapel. A scheduled iron age defended enclosure is present, but recorded archaeology is otherwise limited to post-medieval buildings and disused quarries. Summary of the most significant archaeological elements: iron age fort, post-medieval quarries.	

landmap-maps.naturalresources.wales/PMBRKHL46224

LANMAP Landscape Habitat Aspect Areas

Table 41 Gaer and Vaynor-fach Woods (LH)

Gaer and Vaynor-fach Woods (PMBRK-LH-496)		
Condition: Unassessed	**Value:** Moderate	**Connectivity/Cohesion:** Moderate
Overall Evaluation: Moderate Overall moderate habitat with moderate value for key species although the southern part is probably high value.		
Summary of Key Features Area is broadleaved woodland with smaller elements of planted woodland and scrub.		

landmap-maps.naturalresources.wales/PMBRKLH496

Table 42 N.E. of Saundersfoot (LH)

N.E. of Saundersfoot (PMBRK-LH-885)		
Condition: Unassessed	**Value:** Moderate	**Connectivity/Cohesion:** Low
Overall Evaluation: Moderate Generally low value habitat but has some areas of real value that support a range of key species. A number of relatively large woodland areas are present, particularly near the centre of the Aspect Area which are of value but are not large enough to warrant a separate Aspect Area for a level 3 study. The area also has a number of designations present all be it covering only a small % of the Aspect Area. The area certainly appears to have greater ecological value than a number of other improved grassland dominated Aspect Areas.		
Summary of Key Features An area of predominately improved grassland comprising a considerable number of fields with associated field boundaries. Also present are some small areas of a number of other habitats.		

landmap-maps.naturalresources.wales/PMBRKLH885

Table 43 N.E. of Penblewin Roundabout (LH)

N.E. of Penblewin Roundabout (PMBRK-LH-899)		
Condition: Unassessed	**Value:** Moderate	**Connectivity/Cohesion:** Moderate
Overall Evaluation: Moderate A number of quite valuable habitats but not a very large area. It is likely to support a number of key species		
Summary of Key Features Area is a mosaic of grassland (marshy, semi-improved and improved) and broadleaved woodland.		

landmap-maps.naturalresources.wales/PMBRKLH899

LANDMAP Visual and Sensory Aspect Areas

Table 44 Mid Taf Valley (VS)

Mid Taf Valley (CRMRT-VS-459)			
Condition: Unassessed	**Value:** High	**Scenic Quality:** High	**Character:** High
Overall Evaluation: High On account of the scenic quality of the area, its integrity and character.			
Summary Description Lowland river valley, relatively wide valley floor compared to valleys to the east. More wooded to the north and larger agricultural fields to the west. A gentle lush and green landscape, well wooded, strong field pattern with hedgerows in the main. Many mature trees. Small settlement with several traditional buildings at Llanfallteg, elsewhere scattered farms, some with fairly large farmhouses - more akin to Pembrokeshire. Railway runs through the area, but barely visible. Some feeling of enclosure but this is a wider, more open valley than those to the east.			

landmap-maps.naturalresources.wales/CRMRTVS459

Table 45 Cwmfelin Boeth (VS)

Cwmfelin Boeth (CRMRT-VS-747)			
Condition: Unassessed	**Value:** Moderate	**Scenic Quality:** Moderate	**Character:** Moderate
Overall Evaluation: Moderate The overall score is moderate, although some criteria score high.			
Summary Description A network of open valleys and hills with an overall southerly aspect, valleys are less wooded than adjacent areas. Scattered traditional farms plus small settlements. Mostly narrow roads, some with more open aspect and wider. A hedges landscape with significant tree cover, some small woods and water courses.			

landmap-maps.naturalresources.wales/CRMRTVS747

Table 46 Efailwen Uplands (VS)

Efailwen Uplands (CRMRT-VS-964)			
Condition: Unassessed	**Value:** High	**Scenic Quality:** High	**Character:** High
Overall Evaluation: High High in terms of its scenic quality and sense of place. Considered to be high on account of scenic quality largely due to the variety of elements consistent with an upland plateau landscape. The views from this area are also considered to be of high quality.			
Summary Description Exposed upland, with extensive views particularly to the east. Enclosed grazing with hedged field boundaries of varying types as well as unenclosed land.			

landmap-maps.naturalresources.wales/CRMRTVS964

Table 47 Clarbeston Road (VS)

Clarbeston Road (PMBRK-VS-042)			
Condition: Fair	**Value:** Moderate	**Scenic Quality:** Moderate	**Character:** Moderate
Overall Evaluation: Moderate Fairly typical rural landscape featuring a rolling agricultural and woodland mosaic with scattered villages and farmsteads that is enhanced by the presence of a large number of mature trees. The various criteria of scenic quality, integrity, character and rarity have all been given values of "moderate" which is reflected in the overall valuation of the same. This accounts for the common occurrence of this agricultural landscape type within the study area.			
Summary Description An agricultural landscape with a mixture of large open fields and smaller fields which typically have mature trees in hedgerow boundaries. Some areas contain clusters of small scale wooded valleys and the area is interspersed with occasional farmsteads and small villages. The relatively "enclosed" character to the landscape results from a high degree of mature hedgerow and woodland. Change detection 2014: Various developments at Withybush means that this part now forms new aspect area. Generally some increase of developments north of Haverfordwest. This is now 'landscape with very occasional turbines'.			

landmap-maps.naturalresources.wales/PMBRKVS042

Table 48 New Inn (VS)

New Inn (PMBRK-VS-044)			
Condition: Fair	**Value:** High	**Scenic Quality:** High	**Character:** High
Overall Evaluation: High A significant upland character which is enhanced by the presence of conifer plantations and borrowed views of the Preseli Hills. and the coast. The area has been judged as having two moderate and high evaluations. The fine grained field patterns on the upland slopes and views over the coast justify high evaluation.			
Summary Description Covering several geographically close areas of land contains an upland agricultural landscape with scattered farmsteads throughout. Mature trees in overgrown hedges and woodland belts often associated with small valleys include a strong presence of conifer plantations which add to the upland association of the landscape. Borrowed views of Preseli Hills add to this upland sense of place.			

landmap-maps.naturalresources.wales/PMBRKVS044

Table 49 Eastern Cleddau (VS)

Eastern Cleddau (PMBRK-VS-046)			
Condition: Fair	**Value:** High	**Scenic Quality:** High	**Character:** High
Overall Evaluation: High There are fine views along and across the valley focussing on the river corridors with their riparian vegetation and on the pleasing scale of the valley floor with steep wooded valley sides in places. There are also highlights of stone bridges and vernacular architecture and positive landmarks such as Llawhaden church. The area has a consistent character and is generally well managed with only the A40[T] as a detractor affecting a small part of the southern stretch of the aspect area. The area has a sense of place that is defined by the river corridors set within the wider agricultural landscape that is visually enhanced by the high frequency of mature trees along the rivers and in overgrown hedgerows. Places such as around Llawhaden church and bridge have a strong sense of place. The landscape is similar to many valleys in Pembrokeshire. 3 highs and 1 moderate= high			
Summary Description Gentle agricultural valley landscape with an open lowland character, dominated by the meandering Eastern Cleddau river through the valley bottom. The area also includes steep valley sides in places, covered with deciduous woodland that help define the character and enclosed feel of the area. The area has with some clumps of riparian woodland and mature trees featuring in overgrown hedgerows and contains scattered farmsteads and hamlets linked by minor lanes. There are stone bridges such as at Llawhaden which add to the character and vistas along the valley towards traditional settlements. Overall the area feels tranquil apart from where it is crossed by the A40[T]. Change detection 2014: Robeston Watham bypass and junction has cut through and opened up some views to and from.			

landmap-maps.naturalresources.wales/PMBRKVS046

Table 50 Templeton (VS)

Templeton (PMBRK-VS-047)			
Condition: Fair	**Value:** Moderate	**Scenic Quality:** Moderate	**Character:** Moderate
Overall Evaluation: Moderate High presence of attractive minor lanes with species rich hedgebanks and scattered woodland associated with small streams set in a lowland farm landscape. These are affected only locally by modern leisure development to the west. The overall value of "moderate" reflects the "moderate" valuations given to each of the criteria of scenic quality, integrity, character and rarity which portray the typicality of this agricultural mosaic landscape within Pembroke...			
Summary Description Undulating farmland landscape on the eastern edge of the study area. The area is crossed by a series of connected hedgebank bounded lanes, with farmland incised by numerous small wooded stream valleys and occasional woodland patches and plantations. It is crossed by the A40[T] and surrounds Narberth and also includes Oakwood Leisure Park and Bluestone Holiday Village. These reduce tranquillity locally. Elsewhere, quiet rural villages & smaller settlements are dispersed throughout. Change detection 2014: increase/enlargement of Bluestone/Oakwood and Folly Farm has made tourism developments more intrusive and a key feature of this area. Robeston Wathen bypass also adds to intrusions.			

landmap-maps.naturalresources.wales/PMBRKVS047

Table 51 Narberth (VS)

Narberth (PMBRK-VS-048)			
Condition: Fair	**Value:** Moderate	**Scenic Quality:** Moderate	**Character:** Moderate
Overall Evaluation: Moderate Relatively attractive market town set within the agricultural landscape of south Pembrokeshire. The area has been judged as having a "moderate" level of scenic quality, integrity, character and rarity with a resultant overall "moderate" level. This relates to the typicality of this development with its traditional elements and relatively in keeping modern additions.			
Summary Description Mid-sized historic market town of Narberth which is situated on a higher area of ground at the western limit of Lampeter Vale and acts as a focal point within the wider landscape of agricultural land in other Aspect Areas. The settlement contains mixed development with the remains of Narberth Castle adding to the sense of place. Change detection 2014: expansion of housing and industry in north.			

landmap-maps.naturalresources.wales/PMBRKVS048

Table 52 Lampeter Vale (VS)

Clarbeston Road (PMBRK-VS-049)			
Condition:	**Value:**	**Scenic Quality:**	**Character:**
Fair	Moderate	Moderate	Moderate
Overall Evaluation: Moderate Valuable areas of open valley farmland with trees in hedgerows and woodland with very low levels of development yet this is detracted from by the dissecting railway and A40 corridor. The Aspect Areas overall evaluation of "moderate" takes into account the "moderate. values given for all assessment criteria of scenic quality, integrity, character and rarity due to the common nature of this agricultural landscape type within Pembrokeshire.			
Summary Description An agricultural landscape within a gentle "U" shaped valley with areas of rough grazing and frequent overgrown hedgerows displaying mature trees. Woodland plantations and small clumps of trees add to the wooded character of the landscape which has occasional scattered farmsteads throughout. A visual and sensory (noise) detractor is formed by the railway that bisects the southern valley edge and the A40 corridor through the centre of the area.			

landmap-maps.naturalresources.wales/PMBRKVS049

Table 53 Martletwy (VS)

Martletwy (PMBRK-VS-050)			
Condition:	**Value:**	**Scenic Quality:**	**Character:**
Fair	High	High	High
Overall Evaluation: High The area of land around Martletwy has a strong and locally unique character with mosaic structure including moorland and parkland and close association with the adjacent Daugleddau estuary. 3 highs and 1 moderate = high. The areas overall "high" value has been reached through comparing the values of "moderate" given for the areas integrity, reflecting the extent of conifer plantations and "high" given to the areas scenic quality, character and rarity reflecting the extent of woodland within the agricultural mosaic landscape.			
Summary Description An agricultural and woodland mosaic landscape with an undulating landform characterised by parkland, clusters of mixed woodland and fields with mature trees featuring in overgrown hedgerows... The area has scattered farmsteads throughout and enjoys borrowed views of the estuary at Daugleddau which add to the areas sense of place...			

landmap-maps.naturalresources.wales/PMBRKVS050

Table 54 Daugleddau (VS)

Daugleddau (PMBRK-VS-051)			
Condition: Good	**Value:** Outstanding	**Scenic Quality:** Outstanding	**Character:** Outstanding
Overall Evaluation: Outstanding The extensive and unspoilt estuary and creek environment of the Daugleddau, Carew and Cresswell, with low level traditional built development along the wooded margins account for the outstanding rating for this Aspect Area. The "outstanding" overall evaluation for this Aspect Area has been reached through consideration of the relative values attributed for integrity and character, which have been rated as "high" and scenic quality and rarity which have been rated as "outstanding". This reflects the unspoilt nature of these extensive estuarine areas with rich riparian landscapes which are unique within south Wales.			
Summary Description A peaceful intimate landscape of estuarine river and associated riparian areas and inlets. These include the tidal river and mudflats bordered by mixed, generally broadleaf woodland & occasional traditional small settlements. This is a particularly attractive landscape with low development levels having a slight visual detractor in the nonetheless interesting borrowed view of Pembroke Dock to the south. In sensory terms the Aspect Area provides probably a unique landscape within Pembrokeshire where the coastal areas are often more readily associated with rocky shorelines.			

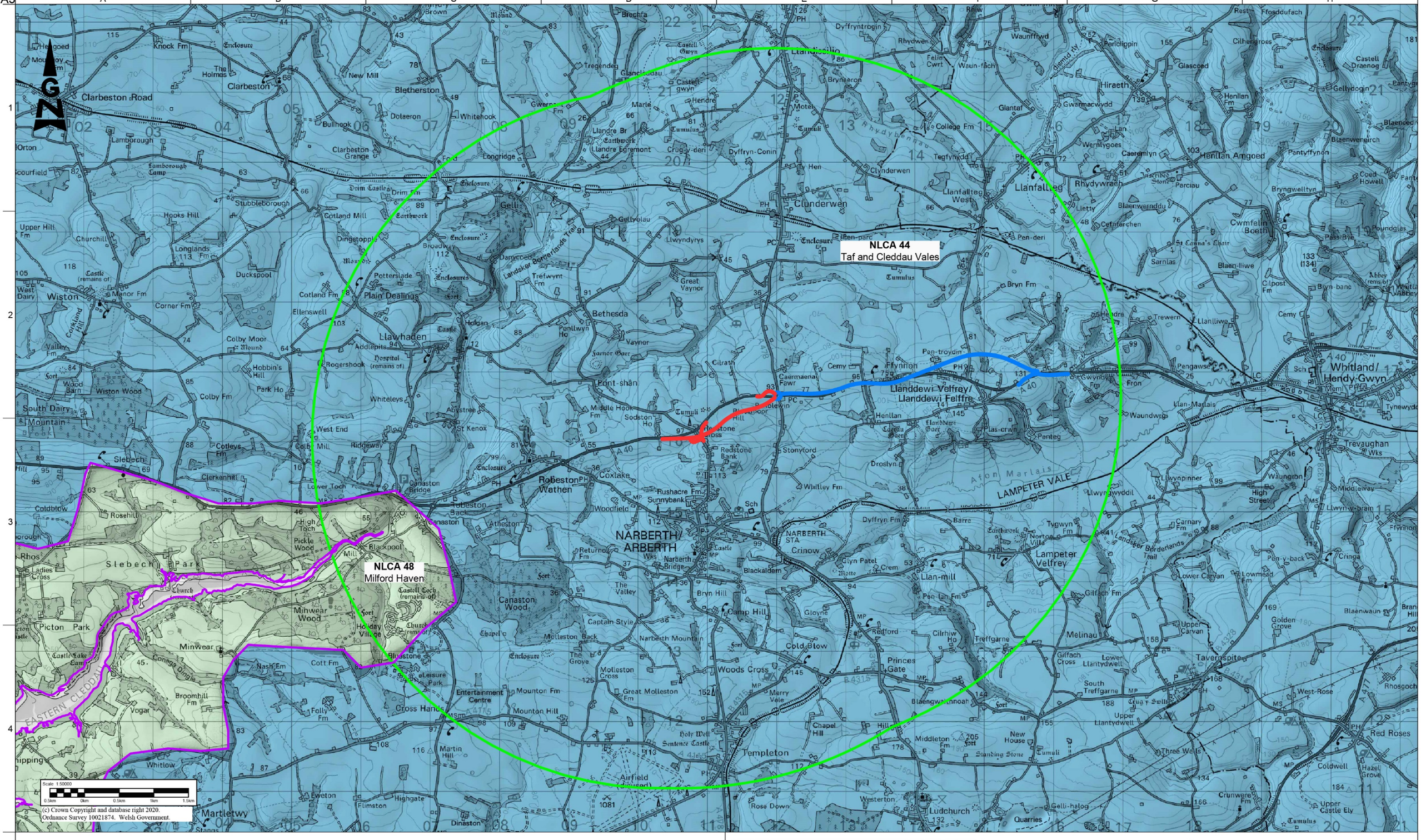
landmap-maps.naturalresources.wales/PMBRKVS051

Table 55 Sageston (VS)

Sageston (PMBRK-VS-052)			
Condition: Fair	**Value:** Moderate	**Scenic Quality:** Moderate	**Character:** Moderate
Overall Evaluation: Moderate The traditional agricultural landscape of this part of Pembrokeshire has been affected by insensitive developments including modern buildings and busy and frequent roads... The Aspect Area has been given an overall evaluation of "moderate" taking into account its "moderate" valuation given for scenic quality, character and rarity and "low" value given for integrity, reflecting the extent of built up areas within the agricultural landscape...			
Summary Description Farmland landscape predominantly used for grazing. The area contains scattered small woodland clumps and occasional villages and small towns including East Williamston and Broadmoor, connected by major roads & a network of hedgebank bordered lanes. Caravan/camp sites concentrated around villages act as a detractor as do large pylons which traverse the landscape.			

landmap-maps.naturalresources.wales/PMBRKVS052

A3



Legend

- Scheme centre-line
- 5 km study area boundary
- A40 Llanddewi Velfrey Improvement centre-line

National Landscape Character Areas

44 - Taf and Cleddau Vales
48 - Milford Haven

Rev	Date	Description	By	Chkd	Appd	Auth
P01.1	---	---	---	---	---	---

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS · MOTT MACDONALD · ARUP · RICHARDS

Drawing Title
ES APPENDIX 9.1A
NATIONAL LANDSCAPE CHARACTER AREAS

Suitability
S0 | INITIAL STATUS OR WIP

Scale at A1 1:50000

Rev	By	Chkd	Appd	Auth
P01.1	---	---	---	---
	Date	Date	Date	Date
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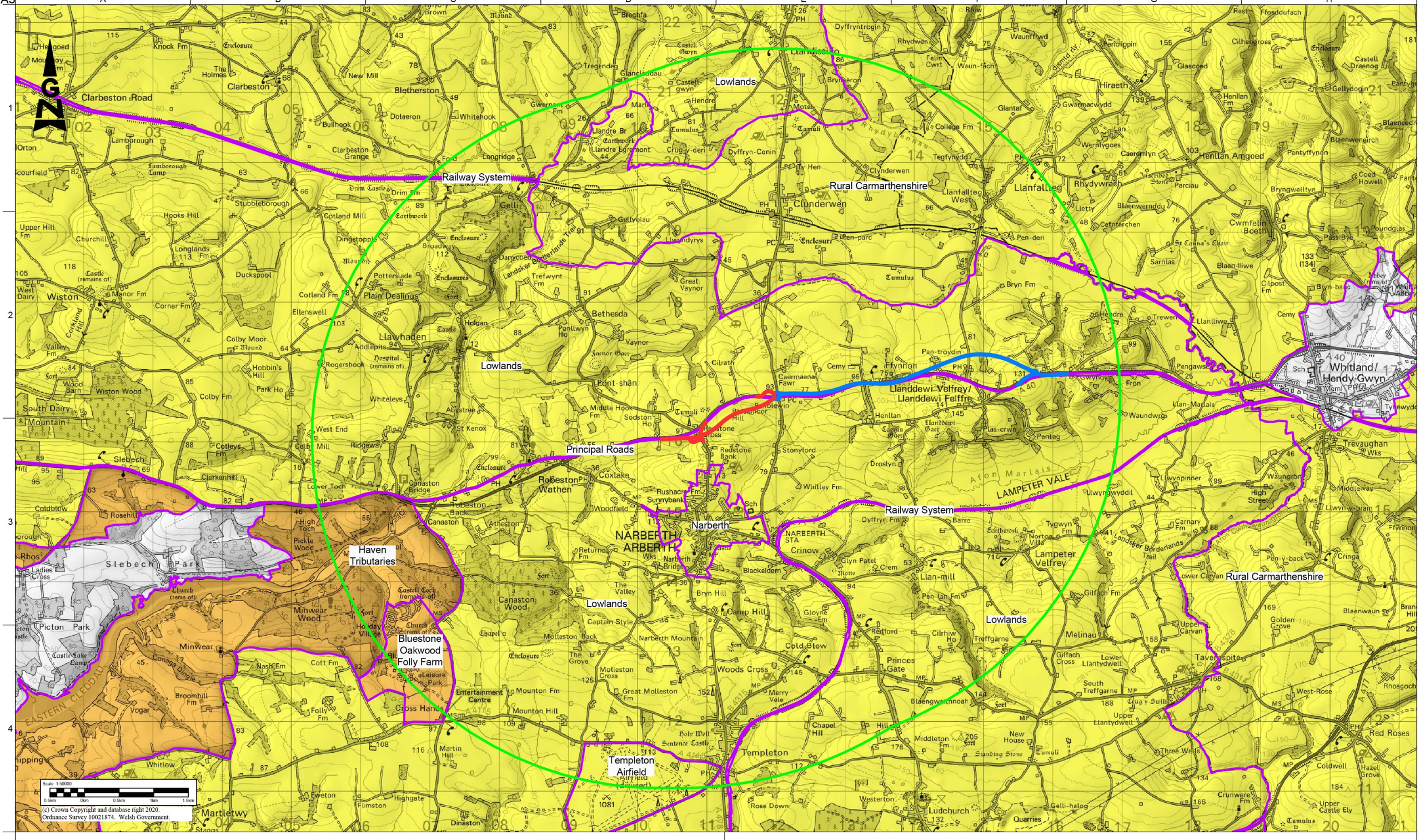
Name
A40PRC-RML-ELS-SWI-DR-L-0921
Project | Originator | Volume | Location | Type | Role | Number

Do not scale



Legend

- Scheme centre-line
- 5 km study area boundary
- A40 Llanddewi Velfrey Improvement centre-line

Cultural Landscape Aspect Overall Evaluation

- Outstanding
- High
- Moderate
- Low

Cultural Landscape Aspect Areas

Pembrokeshire
002 - Haven Tributaries
009 - Railway System
196 - Lowlands
589 - Bluestone, Oakwood, Folly Farm
819 - Castlemartin Training Area and Pembrokeshire Airfields
829 - Narberth
977 - Principal Roads

Carmarthenshire
061 - Rural Carmarthenshire

Rev	Date	Description	By	Chkd	Appd	Auth
P01.1	---	---	---	---	---	---

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
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Drawing Title
ES APPENDIX 9.1B
LANDMAP EVALUATION
CULTURAL LANDSCAPE ASPECT

Suitability
S0 | INITIAL STATUS OR WIP

Scale at A1 1:50000

Rev	By	Chkd	Appd	Auth
P01.1	---	---	---	---
	Date	Date	Date	Date
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Name
A40PRC - RML - ELS - SWI - DR - L - 0922
Project | Originator | Volume | Location | Type | Role | Number

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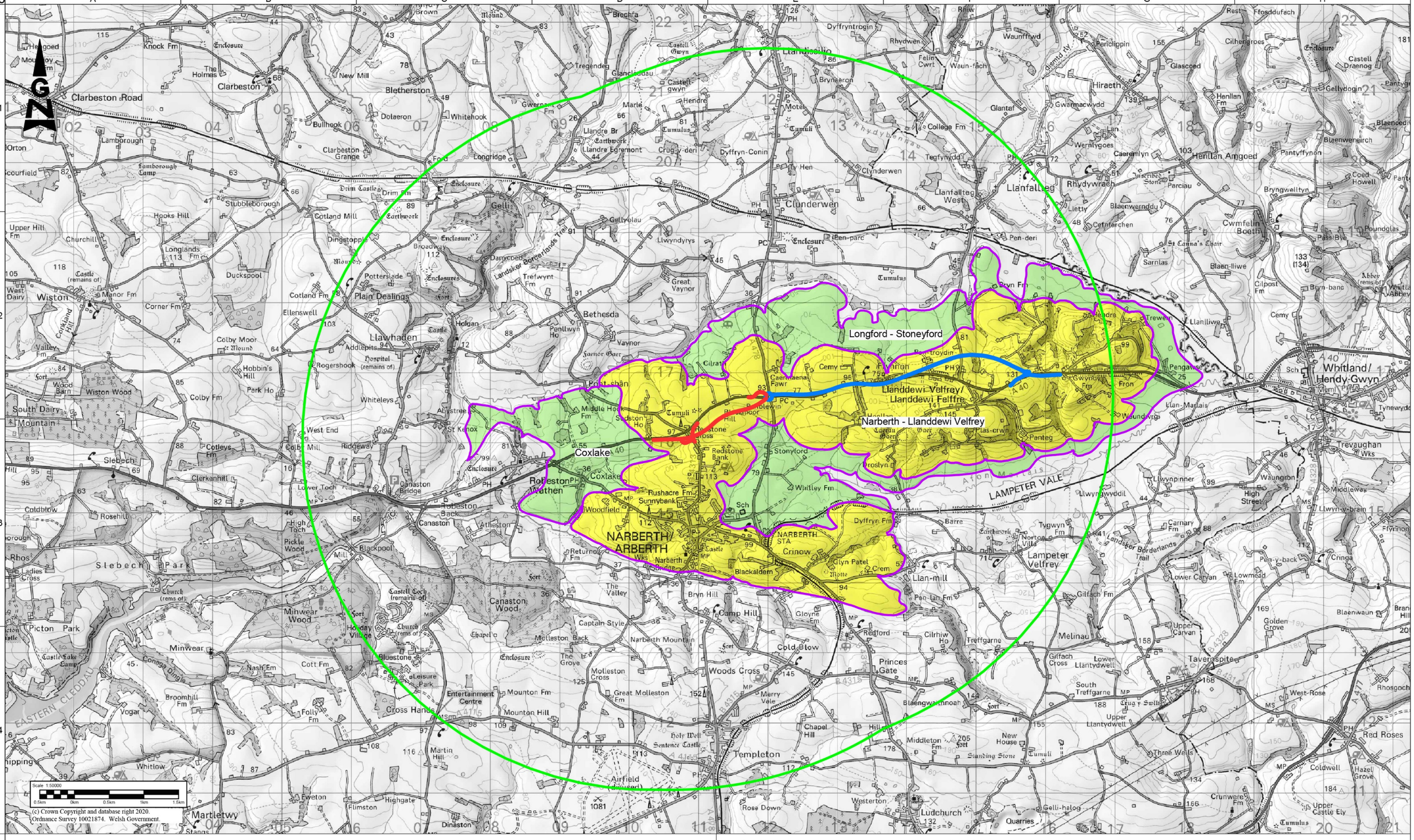
A3



Legend

- Scheme centre-line
- 5 km study area boundary
- A40 Llanddewi Velfrey Improvement centre-line

Geological Landscape Aspect Overall Evaluation

- Outstanding
- High
- Moderate
- Low

Geological Landscape Aspect Areas

Pembrokeshire
193 - Coxlake
194 - Longford, Stoneyford
195 - Narberth, Llanddewi Velfrey

Rev	Date	Description	By	Chkd	Appd	Auth
P01.1	---		---	---	---	---

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

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Drawing Title
ES APPENDIX 9.1C
LANDMAP EVALUATION
GEOLOGICAL LANDSCAPE ASPECT

Suitability
S0 | INITIAL STATUS OR WIP

Scale at A1 1:50000

Rev	By	Chkd	Appd	Auth
P01.1	---	---	---	---
	Date	Date	Date	Date
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Name
A40PRC-RML-ELS-SWI-DR-L-0923
Project | Originator | Volume | Location | Type | Role | Number

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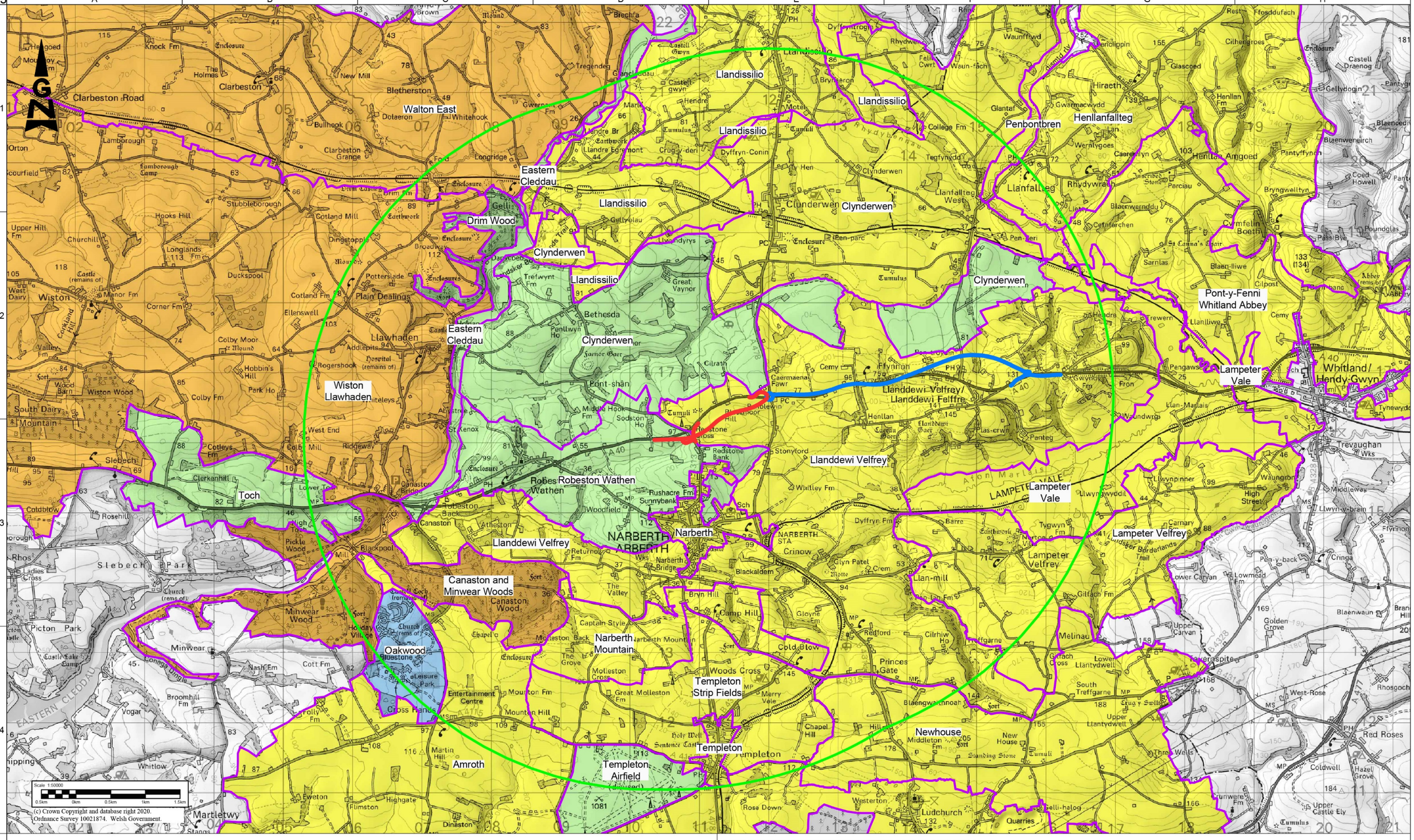

Legend

- Scheme centre-line
- 5 km study area boundary
- A40 Llanddewi Velfrey Improvement centre-line

Historic Landscape Aspect Overall Evaluation

- Outstanding
- High
- Moderate
- Low

Historic Landscape Aspect Areas

Pembrokeshire

40349 - Lampeter Velfrey
40353 - Lampeter Vale
42471 - Eastern Cleddau
42472 - Llandissilio
42473 - Clynderwen
43905 - Toch
43906 - Canaston and Minwear Woods
46162 - Amroth
46164 - Newhouse
46166 - Templeton Strip Fields
46167 - Templeton
46169 - Templeton Airfield
46204 - Wiston, Llawhaden
46205 - Robeston Wathen
46206 - Llanddewi Velfrey
46207 - Narberth
46208 - Walton East
46223 - Oakwood
46224 - Drim Wood

Carmarthenshire

40346 - Pont-y-Fenni, Whitland
40353 - Lampeter Vale
40354 - Penbontbren
42460 - Henllanfallteg
42471 - Eastern Cleddau
42472 - Llandissilio
42473 - Clynderwen

Rev	Date	Description	By	Chkd	Appd	Auth
P01.1	---	---	---	---	---	---

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru Welsh Government

Delivery Team
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RICHARDS

Drawing Title
ES APPENDIX 9.1D
LANDMAP EVALUATION
HISTORIC LANDSCAPE ASPECT

Suitability
S0 | INITIAL STATUS OR WIP

Scale at A1 1:50000

Rev	By	Chkd	Appd	Auth
P01.1	---	---	---	---
	Date	Date	Date	Date
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Name
A40PRC-RML-ELS-SWI-DR-L-0924
Project | Originator | Volume | Location | Type | Role | Number

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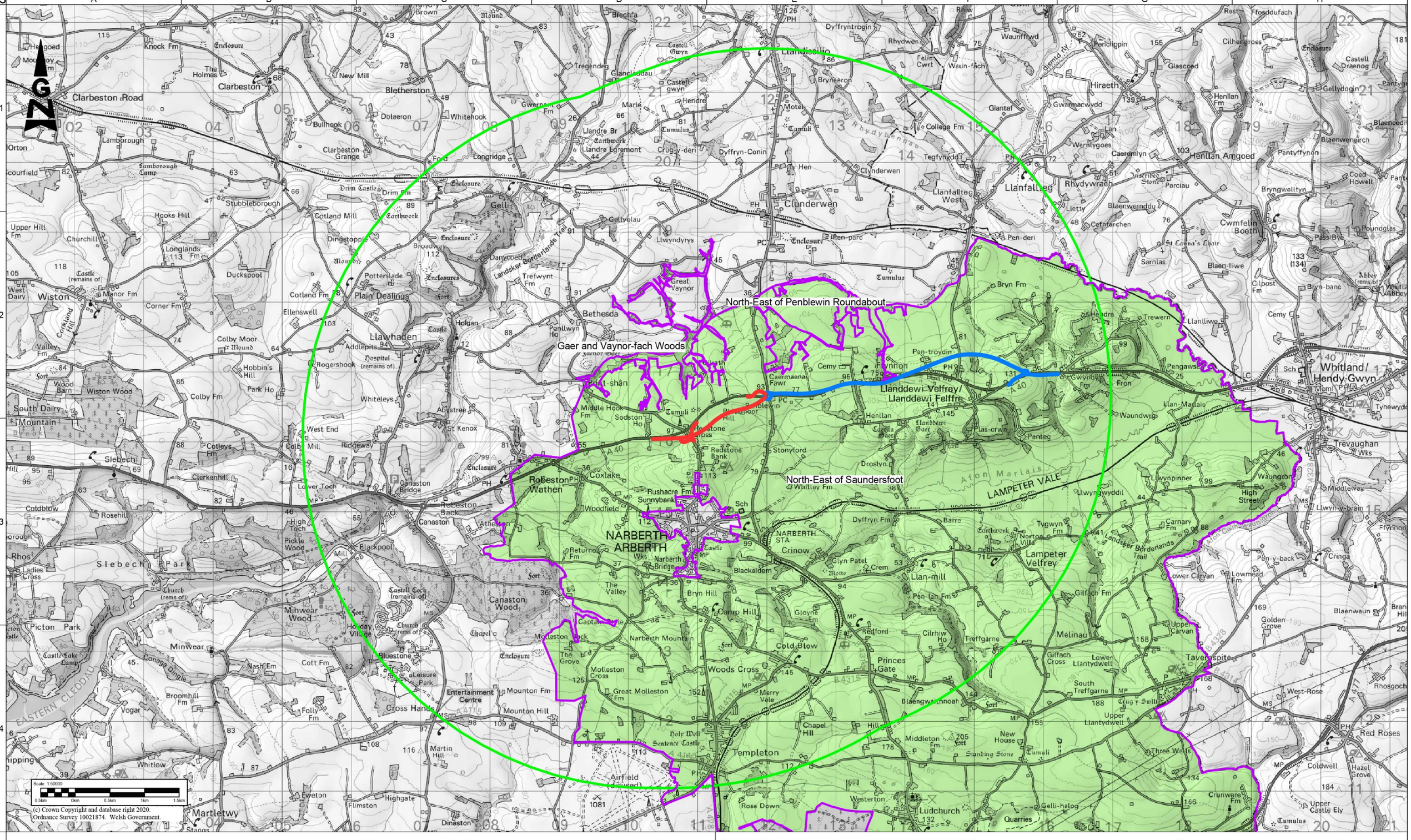

Legend

- Scheme centre-line
- 5 km study area boundary
- A40 Llanddewi Velfrey Improvement centre-line

Landscape Habitat Aspect Overall Evaluation

- Outstanding
- High
- Moderate
- Low

Landscape Habitat Aspect Areas

Pembrokeshire

496 - Gaer and Vaynor-fach Woods
885 - North-East of Saundersfoot
899 - North-East of Penblewin Roundabout

Rev	Date	Description	By	Chkd	Appd	Auth
P01.1	---	---	---	---	---	---

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
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Welsh Government

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ARUP
RICHARDS

Drawing Title
ES APPENDIX 9.1E
LANDMAP EVALUATION
LANDSCAPE HABITAT ASPECT

Suitability
S0 | INITIAL STATUS OR WIP

Scale at A1 1:50000

Rev	By	Chkd	Appd	Auth
P01.1	---	---	---	---
	Date	Date	Date	Date
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Name
A40PRC-RML-ELS-SWI-DR-L-0925
Project | Originator | Volume | Location | Type | Role | Number

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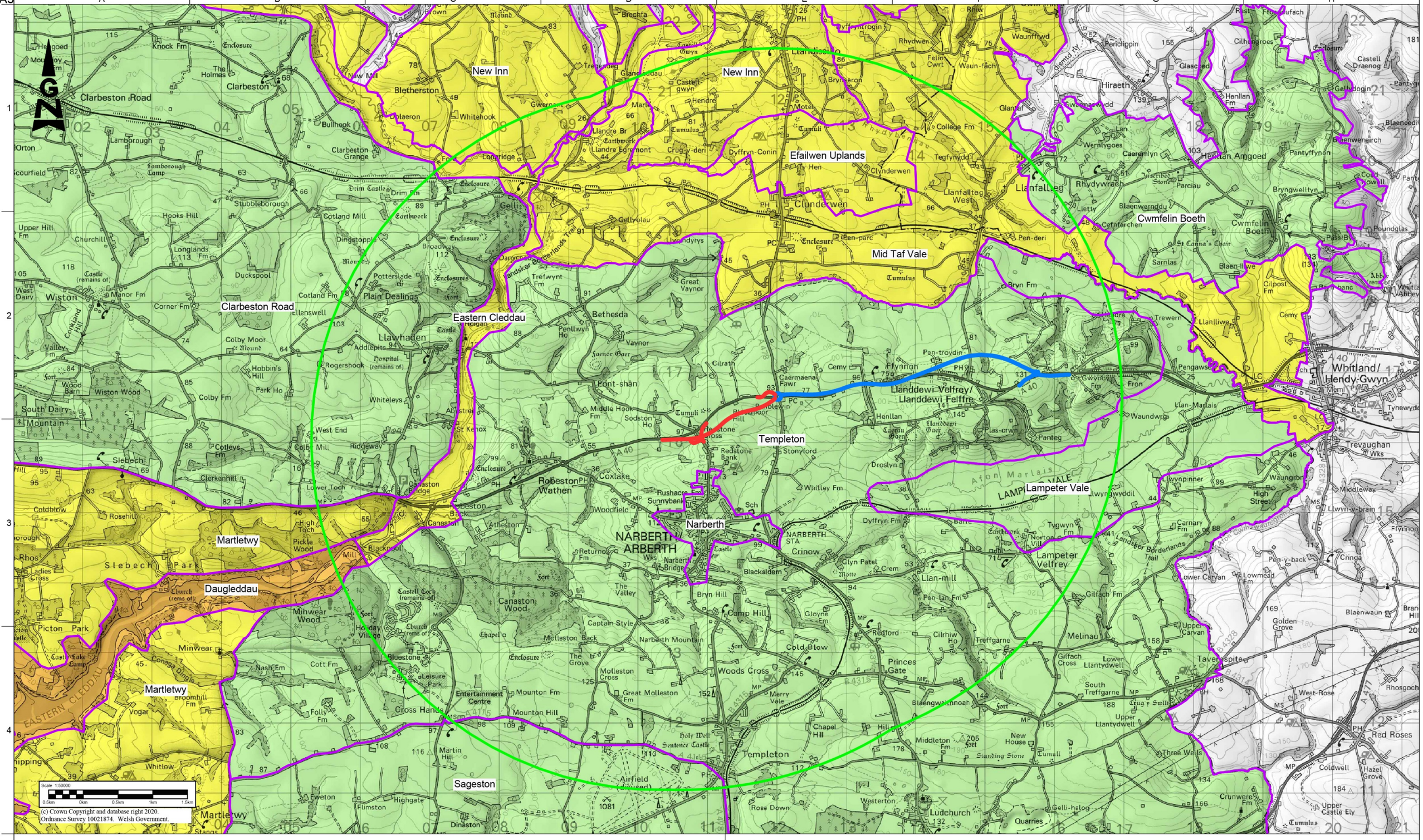

Legend

- Scheme centre-line
- 5 km study area boundary
- A40 Llanddewi Velfrey Improvement centre-line

Visual and Sensory Aspect Overall Evaluation

- Outstanding
- High
- Moderate
- Low

Visual and Sensory Aspect Areas

Pembrokeshire
042 - Clarbeston Road
044 - New Inn
046 - Eastern Cleddau
047 - Templeton
048 - Narberth
049 - Lampeter Vale
050 - Martletwy
051 - Daugleddau
052 - Sageston

Carmarthenshire
459 - Mid Taf Vale
747 - Cwmfelin Boeth
964 - Efailwen Uplands

Rev	Date	Description	By	Chkd	Appd	Auth
P01.1	---	---	---	---	---	---

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS

Drawing Title
ES APPENDIX 9.1F
LANDMAP EVALUATION
VISUAL AND SENSORY ASPECT

Suitability
S0 | INITIAL STATUS OR WIP

Scale at A1 1:50000

Rev	By	Chkd	Appd	Auth
P01.1	---	---	---	---
	Date	Date	Date	Date
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Name
A40PRC - RML - ELS - SWI - DR - L - 0926
Project | Originator | Volume | Location | Type | Role | Number

Do not scale

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 9.2 LCA Descriptions

A40PRC-RML-ELS-SWI-RP-L-0902

P03 | S3

29/05/20

Appendix 9.2 Contents

Appendix 9.2 – Landscape Character Area Descriptions

Table 1 LCA1 Description

LCA1 - Daugleddau		
Category	Coastal Water, River	
LANDMAP overlap	PMBRKVS051 Daugleddau	
General Description and Designations		
General Description	Section of estuarine river upstream of Cleddau Toll Bridge including inlets, pills and mudflats. Bordered by steep wooded slopes and small settlements.	
Designations	Pembrokeshire Coast National Park, Milford haven Waterway SSSI, Pembrokeshire Marine SAC, Milford Haven Waterway RLOH	
Physical Characteristics		
Built Environment	Dispersed settlements associated with wharfs, quays and mills.	
Landform, Geology and Hydrology	Lowland valley river system with extensive mudflats and salt marsh.	
Landcover and Vegetation	Open water, mud, marshland, woodland and built elements.	
Perceptual Characteristics		
Scale and Appearance	Medium scale and enclosed.	
Scenic Quality	Outstanding, views of open estuary, sheltered inlets and wooded edges.	
Tranquillity	Tranquil and peaceful where not influenced by A40 at Canaston Bridge, A477 Cleddau Toll Bridge and A4076 in Haverfordwest.	
Discordant/Intrusive Features	A477 Cleddau Toll Bridge connecting Neyland to Pembroke Dock.	
Night-Time Light Sources	Eastern Cleddau from Canaston Bridge to Landshipping is dark. Western Cleddau from Haverfordwest to where it meets the Eastern branch influenced by urban areas and scattered settlements. Daugleddau strongly influenced by light sources at Pembroke Dock and slightly influenced by the scattered settlements along the riverside. Conservation Areas at Carew, Cosheston and Llangwm.	
Cultural / Social		
Historic Features and Elements	Prehistoric forts at Picton Point and Crafty Wood, medieval buildings and mounds found on Eastern Cleddau at Minwear and Slebech. Post medieval quay on Western Cleddau at Hook. Medieval house and post medieval quay at Creswell. Medieval castle at Carew. Post medieval fortification at Burton.	
Human Interaction	Sailing, boating, water-based leisure and recreation activities.	
Landscape Value		
National Park, Registered Historic Park and Garden, Historic Landscape, statutorily protected nature conservation sites. High distribution of historic sites.		
Quality	**Condition**	**Overall Landscape Value**
Outstanding	Good	Outstanding

Figure 1 LCA1 Map and Representative Photograph

LCA1 - Daugleddau

Map Inset

Representative Photograph

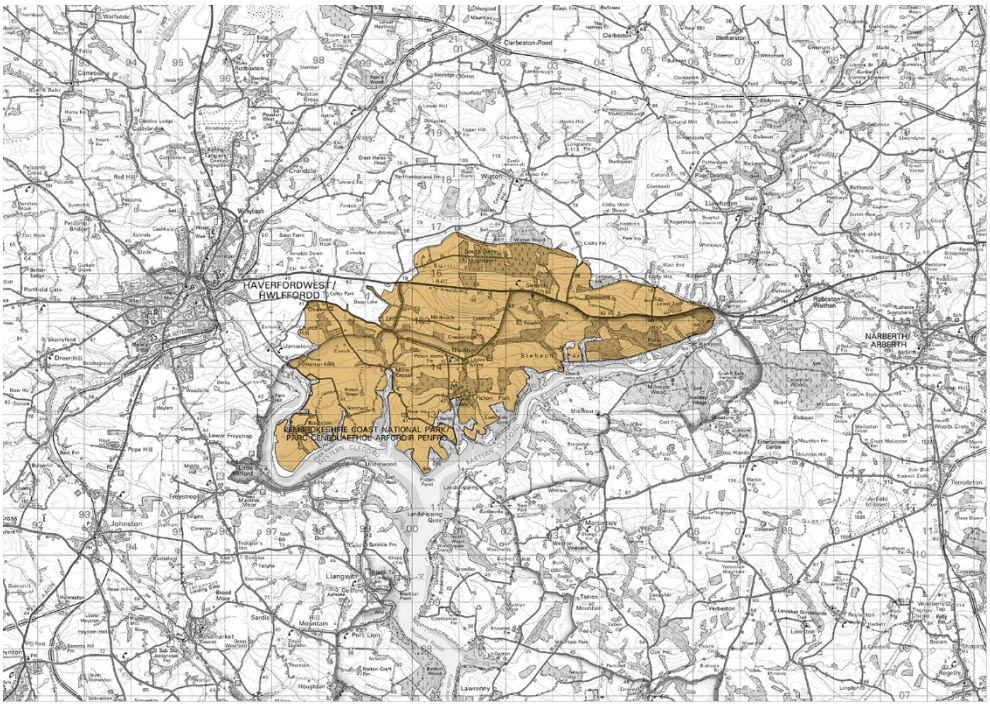
Table 2 LCA2 Description

LCA2 – Slebech Parkland		
Category	Rolling Lowland, Mosaic	
LANDMAP overlap	PMBRKVS050 Martletwy	
General Description and Designations		
General Description	Gently undulating parkland north of the Western and Eastern Cleddau, bisected by the A40 from Canaston Bridge to Deeplake Bridge.	
Designations	Partly within Pembrokeshire Coast National Park, Picton Castle, Slebech Park and Boulston Old Hall RHPG, partly within Milford Haven Waterway RLOH.	
Physical Characteristics		
Built Environment	Clustered settlement associated with estates and dispersed settlement along roads.	
Landform, Geology and Hydrology	Undulating lowland hill and valley draining into Western and Eastern Cleddau rivers. Sedimentary bedrock dominated.	
Landcover and Vegetation	Pastoral farmland, parkland with woodland and cover plantations.	
Perceptual Characteristics		
Scale and Appearance	Medium scale and open.	
Scenic Quality	High, views of the undulating landscape mosaic, enhanced by views of estuary.	
Tranquillity	Tranquil and peaceful where not influenced by A40.	
Discordant/Intrusive Features	No significant detractors.	
Night-Time Light Sources	Even distribution of light sources from clustered settlements. Western portion influenced by Haverfordwest.	
Cultural / Social		
Historic Features and Elements	Prehistoric fort at Picton point, and barrows at Hanton. Medieval castles at Picoton, and church at Slebech. Listed buildings clustered within estates.	
Human Interaction	Pastoral farming and visitor attractions.	
Landscape Value		
National Park, Registered Historic Parks and Gardens and Historic Landscape. Statutorily protected nature conservation sites. Moderate distribution of historic sites.		
Quality	**Condition**	**Overall Landscape Value**
High	Good	High.

Figure 2 LCA2 Map and Representative Photograph

LCA2 - Slebech Parkland

Map Inset



Representative Photograph

Table 3 LCA3 Description

LCA3 – Eastern Cleddau Western Tributaries		
Category	Lowland Valley, Wooded	
LANDMAP overlap	PMBRKVS042 Clarbeston Road, VS045 Eastern Cleddau Tributaries and VS046 Eastern Cleddau	
General Description and Designations		
General Description	Afon Syfni and tributaries draining Llawhaden, New Moat and Walton East communities.	
Designations	Eastern Cleddau River and Mountain Meadows SSSI, Cleddau Rivers SAC, Llys-y-fran Reservoir Country Park.	
Physical Characteristics		
Built Environment	Dispersed rural settlements associated with mills and river crossings.	
Landform, Geology and Hydrology	Lowland river system and incised valleys draining into Eastern Cleddau. Fluival drift dominated.	
Landcover and Vegetation	Mosaic of meadow grassland and woodland where slopes are too steep for agricultural use.	
Perceptual Characteristics		
Scale and Appearance	Small scale and enclosed. Confined in the steeper sided and wooded valleys.	
Scenic Quality	Moderate, contains attractive views of river and valley slopes.	
Tranquillity	This area is tranquil and intermittently influenced by railway movement and traffic on minor roads.	
Discordant/Intrusive Features	Great Western Railway.	
Night-Time Light Sources	Incised valleys draining southward are dark. More open valleys are very slightly influenced by dispersed settlement.	
Cultural / Social		
Historic Features and Elements	Prehistoric defences at Lamborough and Posty, and monument at Walton Mill. Early medieval defence at Drim, Medieval castle mounds at Dingstopple and New Moat.	
Human Interaction	Great Western Railway, Pastoral farming, Settlements.	
Landscape Value		
Statutorily protected nature conservation sites. High distribution of historic sites.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	High

Figure 3 LCA3 Map and Representative Photograph

LCA3 - Eastern Cleddau Western Tributaries

Map Inset

Representative Photograph

Table 4 LCA4 Description

LCA4 - Llawhaden		
Category	Rolling Lowland, Mosaic	
LANDMAP overlap	PMBRKVS048 Clarbeston Road	
General Description and Designations		
General Description	Agricultural landscape to west of Eastern Cleddau. Great Western Railway forms the northern boundary.	
Designations	Llawhaden Conservation Area. Scheduled monuments and listed buildings.	
Physical Characteristics		
Built Environment	Small villages and dispersed rural settlements. Crossed by several minor roads where views of the surrounding landscape are limited to field access gates and gaps in roadside hedgerows.	
Landform, Geology and Hydrology	Undulating lowland hill terrain. Sedimentary bedrock dominated.	
Landcover and Vegetation	Mosaic of grassland and woodland. Woodland is more prominent where the rolling lowland meets the steeper valley slopes of the Eastern Cleddau.	
Perceptual Characteristics		
Scale and Appearance	Field sizes are of medium scale and the boundary hedge-banks with trees provide an enclosed character. Llawhaden Castle is a prominent building that overlooks the Eastern Cleddau. Llawhaden village also features a cluster of listed buildings associated with Llawhaden House.	
Scenic Quality	Moderate, pleasant views of rolling agricultural landscape.	
Tranquillity	Away from the sound of traffic using the A40 corridor and the intermittent sound of trains using the Carmarthen to Fishguard railway line, the landscape is tranquil due to rolling terrain and field boundaries. It is crossed by several minor roads where views of the surrounding landscape are limited to field access gates and gaps in roadside hedgerows.	
Discordant/Intrusive Features	Transport corridor of the A40, but this is also considered as essential to the area's economy. Great Western Railway.	
Night-Time Light Sources	The LCA is generally dark away from the influence of the A40 corridor. Light sources come from the small villages and scattered rural dwellings distributed throughout the area.	
Cultural / Social		
Historic Features and Elements	Prehistoric forts, raths and enclosures, an early medieval ringwork, medieval motte, castle and hospital. Llawhaden Castle is a prominent building that overlooks the Eastern Cleddau. Llawhaden village also features a cluster of listed buildings associated with Llawhaden House.	
Human Interaction	Pastoral farming and settlement.	
Landscape Value		
High distribution of historic sites near to Llawhaden village.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	Medium

Figure 4 LCA4 Map and Representative Photograph

LCA4 - Llawhaden

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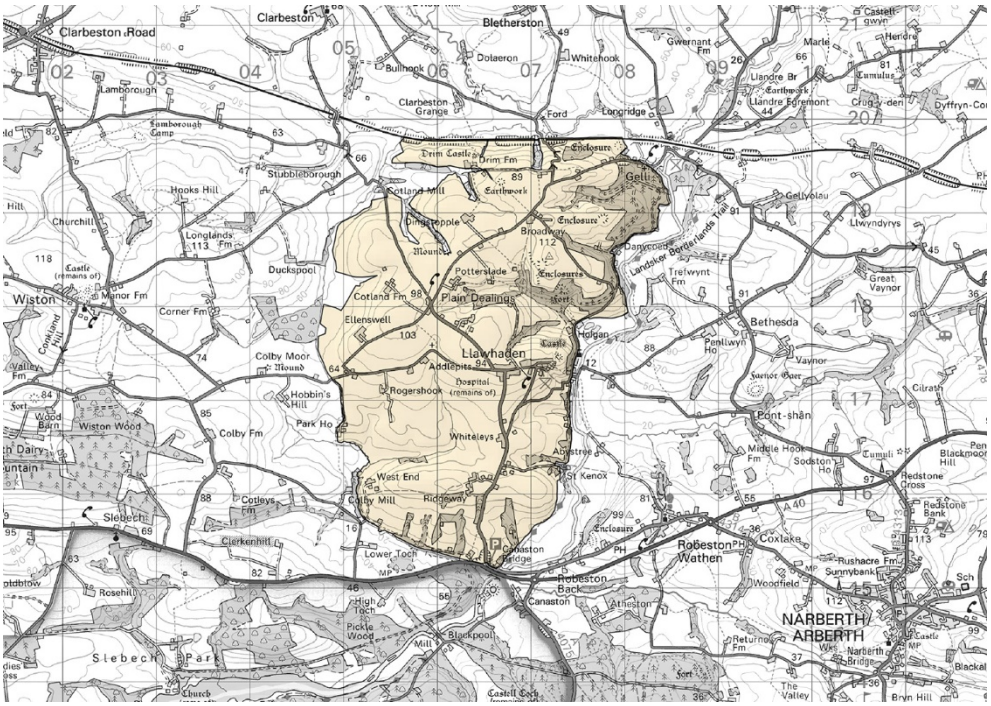


Representative Photograph

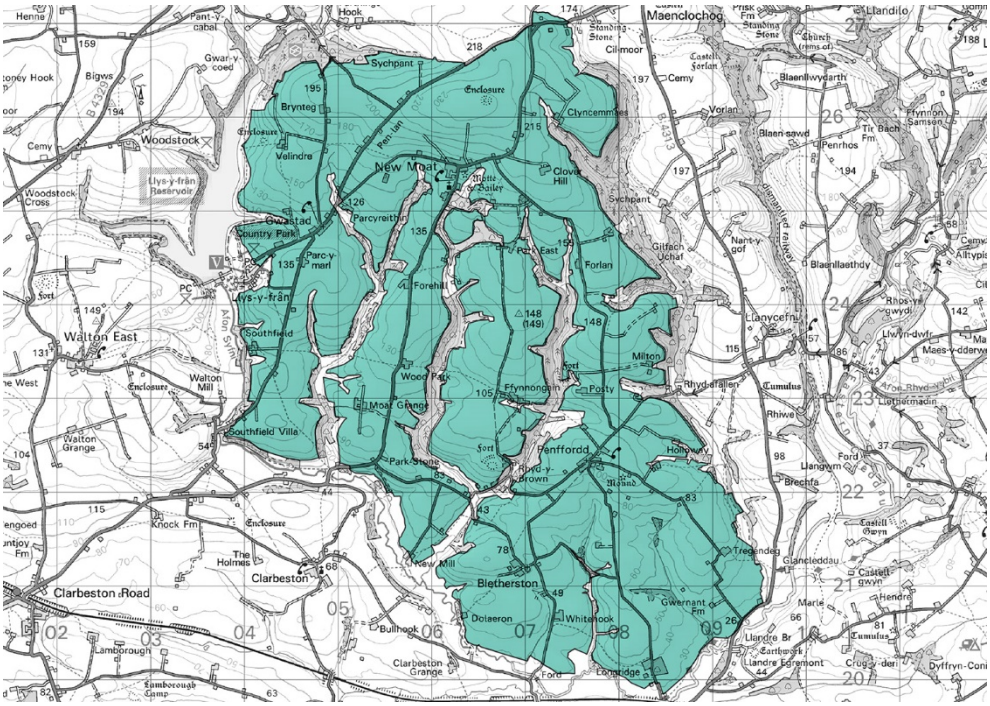
Table 5 LCA5 Description

LCA5 – New Moat		
Category	Rolling Lowland, Open	
LANDMAP overlap	PMBRKVS044 New Inn	
General Description and Designations		
General Description	Agricultural landscape to the north of Afon Syfni. that gradually rises from the lowlands of the Eastern Cleddau towards the Preseli hills.	
Designations	Scheduled monuments and listed buildings.	
Physical Characteristics		
Built Environment	Small villages and dispersed rural settlements connected by a network of minor roads.	
Landform, Geology and Hydrology	Undulating lowland hill terrain incised by steep river valleys. Sedimentary bedrock dominated.	
Landcover and Vegetation	Predominantly grassland fields bounded by maintained hedges with occasional trees. Woodland tends to be confined to small stream valley sides.	
Perceptual Characteristics		
Scale and Appearance	Field sizes are a mixture of small to medium scale, with mostly well-maintained hedge boundaries that provide an open character. Prominent buildings tend to be agricultural sheds, and St Nicholas' Church in New Moat. Elsewhere religious buildings tend not to have spires and blend into the landscape.	
Scenic Quality	High, attractive views of lowland landscape with more exposed upland character. Views of Preseli hills.	
Tranquillity	Minor roads follow the ridges in-between small wooded valleys and enjoy views of their surroundings and the Preseli Hills.	
Discordant/Intrusive Features	None.	
Night-Time Light Sources	Away from the small villages light sources are confined to scattered farms distributed throughout the area.	
Cultural / Social		
Historic Features and Elements	Prehistoric forts and enclosures, early medieval ritual sites, and medieval motte and bailey defences. Listed buildings clustered in the small hamlets of New Moat, Bletherston and Llys-y-frân.	
Human Interaction	Pastoral farming and scattered settlement.	
Landscape Value		
Llys-y-frân reservoir forms part of the western boundary to this area, part of which is a Country Park, and the waterbody is part of Cleddau Rivers SAC and Afon Cleddau SSSI. There is a very low distribution of listed buildings and scheduled monuments throughout.		
Quality	**Condition**	**Overall Landscape Value**
High	Fair	High

Figure 5 LCA5 Map and Representative Photograph

LCA5 - New Moat

Map Inset



Representative Photograph

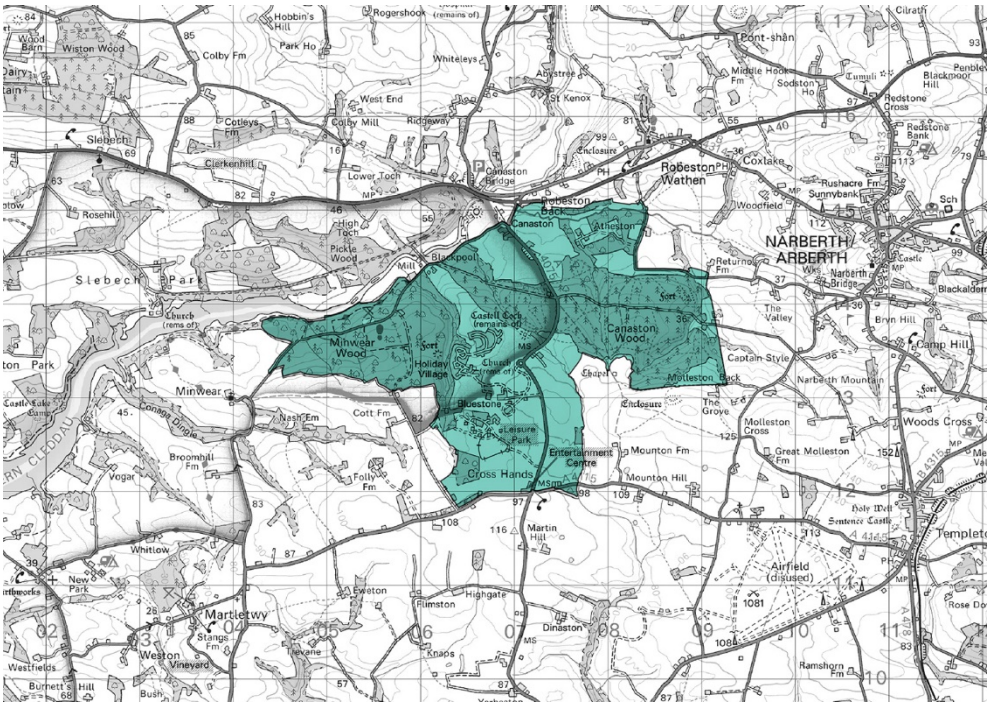
Table 6 LCA6 Description

LCA6 – Oakwood Leisure		
Category	Rolling Lowland, Wooded	
LANDMAP overlap	PMBRKVS047 Templeton	
General Description and Designations		
General Description	Rolling lowland mosaic of woodland and developed areas including Oakwood leisure park and Bluestone holiday village.	
Designations	Partly within Pembrokeshire Coast National Park, Eastern Cleddau River and Minwear Wood SSSI, Cleddau Rivers SAC, partly within Milford Haven Waterway RLOH.	
Physical Characteristics		
Built Environment	Clustered developments, dominated by leisure facilities.	
Landform, Geology and Hydrology	Lowland escarpment and depositional terrain. Mixture of sedimentary bedrock and fluvioglacial drift.	
Landcover and Vegetation	Significant areas of woodland at Canaston and Minwear which provide a setting for the leisure facilities.	
Perceptual Characteristics		
Scale and Appearance	Medium scale and enclosed by areas of woodland.	
Scenic Quality	Moderate. Pleasant views of areas of agriculture bounded by hedge banks and lanes.	
Tranquillity	Influenced by leisure facilities and approach roads.	
Discordant/Intrusive Features	Oakwood amusement rides.	
Night-Time Light Sources	Oakwood leisure park is a significant source of night-time light. Woodlands to east and west limit the influence.	
Cultural / Social		
Historic Features and Elements	Prehistoric enclosure at Canaston Wood. Medieval dwelling at Castell Coch and ringwork at Minwear. Post medieval church at Newton North and iron furnace at Blackpool.	
Human Interaction	Leisure.	
Landscape Value		
National Park and includes statutorily designated nature conservation sites. Low distribution of historic sites. Major tourist attraction in Pembrokeshire.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	High

Figure 6 LCA6 Map and Representative Photograph

LCA6 - Oakwood Leisure

Map Inset



Representative Photograph

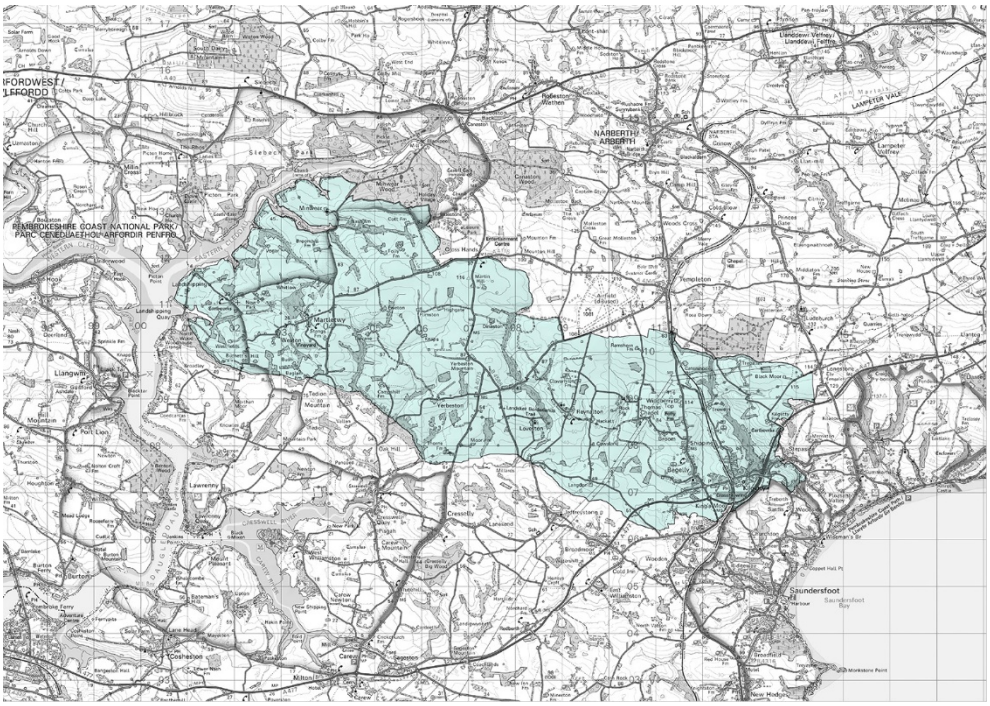
Table 7 LCA7 Description

LCA7 – Kilgetty and Martletwy		
Category	Rolling Lowland, Mosaic	
LANDMAP overlap	PMBRKVS047 Templeton, VS050 Martletwy, VS052 Sageston and VS053 Kilgetty	
General Description and Designations		
General Description	Predominantly agricultural land with small settlements and visitor attractions.	
Designations	Partly within Pembrokeshire Coast National Park. Includes multiple sites of Yerbeston Moors SSSI and Yerbeston Tops SAC. Includes Landshipping and Kilgetty RHPG and is partly within Milford haven Waterway RLOH.	
Physical Characteristics		
Built Environment	Includes clustered settlements of Martletwy, Yerbeston, Reynalton, Begelly and Kilgetty, and distributed rural dwellings and farms.	
Landform, Geology and Hydrology	Undulating lowland hill and valley terrain. Sedimentary bedrock dominated hills and alluvial drift dominated valleys.	
Landcover and Vegetation	Mosaic of pasture, woodland, moorland and built elements.	
Perceptual Characteristics		
Scale and Appearance	Medium scale and open.	
Scenic Quality	Moderate, featuring attractive views of undulating landscape and views of Daugleddau but detractive views including overhead power lines.	
Tranquillity	Agricultural activities, visitor attractions at Folly Farm, settlements, roads and railways influence the tranquillity.	
Discordant/Intrusive Features	Overhead powerlines crossing Kilgetty/Begelly community.	
Night-Time Light Sources	Light sources increase in intensity from the west to east. The shores of the Eastern Cleddau are dark. Nearer to the A478 corridor and Kilgetty/Begelly there is a greater night-time light influence.	
Cultural / Social		
Historic Features and Elements	Features prehistoric burnt mound at Dinaston farm, post-medieval industry east of Kilgetty and post-medieval garden at Landshipping.	
Human Interaction	Predominantly agriculture, visitor attractions and settlement.	
Landscape Value		
Designated landscapes, statutorily protected nature conservations sites and a very low distribution of historic sites. Includes Folly farm tourist destination. Landsker Borderlands Trail links Kilgetty to Creswell Quay and the Daugleddau.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	High

Figure 7 LCA7 Map and Representative Photograph

LCA7 - Kilgetty and Martletwy

Map Inset



Representative Photograph

Table 8 LCA8 Description

LCA8 – Eastern Cleddau Vale		
Category	Lowland Valley, Mosaic	
LANDMAP overlap	PMBRKVS046 Eastern Cleddau	
General Description and Designations		
General Description	Within Llawhaden community the area is a flat pastoral valley with field boundary hedgerows containing many trees and wooded valley sides that provide an enclosed character. Upstream of the confluence with the Syfyni, the valley has a more open character but is contained by surrounding hills.	
Designations	Section south of Canaston Bridge within Pembrokeshire Coast National Park and Milford Haven Waterway RLOH. Eastern Cleddau River SSSI. Cleddau Rivers SAC.	
Physical Characteristics		
Built Environment	St Aidan's Church at Llawhaden is the most prominent building, elsewhere building are limited to old mills, fisheries and a small number of dwellings and bridges.	
Landform, Geology and Hydrology	Lowland river drainage system. Fluvial drift dominated.	
Landcover and Vegetation	A mosaic of pastoral meadows bounded by hedges and wooded valley sides.	
Perceptual Characteristics		
Scale and Appearance	Field sizes are defined by the valley sides but are generally of medium scale. An enclosed character influenced by steep wooded valley sides.	
Scenic Quality	High, offering attractive views of the river valley and the uplands to the north.	
Tranquillity	Away from the sound of road traffic and intermittent sound of trains this is a tranquil area.	
Discordant/Intrusive Features	The A40 is a detractor where it crosses the Eastern Cleddau, as is the steep sided Carmarthen to Fishguard Railway embankment.	
Night-Time Light Sources	This LCA is dark away from the influence of the A40 road corridor. Light sources are limited to the small number of dwellings built alongside the two rivers.	
Cultural / Social		
Historic Features and Elements	Listed buildings are distributed along the rivers feature bridges, mills, a church, cottages and farmhouses.	
Human Interaction	Agriculture and scattered settlement but crossed by transport corridors.	
Landscape Value		
The Landsker Borderlands trail follows the Eastern Cleddau. Part of the Cleddau Rivers SAC and Afon Cleddau SSSI. A high distribution of listed buildings throughout. The section of river valley between Canaston Bridge and Blackpool Bridge lies within the Pembrokeshire Coast National Park and the Milford Haven Waterway RLOH.		
Quality	**Condition**	**Overall Landscape Value**
High	Fair	Outstanding

Figure 8 LCA8 Map and Representative Photograph

LCA8 - Eastern Cleddau Vale

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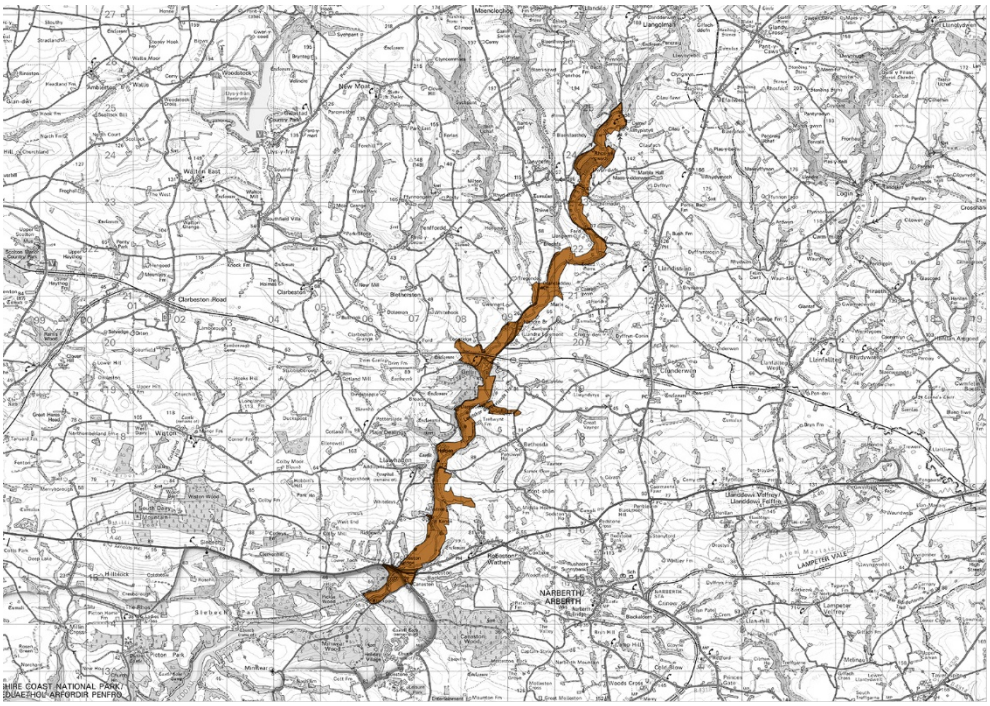

Representative Photograph

Table 9 LCA9 Description

LCA9 – Narberth Rural		
Category	Rolling Lowland, Mosaic	
LANDMAP overlap	PMBRKVS047 Templeton	
General Description and Designations		
General Description	Undulating farmland landscape with small settlements and transport corridors.	
Designations	Eastern Cleddau Rivers SSSI and Cleddau Rivers SAC to west of Narberth. Blackaldern RHPG.	
Physical Characteristics		
Built Environment	Includes the settlements of Robeston Wathen, A40 between Canaston Bridge and Penblewin Roundabout, dispersed farms and dwellings.	
Landform, Geology and Hydrology	A mixture of lowland river drainage system, undulating hill terrain, escarpment, glacial deposition and flood plain. Sedimentary bedrock with fluvial and fluvioglacial drift.	
Landcover and Vegetation	Predominantly pastoral farmland with field boundaries made of significant hedgerow-banks with many trees, areas of woodland, dispersed settlements connected by main and minor roads.	
Perceptual Characteristics		
Scale and Appearance	Field sizes range from small where ground is steep, or conditions are wet to medium scale where ground is more suitable for harvesting forage. The numerous hedgerow banks with trees and areas of woodland can provide an enclosed character	
Scenic Quality	Moderate, features attractive mosaic of grassland and woodland.	
Tranquillity	The A40 and A477 are essential transport corridors that influence the LCA Within the wooded valleys and sunken lanes throughout the area the perception of the transport corridors is reduced. Agricultural vehicles and traffic using the minor roads interrupt the tranquillity in other areas.	
Discordant/Intrusive Features	A40 Robeston Wathen bypass is a prominent feature.	
Night-Time Light Sources	There is an even distribution of settlements and rural dwellings that are connected by the network of main and minor roads. Light sources are distributed throughout the area, with concentrations based along the main roads.	
Cultural / Social		
Historic Features and Elements	Prehistoric round barrows and defence structures. Listed buildings are clustered within small settlements and estates.	
Human Interaction	Agriculture, settlement and transport.	
Landscape Value		
Westward flowing tributaries of the Eastern Cleddau are statutorily protected nature conservation sites. There is a high distribution of historic sites.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	High

Figure 9 LCA9 Map and Representative Photograph

LCA9 - Narberth Rural

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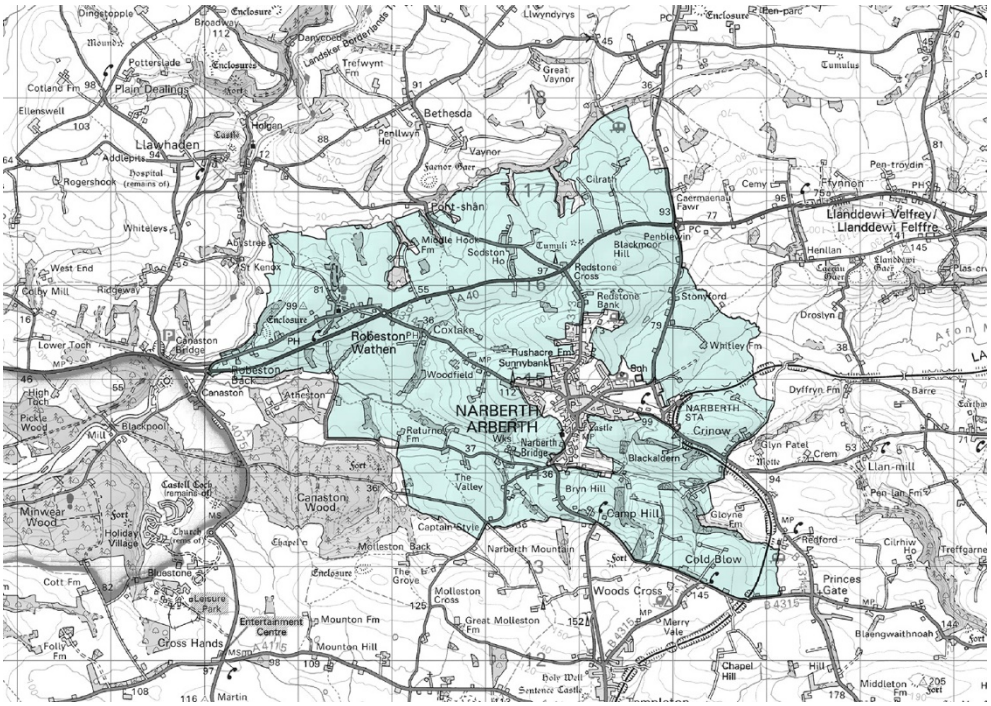

Representative Photograph

Table 10 LCA10 Description

LCA10 – Eastern Cleddau Eastern Tributaries		
Category	Lowland Valley, Wooded	
LANDMAP overlap	CRMRTVS026 Eastern Cleddau Valley, VS459 Mid Taf Valley, PMBRKVS044 New Inn and VS047 Templeton	
General Description and Designations		
General Description	Four separate and small scale lowland valleys of similar character, flowing westward into the Eastern Cleddau. The watercourses include the rivers Rhyd-y-bil and Conyn. Valleys connected by Eastern Cleddau	
Designations	Part of and draining into Eastern Cleddau SSSI and Cleddau Rivers SAC.	
Physical Characteristics		
Built Environment	Disused railways, bridges and other buildings associated with river crossings.	
Landform, Geology and Hydrology	Lowland river valley draining lowland hill terrain and a glacial plain. Dominated by glacial and fluvioglacial drift.	
Landcover and Vegetation	Predominantly woodland, with marshland and pastoral meadows.	
Perceptual Characteristics		
Scale and Appearance	Small scale and enclosed.	
Scenic Quality	High, there are attractive views of river valleys and woodland.	
Tranquillity	Enclosed aspect makes this a tranquil area, only intermittently influenced by agriculture and movement on minor roads.	
Discordant/Intrusive Features	Great Western Railway is next to Afon Conyn.	
Night-Time Light Sources	Restricted to effect from scattered rural dwellings. This is a dark area.	
Cultural / Social		
Historic Features and Elements	Listed buildings.	
Human Interaction	Agriculture and dispersed settlement.	
Landscape Value		
Statutorily protected nature conservation sites. A low distribution of historic sites.		
Quality	**Condition**	**Overall Landscape Value**
High	Fair	High

Figure 10 LCA10 Map and Representative Photograph

LCA10 - Eastern Cleddau Eastern Tributaries

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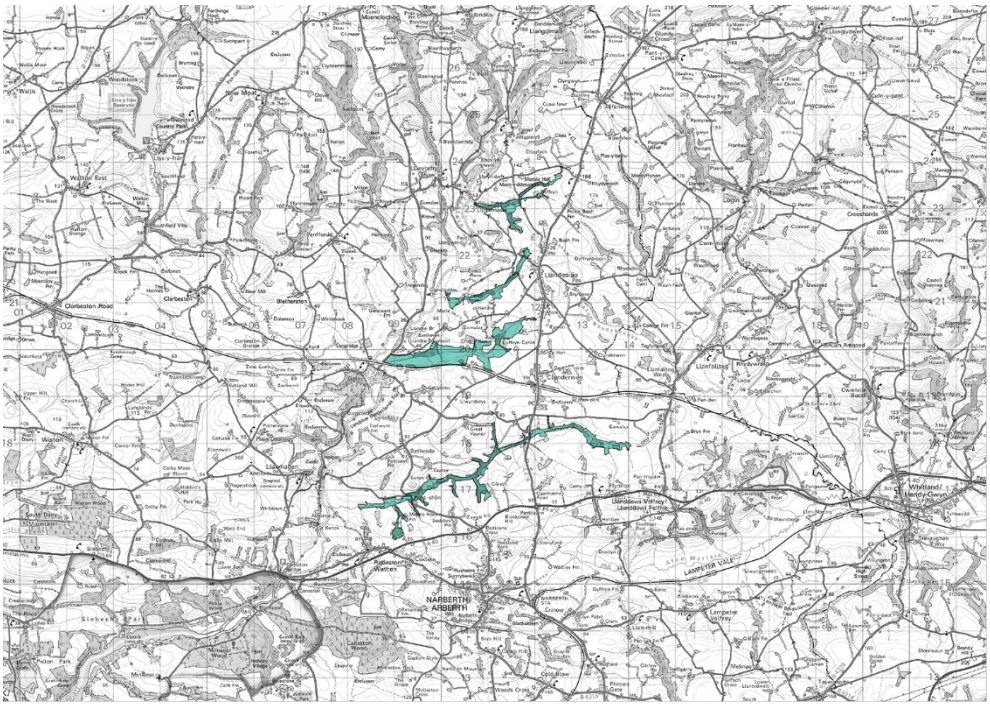

Representative Photograph

Table 11 LCA11 Description

LCA11 – Narberth		
Category	Built Land, Village	
LANDMAP overlap	PMBRKVS048 Narberth	
General Description and Designations		
General Description	A large village or small market town developed informally along what is now the A478 around the medieval castle and church located on the south facing slopes at the southern edge of the village. Narberth developed significantly in the 19th Century around the market square and along the main roads that connect it to neighbouring settlements.	
Designations	Historic core of village is a Conservation Area.	
Physical Characteristics		
Built Environment	A mixture of building types, including large industrial units and caravan parks at the northern outskirts.	
Landform, Geology and Hydrology	Lowland escarpment, sedimentary bedrock dominated.	
Landcover and Vegetation	Built up area with recreational and amenity spaces.	
Perceptual Characteristics		
Scale and Appearance	Although considered to be a village, Narberth has the appearance of a small market town. Buildings are typically of stone with a smooth rendered and painted finish and the bustling streets are narrow with several antique, and specialist food and gift shops serving the Pembrokeshire tourist trade. North of the centre 20th Century ribbon development includes suburban housing estates, retail and leisure parks.	
Scenic Quality	Moderate, the majority of traditional buildings are picturesque.	
Tranquillity	The area is lively. Narrow roads are busy with cars and drivers looking for parking places and the pavements are busy with shoppers.	
Discordant/Intrusive Features	Edge of settlement industrial units and caravan parks.	
Night-Time Light Sources	Streetlights are limited to the core of the settlement but retail and leisure development along the B4313 to the north cause the overspill of night-time lighting to the surrounding countryside.	
Cultural / Social		
Historic Features and Elements	The area features medieval Narberth Castle and several listed buildings concentrated in the centre along the High Street, St James Street, Market Street and Church Street. Narberth has become a tourist centre and is known as the "capital" of the Landsker Borderlands.	
Human Interaction	Bustling village.	
Landscape Value		
South of Landsker trail passes through Narberth. There is a very high distribution of listed buildings and a scheduled monument in the village centre.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	Medium

Figure 11 LCA11 Map and Representative Photograph

LCA11 – Narberth
Map Inset

Representative Photograph


Table 12 LCA12 Description

LCA12 – Llandissilio and Clynderwen		
Category	Lowland Plateau, Mosaic	
LANDMAP overlap	CRMRTVS459 Mid Taf Valley, VS964 Efailwen Uplands, PMBRKVS044 New Inn and VS047 Templeton	
General Description and Designations		
General Description	Gently undulating agricultural land between Eastern Cleddau and Afon Taf lowland valleys, crossed north-south by A478 and east-west by Great Western Railway.	
Designations	Partly within Preseli RLOH.	
Physical Characteristics		
Built Environment	Llandissilio and Clynderwen are linear settlements that have developed alongside the A478 and are at the core of a network of minor roads that spread out into neighbouring areas. Bethesda and Llandre Egremont are small hamlets accessed by minor roads. Elsewhere settlement is scattered.	
Landform, Geology and Hydrology	Lowland hill and lower plateau. Sedimentary bedrock dominated with areas of glacial drift. Watershed between Eastern Cleddau and Afon Taf.	
Landcover and Vegetation	Mosaic of pastoral fields with hedge-bank boundaries and hedgerows trees and areas of woodland.	
Perceptual Characteristics		
Scale and Appearance	Field sizes are a mixture of small to medium scale, away from areas of woodland and settlement the character is open, and views of adjacent character areas are available from hill tops and ridges.	
Scenic Quality	High, good views of agricultural landscape featuring distributed settlements and narrow lanes bound by hedgerows and hedge-banks. Views out to neighbouring valleys and Preseli Hills.	
Tranquillity	There is a radial network of roads spreading out from settlements which affects the tranquillity of the area with the A478 providing the most prominent source of noise and movement.	
Discordant/Intrusive Features	20th Century ribbon development in Llandissilio.	
Night-Time Light Sources	Light sources from the A478 and Llandissilio and Clynderwen have a small influence on the surrounding area.	
Cultural / Social		
Historic Features and Elements	There is a prehistoric hillfort and round barrow, and an early medieval ritual site in this area. Listed buildings are spread along the A478 in Llandissilio and include a church, cottage and war memorial.	
Human Interaction	Agriculture, settlement, transport.	
Landscape Value		
Ancient woodland is a feature where land is not appropriate for agriculture. Landsker Borderlands trail crosses the western portion of this area. A westward flowing tributary of the Eastern Cleddau is part of the Cleddau Rivers SAC and Afon Cleddau SSSI. There is a low distribution of historic monuments.		
Quality	**Condition**	**Overall Landscape Value**
High	Fair	High

Figure 12 LCA12 Map and Representative Photograph

LCA12 - Llandissilio and Clynderwen

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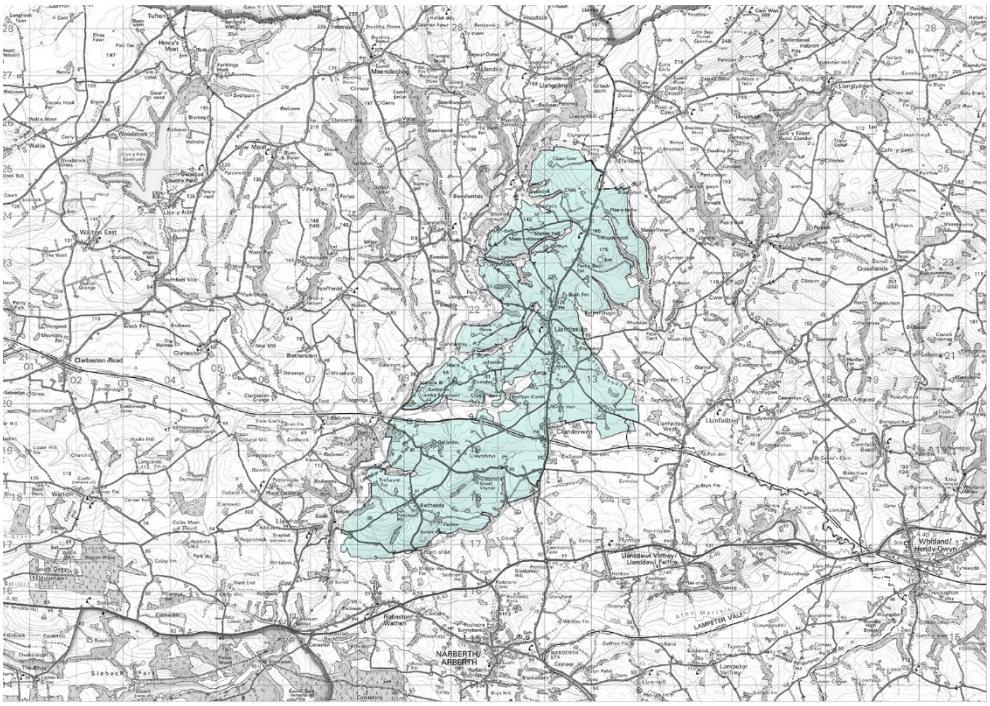

Representative Photograph

Table 13 LCA13 Description

LCA13 – Templeton Ridge		
Category	Rolling Lowland, Open	
LANDMAP overlap	CRMRTVS103 Brandy Hill, VS814 Marros Hills, PMBRKVS047 Templeton and VS052 Sageston	
General Description and Designations		
General Description	Lowland ridge and plateau separating Lampeter Vale from Carmarthen Bay. Crossed east-west by A4115 and B4328, and north-south by Lampeter Vale railway line. A477 trunk road crosses eastern portion.	
Designations	Bordering parts of the National Park at Minwear and Saundersfoot.	
Physical Characteristics		
Built Environment	Includes small settlements of Templeton and Ludchurch, elsewhere settlement is scattered. There are limestone quarries and a disused airfield.	
Landform, Geology and Hydrology	Rolling lowland ridge and hills. East-west aligned block sedimentary bedrock dominated. Northward slopes drain into Taf and Cleddau, southward slopes drain into Carmarthen Bay.	
Landcover and Vegetation	Predominantly pastoral farmland with areas of woodland, conifer plantation, heath and developed areas. Fields and roads bounded by hedge-banks, hedgerows and trees.	
Perceptual Characteristics		
Scale and Appearance	Fields are of large scale, being close to the sea this broad lowland ridge has an exposed aspect in places yet sheltered and enclosed in other parts.	
Scenic Quality	Moderate, farmland mosaic featuring hedge-bank lined country lanes.	
Tranquillity	Tranquil in parts, active in others.	
Discordant/Intrusive Features	National Grid power lines cross the character area to the east of Templeton. Wind turbines also located at exposed sites.	
Night-Time Light Sources	Even distribution of lighting form settlement and quarries throughout character area.	
Cultural / Social		
Historic Features and Elements	There are prehistoric barrows at Castle Heli, Crug Swllt and New House, monuments at Narberth Mountain, Longstone and Molleston and defence sites at Castell Meherin and a medieval defence site at Sentence Castle.	
Human Interaction	Settlement, agriculture and travel.	
Landscape Value		
Moderate distribution of historic sites.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	Medium

Figure 13 LCA13 Map and Representative Photograph

LCA13 - Templeton Ridge

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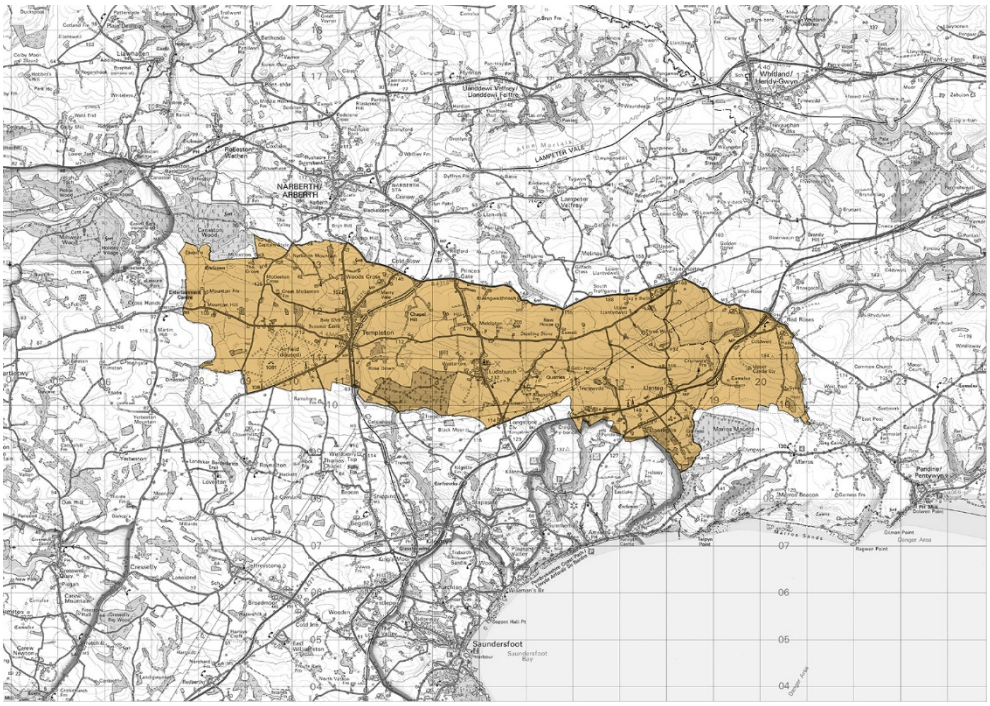

Representative Photograph

Table 14 LCA14 Description

LCA14 – Llanddewi Velfrey Ridge		
Category	Rolling Lowland, Mosaic	
LANDMAP overlap	PMBRKVS047 Templeton	
General Description and Designations		
General Description	Lowland ridge separating Lampeter Vale from Afon Taf Vale. Crossed east-west by the A40. The A478 forms the western boundary.	
Designations	Scheduled ancient monuments located on the ridge to the south of Llanddewi Velfrey.	
Physical Characteristics		
Built Environment	Settlement of Llanddewi Velfrey dispersed along A40 corridor, older parts of the village located alongside historic routes, now minor roads. Farms and rural dwellings scattered throughout.	
Landform, Geology and Hydrology	Prominent ridge with steep scarp slopes. Sedimentary bedrock dominated. South facing slopes drain into Afon Marlais, north facing slopes drain into Afon Taf.	
Landcover and Vegetation	Mosaic of pastoral farmland with hedge-bank boundaries and woodland, with some settlement. Hedge-banks feature mature trees.	
Perceptual Characteristics		
Scale and Appearance	Fields are of medium scale. Away from areas of woodland and settlement the character is open, providing views of adjacent hills and valleys.	
Scenic Quality	Medium, pleasant views of agricultural mosaic featuring narrow lanes bounded by hedge-banks rich in flora. High quality views out towards Preseli Hills.	
Tranquillity	North facing slopes influenced by the A40 road corridor. South facing slopes overlooking Lampeter Vale more tranquil.	
Discordant/Intrusive Features	Scattered settlement that has developed next to main roads.	
Night-Time Light Sources	North facing slopes influenced by light sources within Llanddewi Velfrey village and the A40 including lighting at Penblewin Roundabout. South facing slopes are darker.	
Cultural / Social		
Historic Features and Elements	There are prehistoric hill forts and cairns located along the ridge. Listed buildings are distributed along roads.	
Human Interaction	Agriculture, settlement, transport	
Landscape Value		
Ancient woodland is a feature where land is not suitable for agriculture. There is a relatively low distribution of listed buildings throughout the area.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	Medium

Figure 14 LCA14 Map and Representative Photograph

LCA14 - Llanddewi Velfrey Ridge

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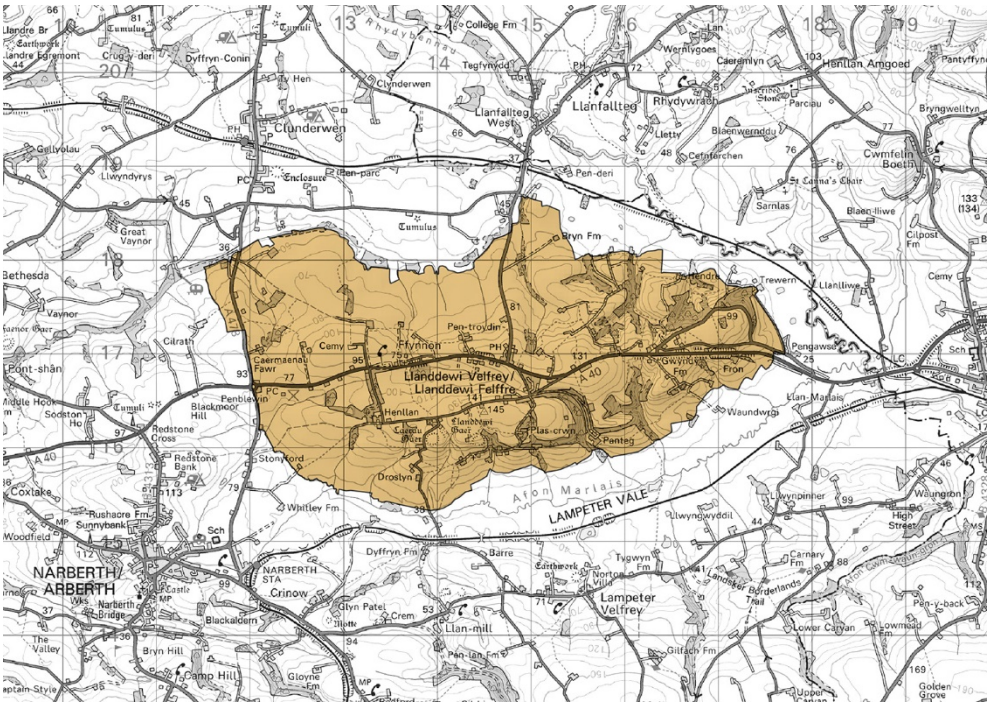

Representative Photograph

Table 15 LCA15 Description

LCA15 – Mid Taf Vale		
Category	Lowland Valley, Mosaic	
LANDMAP overlap	CRMRTVS459 Mid Taf Valley and PMBRKVS049 Lampeter Vale	
General Description and Designations		
General Description	Lowland river valley west of Whitland, with a relatively wide valley floor. Southern portion crossed by the Great Western Railway, elsewhere roads are minor and unclassified.	
Designations	Scheduled ancient monuments evenly distributed within area.	
Physical Characteristics		
Built Environment	Prominent buildings tend to be agricultural or those of religious use.	
Landform, Geology and Hydrology	Lowland river-flood plain system, lowland hill terrain and glacial outwash plain. A mixture of sedimentary bedrock and fluvial deposits.	
Landcover and Vegetation	Cover throughout is a mosaic of pastoral fields with hedge-bank and woodland boundaries, small villages and dispersed rural dwellings.	
Perceptual Characteristics		
Scale and Appearance	Field sizes tend to be of medium scale with boundaries featuring a mixture of managed hedges, hedge-banks, hedgerows and trees. There is generally an open aspect away from the valley floors. Views out of the character area are available away from tall boundary hedgerows and areas of woodland.	
Scenic Quality	High, attractive and relatively unspoilt river valley with small clusters of settlement.	
Tranquillity	The A478 bounds the area at Clunderwen, the A40 at Whitland, and the Great Western Railway line travels along the area. Apart from the main transport the character area is served by a network of minor roads.	
Discordant/Intrusive Features	Caermelyn Solar Farm occupies approximately 25 ha of land next to the railway line near to Whitland.	
Night-Time Light Sources	The LCA is generally dark away from the influence of Whitland and the A478 at Clunderwen. Llanfallteg village and dispersed farms along Llanfallteg Road contribute a little to the overall influence.	
Cultural / Social		
Historic Features and Elements	Prehistoric monuments and defences and a Roman Road. There is a small cluster of listed buildings associated with Glanrhyd Farm, which is located near to Llanfallteg Road.	
Human Interaction	Agriculture, settlement, transport	
Landscape Value		
Ancient woodland surrounding Llanfallteg West and valley sides that connect to Afon Taf vale. There is a low distribution of historic monuments throughout the area.		
Quality	**Condition**	**Overall Landscape Value**
High	Fair	High

Figure 15 LCA15 Map and Representative Photograph

LCA15 - Mid Taf Vale

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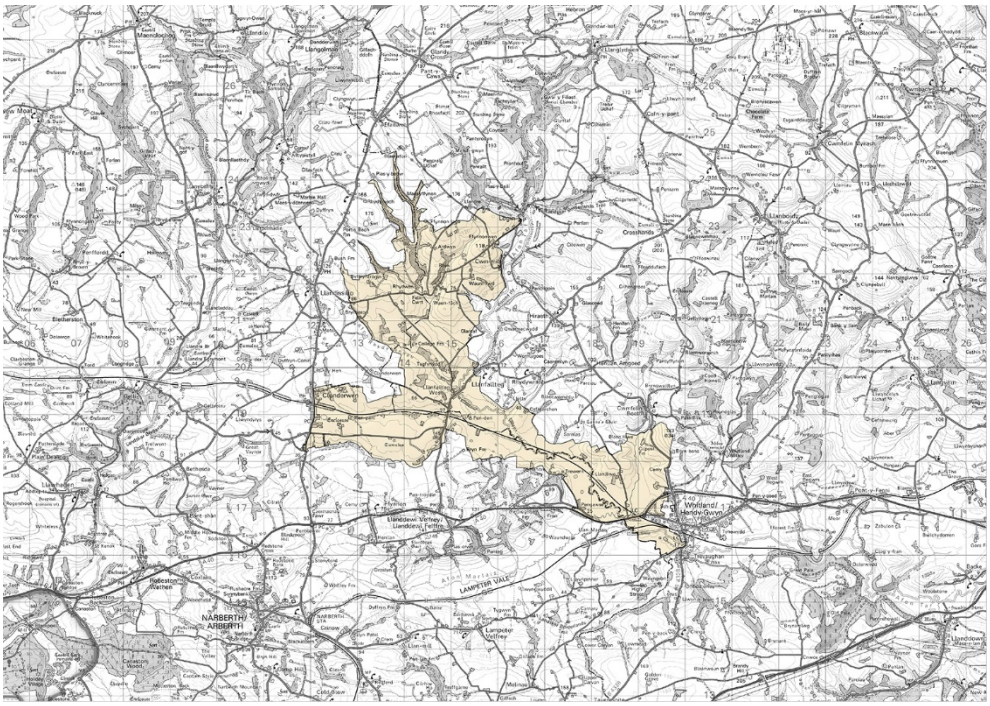

Representative Photograph

Table 16 LCA16 Description

LCA16 – Lampeter Velfrey Slopes		
Category	Rolling Lowland, Mosaic	
LANDMAP overlap	PMBRKVS047 Templeton	
General Description and Designations		
General Description	Undulating pastoral farmland formed of the north-facing slopes of Templeton Ridge. Afon Marlais and Lampeter Vale form the northern limits.	
Designations	Scheduled ancient monuments evenly distributed.	
Physical Characteristics		
Built Environment	Settlement of Lampeter Velfrey located next to valley floor, farms and rural dwellings distributed along a network of minor roads. Lampeter Vale railway forms the western boundary to the character area.	
Landform, Geology and Hydrology	Lowland escarpment incised by river drainage system. Predominantly sedimentary bedrock.	
Landcover and Vegetation	Predominantly pastoral farmland with hedge-bank and hedgerow field boundaries. Wooded where land is unsuitable for agriculture, such as steep sided river valleys.	
Perceptual Characteristics		
Scale and Appearance	Fields of varying scale, medium to large. The character is open with views of surrounding areas.	
Scenic Quality	Medium, pleasant views of agricultural mosaic featuring narrow lanes bounded by hedge-banks rich in flora. Good views out towards Lampeter Vale and Llanddewi Velfrey ridge.	
Tranquillity	Minor roads cross the slopes, area is peaceful.	
Discordant/Intrusive Features	None.	
Night-Time Light Sources	Away from the small villages light sources are confined to scattered farms distributed throughout the area.	
Cultural / Social		
Historic Features and Elements	Prehistoric ritual sites and defences and medieval castles. Listed buildings distributed throughout.	
Human Interaction	Agriculture, leisure, settlement.	
Landscape Value		
Landscker Borderland Trail crosses the area from Whitland to Lampeter Velfrey to Tavernspite. A moderate distribution of listed buildings throughout.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Good	Medium

Figure 16 LCA16 Map and Representative Photograph

LCA16 - Lampeter Velfrey Slopes

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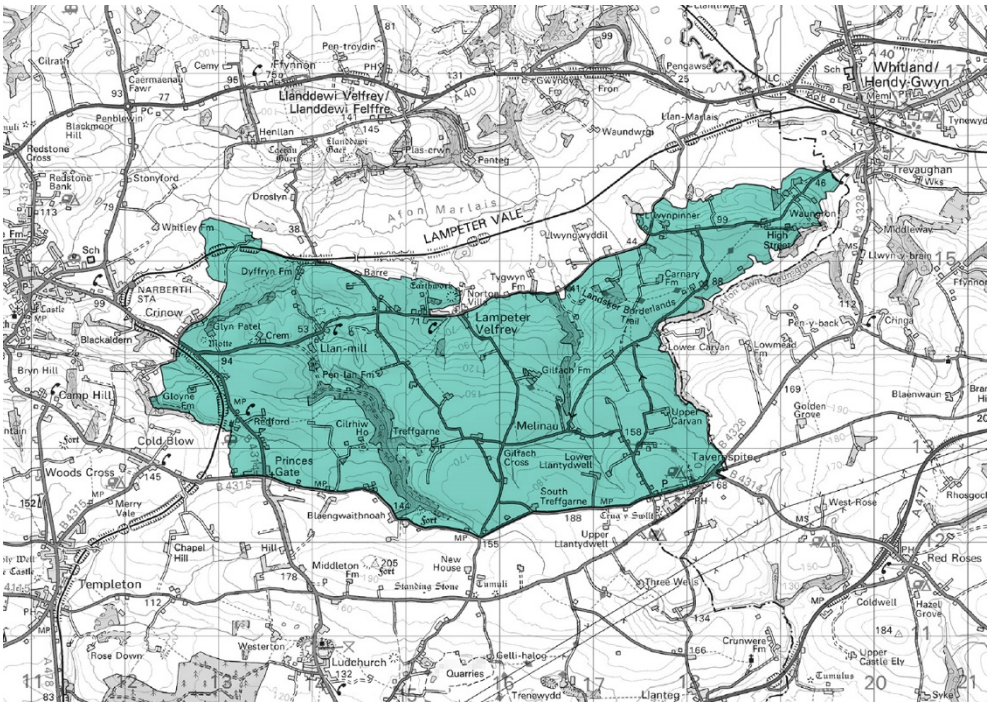


Representative Photograph

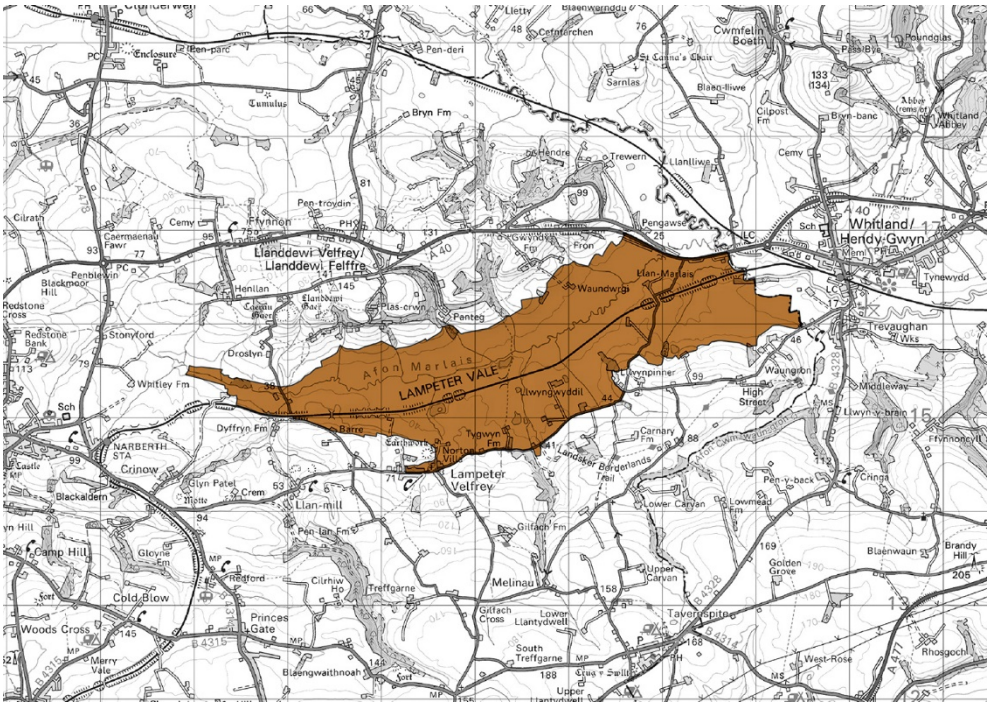
Table 17 LCA17 Description

LCA17 – Lampeter Vale		
Category	Lowland Valley, Mosaic	
LANDMAP overlap	PMBRKVS049 Lampeter Vale	
General Description and Designations		
General Description	Agricultural landscape within a broad valley of the Afon Marlais. Bounded to the north and south by prominent ridges.	
Designations	Scheduled monuments and listed buildings.	
Physical Characteristics		
Built Environment	Settlement is limited to scattered farms and the outlying edges of Lampeter Velfrey and Trevaughan. Other than the railway bridges that cross the minor roads, St Peter's Church in Lampeter Velfrey at the edge of this LCA is perhaps the most prominent building.	
Landform, Geology and Hydrology	Glacial and fluvioglacial deposits and lowland river drainage system.	
Landcover and Vegetation	A mosaic of meadows, fisheries and areas of carr woodland and conifer plantations. Field boundaries are made up of hedgerows and ditches.	
Perceptual Characteristics		
Scale and Appearance	Field sizes are of a medium scale, the areas of woodland at the edge of the valley provide an enclosed character, although this trait does become more open nearer to the confluence of the Afon Tâf and Afon Marlais.	
Scenic Quality	Medium, pleasant views of valley floor including built elements.	
Tranquillity	The A40 defines the eastern boundary to this LCA, and the Lampeter Vale railway line is a prominent feature that runs along the valley floor. Away from the influence of the A40, noise and movement is limited to that of intermittent trains and users of minor roads.	
Discordant/Intrusive Features	The Lampeter Vale section of the Whitland to Pembroke Dock railway line and associated structures are a major feature of this LCA.	
Night-Time Light Sources	This LCA is dark away from the influence of Whitland and Narberth. The Llanddewi Velfrey ridge interrupts night-time influence from much of the A40 corridor.	
Cultural / Social		
Historic Features and Elements	There is a prehistoric round barrow, and medieval manor, motte and ringwork. Waundwrgi farmhouse is the only listed building within the valley floor, although there is a small cluster of buildings in the centre of Lampeter Velfrey, which falls within neighbouring LCA.	
Human Interaction	Agriculture, leisure, transport.	
Landscape Value		
A moderate distribution of historic monuments.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Fair	Medium

Figure 17 LCA17 Map and Representative Photograph

LCA17 - Lampeter Vale

Map Inset



Representative Photograph

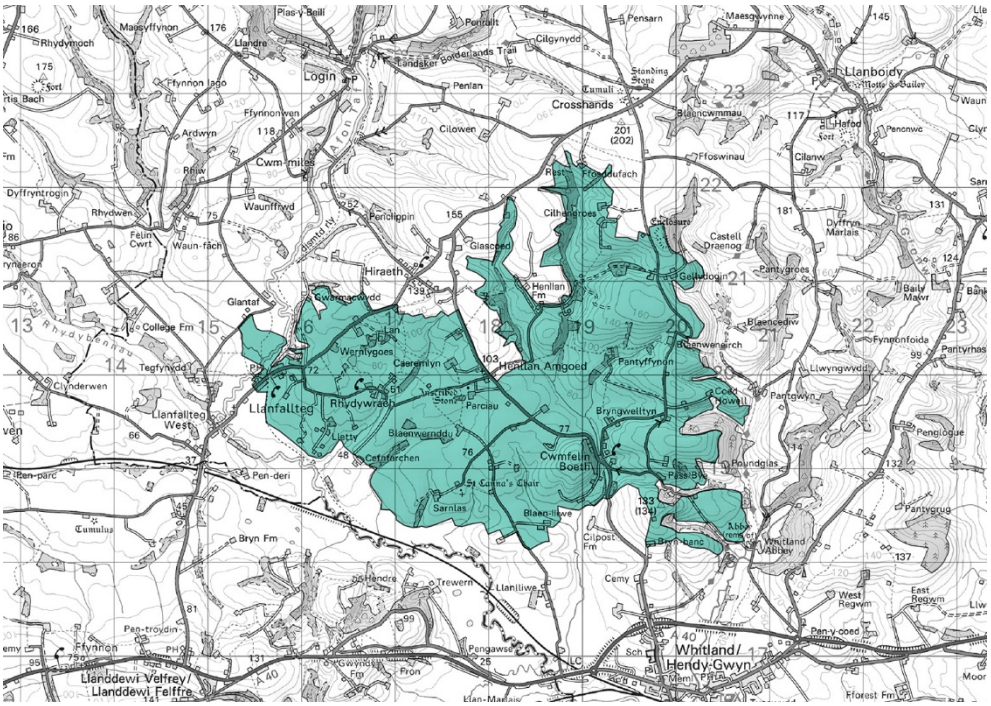
Table 18 LCA18 Description

LCA18 – Cwmfelin Boeth		
Category	Rolling Lowland, Mosaic	
LANDMAP overlap	CRMRTVS747 Cwmfelin Boeth	
General Description and Designations		
General Description	Open hills and valleys with a southward aspect. Some wooded valleys and prominent hills. Lanes bounded by hedge-banks.	
Designations	Scheduled monuments and listed buildings.	
Physical Characteristics		
Built Environment	Hamlets and scattered rural dwellings and crossed by several minor roads. Religious and agricultural buildings are prominent.	
Landform, Geology and Hydrology	Rolling lowland pastoral farmland with prominent hills.	
Landcover and Vegetation	A mosaic of fields bounded by a mixture of maintained hedge-banks and hedges with trees, and woodland.	
Perceptual Characteristics		
Scale and Appearance	Field sizes are of medium scale and well-maintained hedges and hilltops provide an open character where views of neighbouring character areas are available.	
Scenic Quality	Medium, some attractive elements with few detractive elements.	
Tranquillity	There are several small settlements distributed throughout this LCA, connected by a network of minor roads. The presence of the wind turbine and agricultural vehicles using local roads provide intermittent movement.	
Discordant/Intrusive Features	A single wind turbine at Cwmfelin Boeth is the most prominent structure.	
Night-Time Light Sources	Light sources tend to be from farms and rural dwellings rather than small hamlets. There is also some influence from nearby Whitland and the A40 corridor.	
Cultural / Social		
Historic Features and Elements	There are prehistoric monuments and early medieval ritual sites, listed buildings are rural dwellings.	
Human Interaction	The main cultural activity is farming.	
Landscape Value		
A very low distribution of historic monuments.		
Quality	**Condition**	**Overall Landscape Value**
Medium	Good	Medium

Figure 18 LCA18 Map and Representative Photograph

LCA18 - Cwmfelin Boeth

Map Inset



Representative Photograph

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 9.3 Representative Viewpoints

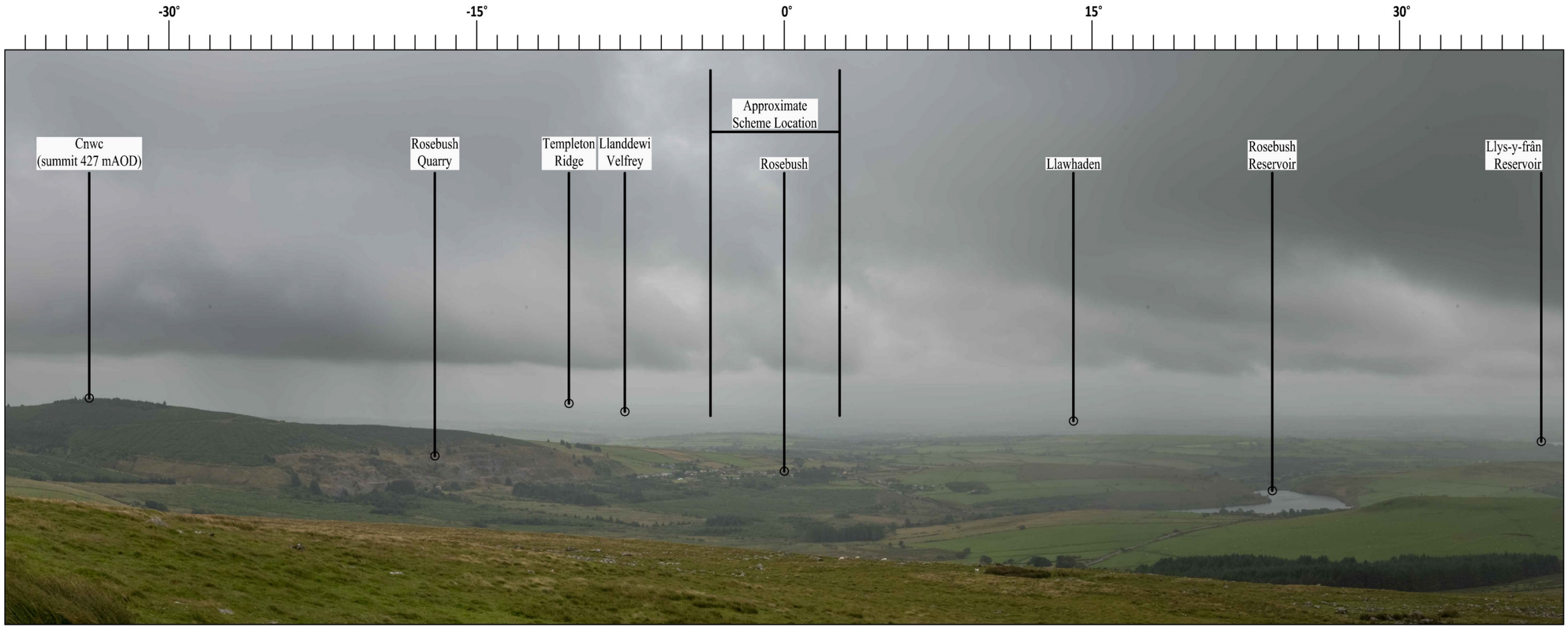
A40PRC-RML-ELS-SWI-RP-L-0903

P03 | S3

29/05/20

Viewpoint A

Foel Eryr Summit



National Grid Reference:	SN 06575 32065
Date (Time):	27th July 2017 (13:45)
Weather Conditions/ Visibility:	thick cloud/ moderate
Elevation:	468 mAOD
Image Bearing:	165° (SSE to S)
Distance from Scheme:	16.2 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

Cairn at Foel Eryr, Pembrokeshire Coast National Park. Promoted viewpoint shown on Ordnance Survey maps, one of the westernmost summits of the Preseli range of hills and accessible from the B4329 at Bwlch-gwynt. The summit at 468 m AOD makes it the second highest peak of the Preseli Hills. The Scheme would occupy an approximately 6.5° horizontal field of view, in a south-south-eastward to southward direction.

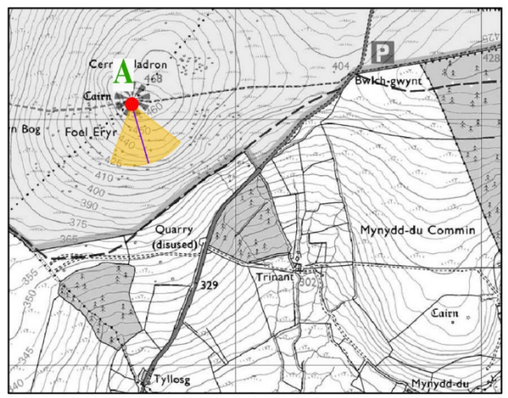
Component of View

During periods of excellent visibility views of Snowdonia, Plynlimon Hills, Brecon Beacons, Exmoor and Dartmoor, Wexford and Wicklow, are available. The moorland pasture in the foreground slopes steeply south-eastward towards the B4329 and the Afon Syfni. Beyond the Afon Syfni, is the settlement of Rosebush, with Rosebush Quarry a prominent feature. Rosebush is set against a ridge that runs south-westward from the summit of Foel Cwmcerwyn. Beyond this ridge, are the undulating lowland hills and settlement of Maenclochog and the heads of the wooded valleys that drain into the Eastern Cleddau. The next range of lowland hills visible are those in Llandissilio, followed by the Llanddewi Velfrey ridge and finally the Templeton ridge forms the horizon. The existing A40 is not distinguishable in the view despite running close to the summit of the Llanddewi Velfrey ridge. The landscape is rural, with an irregular pattern of moorland, quarries, pastoral farmland, reservoirs, woodland, roads, settlements, groups of dwellings and isolated farms. The view is open and panoramic, the description here is focussed on the southward view. Some of the woodland and pastoral farmland of the Llanddewi Velfrey ridge is visible but the accumulation of field boundary hedgerows and trees gives the appearance of woodland. There are a few wind turbines and National Grid pylons visible on the Templeton ridge in the far distance from this elevated vantage point.

Anticipated Change in View

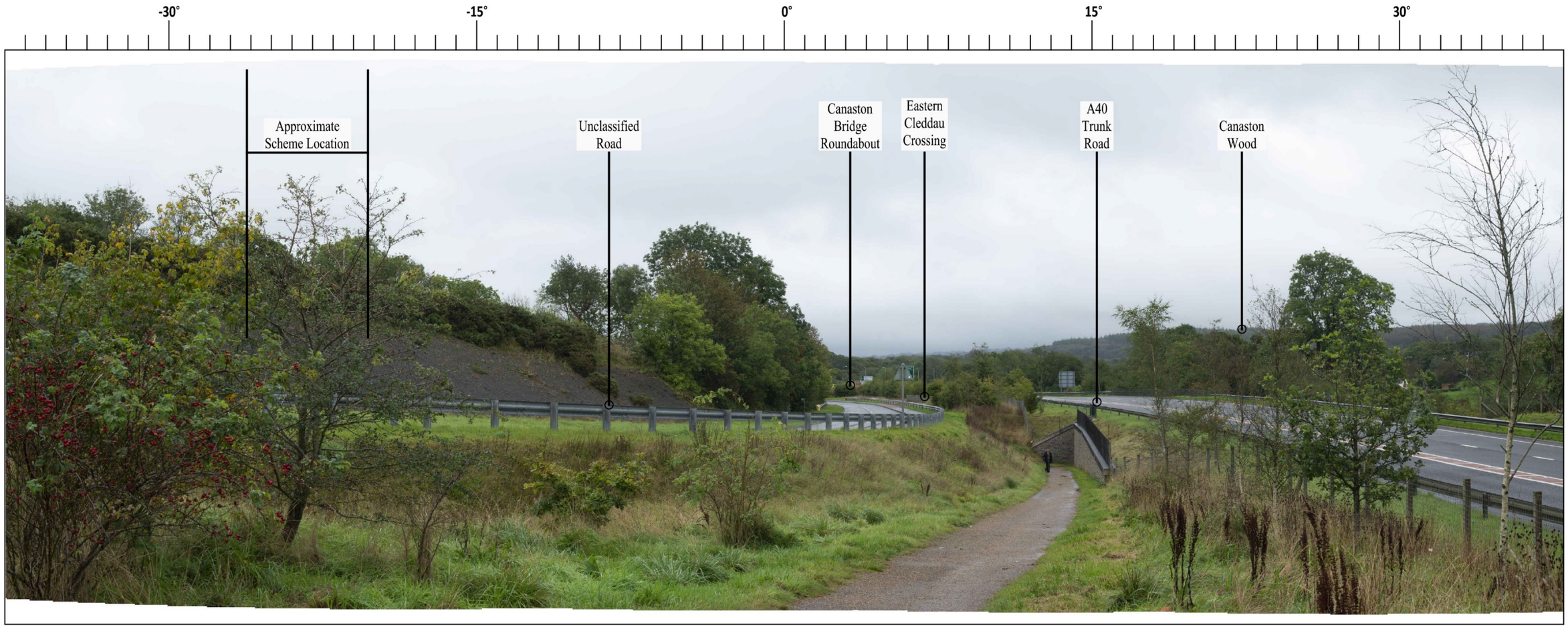
A view of the Scheme is theoretically available, but at such a distance details would be difficult to distinguish.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint B
Canaston Bridge



National Grid Reference:	SN 06515 15240
Date (Time):	25th September 2019 (11:15)
Weather Conditions/ Visibility:	light cloud/ good
Elevation:	15 mAOD
Image Bearing:	100° (E to ESE)
Distance from Scheme:	3.9 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image
Important Viewing Instructions

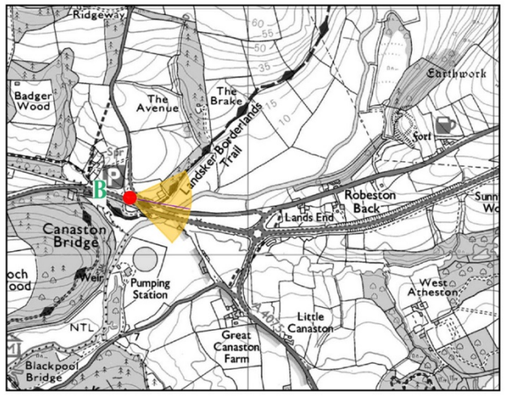
This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position
Located at a car park accessed from an unclassified road that connects Canaston Bridge to Llawhaden and is orientated in an eastward direction towards Narberth, the outskirts of which is approximately 3.8 km distant. The Landsker Borderlands Trail passes close to here and can be accessed by footpaths from the car park. The viewpoint is representative of views experienced by users of the car park and part of the trail, which follows the western side of the Eastern Cleddau vale north of here and goes through Toch Wood and Canaston Wood south of here, crossing the Eastern Cleddau at Blackpool Bridge.

Component of View
The view overlooks recent improvements to the A40 at Robeston Wathen. The unclassified road connecting to Llawhaden has been realigned to connect with the A40 at Canaston Bridge Roundabout, creating a sidelong cutting into the lower slopes of Ridgeway. The footpath and bridleway connect to the Landsker Borderlands Trail on the southern side of the A40 through an underpass. Views to the north are of the south facing slopes of Ridgeway and to the south of Toch Wood. The location is noisy and busy.

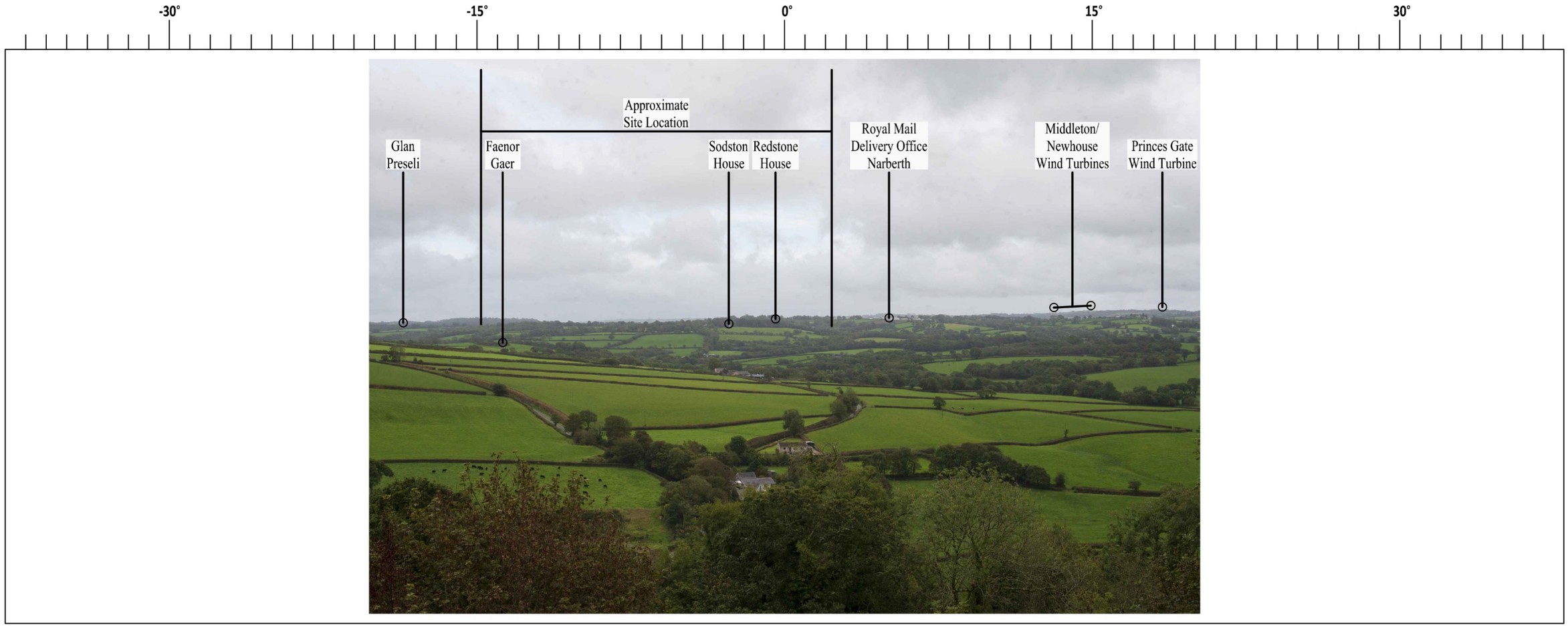
Anticipated Change in View
There is no change in view anticipated. The view of the Scheme would be interrupted by the rising landform of Ridgeway. From the Landsker Borderlands Trail to the north the view would be interrupted by the triangular hill west of Robeston Wathen. From the trail to the south a theoretical view of the Scheme between Sodston House Lodge and Blaenffynnonau is predicted but the path is within woodland and the view would be interrupted.

Location Plan (1:25,000)


Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint C

Llawhaden Castle



National Grid Reference:	SN 07320, 17430
Date (Time):	25th September 2019 (15:30)
Weather Conditions/ Visibility:	light cloud/ good
Elevation:	90 mAOD
Image Bearing:	115° (ESE to SE)
Distance from Scheme:	3.3 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing Single Image

Important Viewing Instructions

This is a single image.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

Located in the south-eastern tower of Llawhaden Castle at about 11.5 m above the level of the inner courtyard, accessible by modern stairs and medieval spiral staircase. It is orientated in an east-south-eastward direction towards Redstone Bank, which is approximately 4.0 km distant. The viewpoint is representative of views experienced by visitors to the Scheduled Ancient Monument and Conservation Area.

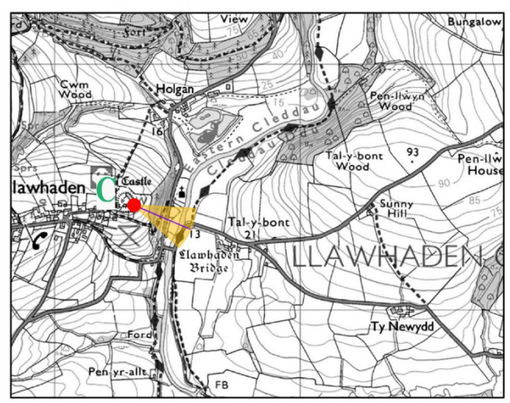
Component of View

The image bearing and field of view is limited by the frame of the tower window. It overlooks the Eastern Cleddau and includes a rolling lowland landscape of pastoral fields bounded by hedge-banks, deciduous woodland, scattered settlements and the northern outskirts of Narberth. The horizon to the view is made up of a wooded Llanddewi Velfrey Ridge, Redstone Bank and the broad Templeton Ridge with its overhead power lines and wind turbines. The location is peaceful with a little activity within Llawhaden village and the network of narrow lanes that serve the village. The existing A40 crosses the area from near to Glan Preseli in Llanddewi Velfrey, between Sodston House and Redstone House, and then gradually descends as it nears Robeston Wathen. It is not visible due to a combination of the intervening landform and significant vegetation to the north of the A40.

Anticipated Change in View

A theoretical view of the Scheme between Sodston House Lodge and Blaenmarlais is predicted but woodland at Sodston House and hedgerows on the northern side of the existing A40 would create a visual barrier.

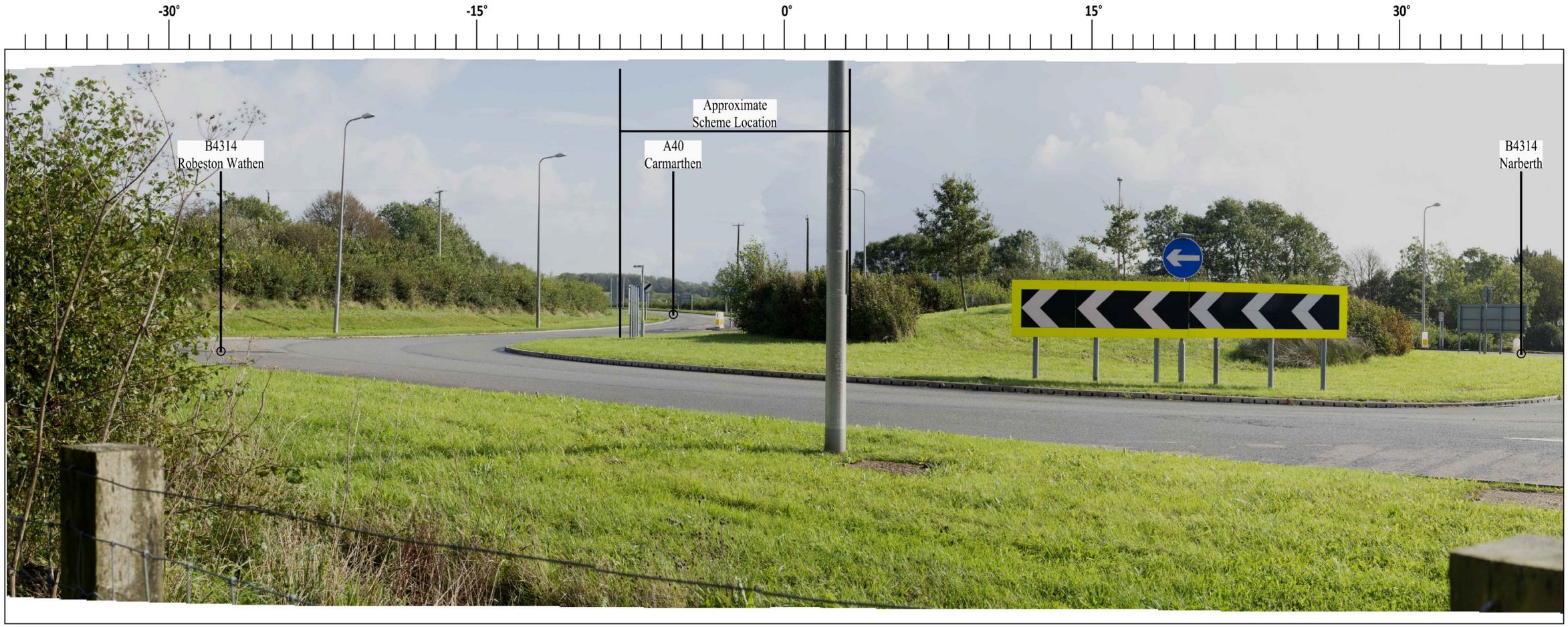
Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Single image field of view (39.5°)
Red line - Scheme footprint

Viewpoint D

Robeston Wathen



National Grid Reference:	SN 08867 15710
Date (Time):	26th September 2019 (11:15)
Weather Conditions/ Visibility:	light cloud/ good
Elevation:	50 mAOD
Image Bearing:	80° (ENE to E)
Distance from Scheme:	1.5 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

Located on a shared pedestrian/cyclist path at Robeston Wathen Roundabout that is accessible from the B4314 connecting Narberth and Robeston Wathen. It is orientated in an east-north-eastward to eastward direction towards Redstone Cross, which is approximately 2.0 km distant. The roundabout is located in a dip between Cox Hill and Robeston Wathen. The ground rises west of the viewpoint which enables views for road users and passengers that overlook the roundabout. . The viewpoint is representative of views experienced by pedestrians and cyclists.

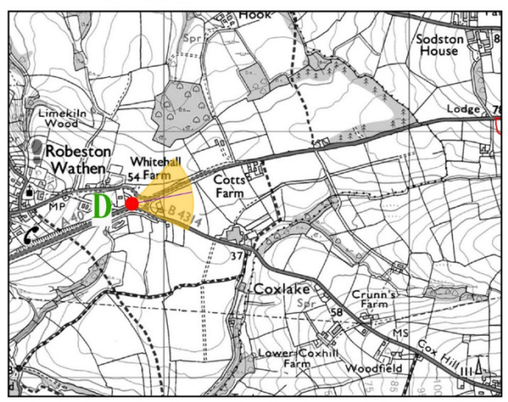
Component of View

The view overlooks the eastern end of the Robeston Wathen improvements to the A40. The B4314 has been realigned to follow the pre-improvement alignment of the A40, which went through Robeston Wathen. The roundabout and planting associated with it interrupt the eastward view. The location is noisy and busy.

Anticipated Change in View

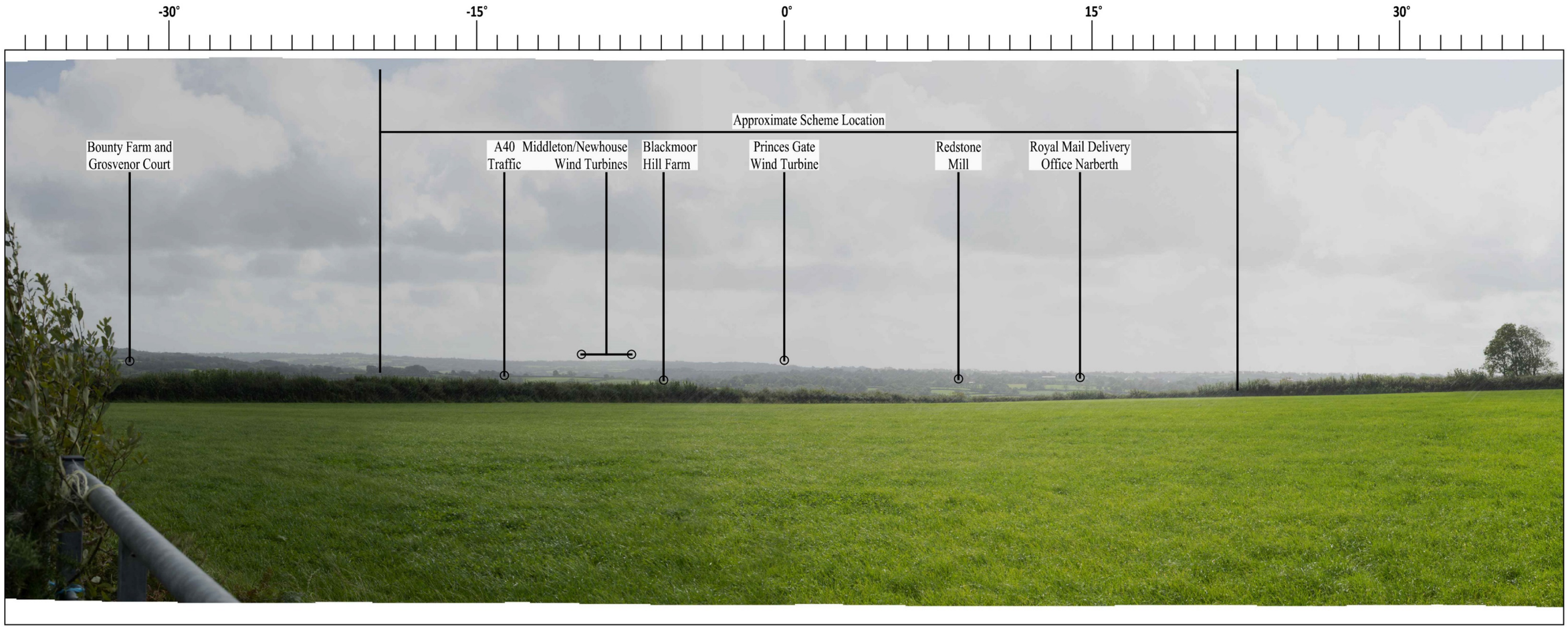
A theoretical view of the Scheme and traffic between Sodston House Lodge and Blaenmarlais is predicted but an accumulation of hedge-bank field boundaries with large trees create a visual barrier.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint E
near Great Vaynor



National Grid Reference:	SN 10150 18530
Date (Time):	26th September 2019 (12:25)
Weather Conditions/ Visibility:	rain/ moderate
Elevation:	110 mAOD
Image Bearing:	155° (SE to SSE)
Distance from Scheme:	2.4 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image
Important Viewing Instructions

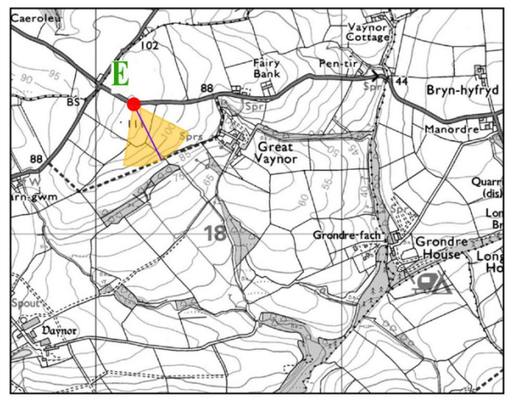
This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position
A field access gate at the summit of a small hill to the west of Great Vaynor. It is orientated in a south-eastward to south-south-eastward direction and represents the view available from rolling farmland to the north of the A40 and to the west of the A478. The area is served by the B4313 and a network of narrow roads with hedge-bank sides connecting to neighbouring areas.

Component of View
Roadside hedge-banks limit the availability of outward views. Where there is a gap, such as at a field access gate, road users gain a glimpse of the surrounding pastoral landscape. From ridges and hills the view of the existing A40 is screened by roadside hedges, although commercial vehicles and road signs are visible. The Templeton ridge forms the horizon to the view, including a view of power distribution lines and wind turbines. The view is representative of one experienced by countryside workers and road users. The location is quite tranquil, quietness is interrupted occasionally by traffic on minor roads and there is some background noise from main roads, but this is influenced by wind direction.

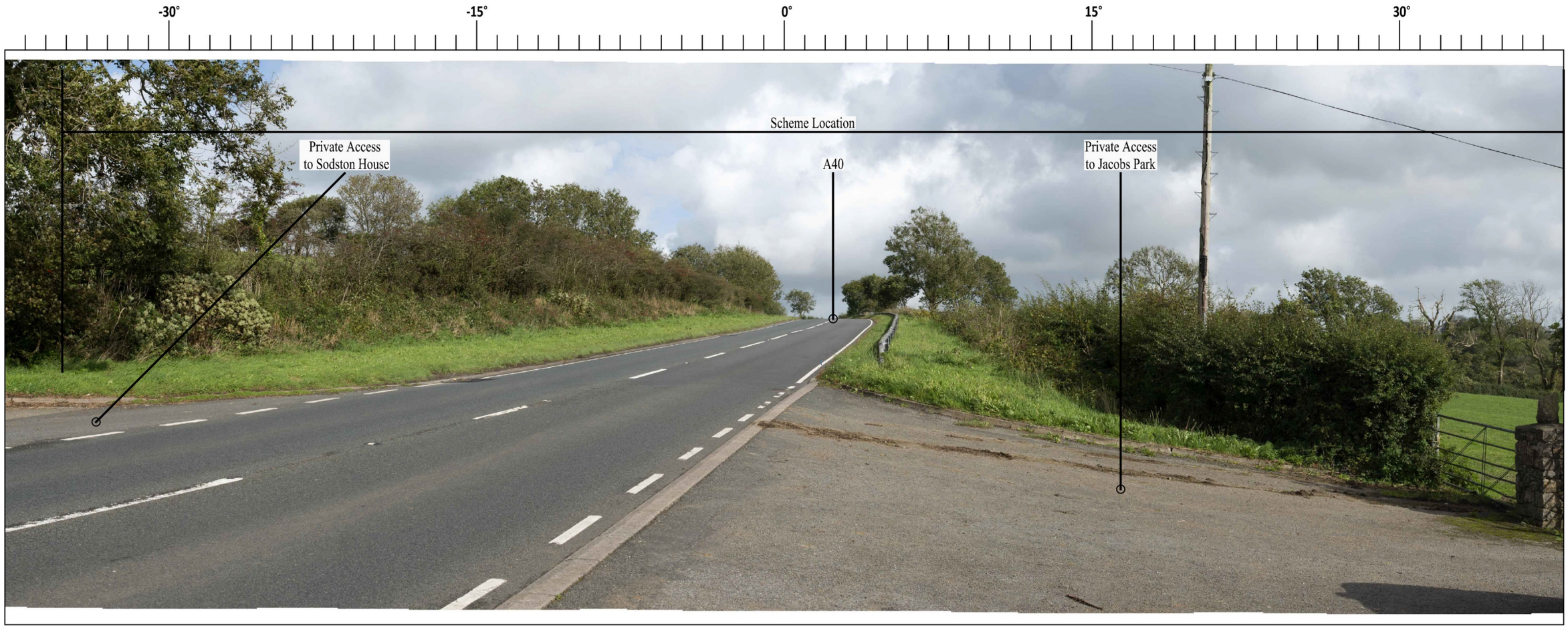
Anticipated Change in View
A theoretical view of the Scheme and traffic where the road is in cutting at Penblewin, and a section between Blaenffynnonau and Redstone Cross is predicted. The section at Penblewin would be further from view than is the existing A40 and screened by the same boundary features. The section between Blaenffynnonau and Redstone Cross is difficult to distinguish in the view, there is an accumulation of small wooded areas and field boundary hedge-banks that contribute to a visual barrier.

Location Plan (1:25,000)


Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint F

Sodston House Lodge



National Grid Reference:	SN 10330 16040
Date (Time):	26th September 2019 (15:20)
Weather Conditions/ Visibility:	thick cloud/ good
Elevation:	75 mAOD
Image Bearing:	80° (ENE to E)
Distance from Scheme:	20 m
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

Located in the wide roadside verge next to the private access track to Jacobs Park. This is where the Scheme would tie-in with the existing A40. The view is representative of one experienced by road users.

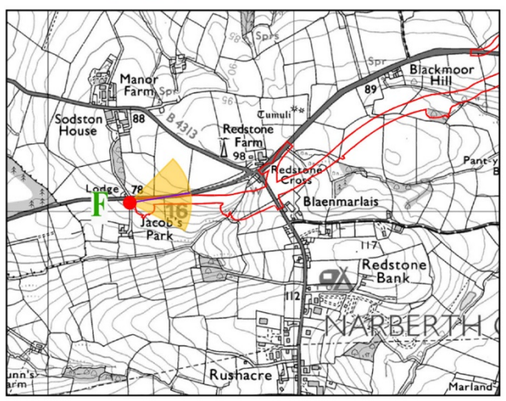
Component of View

The A40 set within the pastoral landscape with boundaries of maintained hedges and hedgerows with mature trees is the main feature. There is a gradual rise in the terrain, where the road reaches the broad Redstone ridge it disappears from view. Field boundaries contribute to the visual screen of the road and traffic at the horizon of this view. From this location, the rising landform and significant vegetation interrupt the view to the north. To the south, the view overlooks a small valley towards Narberth where industrial units at Rushacre Enterprise Park are visible.

Anticipated Change in View

The ZTV predicts that there will be a view of the Scheme where it crosses the fields to the south side of the existing A40 in cutting. The roadside hedge on the northern side of the road would be retained, but that on the southern side would be partially removed. A surface water attenuation pond would be located in the north-western corner of field that is visible in the right-hand side of the view. The existing A40 would be removed.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint G
Blaenmarlais

National Grid Reference:	SN 10945 16030
Date (Time):	26th September 2019 (09:05)
Weather Conditions/ Visibility:	light rain/ moderate
Elevation:	100 mAOD
Image Bearing:	330° (NW to NNW)
Distance from Scheme:	0 m
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image
Important Viewing Instructions

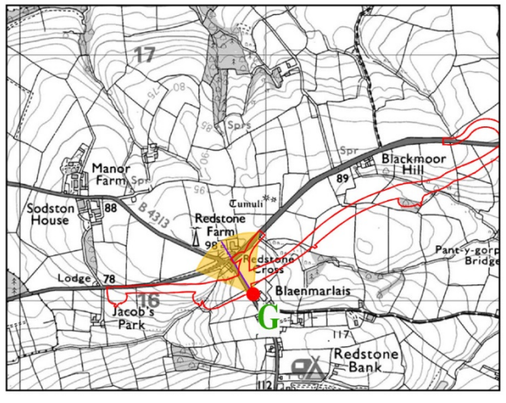
This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position
Located at the entrance to Blaenmarlais Care Home on the pavement to the B4313 Redstone Road. This is where the scheme would tie-in with Redstone Road and is representative of the view experienced by road users, pedestrians and those using the grounds of the care home.

Component of View
The view is towards Redstone Cross junction of the A40 and B4313. A roadside hedge-bank limits the westward view and a boundary wall to the grounds of the care home limit the eastward view. The view is directed towards the junction and the properties of Redstone Farm and Redstone Cottages.

Anticipated Change in View
The main line of the Scheme would run in a deep cutting (depth to about 5.6 m), the centreline of the road would be about 80 m from the viewpoint, which would bring the trunk road closer to the viewpoint than is the existing situation. Redstone Road would be realigned horizontally to tie in with the existing A40 just to the east of Redstone Farm, the vertical alignment would raise the road in order to cross the A40 (height to about 4.7 m above the level of the existing B4313). The A40 between Redstone Farm and Penblewin Roundabout would be de-trunked but retained as the eastbound access onto the A40. A new junction with the B4313 connection to Maenclochog and Bethesda would be located to the south-east of Redstone Farm. To gain access onto the A40 in a westward direction a new junction is proposed that would cross a small wooded valley on embankment (height to about 12.7 m). This junction would provide access onto Redstone Road and into the north of Narberth from east and west. Construction works would result in the loss of most of the hedge-banks alongside Redstone Road between the viewpoint and Redstone Cottages. The boundary wall to the garden of Blaenmarlais Cottage would not be affected and will provide a visual barrier of the Scheme to the east of Redstone Road.

Location Plan (1:25,000)


Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint H

Redstone Cross Round Barrows

National Grid Reference:	SN 10995 16455
Date (Time):	26th September 2019 (13:35)
Weather Conditions/ Visibility:	thick cloud/ good
Elevation:	95 mAOD
Image Bearing:	165° (SSE to S)
Distance from Scheme:	170 m
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

On land associated with Redstone Farm in a field to the north of the Redstone Cross round barrows, at an intersection of field boundary hedgerows.

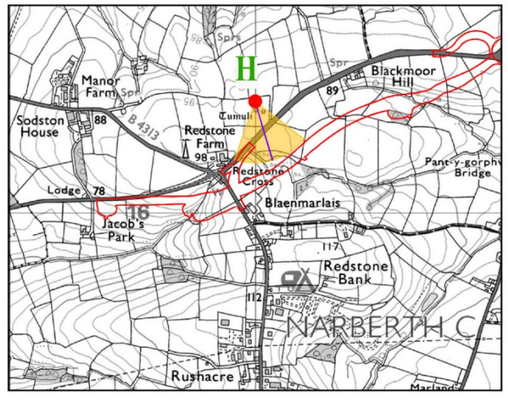
Component of View

The field is next to the A40, which is separated from it by a roadside hedgerow. The hedgerow provides a partial screen to road, traffic and road signs. Gaps in the hedgerow occur where there is a gated access to the field from the A40. The Redstone Cross junction sign and overhead power lines to the south of the A40 are visible through the tree canopies. The barrows are visible in the foreground. The tranquillity of the viewpoint is affected by traffic on the A40.

Anticipated Change in View

The ZTV predicts that the majority of the Scheme would be visible but the ZTV takes no account of the substantial vegetation that would interrupt the view. The mainline of the Scheme would be located further away than the existing A40, which would be de-trunked and used as an eastbound access connecting to the Scheme at Penblewin Roundabout.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint I

Blaenffynnonau

National Grid Reference:	SN 11300 15970
Date (Time):	26th September 2019 (08:55)
Weather Conditions/ Visibility:	light cloud/ good
Elevation:	105 mAOD
Image Bearing:	5° (N)
Distance from Scheme:	275 m
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

Located at a field access gate near to the entrance to Blaenffynnonau Farm. The track is a bridle path that connects the B4313 at Blaenmarlais to the A478 at Stonyford. The view is representative of one experienced by users of public rights of way.

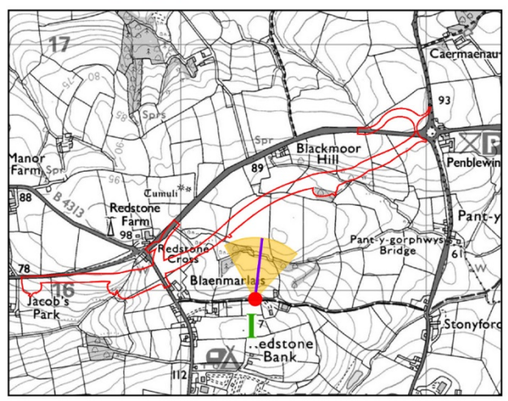
Component of View

Looking towards Blackmoor Hill Farm across a remnant of parkland, a wooded valley and undulating pastoral landscape with hedgerow field boundaries. Wooded where agricultural use is unsuitable and featuring some veteran parkland trees. Beyond Blackmoor Hill is a view of Llandissilio and the gradually rising landform towards the Preseli Hills. The location is quite tranquil, traffic on the B4313 Redstone Road and the A40 contribute to the background noise. To the east of Blackmoor Hill farm the hedgerow on the southern side of the A40 screens the view of traffic. The wooded valley in the foreground is the origin of the Afon Marlais, which travels eastward through Lampeter Velfrey flowing into to the Afon Taf west of Whitland.

Anticipated Change in View

The ZTV predicts that there will be a view of the Scheme where the road passes Blaenmarlais in cutting (depth to 5.1 m), crosses the wooded valley and meadows that lie between Blaenffynnonau Farm and Blackmoor Hill Farm on embankment (height to 11.1 m), and climbs towards Penblewin Roundabout on embankment (height to 5.4 m). There is a plateau between two wooded valleys that feed the Afon Marlais, the Scheme would occupy land on the north facing slopes where the plateau meets the northernmost tributary valley, this in combination with woodland would contribute to a visual screen of the road from Blaenmarlais to Blackmoor Hill from this viewpoint. Between Blackmoor Hill Farm and Penblewin Roundabout part of the Scheme would be visible but filtered in the view by tree canopies.

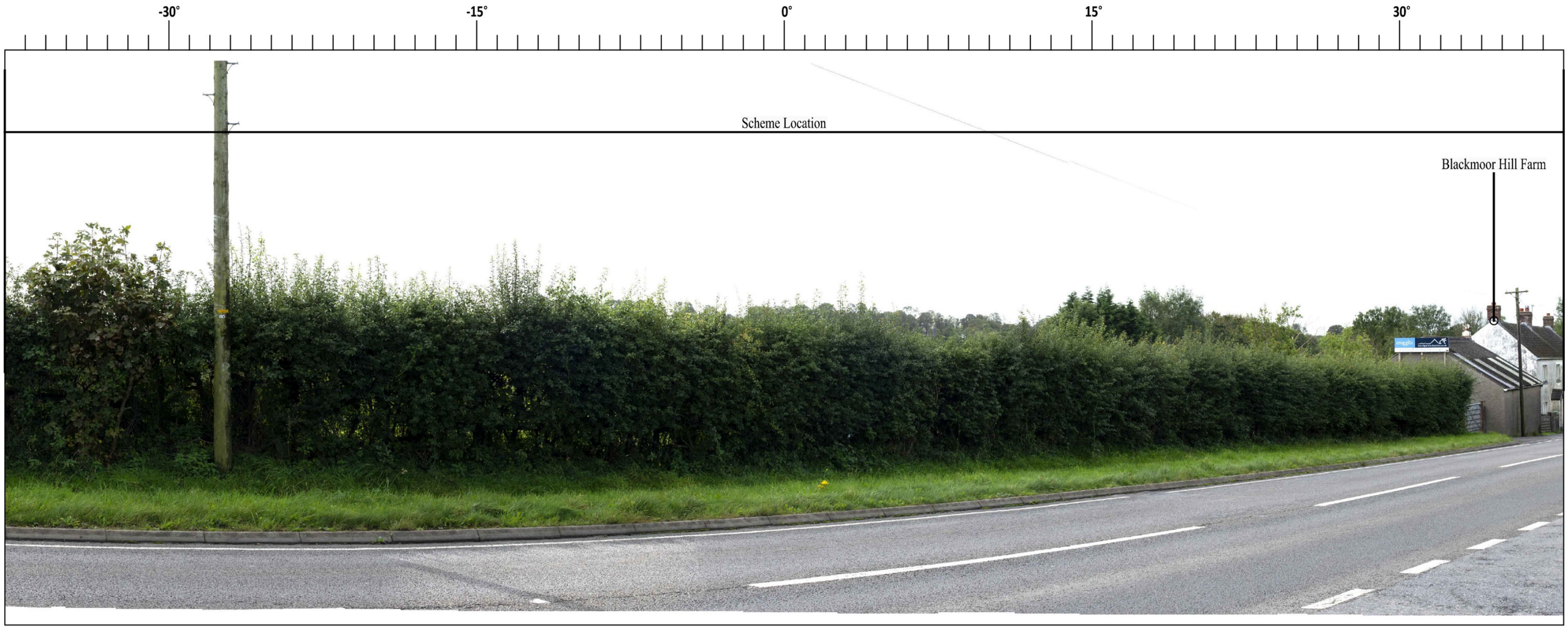
Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint J

Blackmoor Hill



National Grid Reference:	SN 11475 16625
Date (Time):	26th September 2019 (11:35)
Weather Conditions/ Visibility:	thick cloud/ good
Elevation:	95 mAOD
Image Bearing:	200° (SSW)
Distance from Scheme:	160 m
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

Located at the point where the public footpath from Brynhill Farm on the A478 meets the A40 to the south of Cilrath Fawr. The viewpoint is representative of views experienced by pedestrians and road users.

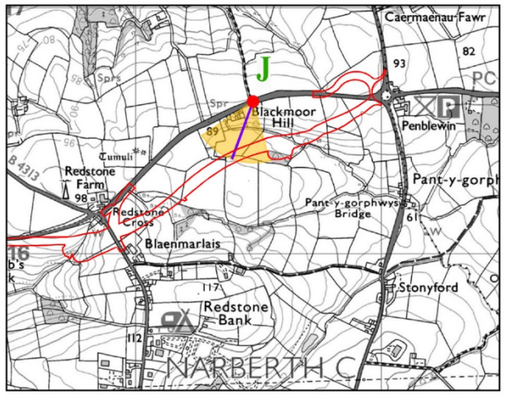
Component of View

The southward view is limited by the roadside hedge to the south of the A40. The viewpoint is noisy and busy. Views eastward towards Penblewin Roundabout are limited by a rise in terrain and roadside vegetation. The westward view is of the A40 beyond Blackmoor Hill Farm.

Anticipated Change in View

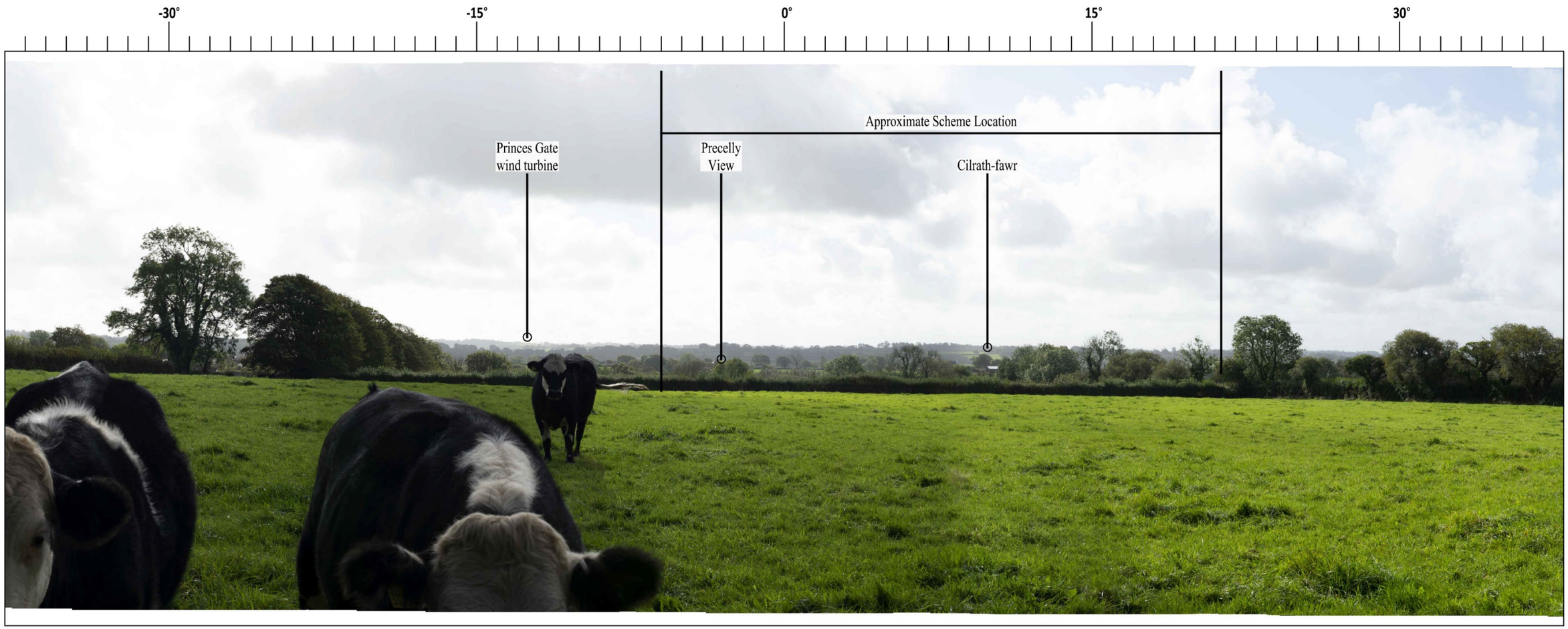
The ZTV predicts that there will be a view of the Scheme where the road passes Blaenmarlais in cutting (depth to 5.1 m), crosses the wooded valley and meadows that lie between Blaenffynnonau Farm and Blackmoor Hill Farm on embankment (height to 11.1 m), and climbs towards Penblewin Roundabout on embankment (height to 5.4 m). The Scheme would be screened from view by the existing roadside hedge when vegetation is in leaf. During winter months, the hedge would provide a filter of southward views. The existing A40 will continue to be used as an eastbound connection to Penblewin Roundabout from B4313 Redstone Road in Narberth. The frequency of traffic would be reduced.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint K
near Clynderwen



National Grid Reference:	SN 11710 19570
Date (Time):	26th September 2019 (12:10)
Weather Conditions/ Visibility:	light cloud/ good
Elevation:	50 mAOD
Image Bearing:	180° (S)
Distance from Scheme:	2.8 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

Located on a public footpath that connects Dyffryn-Conin to Clynderwen village centre and railway station. The view is representative of one experienced by users of public rights of way and countryside workers.

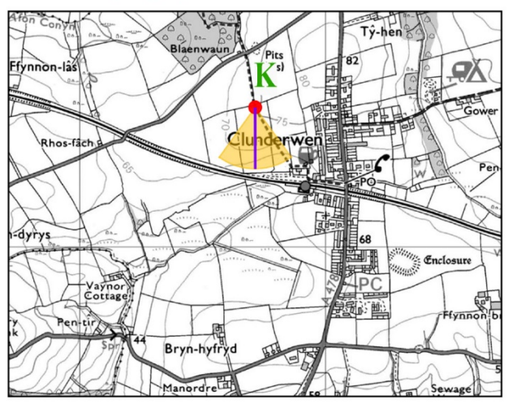
Component of View

A gently undulating pastoral farmland bounded by hedgerows and hedge-banks with mature trees. A series of broad ridges gradually increase in elevation culminating with the Templeton ridge and Blackmoor Hill that form the horizon to the view. Scattered rural dwellings including a row of houses at Precelly View in Clynderwen and Cilrath-fawr are recognisable, as is the wind turbine at Princes Gate.

Anticipated Change in View

The ZTV predicts that there would be a view of the Scheme at Penblewin and also at Redstone Cross. There is sufficient vegetation in the landscape between the viewpoint and the Scheme that the view would be interrupted.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint L

near Narberth Station

National Grid Reference:	SN 11810 14955
Date (Time):	26th September 2019 (09:25)
Weather Conditions/ Visibility:	light cloud/ good
Elevation:	90 mAOD
Image Bearing:	340° (NNW)
Distance from Scheme:	1.3 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

In the grass verge at the junction between the A478 and Kiln Park Road, which is the eastern entry into Narberth from Penblewin Roundabout. The view is representative of one experienced by residents of Kiln Park Road and road users.

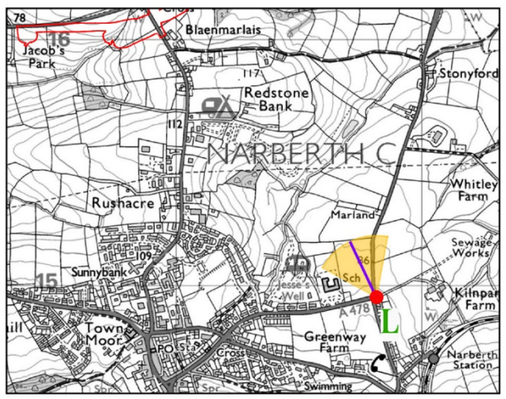
Component of View

The road junction, roadside verges and hedges are the main components of the view. Industrial buildings, sheds and hedgerows on the south facing slopes of Redstone Bank are visible. The view towards Penblewin Roundabout is interrupted by roadside hedges and mature trees.

Anticipated Change in View

The ZTV predicts that there would be a view of the Scheme at Penblewin where the road would be on embankment (height to 5.6 m), and where it crosses the meadows south of Blackmoor hill (on embankment, height to 11.1 m). Hedgerows with mature trees and rows of trees next to streams create to a visual barrier. Kiln Park Road climbs in a southward direction to the junction with the B4314. From an elevated location a view of high sided vehicles and lighting columns at Penblewin Roundabout would be available.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)

Viewpoint M
Penblewin

National Grid Reference:	SN 12055 16570
Date (Time):	26th September 2019 (11:00)
Weather Conditions/ Visibility:	light cloud/ good
Elevation:	90 mAOD
Image Bearing:	290° (WNW)
Distance from Scheme:	65 m
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image
Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

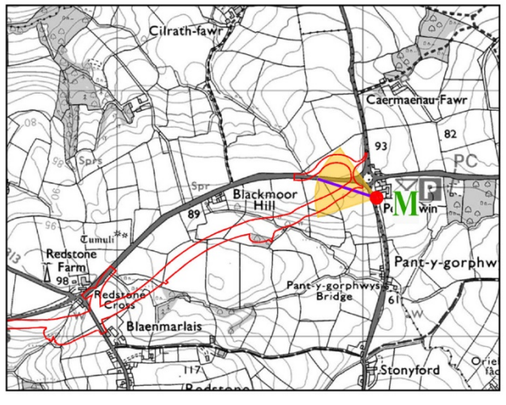
For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position
At the eastern tie-in of the Scheme with the A40 and the Llanddewi Velfrey to Penblewin Improvement Scheme. The location is at the entrance to Penblewin Farm from the A478. It is representative of the view available form Penblewin Farm dwelling and farmyard.

Component of View
The A478, Penblewin Roundabout and the field that bounds both the A40 and A478 are the main components of the view. High sided vehicles and road signs are visible using the A40 west of the roundabout, the roadside hedge screens the view of the road surface and of cars. The field's western boundary hedge-bank terminates the view westward.

Anticipated Change in View
The main line of the Scheme would cross the field and breach the western boundary in-between the two tallest trees in the photograph. A breach would introduce a view of the next field to the west, that is similarly bounded by hedges and hedge-banks. Retained field boundaries would screen the view of the Scheme further to the west. The existing A40 would be realigned to join Penblewin Roundabout as a north-western arm. Trees and hedges would be removed to enable the enlargement of the roundabout, which would open up views of more distant hedgerows and trees to the north and north-west. The main line traffic would be positioned closer to the viewpoint than is the existing situation.

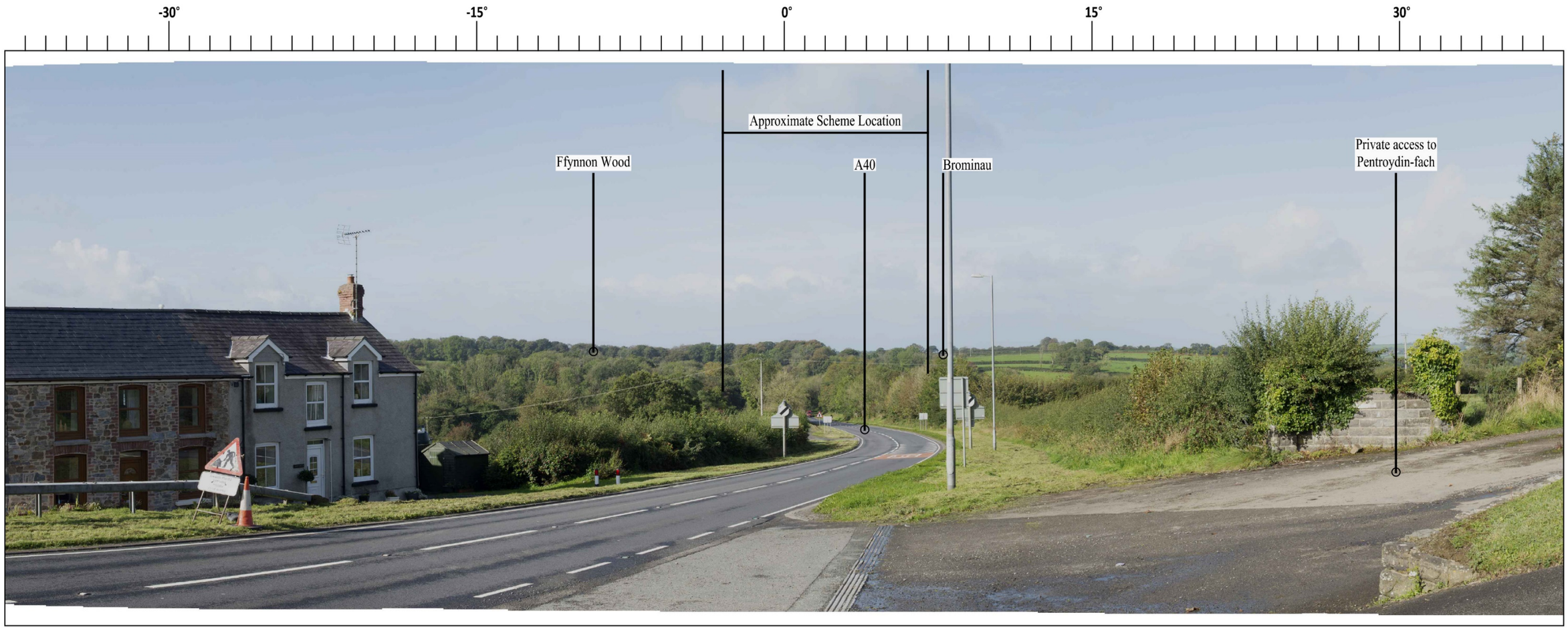
Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint N

Llanddewi Velfrey



National Grid Reference:	SN 14385 16985
Date (Time):	26th September 2019 (10:35)
Weather Conditions/ Visibility:	clear/ good
Elevation:	105 mAOD
Image Bearing:	255° (WSW to W)
Distance from Scheme:	2.4 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

In the grass verge next to the A40 and near the entrance to Maes-y-Rhos, at the western extent of Llanddewiu Velfrey. It is representative of the view experienced by road users.

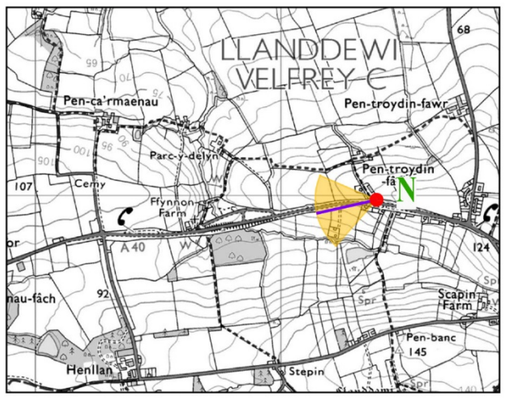
Component of View

Broadly westward view towards Penblewin. Features a gently undulating landscape with a mosaic of woodland and pastoral farmland with hedge-bank field boundaries. Settlement is scattered. The location is noisy and busy.

Anticipated Change in View

The ZTV predicts that there would be a view of the Scheme from where it crosses the lowland meadows on embankment to Penblewin Roundabout. The significant amount of woodland in the middle distance of the view would interrupt a view of the Scheme. This viewpoint would experience a change in view from the Llanddewi Velfrey to Penblewin improvement scheme.

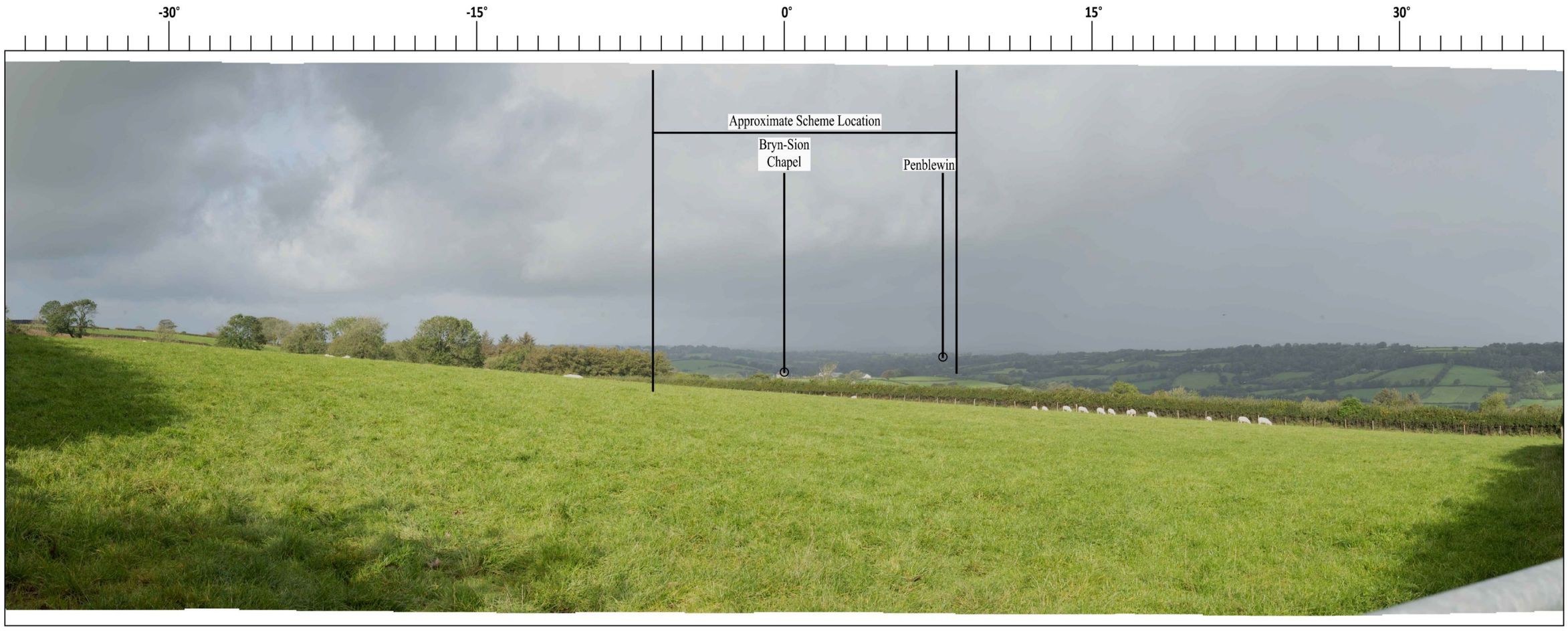
Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint O

near LampeterVelfrey



National Grid Reference:	SN 16175 1 13700
Date (Time):	26th September 2019 (09:55)
Weather Conditions/ Visibility:	thick cloud/ good
Elevation:	135 mAOD
Image Bearing:	300° (WNW to NW)
Distance from Scheme:	5.1 km
Camera and Lens:	Nikon D610 - 50 mm lens
Horizontal Field of View:	75°
Camera Height:	1.5 m
Recommended Viewing Distance:	300 mm

Existing 75° Stitched Panoramic Image

Important Viewing Instructions

This is a composite image made up of 3.75 nr 50 mm prime lens photographs, joined together horizontally to form an overall field of view which is wider than that seen in detail by the human eye.

For correct perspective viewing, this image must be viewed at an exact distance of 300 mm with one eye whilst curving the image in an exact arc of 90°. This image should only be assessed in the real landscape from the same viewpoint.

Viewing Position

At a field access gate near to the entrance to Gilfach Farm. The unclassified road descends the north facing slope of the Templeton ridge linking Gilfach Cross to Lampeter Velfrey. It is representative of the view available to countryside workers and users of minor roads.

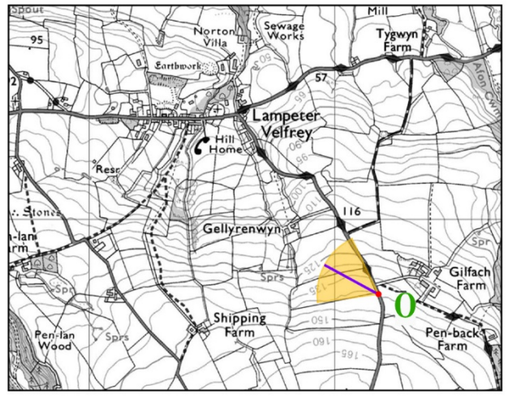
Component of View

In the foreground is the pastoral farmland that makes up the landscape between the Templeton ridge and the Lampeter Velfrey vale. Bryn-Sion Chapel and a cluster of properties occupy a high point of a broad and low-lying ridge that runs westward from Lampeter Velfrey village. Beyond Bryn-Sion is the higher ground at Narberth Station, through to Llanddewi Velfrey, the cover of which is a mosaic of woodland and pastoral farmland. Penblewin Farm is just visible, as is a road sign on the A40 west of Penblewin Roundabout.

Anticipated Change in View

A distant view of the Scheme where it crosses fields west of Penblewin Farm on an embankment would be available. Trees within the Scheme footprint would be removed to enable construction. Traffic would also be visible.

Location Plan (1:25,000)



Red dot - Viewpoint
Purple line - Image bearing
Orange - Panoramic image field of view (75°)
Red line - Scheme footprint

Viewpoint Locations (Scale 1:25,000)

Red dot - Viewpoint
Purple line - Image bearing
Red line - Scheme footprint

A
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O

Inset - Cairn at Foel Eryr summit

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 9.4 Visual Effects Schedule (Properties)

A40PRC-RML-ELS-SWI-RP-L-0904

P03 S4

01/06/2020

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
8EY .1	SN 0924 1648	SA67 8EY	Llawhaden	Middle Hook Farm	A40	detached, 2 storey	1,180	Dwelling has south-west/north-east aspect. The east-south-eastward view towards the Scheme is interrupted by farm buildings. From outdoor spaces views towards the Scheme are interrupted by blocks of woodland and plantation.	High	Medium	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EJ .1	SN 0930 1555	SA67 8EJ	Llawhaden	Cox Lake Farm	B4314	detached, 2 storey	1,150	Dwelling with mainly southward aspect overlooking B4314 towards roadside hedge-bank, view from first floor rooms overlooks hedgerow towards Narberth Brook valley, Templeton Ridge and Canaston Wood. Northward view interrupted by farm buildings.	High	Medium	Medium	Construction View of works interrupted by farm buildings. Operation Winter Year 1 View of Scheme and traffic interrupted by farm buildings and woodland. Operation Summer Year 15 View of Scheme and traffic interrupted by farm buildings and woodland.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EJ .2	SN 0935 1551	SA67 8EJ	Llawhaden	The Bridge Inn	B4314	complex, 1 storey	1,125	Business located at low point of B4314 where it crosses a stream valley that is a tributary of Narberth Brook and Eastern Cleddau. Northward and westward aspect with view of minor road, traditional stone bridge and woodland in stream valley and along road side.	Medium	Medium	Medium	Construction View of works interrupted by valley woodland. Operation Winter Year 1 View of Scheme and traffic interrupted by valley woodland. Operation Summer Year 15 View of Scheme and traffic interrupted by valley woodland.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EY .2	SN 0939 1586	SA67 8EY	Llawhaden	Cotts Farm Equine Hospital	A40	complex, 1 and 2 storey	965	Business located next to A40 near to summit of small hill that offers views of the rolling Pembrokeshire countryside in all directions.	Low	High	Medium	Construction Indirect view/view from outdoor spaces of works at western end of Scheme, between Sodston Lodge and Redstone Road. View partially interrupted by hedgerows to southern side of A40. Operation Winter Year 1 View of Scheme and traffic filtered by field boundary hedgerows. Operation Summer Year 15 View of Scheme and traffic interrupted by field boundary hedgerows in full leaf.	Minor Minor No Change	Short Term Medium Term Long Term	Middle Distance	Negligible Adverse Minor Adverse No Change	Neutral	Neutral	Neutral
8HD .1	SN 0950 1666	SA67 8HD	Narberth Rural	Tobinai Cottage	B4313	detached, 2 storey	1,040	Dwelling with northward aspect overlooking B4313 towards fields and wooded valley to east of Pont Shan. Indirect view/view from outdoor spaces towards Redstone Cross of pastoral fields with hedge-banks and mature tree boundaries.	High	Medium	Medium	Construction View of works interrupted by landform and significant vegetation. Operation Winter Year 1 View of Scheme and traffic interrupted by landform and significant vegetation. Operation Summer Year 15 View of Scheme and traffic interrupted by landform and significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EY .3	SN 0965 1596	SA67 8EY	Llawhaden	Cotts Equine	A40	detached, 1.5 storey	695	Dwelling/business with east-west aspect. View eastward is of the rolling landscape towards Great Vaynor framed by plantations. A view westward of rolling landform towards Canaston Wood is only available form loft spaces.	Medium	High	Medium	Construction View of works interrupted by substantial vegetation. Operation Winter Year 1 View of Scheme and traffic interrupted by substantial vegetation. Operation Summer Year 15 View of Scheme and traffic interrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EH .1	SN 0966 1514	SA67 8EH	Narberth Rural	View Point and Crud-yr-Awel	Cox Hill	semi-detached, 1.5 and 2 storey	985	Dwellings with north-eastward aspect with view of roadside hedge-bank and B4314. Views from first floor rooms overlook hedge-bank of undulating valley between Cox Hill and Redstone Bank	High	Medium	Medium	Construction View of works only available from first floor rooms interrupted by vegetation on Redstone Bank ridge. Operation Winter Year 1 View of Scheme and traffic from first floor rooms interrupted by vegetation on Redstone Bank ridge. Operation Summer Year 15 View of Scheme and traffic from first floor rooms interrupted by vegetation on Redstone Bank ridge.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EH .2	SN 0969 1514	SA67 8EH	Narberth Rural	Lower Coxhill Farm	Cox Hill	detached, 2 storey	1,115	Farm dwelling with north-east/south-west aspect. On western edge of Cox Hill with predominant view towards Narberth Brook valley and Canaston Wood. North-eastward the view is framed and interrupted by farm buildings and vegetation next to the B4314.	High	High	High	Construction View of works interrupted by buildings and significant vegetation. Operation Winter Year 1 View of Scheme and traffic interrupted by buildings and significant vegetation. Operation Summer Year 15 View of Scheme and traffic interrupted by buildings and significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
8EH .3	SN 0983 1525	SA67 8EH	Narberth Rural	Crunn's Farm	Cox Hill	detached, 2 storey	950	Dwelling with northward/southward aspect. Wide and long-distant view of Pembrokeshire landscape available to north including Preseli Hills. A view of the existing A40 is available but partially interrupted by vegetation.	High	High	High	Construction Indirect view/view from outdoor spaces of works between Sodston Lodge and Redstone Road available, but partially interrupted by vegetation and Redstone Bank ridge. Operation Winter Year 1 Indirect view/view from outdoor spaces of traffic where road travels in cutting between Sodston lodge and the junction with Redstone Road, partially interrupted by vegetation and landform. Operation Summer Year 15 Indirect view/view from outdoor spaces of high sided traffic where road is in cutting between Sodston Lodge and junction with Redstone Road, partially interrupted by landform and vegetation.	Negligible Negligible No Change	Short Term Medium Term Long Term	Middle Distance	No Change Negligible Adverse No Change	Neutral	Slight Negative	Neutral
8EH .4	SN 0986 1516	SA67 8EH	Narberth Rural	Hill Rise and Hillside	Cox Hill	detached, 1 and 2 storey	1,005	Hill Rise is single storey and has westward aspect. Views northward and eastward are limited by B4314 roadside hedge-banks. Hillside has predominantly northward aspect. The view form the ground floor and outdoor spaces is limited by B4314 roadside hedge-bank. From first floor rooms a view overlooking the roadside hedge-bank is available of Redstone Bank and the rolling landscape beyond.	High	Medium	Medium	Construction The view of works from first floor rooms would be interrupted by vegetation within the dwelling's garden and on Redstone Bank. Operation Winter Year 1 The view of the Scheme and traffic from first floor rooms would be interrupted by vegetation. Operation Summer Year 15 The view of the Scheme and traffic from first floor rooms would be interrupted by vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EH .5	SN 0995 1510	SA67 8EH	Narberth Rural	Woodfield	Cox Hill	complex, 1 and 2 storey	1,020	Nursing Home on western side of Cox Hill. The view from west to north is limited by ornamental/evergreen hedges and mature trees. The southward aspect is more open and features a view of the Narberth Brook valley and Templeton/Canaston.	Medium	High	Medium	Construction View of works interrupted by vegetation within property grounds. Operation Winter Year 1 View of Scheme and traffic interrupted by vegetation. Operation Summer Year 15 View of Scheme and traffic interrupted by vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EY .4	SN 0996 1516	SA67 8EY	Narberth Rural	Flimston Farm	Flimstone Lane	detached, 2 storey	705	Farm dwelling with north/south aspect located in valley between Cox Hill and Redstone Bank. Views out limited by areas of woodland and hedgerows with mature trees.	High	Medium	Medium	Construction View of works interrupted by Redstone Bank ridge. Operation Winter Year 1 View of Scheme and traffic interrupted by Redstone Bank ridge. Operation Summer Year 15 View of Scheme and traffic interrupted by Redstone Bank-ridge.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EH .6	SN 1005 1508	SA67 8EH	Narberth Rural	High Meadows	Cox Hill	detached, 2 storey	1,005	Dwelling located to west of Cox Hill summit with east/west aspect. Views to north limited by B4314 roadside hedge-bank, more open aspect southward towards Narberth Brook valley and Templeton Ridge.	High	Medium	Medium	Construction View of works interrupted by roadside hedge-bank. Operation Winter Year 1 View of Scheme and traffic interrupted by roadside hedge-bank. Operation Summer Year 15 View of Scheme and traffic interrupted by B4314 roadside hedge-bank.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	no Change No Change No Change	Neutral	Neutral	Neutral
8HB .1	SN 1022 1508	SA67 8HB	Narberth Rural	Sodston Manor and Coach House	B4313	detached, 2 storey	520	Independent School and associated dwelling with north-south aspect. Outward views limited by hedgerows and mature trees.	Medium	Medium	Medium	Construction View of works interrupted by landform (Sodston Ridge), buildings and vegetation. Operation Winter Year 1 No view of Scheme and traffic predicted. Operation Summer Year 15 No view of Scheme and traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EH .7	SN 1023 1496	SA67 8EH	Narberth Rural	Crosswood, Crosswood Cottage and Stone Crest	Cox Hill	detached, 1 and 1.5 storey	1,075	Dwellings located near to summit of Cox Hill. Predominant view is westward towards Daugleddau and features Narberth Brook valley and Canaston Wood. Northward view is limited by evergreen hedges and buildings.	High	High	High	Construction View of works interrupted by vegetation. Operation Winter Year 1 View of Scheme and traffic interrupted by vegetation. Operation Summer Year 15 View of Scheme and traffic interrupted by vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8HB .2	SN 1023 1645	SA67 8HB	Narberth Rural	Ty Rhosyn, Ivy Court Cottage and Bryn Coed	B4313	detached, 1 and 2 storey	415	Dwellings with southward aspect and view of B4313 overlooking private gardens. View beyond B4313 is limited by roadside hedge-bank and hedgerow.	High	Medium	Medium	Construction View of works interrupted by landform (Sodston Ridge), buildings at Sodston House and significant vegetation. Operation Winter Year 1 View of Scheme and traffic interrupted by landform, buildings and substantial vegetation. Operation Summer Year 15 View of Scheme and traffic interrupted by landform, buildings and substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
8HB .3	SN 1030 1633	SA67 8HB	Narberth Rural	Sodston House	A40	complex, 2 storey	265	Dwellings with north-south aspect and located within gardens featuring many trees and areas of woodland. Views outward limited by trees.	High	Medium	Medium	Construction View of works interrupted by substantial vegetation. Operation Winter Year 1 View of Scheme and traffic interrupted by substantial vegetation. Operation Summer Year 15 View of Scheme and traffic interrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8HA .1	SN 1032 1592	SA67 8HA	Narberth Rural	Jacobs Park	A40	detached, 2 storey	130	Dwelling with north-south aspect. Views outward limited by field boundary hedgerows. From outdoor spaces a westward view of the valley between Redstone Bank and Sodston Ridge is available.	High	Medium	Medium	Construction Preparatory works - removal of roadside hedges and trees between Sodston Lodge and Redstone Road would be noticeable from outdoor spaces. Earthworks - excavation of cutting at Sodston Lodge and construction of embankment at junction with Redstone Road would be visible, as would work associated with the proposed attenuation pond and drain connecting to watercourse. Road pavement - a view of works activities where the road would be in cutting at Sodston Lodge and on embankment at junction with Redstone Road. Operation Winter Year 1 The road and traffic would be slightly closer to the dwelling than is the existing situation. A view of the Scheme and traffic and attenuation basin would be filtered by hedgerows. Operation Summer Year 15 Roadside hedgerow and woodland planting to integrate attenuation basin with surroundings would screen views of cars. A glimpse of passing high sided vehicles would be available.	Moderate Minor No Change	Short Term Medium Term Long Term	Short Distance	Moderate Adverse Moderate Adverse No Change	Moderate Negative	Moderate Negative	Neutral
8HB .4	SN 1033 1607	SA67 8HB	Narberth Rural	Sodston Lodge	A40	detached, 1 storey	25	Dwelling is surrounded by hedgerows and trees. A view southwards towards the A40 and Jacobs Park and Redstone Bank beyond is available from outdoor spaces.	High	Medium	Medium	Construction Preparatory works - The removal of part of a roadside hedge would be visible from outdoor spaces. Earthworks - excavation of cutting and works associated with the proposed attenuation pond would be visible from outdoor spaces. Road pavement - vehicles associated with the pavement construction would be visible from outdoor spaces. Operation Winter Year 1 The removal of part of a hedge would open views southward towards Narberth and Redstone Bank. The view of road and traffic would be very similar to the existing situation. Operation Summer Year 15 Proposed roadside hedgerow and planting to integrate attenuation basin would interrupt the view of Redstone Bank and Narberth.	Minor Negligible No Change	Short Term Medium Term Long Term	Short Distance	Minor Adverse Minor Adverse No Change	Slight Negative	Slight Negative	Neutral
8EH .8	SN 1033 1493	SA67 8EH	Narberth Rural	West Lodge and Delfryn	Cox Hill	detached, 1.5 and 2 storey	1,110	Dwellings at summit of Cox Hill to south side of B4314. Views outward are limited by vegetation. Views of Narberth Brook valley and Canaston Wood available to south-west. Views northward interrupted by buildings.	High	High	High	Construction A view of works would be interrupted by buildings. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by buildings. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by buildings.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EH .9	SN 1035 1496	SA67 8EH	Narberth Rural	Upper Coxhill Farm (including 1 and 3)	Cox Hill	terraced, 2 storey	1,080	Roadside dwellings with predominantly southward aspect and direct and uninterrupted view of B4314, further views southward limited by tall roadside/property boundary hedge.	High	Low	Medium	Construction A view of works would be interrupted by farm buildings to the north of the property. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by buildings. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by buildings.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8EH .10	SN 1040 1496	SA67 8EH	Narberth Urban	Hill Crest, Hen Faes and The Grange	Cox Hill	detached, 1 storey	1,080	Dwellings with north-south aspect and at a higher level than the B4314. Southward view of neighbouring buildings overlooking road and gardens. Northward views from summit of hill limited by hedgerows to side of farm track.	High	Low	Medium	Construction Views of construction activities would be limited by vegetation and field boundary hedgerows near to the summit of Cox Hill and on Redstone Bank. Operation Winter Year 1 A view of the Scheme and traffic would be filtered by vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by vegetation.	Negligible Negligible No Change	Short Term Medium Term Long Term	Middle Distance	No Change Negligible Adverse No Change	Neutral	Neutral	Neutral

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7UN .1	SN 1050 1498	SA67 7UN	Narberth Urban	7 to 15	Highfield Park	detached, 1 storey	1,060	Dwellings with east-west aspect and views from gable ends north and south. Located at eastern side of Cox Hill crest. Northward view is partially interrupted by a field/garden boundary hedge but a broad view of the pastoral landscape between Cox Hill and Redstone Bank and gradually rising landform culminating at the Preseli Hills is available.	High	High	High	Construction A view of construction activities between the tie-in with the A40 at Sodston Lodge and the junction with Redstone Road would be interrupted by field boundary hedgerows on Redstone bank ridge. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by hedgerows on Redstone Bank ridge. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
8HB .5	SN 1052 1657	SA67 8HB	Narberth Rural	Broomley	B4313	detached, 2 storey	505	Dwelling with east-west aspect and located on north facing side of Sodston Ridge. Views of pastoral landscape and hedgerows available from outdoor spaces. Few visual detractors.	High	High	High	Construction A view of works would be interrupted by the landform of Sodston Ridge. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7EE .1	SN 1071 1513	SA67 7EE	Narberth Urban	2 to 8 (evens)	Beechwood Place	detached, 2 storey	895	Dwellings with east west aspect at western edge of Narberth. Westward view of pastoral landscape and valley between Cox Hill and Redstone Bank partially interrupted by a row of mature trees on hedge-bank.	High	High	High	Construction An indirect view/view from outdoor spaces of works would be interrupted by the landform of Redstone Bank ridge. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7EE .2	SN 1073 1505	SA67 7EE	Narberth Urban	10 to 16 (evens)	Beechwood Place	detached, 2 storey	980	Dwellings with east west aspect at western edge of Narberth. Westward view of pastoral landscape and valley between Cox Hill and Redstone Bank partially interrupted by a row of mature trees on hedge-bank. Northward view available from outdoor spaces of Beechwood Place road and neighbouring houses at beechwood Gardens.	High	High	High	Construction An indirect view/view from outdoor spaces of works would be interrupted by the landform of Redstone Bank ridge and neighbouring buildings. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform and buildings. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform and buildings.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7EF .1	SN 1074 1523	SA67 7EF	Narberth Urban	1 to 4	Landsker Lane	detached and semi-detached, 2 storey	825	Dwellings with north-south aspect at northern edge of Narberth. Outward views limited by hedgerows and mature trees. Views from first floor rooms of Redstone Bank pastoral landscape available through tree canopies.	High	Medium	Medium	Construction A view of works from first floor rooms would be interrupted by the landform of Redstone Bank. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ET .2	SN 1080 1554	SA67 7ET	Narberth Rural	Narberth Delivery Office, Unit 18	Rushacre Enterprise Park	industrial unit, 2 storey	505	Business located in prominent position on Redstone Bank and visible from the A40. Broad view of surrounding countryside available form outdoor spaces. Nearby industrial units detract from the view.	Low	Medium	Low	Construction The view of works from outdoor spaces would be interrupted by a field boundary hedge to the north of the Enterprise Park Operation Winter Year 1 The view of the Scheme and traffic from outdoor spaces would be interrupted by a boundary hedge. Operation Summer Year 15 The view of the Scheme and traffic from outdoor spaces would be interrupted by a boundary hedge.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

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7EX .1	SN 1083 1622	SA67 7EX	Narberth Rural	Redstone Farm Cottage	B4313	detached, 2 storey	145	Dwelling with north-south aspect located near to Redstone Cross junction. Southward and westward view towards the junction is partially interrupted by trees within the gardens of Redstone Farm and Redstone Farm Cottage. Eastward view is interrupted by farm buildings. Located at a summit of Sodston Ridge the dwelling benefits from northward views of the rolling pastoral landscape culminating at the Preseli Hills.	High	Medium	Medium	Construction Preparatory works - the removal of trees to accommodate the rearranged Redstone Cross junction would be partially interrupted by buildings and vegetation. A narrow field of view towards Redstone Cottages would be available. Earthworks - construction of the embankment would be partially interrupted by landform, buildings and vegetation, a glimpse of construction vehicles would be available. Structures - the view of Redstone Road overbridge would be interrupted by buildings at Redstone Farm and Redstone Cottages, and a view of culverts to carry the watercourse would be interrupted by the landform. Road pavement - a glimpse of vehicles constructing the road would Operation Winter Year 1 The main movement of traffic would be further away from the dwelling than is the current situation and at a lower elevation. Visual barriers to the south of Redstone Cottages would interrupt a view of traffic in southward views. Existing vegetation and buildings would interrupt the view of the Scheme and traffic in south-westward and south-eastward views. Operation Summer Year 15 The view of the Scheme and traffic would be interrupted by a combination of buildings, vegetation and visual barriers in the form of earth bunds and hedge-banks.	Minor Negligible Negligible	Short Term Medium Term Long Term	Short Distance	Minor Adverse Minor Benefit Minor Benefit	Slight Negative	Slight Positive	Slight Positive
7EF .2	SN 1084 1523	SA67 7EF	Narberth Urban	7 to 10	Landsker Lane	detached, 2 storey	825	Dwellings with north-south aspect at northern edge of Narberth. Outward views limited by hedgerows and mature trees. Views from first floor rooms of Redstone Road retail and industrial areas available through tree canopies.	High	Low	Medium	Construction A view of works would be interrupted by the landform of Redstone bank and industrial/retail buildings. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform and buildings. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform and buildings.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
7EX.2	SN 1085 1619	SA67 7EX	Narberth Rural	Redstone Farm	A40	semi-detached, 2 storey	110	Farm dwelling with predominantly southward aspect with direct and uninterrupted view of the A40 and Redstone Road at Redstone Cross. Views beyond the road are interrupted by buildings, trees, vegetated slopes and roadside hedge-banks but an indirect view of the valley to the west of Redstone Cottages is available.	High	Low	Medium	Construction Preparatory works - the removal of vegetation at the junction between Redstone Road and the A40 would open up views towards Blaenmarlais and Blaenffynnonau, and the removal of trees within the valley west of Redstone Cottages would be noticeable. Removal of existing road surface at A40 and Redstone Road would be visible. Earthworks - excavation of cutting beneath Redstone Road and construction of embankment to accommodate link between A40 and Redstone Road would be visible, with views of construction vehicles available. Also uninterrupted view of the construction of approach embankments to proposed overbridge. Structures - direct and uninterrupted view of the construction of Redstone Road overbridge and partial view of construction of culverts to take watercourse beneath embankment. Road pavement - direct and uninterrupted view of rearrangement to Redstone Cross junction and realignment of Redstone Road to meet detrunked A40, and partial view of proposed link road between Scheme and Redstone Road where on embankment	Major	Short Term	Short Distance	Major Adverse	Large Negative		
												Operation Winter Year 1 Main movement of traffic would be further from dwelling than is the existing situation with part of the existing Redstone Road used as a spur to serve Redstone Cottages and Redstone Forge and part of the existing A40 used as a link to the B4313 and Bethesda. New junction of Redstone Road and detrunked A40 would be indirect to view from dwelling and the view of cars using the eastward link to Penblewin would be screened by visual barriers in the form of earthwork bunds and hedge-banks. A view of high sided vehicles would remain. Visual barriers would interrupt a view of the overbridge also. The Scheme main line would be in a deep cutting and a view of high sided vehicles would be interrupted by visual barriers. The dwelling would experience a view of the junction between the link road and the Scheme through a gap to the west of Redstone Cottages. There would be a glimpse of traffic and signage also through this gap.	Negligible	Medium Term		Minor Benefit		Slight Positive	
												Operation Summer Year 15 Established vegetation on cutting slopes and to eastern side of Redstone Road would interrupt the view of Blaenmarlais and Blaenffynnonau and further strengthen the visual barrier south of Redstone Cottages. Streamside planting to west of Redstone Cottages would provide a visual barrier to the junction between the link road and the Scheme main line. The movement of the majority of traffic away from the dwelling would be a benefit to views and there would be a reduction in road surface visible from the	Negligible	Long Term		Minor Benefit			Slight Positive

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7EX.3	SN 1086 1615	SA67 7EX	Narberth Rural	1 and 2 Redstone Cottages	Redstone Road	semi-detached, 2 storey	55	Dwellings with east-west aspect and with direct and uninterrupted view of Redstone Cross junction in a northward and eastward direction. Westward view is of the valley between Sodston Ridge and Redstone Bank towards Jacob's Park and is available from rear gardens and ground floor rooms.	High	Medium	Medium	Construction Preparatory works - the removal of vegetation to the eastern side of Redstone Road would open up views of fields and make more of the existing trunk road visible, there would also be an indirect view towards Blaenffynnonau available. Westward view would see the removal of a significant amount of trees from the wooded valley to accommodate the Scheme main line and link with Redstone Road. Earthworks - the construction of the overbridge approach embankment would be prominent in the eastward view. There would be an indirect view of the excavation of the cutting beneath Redstone Road in southward views. To the west there would be a direct view of the construction of the main line embankment and link road embankment where it crosses the valley, also there would be a view of excavation works between the proposed junction and the western tie-in with the A40 and formation of a water attenuation area. Construction vehicles would be near and obvious features. Structures - there would be an indirect southward view of construction works associated with the Redstone Road overbridge, an indirect eastward view of the construction works associated with the green bridge and a direct westward view of the construction of culverts to carry the valley watercourse. Road pavement - works would be apparent at the rearranged junction and realignment of Redstone Road/detrunked A40 in the eastward view and at the main line and link between Scheme and Redstone Road to the west of the dwelling. Operation Winter Year 1 In the eastward view, the approach embankment to the overbridge would be graded to meet the edge of the retained spur of Redstone Road and a hedge-bank located near to the top of the slope would screen the view of cars and the road surface of the realigned road. The frequency of traffic passing close to the property would be much reduced, used as a local access to/from Bethesda. There would be a view of the junction between the B4313 and the detrunked A40. In the southward view the view towards the overbridge, main line and link road would be interrupted by an earthwork bund and hedge-bank but high sided vehicles using the link road would be visible. In the westward view the Scheme main line would cross the valley and form a dominant feature in the view. A hedge-bank and acoustic barrier would screen the view of the road surface and of cars as far as the junction with Redstone Road. Lighting would not be required at the proposed junction reducing the area influenced by night-time light. Operation Summer Year 15 Vegetation would be established including a hedgerow to the north of the Scheme and planting on cutting slopes and hedge-banks. This would further reduce the visibility of traffic and high sided vehicles using the main line, link road and connection to Penblewin. The road corridor would be prominent in the westward view crossing the valley.	Major Moderate Moderate	Short Term Medium Term Long Term		Major Adverse Major Adverse Major Adverse	Large Negative	Large Negative	Large Negative

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7EX.4	SN 1087 1613	SA67 7EX	Narberth Rural	Redstone Forge	Redstone Road	detached, 1 storey	40	Dwelling with east-west aspect set back slightly from B4313 Redstone Road and sheltered from the view of the A40 by Redstone Cottages. Westward view is of wooded valley and field. Onward view towards Jacob's Park limited by woodland.	High	Low	Medium	Construction Preparatory works - the removal of vegetation to the both sides of Redstone Road would open up views of fields and make more of Redstone Road visible, there would also be an indirect view towards Blaenmarlais available. Westward view would see the removal of a significant amount of trees from the wooded valley to accommodate the Scheme main line and link with Redstone Road, this would open up the westward view. Earthworks - the construction of the overbridge approach embankment would be prominent in the eastward view. There would be an indirect view of the excavation of the cutting beneath Redstone Road in southward views. To the west there would be a direct view of the construction of the main line embankment and link road embankment where it crosses the valley, also there would be a view of excavation works between the proposed junction and the western tie-in with the A40 and formation of a water attenuation area. Construction vehicles would be near and obvious features. Structures - there would be an indirect southward view of construction works associated with the Redstone Road overbridge, an indirect eastward view of the construction works associated with the green bridge and a direct westward view of the construction of culverts to carry the valley watercourse. Road pavement - works would be apparent at the rearranged junction and realignment of Redstone Road/detrunked A40 in the eastward view and at the main line and link between Scheme and Redstone Road to the west of the dwelling Operation Winter Year 1 In the eastward view, the approach embankment to the overbridge would be graded to meet the edge of the retained spur of Redstone Road and a hedge-bank located near to the top of the slope would screen the view of cars and the road surface of the realigned road. There would be a view of the junction between the B4313 and the detrunked A40. In the southward view the view towards the overbridge, the main line and link road would be interrupted by an earthwork bund and hedge-bank. In the westward view the Scheme main line would cross the valley and form a dominant feature in the view. A hedge-bank and acoustic barrier would screen the view of the road surface and of cars as far as the junction with Redstone Road. Lighting would not be required at the proposed junction reducing the area influenced by night-time light. Operation Summer Year 15 Vegetation would be established including a hedgerow to the north of the Scheme and planting on cutting slopes and hedge-banks. This would further reduce the visibility of traffic and high sided vehicles using the main line, link road and connection to Penblewin. The road corridor would be prominent in the westward view crossing the valley	Major Major Moderate	Short Term Medium Term Long Term		Major Adverse Major Adverse Major Adverse	Large Negative	Large Negative	Large Negative
7ES.1	SN 1088 1556	SA67 7ES	Narberth Rural	Gravells	Redstone Road	industrial unit, 1 storey	505	Business located in prominent position on Redstone Bank and visible from the A40 near to the Royal Mail delivery office. Views from outdoor spaces to the north limited by a landscaped bund.	Low	Medium	Low	Construction A view of works from outdoor spaces would be interrupted by a landscaped bund and hedge to the north of the industrial unit. Operation Winter Year 1 A view of the Scheme and traffic from outdoor spaces would be interrupted by a landscape bund and hedge to the north of the industrial unit. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by a landscaped bund and hedge.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ET.1	SN 1088 1556	SA67 7ET	Narberth Rural	Units 1 to 12	Rushacre Enterprise Park	complex, 1 storey	605	Business/Retail units located to south of Redstone Ridge. Outward views limited by buildings and hedgerows.	Low	Low	Low	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

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7ES .2	SN 1096 1522	SA67 7ES	Narberth Urban	Swallow Tree, Landsker House, Llys-y-fran, Southacre, Bumblebee House and Ty Melyn	Redstone Road	detached, 1 storey	835	Cluster of dwellings accessible from B4313 Redstone Road. Outward views limited by neighbouring buildings, hedgerows with mature trees and industrial/retail units at Rushacre.	High	Low	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .3	SN 1097 1549	SA67 7ES	Narberth Rural	DP Building Supplies and Tallis Amos Group	Redstone Road	industrial units, 1-2 storey	570	Business/Retail units located near to the summit of Redstone Ridge. Views from outdoor spaces limited by neighbouring buildings, roadside hedge-banks, areas of ornamental planting and hedgerows with mature trees.	Low	Low	Low	Construction View from outdoor spaces of works interrupted by a combination of security fences, ornamental hedge and field boundary hedgerow with mature trees. Operation Winter Year 1 View of Scheme and traffic interrupted by built elements and vegetation. Operation Summer Year 15 View of Scheme and traffic limited by built elements and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .4	SN 1098 1553	SA67 7ES	Narberth Rural	Maes Yr Awel	Redstone Road	detached, 2-storey	555	Dwelling with east-west aspect located within business park with access road to Gravells to northern side. Outward views are limited by ornamental hedges and built elements.	High	Low	Medium	Construction View from outdoor spaces of works interrupted by evergreen and native species hedges with mature trees. Operation Winter Year 1 View of Scheme and traffic interrupted by evergreen and deciduous hedges with mature trees. Operation Summer Year 15 View of Scheme and traffic interrupted by evergreen and deciduous hedges with mature trees.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .5	SN 1098 1533	SA67 7ES	Narberth Rural	Hampton Court, Rushacre House, Chestnut House, Miskin House and Rushacre Villa	Redstone Road	detached, 1 and 2 storey	745	Cluster of dwellings at northern outskirts of Narberth. Outward views are limited by enterprise park to the north, housing estates to the south and a mixture of retail and housing to the east. The westward view offers a glimpse of the surrounding countryside.	High	Low	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

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7ES.6	SN 1098 1602	SA67 7ES	Narberth Rural	Blaenmarlais Care Home	Redstone Road	detached, 2 storey	80	Residential care home located next to the B4313 Redstone Road. Direct view of road from outdoor spaces. Outward views limited by roadside hedge-bank to west, by garden wall to north and east, and by neighbouring buildings to south. A view of Redstone Cross junction is available form outdoor spaces along Redstone Road. Views from first floor rooms overlook roadside hedge-bank and garden wall.	Medium	Low	Low	Construction Preparatory works - roadside hedge-banks from the care home to Redstone Cottages would be removed, there would be a gap where a view beyond Redstone Road to the west and north-west would enable a view of the wooded valley, trees of which would be removed to accommodate the link road and junction between the A40 and Redstone Road which would open up views of the A40 at Sodston Lodge. From first floor rooms there would be views eastward of the removal of trees and hedgerows where the Scheme would cross the lowland meadows. Earthworks - from ground floor and outdoor spaces there would be a view of excavation of cutting beneath Redstone Road and construction of embankment to carry link between Redstone road and Scheme, embankment where main line crosses the valley and approach embankment to the overbridge, the garden wall to the property's northern and eastern boundary would screen the view of works to the east of Redstone Road. From first floor rooms there would be a view overlooking the garden boundary wall including the construction of the embankment through the lowland meadow. It is predicted that the garden wall would screen the view of the majority of the cutting to the north from first floor rooms. Structures - there would be a view of the construction of part of the Redstone Road overbridge and the culverts to carry the valley watercourse from outdoor spaces. From first floor rooms the garden wall would be of sufficient height to screen the view of the remainder of the bridge but a view of construction of the wildlife crossing would be available. Construction vehicles would be noticeable. Road pavement - there would be a view of the construction of the link road and main line where it crosses the valley on embankment and also the realignment of Redstone Road. Operation Winter Year 1 From ground floor rooms and outdoor spaces there would be a view of the junction between the link road and Redstone Road. A hedge-bank would screen the view of part of the link road surface. An earthwork bund and acoustic barrier would interrupt the view of the main line but there would be a gap where a view of the junction between the link road and the Scheme would be available. The gap would also enable a view of the main line to the west of the junction where traffic would be visible. From first floor rooms the link road and traffic would be visible in the westward view, the realigned Redstone Road and junction with detrunked A40 in the northward view and the main line and traffic where the Scheme crosses the lowland meadows on embankment in the eastward view. Lighting would not be required at the junction between Scheme and Redstone Road reducing the area of night time influence. Operation Summer Year 15 Vegetation established on hedge-bank, on cutting and embankment slopes and hedgerows at roadside would contribute to a visual barrier screening the road surface and cars from ground floor rooms and outdoor spaces. The junction between the link road and Redstone Road would be clearly visible being located almost opposite to the entrance to the care home. Vehicles would be visible on the Scheme main line through a gap between a hedge bank and acoustic barrier at the junctions of Redstone Road with the link road and of the Scheme main line and link road. From first floor rooms a greater amount of road surface and traffic would be visible.	Major Moderate Minor	Short Term Medium Term Long Term	Short Distance	Major Adverse Major Adverse Moderate Adverse	Moderate Negative	Moderate Negative	Slight Negative
7ES.7	SN 1098 1537	SA67 7ES	Narberth Rural	Rushacre Farm, Chalkwell Lodge, Rushacre Court, Rushacre Cottage and Bryncoed	Redstone Road	detached and semi-detached, 1 and 2 storey	715	Cluster of dwellings at northern outskirts of Narberth. Outward views are limited by neighbouring buildings and enterprise park to the north, housing estates to the south and a mixture of retail and housing to the east. The westward view offers a glimpse of the surrounding countryside.	High	Medium	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
7ES .8	SN 1099 1591	SA67 7ES	Narberth Rural	West Winds, Millfields, Strathmore and Oaklands	Redstone Road	detached, 1 and 2 storey	160	Dwellings with east-west aspect set back from Redstone Road. Eastward view overlooks Redstone Road towards neighbouring houses. Westward view is of pastoral farmland limited by boundary hedgerows with mature trees. Visible from A40 to the east of Sodston Lodge	High	Medium	Medium	Construction A view of works activities would be available to first floor rooms through gaps in-between buildings and tree canopies. Operation Winter Year 1 A view of cars and high sided vehicles would be available from first floor rooms only as is the existing situation. Operation Summer Year 15 Established roadside planting would interrupt the view of traffic.	Minor Negligible No Change	Short Term Medium Term Long Term	Short Distance	Minor Adverse Minor Adverse No Change	Slight Negative	Slight Negative	Neutral
7ES .9	SN 1100 1542	SA67 7ES	Narberth Rural	Rushacre Garage	Redstone Road	industrial unit, 1 storey	645	Business units set within Rushacre Enterprise Park. Outward views interrupted by buildings and roadside hedge-bank.	Low	Low	Low	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .10	SN 1101 1597	SA67 7ES	Narberth Rural	Blaenmarlais Cottage	Redstone Road	detached, 2 storey	145	Dwelling with north-south aspect located within grounds associated with care home. Southward view of neighbouring houses and gardens. To the north the view is of the care home and grounds/garden.	High	Medium	Medium	Construction A view of works would be interrupted by buildings and trees within the grounds of the care home and roadside hedge-banks. A glimpse of works activities would be available through gaps in-between trees and buildings. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by neighbouring buildings and trees within the grounds of the care home. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by neighbouring buildings and trees within the grounds of the care home.	Negligible No Change No Change	Short Term Medium Term Long Term	Short Distance	Negligible Adverse No Change No Change	Neutral	Neutral	Neutral
7ES .11	SN 1102 1583	SA67 7ES	Narberth Rural	Bryn Marlais, Tegfan and The Green	Redstone Road	detached, 1 and 2 storey	250	Dwellings with east-west aspect set back from Redstone Road. Eastward view overlooks Redstone Road towards neighbouring houses. Westward view is of pastoral farmland limited by boundary hedgerows with mature trees.	High	Medium	Medium	Construction A view of works would be interrupted by neighbouring buildings and significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by neighbouring buildings and significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by neighbouring buildings and significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .12	SN 1102 1593	SA67 7ES	Narberth Rural	Gill Glen and Ty Gwanwyn	Redstone Road	detached, 1 storey	160	Dwellings with east-west aspect set back from Redstone Road. Westward view overlooks Redstone Road towards neighbouring houses. Eastward view is towards pastoral farmland but is limited by property boundary fences and hedges with mature trees. Long distance views of Preseli hills are available from outdoor spaces but boundary features interrupt the view of the fore and middle ground.	High	Medium	Medium	Construction A view of works would be interrupted by built elements, ornamental/evergreen hedges and mature trees. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by built elements and vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by build elements and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .13	SN 1103 1599	SA67 7ES	Narberth Rural	1 to 4 Blaenmarlais Mews	Redstone Road	terraced, 2 storey	120	Dwellings located within grounds of care home with an east-west aspect. The westward view is of the care home grounds with garden planting and neighbouring buildings limiting the view of Redstone Road available. The eastward view overlooks pastoral farmland and is partially interrupted by trees.	High	High	High	Construction Preparatory works - there would be an indirect view of the removal of trees in an area of woodland to the north-east of the dwelling. Earthworks - With part of the woodland removed, a view of the construction of part of the embankment through the lowland meadows would be enabled. Structures - Blaenmarlais Care Home building would interrupt the view of the construction of Redstone Road overbridge but there would be a view of the wildlife crossing construction. Road pavement - A view of a section of road construction would be visible through a gap between a hedgerow and area of woodland. Operation Winter Year 1 Blaenmarlais Care Home building would interrupted the view of works to the west of Redstone Road. An earthwork bund and would partially interrupt the view of the Scheme and traffic where the road enters the lowland meadows on an embankment. Operation Summer Year 15 With woodland planting established on the earthwork bund and the woodland coppice re-growth the gap in vegetation would be restored to resemble the existing situation.	Minor Negligible No Change	Short Term Medium Term Long Term	Short Distance	Minor Adverse Minor Adverse No Change	Moderate Negative	Moderate Negative	Neutral
7EU .1	SN 1104 1524	SA67 7EU	Narberth Urban	1 to 9 (odds)	Redstone Court	terraced and detached, 2 storey	840	Dwellings located at northern outskirts of Narberth with east-west aspect. Views outward limited by neighbouring buildings, business park and a row of mature trees.	High	Low	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

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7ES .14	SN 1104 1539	SA67 7ES	Narberth Rural	Honeypot House	Redstone Road	detached, 2 storey	705	Dwelling with east-west aspect set back from Redstone Road. Outward views limited by roadside hedge-bank, boundary fences, mature trees and neighbouring buildings. More open aspect to north with a view of Green Meadows Farm fields bounded by tall hedgerows with mature trees. Overhead power lines detract from the view.	High	Medium	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .15	SN 1105 1532	SA67 7ES	Narberth Rural	Arberth Vet Services	Redstone Road	detached, 1 storey	775	Business set back from Redstone Road. Outward views limited by ornamental/evergreen and mixed hedges.	Low	Low	Low	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .16	SN 1105 1587	SA67 7ES	Narberth Rural	Ashfield and Redstone House	Redstone Road	detached, 2 storey	235	Dwellings with east-west aspect set back from Redstone Road. Located in prominent position on Redstone Bank and visible from A40 to the east of Sodston Lodge. Views from ground floor and outdoor spaces limited by neighbouring buildings and mixed ornamental/native hedges and solid fences. Long distance westward view overlooking neighbouring single storey dwelling available form first floor rooms of ridge and valley landscape Sodston Ridge, Redstone Bank and Cox Hill . Eastward view from first floor rooms limited by boundaries of mature trees around Blaenffynnonau.	High	Medium	Medium	Construction Indirect view of the removal of trees where the link road and main line would cross a small wooded valley, but partially interrupted by buildings and hedgerows with mature trees. Prominent location overlooks valley woodland which would enable a view of excavation works between Sodston Lodge and the junction between the main line and the link road. Operation Winter Year 1 A view of the Scheme and traffic between Sodston Lodge and Redstone Road would be available from first floor rooms in the westward view. Operation Summer Year 15 Roadside vegetation would have become established and would restore the view to one that is similar to the existing situation where a glimpse of traffic is available from first floor rooms.	Minor Negligible No Change	Short Term Medium Term Long Term	Short Distance	Minor Adverse Minor Adverse No Change	Slight Negative	Slight Negative	Neutral
7ES .17	SN 1106 1561	SA67 7ES	Narberth Rural	Sunlight House and Moonlight House	Redstone Road	detached, 2 storey	495	Dwellings slightly set back from Redstone Road with east-west aspect. Views from ground floor limited by hedge-banks, hedgerow and neighbouring buildings, notably Redstone Mill and Noble Court. From first floor rooms a westward view overlooking Redstone Road and roadside hedge-bank of pastoral farmland of Redstone Bank.	High	Medium	Medium	Construction A view of works from first floor rooms would be interrupted by several rows of hedgerows between Redstone Bank and the Scheme. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be uninterrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .18	SN 1106 1581	SA67 7ES	Narberth Rural	1 and 2 Redstone Villas	Redstone Road	semi-detached, 2 storey	300	Dwellings located at side of Redstone Road with east-west aspect. Westward view limited by neighbouring buildings and eastward view limited by vegetation. Where there are gaps between buildings and vegetation long distance views are available to the west and a view of nearby pastoral farmland to the south and east.	High	Medium	Medium	Construction A view of works would be interrupted by a combination of buildings and vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by buildings and vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by buildings and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .19	SN 1106 1552	SA67 7ES	Narberth Rural	Mill House, Green Meadows and Green Meadows Farm	Redstone Road	detached and semi-detached, 1 and 2 storey	550	Dwellings slightly set back from Redstone Road with east-west aspect. Views from ground floor limited by hedge-banks, hedgerow and neighbouring buildings, notably Redstone Mill to the north and industrial/retail units off Redstone Road to the east. Predominant view is west to south westward of pastoral landscape and rising ground to Lampeter Velfrey and Templeton Ridge but overhead power lines are a visual detractor.	High	Medium	Medium	Construction A view of works would be interrupted by a combination of buildings and vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by buildings and vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by buildings and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .20	SN 1107 1569	SA67 7ES	Narberth Rural	Poplars Court	Redstone Road	detached, 2 storey	585	Dwelling set back from Redstone Road, the views to north, east and south are limited by hedges, woodland and buildings. A view westward of the ridge and valleys between Redstone bank and Cox Hill overlooking Redstone Road and roadside hedge-bank is available from first floor rooms.	High	Medium	Medium	Construction A view of works from first floor rooms would be interrupted by several rows of hedgerows between Redstone Bank and the Scheme. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be uninterrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7EU .2	SN 1108 1523	SA67 7EU	Narberth Urban	11 to 21 (odds)	Redstone Court	detached and semi-detached, 2 storey	735	Cluster of dwellings with east-west or north-south aspects. Outward views limited by neighbouring buildings, notably West Wales Business Park to the north.	High	Low	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

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7ES .21	SN 1108 1536	SA67 7ES	Narberth Rural	Kadinsky Art & Framing and Grove Garage	Redstone Road	industrial units, 1 storey	845	Retail units set back from Redstone Road. Outward views limited by neighbouring buildings and hedgerows formed of mature trees.	Low	Low	Low	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7EY .4	SN 1109 1692	SA67 7EY	Narberth Rural	Cilrath Fach Farm	A40	detached, 2 storey	155	Farm dwelling with north-south aspect located on north facing slopes of Sodston Ridge with few if any visual detractors of the rolling Pembrokeshire landscape culminating at the Preseli Hills. The southward view towards the A40 is limited by the rising landform.	High	High	High	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .22	SN 1110 1529	SA67 7ES	Narberth Rural	Units 1 to 10 West Wales Business Park	Redstone Road	industrial complex, 1 storey	785	Businesses set back form Redstone Road at the northern outskirts of Narberth. Views outward limited by neighbouring buildings and significant vegetation.	Low	Low	Low	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .23	SN 1111 1559	SA67 7ES	Narberth Rural	Redstone Mill	Redstone Road	industrial complex, 1 storey	515	Business set back form Redstone Road near to a holiday park. Views outward limited by vegetation. Open aspect to south-east of pastoral farmland with views available form outdoor spaces of rolling landscape towards Lampeter Velfrey and Templeton Ridge.	Low	Medium	Low	Construction A view of works would be interrupted by a combination of buildings and vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by buildings and vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by buildings and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7EU .3	SN 1114 1522	SA67 7EU	Narberth Urban	23 to 39 (odds)	Redstone Court	detached and semi-detached, 2 storey	880	Dwellings located at the northern outskirts of Narberth with a broadly north-south aspect. Views of surrounding countryside to east available from outdoor spaces where not limited by neighbouring buildings. West Wales Business Park a visual detractor of northward views.	High	Medium	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .24	SN 1115 1592	SA67 7ES	Narberth Rural	Blaenffynnonau House	Redstone Road	detached, 2 storey	240	Dwelling with northward and westward aspect. Views of surroundings limited by planting in gardens and hedgerow boundaries to the south and north. Few visual detractors.	High	Medium	Medium	Construction The view northward is limited by trees alongside the bridleway connecting Blaenmarlais to Stonyford and hedgerow boundaries to the fields to the north. Where there are gaps in the canopy there would be a view of the removal of trees that overlap the Scheme footprint. The view of construction works would be filtered by vegetation. Operation Winter Year 1 The view of the Scheme and traffic would be filtered by vegetation. Operation Summer Year 15 With planting established to the south side of the Scheme, the view would be restored to one resembling the existing situation.	Negligible Negligible No Change	Short Term Medium Term Long Term	Short Distance	Negligible Adverse Minor Adverse No Change	Neutral	Slight Negative	Neutral
7DQ .1	SN 1123 1519	SA67 7ES	Narberth Urban	32 and 34	Springfield Park	detached, 1 storey	940	Dwellings located at located at high point of Springfield Road that benefit from views overlooking neighbours of Narberth, playing fields, open countryside including long distant views to the east.	High	High	High	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .25	SN 1128 1570	SA67 7ES	Narberth Rural	Courtlands	Redstone Road	detached, 2 storey	500	Dwelling with north-south aspect located to the southern side of a high point on Redstone Bank. Views northward limited by rising landform and vegetation and views southward of Noble Court holiday park.	High	Medium	Medium	Construction A view of works would be interrupted by the landform. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7ES .26	SN 1133 1557	SA67 7ES	Narberth Rural	Noble Court Holiday Park	Redstone Road	caravan, static and touring	505	Caravan park and leisure facilities with capacity for about 60 static caravans and about 75 serviced touring caravans with glamping pods and camping areas. Views outward are limited by hedgerows, rows of mature trees and woodland.	High	Medium	Medium	Construction Views northward would be interrupted by substantial vegetation and the rising landform of Redstone Bank. Operation Winter Year 1 Views northward would be interrupted by substantial vegetation and the rising landform of Redstone Bank. Operation Summer Year 15 Views northward would be interrupted by substantial vegetation and the rising landform of Redstone Bank.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral

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7ES .27	SN 1137 1591	SA67 7ES	Narberth Rural	Blaenffynnonau Farm	Redstone Road	detached, 1 storey	370	Dwelling with east-west aspect located on north facing slopes of Redstone Ridge. Views of surroundings limited by hedgerow boundaries to the north and west. Indirect northward view/view from outdoor spaces is filtered by vegetation but overlooks a pastoral/woodland mosaic with parkland character with few visual detractors. There is a view of Penblewin available to the eastern side of the dwelling.	High	High	High	Construction The view northward is limited by trees alongside the bridleway connecting Blaenmarlais to Stonyford and hedgerow boundaries to the fields to the north. Where there are gaps in the canopy there would be a view of the removal of trees that overlap the Scheme footprint. The view of construction works would be filtered by vegetation. Towards Penblewin there would be an intermediate distance view of activities. Operation Winter Year 1 The northward view of the Scheme and traffic would be filtered by vegetation. To the north-east there would be a glimpse of traffic at Penblewin Operation Summer Year 15 With planting established to the south side of the Scheme, the view would be restored to one resembling the existing situation. There would be a glimpse of traffic at Penblewin, as is the existing situation.	Negligible Negligible No Change	Short Term Medium Term Long Term	Short Distance	Negligible Adverse Minor Adverse No Change	Neutral	Slight Negative	Neutral
7EY .1	SN 1139 1697	SA67 7EY	Narberth Rural	Cilrath Fawr Cottage	A40	detached, 1 storey	530	Dwelling with eastward aspect. View of existing A40 interrupted by landform.	High	Medium	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7EY .2	SN 1141 1658	SA67 7EY	Narberth Rural	1 and 2 Blackmoor Hill	A40	semi-detached, 2 storey	155	Northward aspect directly overlooking the existing A40 (T), a roadside hedge-bank on top of a road cutting slope limits the view beyond. Southward view limited by trees and building within the farm yard and trees occupying a steep bank between the farm yard and the lowland meadows..	High	Low	Medium	Construction Preparatory works - a view of the removal of surface features would be partially interrupted by significant vegetation and partially filtered by rows of trees. Earthworks - a view of the construction of the embankment through the lowland meadow would be filtered by vegetation where there is insufficient depth in canopy to screen the view entirely. Structures - the view of the agricultural underpass would be interrupted by significant vegetation. Road pavement - a view of the road would be filtered by rows of Operation Winter Year 1 A view of the Scheme and traffic would be filtered by vegetation. The majority of traffic would be moved further away from the dwelling, but the detrunked A40 would still be in use and the Scheme would introduce road infrastructure to the southward view. Operation Summer Year 15 With the establishment of woodland planting on the embankment slope the effectiveness of the visual barrier would be improved, interrupting the view of Scheme and traffic.	Minor Minor Negligible	Short Term Medium Term Long Term	Short Distance	Minor Adverse Moderate Adverse Minor Adverse	Slight Negative	Moderate Negative	Slight Negative
7EY .3	SN 1145 1728	SA67 7EY	Narberth Rural	Cilrath Fawr Farm	A40	detached, 2 storey	825	Mainly north-westward aspect with view of mature trees and private garden. South-eastward view of hedgerow bounded fields and farm buildings overlooks farm yard. View of existing A40 interrupted by landform.	High	Medium	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7FE .1	SN 1163 1500	SA67 7FE	Narberth Rural	Narberth Community Primary School	Jesse Road	complex, 1 storey	1,260	Complex with entrance facing southward towards A478 and branches facing eastward and westward. View southward is open and uninterrupted overlooking car park, A478 and fields bounded by mature trees. Views east and west are limited by rows of trees and planted earthwork bunds. To the north the view is more open and available from outdoor spaces and playgrounds overlooking playing fields but the distant view is interrupted by rows of mature trees and the rising	Medium	High	Medium	Construction A view of works would be interrupted by the rising landform and significant vegetation, Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by significant vegetation and the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation and the landform.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .11	SN 1182 1530	SA67 7NX	Narberth Rural	Marland	A478	detached, 1 storey	1,130	Dwelling set back from A478 and surrounded by mature ornamental and native trees and hedges. Eastward view towards Lampeter Vale and Afon Marlais valley interrupted by evergreen roadside hedge.	High	Low	Medium	Construction A view of works would be interrupted by significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7HB .2	SN 1184 1763	SA66 7HB	Llanddewi Velfrey	Brynhill Farm	A478	detached, 2 storey	995	Westward aspect with direct view of A478. Middle and long distance view limited by roadside hedge-bank. Southward and eastward views interrupted by outbuildings.	High	Medium	Medium	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
7NX .1	SN 1197 1569	SA67 7NX	Narberth Rural	Fronlas and Y Gorlan	A478	semi-detached, 2 storey	830	Eastward aspect with direct view of A487. Distant views limited by roadside hedgerow to east of A487. Views of Penblewin to the north available from outdoor spaces.	High	Medium	Medium	Construction A view of activities at Penblewin Roundabout and where the Scheme would cross fields to the west of Penblewin would be available from outdoor spaces. The neighbouring dwelling Haulfryn would partially interrupt the northward view. Operation Winter Year 1 A glimpse of traffic would available from outdoor spaces. The area of lighting at Penblewin Roundabout would spread to cover the larger roundabout. Operation Summer Year 15 A glimpse of traffic would be available to outdoor spaces.	Negligible Negligible Negligible	Short Term Medium Term Long Term	Middle Distance	No Change Negligible Adverse Minor Adverse	Neutral	Neutral	Slight Negative
7NX .2	SN 1197 1572	SA67 7NX	Narberth Rural	Haulfryn	A478	detached, 1 storey	805	Eastward aspect with direct view of A487. Distant views limited by roadside hedgerow to east of A487. A view of Penblewin is available from outdoor spaces.	High	Medium	Medium	Construction A view of activities at Penblewin Roundabout and where the Scheme would cross fields to the west of Penblewin would be available from outdoor spaces. Operation Winter Year 1 A glimpse of traffic would be available from outdoor spaces. The area of lighting at Penblewin Roundabout would spread to cover the larger roundabout. Operation Summer Year 15 A glimpse of traffic would be available to outdoor spaces.	Negligible Negligible Negligible	Short Term Medium Term Long Term	Middle Distance	No Change Negligible Adverse Minor Adverse	Neutral	Neutral	Slight Negative
7NX .3	SN 1200 1593	SA67 7NX	Narberth Rural	Stonyford Cottage and Y Ffermdy	A478	semi-detached, 1-2 storey	615	Eastward aspect with direct view of A487. Distant views limited by roadside hedgerow to east of A487. Indirect northward view interrupted by neighbouring properties. Located in valley between two ridges.	High	Medium	Medium	Construction A view of works would be interrupted by buildings and vegetation. Operation Winter Year 1 A view of works would be interrupted by buildings and vegetation. Operation Summer Year 15 A view of works would be interrupted by buildings and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .4	SN 1200 1582	SA67 7NX	Narberth Rural	1 and 2 Leamington Cottages	A478	semi-detached, 2 storey	725	Eastward aspect with direct view of A487. Distant views limited by roadside hedgerow to east of A487. Northward view available from outdoor spaces limited by hedgerows and mature trees at Stonyford.	High	Medium	Medium	Construction A view of works would be interrupted by significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .5	SN 1200 1596	SA67 7NX	Narberth Rural	Rhyd y Cerrig	A478	detached, 1 storey	595	Eastward aspect with direct view of A487. Distant view limited by roadside vegetation and field boundary hedgerows. Northward view limited by eastern tip of Redstone Bank ridge and hedgerows.	High	Medium	Medium	Construction A view of works would be interrupted by the landform and significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform and significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform and significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .6	SN 1204 1587	SA67 7NX	Narberth Rural	Stoneybarn and Stonyford	A478	detached, 1-2 storey	695	Westward aspect with direct view of A487. Distant views interrupted by roadside vegetation. Northward view interrupted by streamside vegetation. Rising landform visible through gaps in the tree canopy.	High	Medium	Medium	Construction A view of works would be interrupted by the landform and significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform and significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform and significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .7	SN 1203 1587	SA67 7NX	Narberth Rural	Ford Barn	A478	detached, 1 storey	675	Mainly southward aspect. View northward interrupted by neighbouring buildings and streamside vegetation.	High	Medium	Medium	Construction A view of works would be interrupted by buildings and vegetation. Operation Winter Year 1 A view of works would be interrupted by buildings and vegetation. Operation Summer Year 15 A view of works would be interrupted by buildings and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .12	SN 1206 1561	SA67 7EX	Narberth Rural	Beechwood Park	A478	complex, 1-2 storey	930	Mainly south-eastward aspect, with north-westward aspect facing A487. View of farm buildings and dwelling at Penblewin available from outdoor spaces.	High	Medium	Medium	Construction A view of activities at Penblewin Roundabout would be available from outdoor spaces. Operation Winter Year 1 A glimpse of traffic would be available from outdoor spaces. The area of lighting at Penblewin Roundabout would spread to cover the larger roundabout. Operation Summer Year 15 A glimpse of traffic would be available to outdoor spaces as is the case in the existing situation.	Negligible Negligible No Change	Short Term Medium Term Long Term	Middle Distance	No Change Negligible Adverse No Change	Neutral	Neutral	Neutral

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
7NX .8	SN 1207 1625	SA67 7NX	Narberth Rural	Penblewin Cottage, Pine Cottage, Whitsun Brook	A478	detached, 1 storey	340	Dwellings have north-south or east-west aspect, but are located near to Pant-y-gorphwys Bridge at the Afon Marlais valley floor. Views are predominantly southward with few detractors.	High	Medium	Medium	Construction A view of works would be interrupted by neighbouring buildings and the rising landform. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by buildings and the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by buildings and the landform.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .9	SN 1208 1628	SA67 7NX	Narberth Rural	Pantygorphwys Uchaf	A478	detached, 2 storey	340	Southward aspect, view overlooks neighbouring dwelling towards wooded valley of Afon Marlais at head of Lampeter Vale. Northward view filtered by vegetation to property boundary.	High	High	High	Construction A view of works would be filtered by vegetation and partially interrupted by the rising landform. Operation Winter Year 1 A view of the Scheme and traffic would be filtered by vegetation and partially interrupted by the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by vegetation and the landform.	Negligible No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change Negligible Adverse No Change	Neutral	Slight Negative	Neutral
7NY .1	SN 1209 1662	SA67 7NY	Llanddewi Velfrey	Penblewin Farm	A40	detached, 2 storey	105	Farm dwelling has east/west aspect and is located next to the existing A40. Westward view is of farm yard and agricultural buildings. Light columns visible. View of traffic, road signs and road surface at roundabout available from first floor windows. Further west, view is of pastoral farmland at the head of the Lampeter Vale. Eastward view is open and uninterrupted, of A40 including road surface, vehicles and boundary hedges up to Service area. Road is set within pastoral landscape of south facing gentle slopes of the Llanddewi Velfrey ridge, featuring significant areas of woodland, Pembrokeshire hedge-banks and hedges with trees.	High	Medium	Medium	Construction Preparatory works - view of tree and hedge removal at Penblewin available from first floor rooms and outdoor spaces. Farm buildings and trees limit the view north-westward and south-westward. Earthworks - Rearrangement of roundabout and new arm to take the Scheme alignment would be direct view from first floor rooms. New arm to take detrunked A40 alignment would be screened by farm buildings. There would be a direct view of excavation works to the west of Penblewin. Operation Winter Year 1 There would be a direct view of the rearranged roundabout and part of the Scheme where it crosses fields to the west of Penblewin including road surface, traffic, signage and lighting columns. The arm of the existing alignment of the A40 would be realigned from west to north-west and the space it currently occupies restored to pasture. The area of light cover would be extended to incorporate the larger radius roundabout. Operation Summer Year 15 Established hedgerows and planting areas would limit the amount of road surface, traffic and signage visible but the Scheme would be a dominant feature in the westward view.	Major Major Moderate	Short Term Medium Term Long Term	Short Distance	Major Adverse Major Adverse Major Adverse	Large Negative	Large Negative	Large Negative
7NX .10	SN 1211 1622	SA67 7NX	Llanddewi Velfrey	Pantygorphwys Farmhouse	A478	detached, 2 storey	410	Southward and Northward aspect. Northward view of garden and pastoral fields limited by vegetation and gently rising landform north of Afon Marlais.	High	Medium	Medium	Construction A view of works would be interrupted by vegetation and the rising landform. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by vegetation and the landform. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by vegetation and the landform.	No Change No Change No Change	Short Term Medium Term Long Term	Short Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7HB.4	SN 1214 1703	SA66 7HB	Llanddewi Velfrey	Carmaenau Fawr	A478	detached, 2 storey	415	Holiday cottage/dwelling with northward aspect. View southward limited by vegetation in garden, neighbouring field boundaries and rising landform.	High	High	High	Construction No view of works predicted. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NX .13	SN 1254 1579	SA67 7NX	Llanddewi Velfrey	Orielton Fach Farm	A478	detached, 1 storey	1,005	Dwelling with north-east and south-west aspect located near to Afon Marlais on south facing side of Llanddewi velfrey ridge. View from outdoor spaces along Afon Marlais valley limited by streamside woodland and field boundary hedgerows.	High	Medium	Medium	Construction A view of works would be interrupted by significant vegetation. Operation Winter Year 1 A view of the Scheem and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NY .2	SN 1257 1708	SA67 7NY	Llanddewi Velfrey	Bounty Farm and The Lodge	A40	detached, 2 storey	730	Westward aspect. View of rolling landscape with mosaic of woodland and grassland, and scattered rural dwellings, looking towards A487 corridor. View south-westward interrupted by landform and substantial vegetation.	High	High	High	Construction A view of works would be interrupted by significant vegetation. Operation Winter Year 1 A view of the Scheem and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Ref. Nr.	OS Grid Ref	Post Code	Community	Property	Street	Type of Property	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in View	Scale	Duration	Distance	Magnitude	During	Winter	Summer
7NY .3	SN 1262 1702	SA67 7NY	Llanddewi Velfrey	Grosvenor Court	A40	detached, 2 storey	735	Westward aspect. View of rolling landscape with mosaic of woodland and grassland, and scattered rural dwellings, looking over A487 corridor. View southward interrupted by landform and substantial vegetation.	High	High	High	Construction A view of works would be interrupted by significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NY .4	SN 1265 1663	SA67 7NY	Llanddewi Velfrey	Cae'rmaenau-fach	A40	detached, 2 storey	675	East-west aspect, with north gable near to existing A40. View from dwelling is of gently sloping fields and areas of woodland. Roadside hedge screens view of A40 and traffic. From outdoor spaces there is a direct view of the A40 and vehicles available, where not interrupted by boundary wall and timber fence.	High	Medium	Medium	Construction A view of works would be interrupted by significant vegetation between dwelling and rest area. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NY .5	SN 1285 1670	SA67 7NY	Llanddewi Velfrey	Trefangor Farm	A40	detached, 2 storey	865	Direct and uninterrupted northward view of existing A40, including road surface, signs and traffic. View north limited by roadside hedge, although view of fields and rising terrain available from first floor windows. View westward is indirect and interrupted by hedgerows and mature trees.	High	Low	Medium	Construction A view of works would be interrupted by significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NY .6	SN 1311 1682	SA67 7NY	Llanddewi Velfrey	Trefangor Cottage	A40	detached, 2 storey	1,145	Southward aspect. Direct and uninterrupted view of existing A40, contained by roadside hedgerows. View towards gently falling ground to south of A40 of pastoral fields with hedgerows, trees and woodland. View westward is interrupted by signiificant vegetation.	High	Medium	Medium	Construction A view of works would be interrupted by significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NY .7	SN 1323 1694	SA67 7NY	Llanddewi Velfrey	Brominau	A40	detached, 1 storey	1,285	Southward aspect. Direct view of existing A40 interrupted by trees in garden. Indirect view available from single ground floor window of traffic, filtered by vegetation. Westward view features pastoral fields with Pembrokeshore hedge-bank boundaries aligned north-south.	High	Low	Medium	Construction A view of works would be interrupted by hedge-banks and significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by hedge-banks and significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by hedge-banks and significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NY .8	SN 1327 1682	SA67 7NY	Llanddewi Velfrey	Henllan Lodge	A40	detached, 1 storey	1,305	Eastward and northward aspect with direct view of A40 and weighbridge lay-by. View contained by woodland. Westward view of pastoral fields with hedgerow and hedge-bank boundaries.	High	Low	Medium	Construction A view of works would be interrupted by hedge-banks and significant vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by hedge-banks and significant vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by hedge-banks and significant vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
7NZ .1	SN 1335 1627	SA67 7NZ	Llanddewi Velfrey	Henllan Farm (farm dwelling)	C3205	detached, 2 storey	1,410	East-west aspect. Northward view towards A40 interrupted by agricultural buildings and substantial woodland, westward view towards Penblewin interrupted by woodland.	High	Medium	Medium	Construction A view of works would be interrupted by woodland. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by woodland. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by woodland.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 9.5 Visual Effects Schedule (Rights of Way)

A40PRC-RML-ELS-SWI-RP-L-0905

P03 S4

01/06/2020

Number	OS Grid Ref Start	OS Grid Ref End	Community	Description	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in view	Scale	Duration	Distance	Magnitude	During	Winter	Summer
SP 20/21/1	208295 217447	208513 217025	Llawhaden	Footpath connecting Sunny Hill/Tal-Y-Bont Hill to Ty Newydd on the minor road from Llawhaden bridge to Pont-Shan. Crossing undulating ground within pastoral fields.	2085	Predominantly eastward to southward view of rolling countryside in the Robeston Wathen and Narberth areas. View is open and uninterrupted.	High	High	High	Construction Changes to landscape at Penblewin Roundabout in distance not noticeable. Operation Winter Year 1 No view of Scheme or traffic predicted. Operation Summer Year 15 No view of Scheme or traffic predicted.	No Change No Change No Change	Short Term Medium Term Long Term	Long Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 38/6/1	208389 214799	209001 214688	Llawhaden	Footpath connecting Trippis Road at East Atheston to footpath SP 38/5 (from Robeston Wathen to Returno Farm). Following a north facing slope that gradually descends into the Narberth Brook valley. Features pastoral fields bounded by hedgerows and woodland edge.	1915	Eastward and westward views of Narbeth Brook valley and northward views towards Robeston Wathen. Predominantly pastoral farmland and woodland.	High	High	High	Construction A view of works would be interrupted by substantial vegetation, hedge-banks and buildings. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation, hedge-banks and buildings. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation, hedge-banks and buildings.	No Change No Change No Change	Short Term Medium Term Long Term	Long Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 38/4/2	208200 215349	208421 215046	Llawhaden	Footpath connecting Trippis Road north of East Atherton to footpath SP 38/5 (from Robeston Wathern to Returno Farm). Following a track crossing a north facing slope of a tributary valley to Narberth Brook. Bounded by hedgerows with mature trees.	1700	Views outward limited by trees and field boundary hedgerows.	High	Medium	Medium	Construction A view of works from the eastern the tie-in to Redstone Rd predicted would be interrupted by substantial vegetation and hedge-banks. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 38/5/3	208801 215347	208986 215650	Llawhaden	Footpath connecting footpath SP 38/4 to the B4314 at Robeston Wathen Roundabout. Path used to connect to village centre, has since been diverted by Robeston Wathen road improvement scheme. Predominantly on south facing slope crossing pastoral fields and a wooded valley.	1420	View limited by rising landform and field boundary hedgerows, mature trees, and roadside hedges. From higher ground next to A40 there are view southward towards Canaston Wood. A40 traffic and signage also visible.	Medium	Medium	Medium	Construction A view of works from the eastern the tie-in to Redstone Rd predicted would be interrupted by substantial vegetation and hedge-banks. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 38/5/2	208801 215346	209001 214688	Llawhaden	Footpath, continuation of 38/5/3, connecting Robeston Wathen to Returno Farm. Crosses a broad and gently undulating ridge to the north of the Narberth Brook valley within pastoral fields with hedgerow boundaries.	1670	Views eastward and westward are limited by field boundary hedgerows, to the north by a lane bounded by a hedgerow with mature trees. To the south, there is a view of the rising landform of Templeton Ridge and Canaston Wood overlooking Narberth Brook valley.	High	High	High	Construction A view of works from the eastern tie-in to Redstone Rd predicted would be interrupted by substantial vegetation and hedge-banks. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 38/5/1	209000 214687	209073 214284	Llawhaden	Footpath, continuation of 38/5/2, connecting Robeston Wathen to Back Lane south of Returno Farm. Crosses north facing slopes of a ridge to the south of Narberth Brook. Pastoral fields with hedgerows and valley woodland.	1915	Views westward and southward limited by landform and hedgerows wth mature tree. There are more open views to the north and west towars Cox Hill, overlooking woodland in the Narberth Brook valley.	High	High	High	Construction A view of works from the eastern tie-in with the A40 predicted would be interrupted by substantial vegetation and hedge-banks. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 38/4/1	208796 215350	209325 215528	Llawhaden	Footpath, continuation of 38/4/2 from Trippis Road to Teglyn Road near to the Bridge Inn. Following a track bounded by hedgerows across a plateau between two stream valleys that are tributaries of the Narberth Brook.	1145	Views limited by Pembrokeshire hedge-bank and trees. Glimpse outward available from field access gates, more open view northward of pastoral farmland at the eastern end of the path	High	Medium	Medium	Construction A view of works from the eastern tie-in to Redstone Rd predicted would be interrupted by substantial vegetation and hedge-banks. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedge-banks.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 38/3/1	209359 215533	209395 215885	Llawhaden	Footpath connecting the B4314 near Bridge Inn to the A40 at Cotts Farm. Initially follows a wooded valley, then crosses large fields with few boundaries.	955	Views out limited by vegetation where path follows valley side. Where path crosses fields there are more open views of the pastoral landscape towards Sodston Ridge, and southwards towards Cox Hill, Templeton Ridge and Canaston Wood.	High	High	High	Construction A view of works from the eastern the tie-in to Redstone Rd predicted would be interrupted by substantial vegetation where it follows the valley. As it crosses the field the view would be interrupted by hedgerows and mature trees such as those that exist alongside Flimstone La Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedgerows with mature trees.	No Change No Change	Short Term Medium Term	Middle Distance	No Change No Change	Neutral	Neutral	

Number	OS Grid Ref Start	OS Grid Ref End	Community	Description	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in view	Scale	Duration	Distance	Magnitude	During	Winter	Summer
										Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation and hedgerows with mature trees.	No Change	Long Term		No Change			Neutral
SP 38/1/1	209537 216450	209604 215937	Llawhaden	Footpath connecting the B4313 south of Pont Shan to the A40 at Cotts Equine. Continuation of SP 27/18/1, crossing gently sloping ground within large fields bounded by woodland plantations with parkland character.	750	Views outward limited by woodland and plantations. Path meets A40 near to junction with Flimstone Lane.	High	Medium	Medium	Construction A view of works at the western tie-in with the A40 predicted would be interrupted by a mixed deciduous and coniferous plantation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 20/22/1	209800 218282	210487 218559	Llawhaden	Footpath connecting two minor roads and Sarn-gwm to Great Vaynor. Follows south facing slopes of a small hill and crosses large fields with hedgerow boundaries.	2170	Broad southward views of Sodston Ridge and Templeton Ridge beyond, overlooking Eastern Cleddau tributary valley. A glimpse of high sided vehicles and road signs at Penblewin and Blackmoor Hill available, cars screened by roadside hedges.	High	High	High	Construction A glimpse of works at Penblewin Roundabout would be available to the western portion of this path where the view isn't interrupted by hedge-banks, trees and woodland. The view of works predicted at the Sodston Lodge end of the Scheme would be interrutped by vegetation on Sodston Ridge. Operation Winter Year 1 A glimpse of high sided vehicles using de-trunked A40 would be available. Traffic on Scheme main line would be screened by landform. Operation Summer Year 15 A glimpse of high sided vehicles using de-trunked A40 would be available. Traffic on Scheme main line would be screened by landform.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 27/16/1	210039 215097	210078 214428	Narberth Rural	Footpath to the south of the B4314 at Cox Hill. Crosses the ridge towards Shipping Farm and then descends towards narberth Brook. Follows Shipping Farm access road.	995	Northward views limited by B4314 roadside hedge-banks, and eastward by rising landform of Cox Hill. Southward view of Narbarth Brook vallye, rising landform of Templeton Ridge and Canaston Wood.	High	High	High	Construction A view of works from the eastern tie-in to Redstone Rd predicted would be interrupted by the roadside hedge-bank to the eastbound side of the B4314 Cox Hill. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by a roadside hedge-bank. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by a roadside hedge-bank.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 27/2/1	210990 215960	212004 215919	Narberth Rural	Bridleway connecting Blaenmarlais on B4313 Redstone Road to Stonyford on A478. Follows a track/sunken lane bounded by hedgerows with mature trees. Wildlife interest in banks and hedges a main feature.	75	Views out limited to field access gates or below tree canopy. Where available views are of pastoral farmland/remnant parkland featuring solitary mature trees. Views from horseback would overlook hedges.	High	Medium	Medium	Construction The bridleway runs broadly parallel to the Scheme and elements would be visible to parts of the path. Preparatory works - where the path meets the B4313 there would be an indirect view of vegetation removal. Between Blaenmarlais and Blaenffynnonau House a view of woodland removal would be available overlooking a hedge. Between Blaenffynnonau House and Farm removal of trees would be noticeable as thinning of canopy and available overlooking a hedge. East of Blaenffynnonau Farm the view would be filtered by vegetation but glimpses of works at Penblewin would be available where gaps in tree canopy allow. Earthworks - at the B4313 there would be an indirect view of works to cutting and link road. Blaenmarlais to Blaenffynnonau House with part of the woodland removed, a view of the construction of part of the embankment through the lowland meadows would be enabled. Blaenffynnonau House to Farm construction of the embankment through the meadows would be partially screened by landform and glimpse of works at Penblewin would be available. West of Blaenffynnonau Farm glimpse of works filtered by vegetation. Structures - View of structures at Redstone Cross interrupted by buildings, view of wildlife crossin construction visible from the section of path between Blaenmarlais and Blaenffynonau Farm overlooking a clipped hedge, and view of structures south of Blackmoor Hill interrupted by landform and woodland. Road Pavement - views of road pavement construction partially filtered by vegetation. Operation Winter Year 1 At the B4313 there would be an indirect view of the road and traffic at the junction between Redstone Road and the link to the A40. From Blaenmarlais to Blaenffynnonau an earthwork bund and woodland would interrupt the view of the Scheme and traffic where the road enters the lowland meadows on an embankment. Between Blaenffynnonau House and Farm a view of the road on embankment and traffic would be partially interrupted by landform and partially filtered by vegetation, a glimpse of the Scheme and traffic at Penblewin would be available. West of Blaenffynnonau Farm the view of the Scheme and traffic would be	Minor Minor	Short Term Medium Term	Short Distance	Minor Adverse Moderate Adverse	Slight Negative	Moderate Negative	

Number	OS Grid Ref Start	OS Grid Ref End	Community	Description	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in view	Scale	Duration	Distance	Magnitude	During	Winter	Summer
										Operation Summer Year 15 At the B4313 there would be an indirect view of the road and traffic at the junction between Redstone Road and the link to the A40. From Blaenmarlais to Blaenffynnonau an earthwork bund, newly established and existing woodland would interrupt the view of the Scheme and traffic where the road enters the lowland meadows on an embankment. Woodland re-growth from coppice would interrupt the view of the wildlife crossing. Between Blaenffynnonau House and Farm a view of the road on embankment and traffic would be interrupted by landform and newly established vegetation on embankment slopes, a glimpse of high sided vehicles at Penblewin would be available. West of Blaenffynnonau Farm the view of the Scheme and traffic would be interrupted by vegetation.	Negligible	Long Term		Minor Adverse			Slight Negative
SP 27/1/1	211468 216621	211671 217471	Narberth Rural	Footpath connecting the A40 west of Penblewin Roundabout to the A478 near to Bryn Hill passing through Cilrath-fawr farm yard. Follows metalled track bounded by hedge-banks to Cilrath Fawr, crossing fields thereafter.	180	Views east and west limited by hedge-banks. Distant northward view towards Preseli Hills and Carmarthenshire uplands available.	Medium	High	Medium	Construction There would be an indirect view of construction vehicles at Penblewin where the path meets the A40. Construction of a shared use path following the line of the de-trunked A40 would cross the footpath and provide a non-motorised connection to Narberth and Penblewin Roundabout and there would be an uninterrupted view of the construction of this element from a short section of path. Operation Winter Year 1 The majority of traffic would move to the Scheme main line and where the path would meet the de-trunked A40 would be more tranquil. A view of traffic using the Scheme main line would be interrupted by hedges. Operation Summer Year 15 The majority of traffic would move to the Scheme main line and where the path would meet the de-trunked A40 would be more tranquil. A view of traffic using the Scheme main line would be interrupted by hedges.	Minor Negligible Negligible	Short Term Medium Term Long Term	Short Distance	Minor Adverse Minor Benefit Minor Benefit	Slight Negative	Slight Positive	Slight Positive
SP 9/1/1	211935 215557	212504 215712	Narberth Rural	Western part of Footpath connecting the A478 at Beechwood Park to Henllan Lodge, terminating at the community boundary near to Orielton-fach. Used as access to Whitley Farm and crossing fields thereafter.	955	Where Beechwood Park buildings do not interrupt the view, the Llanddewi Velfrey ridge is visible, featuring a mosaic of woodland and pastoral farmland.	High	High	High	Construction A view of activities at Penblewin Roundabout would be available but partially interrupted by buildings and hedge-bank. Operation Winter Year 1 A glimpse of traffic would be available but partially interrupted by buildings and a hedge-bank. Operation Summer Year 15 A glimpse of traffic would be available as is the case in the existing situation.	Negligible Negligible No Change	Short Term Medium Term Long Term	Middle Distance	No Change Negligible Adverse No Change	Neutral	Neutral	Neutral
SP 19/29/1	212019 215919	213120 216213	Llanddewi Velfrey	Bridleway connecting A478 at Stonyford to Henllan, following old tracks and sunken lanes. Overgrown in parts and difficult to negotiate at time of field survey. Sunken lane provides wildlife interest.	605	Slight ridge to north limits views outward, this is in addition to visual barrier created by banks and hedges. Where gaps allow access to fields, near views of neighbouring areas are available featuring a mosaic of woodland and pastoral farmland.	Medium	Medium	Medium	Construction A view of construction activities would be interrupted by the landform and substantial vegetation. Operation Winter Year 1 A view of the Scheme would be interrupted by the landform and substantial vegetation. Operation Summer Year 15 A view of the Scheme would be interrupted by the landform and substantial vegetation	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 19/31/3	212449 217276	212650 216667	Llanddewi Velfrey	Footpath connecting A40 at Ca'rmaenau-fach to fields north of Bounty Farm. Follows access track to Bounty Farm and crosses fields thereafter.	655	Views eastward and westward to the south of Grosvenor Court are limited by hedge-banks. The view of the existing A40 is filtered by a roadside hedge. Field boundaries running north-south restrict the horizontal field of view of the road and traffic. North of Grosvenor Court the road crosses a ridge which interrupts southward views and opens up northward views towards the Preseli Hills. See Viewpoint E.	Medium	Medium	Medium	Construction A view of works would be interrupted by substantial vegetation and Pembrokeshire hedge-banks with mature trees. Operation Winter Year 1 A view of the Scheme would be interrupted by substantial vegetation and Pembrokeshire hedge-banks with mature trees. Operation Summer Year 15 A view of the Scheme would be interrupted by substantial vegetation and Pembrokeshire hedge-banks with mature trees.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 19/28/1	212510 215717	213128 216214	Llanddewi Velfrey	Eastern part of Footpath connecting the A478 at Beechwood Park to Henllan Lodge, beginning at the community boundary near to Orielton-fach. Following farm tracks and crossing fields and hedgerows.	1035	Views northward limited by rising landform and substantial vegetation. Available views are predominantly southward of the Afon Marlais valley.	High	Medium	Medium	Construction A view of works would be interrupted by the rising landform and a series of hedgerows. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform and substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform and substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	no Change No Change No Change	Neutral	Neutral	Neutral
SP 19/34/4	213093 217338	213096 217087	Llanddewi Velfrey	Bridleway connecting Trefangor Burial Ground to the track running from Longford Bridge to Pen-ca'rmaenau. Follows a lane bounded by hedgerows. Vegetation encroaching onto path making access difficult at time of	1205	Views southward limited by rising landform. Views eastward and westward interrupted by substantial vegetation for entirety of route.	Medium	Low	Medium	Construction A view of works would be interrupted by a ridge and Pembrokeshire hedge-banks at the crest of the ridge. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform, built elements and vegetation.	No Change No Change	Short Term Medium Term	Middle Distance	No Change No Change	Neutral	Neutral	

Number	OS Grid Ref Start	OS Grid Ref End	Community	Description	Distance from centre-line (m)	Component of View	Susceptibility to change	Value attached to view	Sensitivity of receptor	Change in view	Scale	Duration	Distance	Magnitude	During	Winter	Summer
				survey.						Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform, built elements and vegetation.	No Change	Long Term		No Change			Neutral
SP 19/29/2	213120 216214	213348 216249	Llanddewi Velfrey	Short section of Bridleway south of Henllan. Follows farm track running between hedgerows, occasionally used as pens for holding livestock and frequently used for movement of livestock.	1220	Views out limited by buildings, banks and vegetation.	Medium	Low	Low	Construction A view of works would be interrupted by substantial vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 19/36/3	213246 217090	213273 217276	Llanddewi Velfrey	Footpath connecting the access to Trefangor Burial Ground to Pen-ca'rmaenau. Follows the access track to Pen-ca'rmaenau.	1345	Views southward limited by rising landform. Uninterrupted views eastward of north-facing slopes of Llanddewi Velfrey ridge. Views northward of Preseli Hills and Carmarthenshire uplands. Views westward limited by hedge-bank. See viewpoint F.	Medium	High	Medium	Construction A view of works would be interrupted by a ridge and Pembrokeshire hedge-banks at the crest of the ridge. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the landform, built elements and vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the landform, built elements and vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 19/29/3	213349 216249	213429 216257	Llanddewi Velfrey	Short section of Bridleway south of Henllan. Follows farm track running between buildings and hedgerow, occasionally used as pens for holding livestock and frequently used for movement of livestock.	1425	Views out interrupted by buildings, banks and vegetation.	Medium	Low	Low	Construction A view of works would be interrupted by farm buildings and substantial vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by farm buildings and substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by farm buildings and substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 19/27/1	213352 216243	213815 215950	Llanddewi Velfrey	Footpath connecting Henllan to Caerau to the south of Caerau Wood. Crosses fields and hedgerows. Follows south facing slopes.	1430	Views northward limited by rising landform and substantial vegetation. Views available predominantly of Lampeter Vale pastoral landscape.	High	High	High	Construction A view of works would be interrupted by the rising landform and substantial vegetation. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by the rising landform and substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by the rising landform substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 19/37/2	213813 217148	214295 217144	Llanddewi Velfrey	Continuation of 19/37/1 from Parc-y-delyn to Pen-troydin-fach crossing fields and following farm tracks.	1905	Follows north-facing slopes. Landform and hedgerows limit southward views. View predominantly north towards Preseli Hills.	High	High	High	Construction A view of works would be interrupted by substantial vegetation, notably at Ffynnon Wood. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral
SP 19/30/1	213699 216844	213980 216317	Llanddewi Velfrey	Footpath connecting A40 at Ffynnon Wood to Stepin and Caerau Gaer. Crosses fields and follows hedgerows and also passes through Ffynnon Wood. Crosses A40 at Ffynnon Chapel and connects to 19/37.	1735	Views predominantly northward near to Stepin, of rolling landform between the two ridges, and beyond of Preseli Hills and Carmarthenshire uplands. Lower down the slopes views are limited by woodland and vegetation. Where path is in woodland there is a degree of tranquillity despite nearness of A40.	High	High	High	Construction A view of works at Penblewin predicetd would be interrutped by substantial vegetation between Henllan Lodge and the A40 rest area. Operation Winter Year 1 A view of the Scheme and traffic would be interrupted by substantial vegetation. Operation Summer Year 15 A view of the Scheme and traffic would be interrupted by substantial vegetation.	No Change No Change No Change	Short Term Medium Term Long Term	Middle Distance	No Change No Change No Change	Neutral	Neutral	Neutral

Archaeology Wales

A40 Penblewin to Redstone Cross, Llanddewi Velfrey, Pembrokeshire

Geophysical Survey

By
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Report No. 1820

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Archaeology Wales

A40 Penblewin to Redstone Cross, Llanddewi Velfrey, Pembrokeshire

Geophysical Survey

Prepared For: Richards, Moorehead & Laing Ltd

Edited by: Philip Poucher	Authorised by: Mark Houliston
Signed: PPoucher	Signed: Mark Houliston
Position: Project Manager	Position: Managing Director
Date: 26/07/19	Date: 26/07/19

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July 2019

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REGISTERED ORGANISATION CIfA

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Summary

This report results from work carried out by Archaeology Wales Ltd for Richards, Moorehead & Laing Ltd. It draws on the results of a geophysical survey undertaken on the site of a proposed road improvement scheme on land between Penblewin roundabout and Redstone Cross, near Llanddewi Velfrey in Pembrokeshire. The geophysical survey is being undertaken as part of a staged approach of archaeological investigations as part of an environmental impact assessment for the project.

Two alternate road corridors were proposed, one running to the north of the current A40, and one running to the south. The aim of the geophysical survey was to determine the nature and extent of any buried archaeological features within the proposed road corridors. The work was undertaken using a Bartington Grad601 gradiometer, covering approximately 30 hectares over 25 separate fields.

The survey of the northern route picked out a number of areas of potentially significant archaeological interest. The centre of the route is of particular note, containing the Scheduled remains of two Bronze Age round barrows, with the survey results suggesting potential associated archaeological activity spread throughout fields to the north and west. Similar archaeological activity, potentially prehistoric in date, was also revealed at the eastern and western ends of the route. It is likely further archaeological mitigation may be required in these areas prior to development works commencing, in order to better understand the date, function, condition and importance of these remains.

Further features of uncertain origin, but potentially archaeological in nature, were also revealed in several fields along the northern route. A number of probable former field boundaries, ploughing activity, and geological features were also identified.

The survey of the southern route did not identify any distinct features of significant archaeological importance, but did identify features of uncertain origin but potential archaeological interest spread throughout the route. Former field boundaries, ploughing activity, and geological features were also identified along this route.

The work was carried out to the Standard and Guidance set out by the Chartered Institute for Archaeologists for archaeological geophysical survey (CIfA 2014).

Crynodeb

Mae'r adroddiad hwn yn ganlyniad i waith a wnaed gan Archaeology Cymru Cyf ar gyfer Richards, Moorehead & Laing Cyf. Mae'n tynnu ar ganlyniadau arolwg geoffisegol ar safle cynllun gwella ffordd arfaethedig ar y tir rhwng cylchfan Penblewin a Redstone Cross, ger Llanddewi Efelffre yn Sir Benfro. Mae'r arolwg geoffisegol yn cael ei gynnal fel rhan o ddull fesul cam o archwiliadau archeolegol fel rhan o asesiad o'r effaith ar yr amgylchedd ar gyfer y prosiect hwn.

Cynigwyd dau o goridorau ffordd amgen, un yn rhedeg i'r gogledd o'r A40 presennol, ac un yn rhedeg i'r de. Diben yr arolwg geoffisegol oedd penderfynu ar natur a maint unrhyw nodweddion archeolegol sydd wedi'u claddu o fewn y coridorau ffordd arfaethedig. Gwnaed y gwaith gan ddefnyddio gradiomedr Bartington Grad601, ac roedd yn cwmpasu oddeutu 30 hectar dros 25 o gaeau ar wahân.

Nododd yr arolwg o'r ffordd ogleddol nifer o ardaloedd o ddiddordeb archeolegol arwyddocaol posibl. Mae canolbwynt y ffordd o bwys penodol, gan ei fod yn cynnwys olion Rhestredig o ddau feddrod crwn o'r Oes Efydd, ac mae canlyniadau'r arolwg yn awgrymu gweithgaredd archeolegol cysylltiedig posibl wedi'i wasgaru drwy'r caeau i'r gogledd a'r gorllewin. Datgelwyd gweithgaredd archeolegol tebyg, cynhanesyddol o bosibl, ar ben dwyreiniol a gorllewinol y ffordd. Mae'n bosibl y bydd angen gwneud gwaith lliniaru archeolegol pellach yn yr ardaloedd hyn cyn i'r gwaith datblygu ddechrau, er mwyn deall yn well ddyddiad, swyddogaeth, cyflwr a phwysigrwydd yr olion hyn.

Datgelwyd nodweddion eraill o darddiad ansicr, ond sydd o bosibl yn archeolegol mewn natur, mewn nifer o gaeau ar hyd y ffordd ogleddol. Nodwyd nifer o ffiniau caeau blaenorol posibl, gweithgaredd aredig, a nodweddion daearegol hefyd.

Ni wnaeth yr arolwg o'r llwybr deheuol nodi unrhyw nodweddion amlwg o bwysigrwydd archeolegol arwyddocaol, ond nodwyd nodweddion o darddiad ansicr ond sydd o ddiddordeb archeolegol posibl a oedd wedi'u gwasgaru ar hyd y llwybr. Nodwyd ffiniau caeau blaenorol, gweithgaredd aredig, a nodweddion daearegol hefyd ar hyd y llwybr hwn.

Gwnaed y gwaith i'r Safon a'r Canllawiau a nodwyd gan Sefydliad Siartredig yr Archeolegwyr ar gyfer arolwg geoffisegol archeolegol (SSA 2014).

1 Introduction

1.1 Location and scope of work

1.1.1 In April, May and August 2019, Archaeology Wales Ltd (AW) carried out a geophysical survey on the site of a proposed road improvement scheme of the A40 between Penblewin roundabout and Redstone Cross, near Llanddewi Velfrey in Pembrokeshire, (henceforth – the site), running between NGR SN 1201 1665 and SN 1038 1605 (Figs 1 & 2). The work was carried out at the request of Richards, Moorehead & Laing Ltd.

1.1.2 Two alternate routes of potential road improvement were surveyed, a route to the north of the current A40, and another to the south. The proposed development area currently consists of a large number of agricultural fields of pasture and arable land, largely bounded by hedgerows. The site covers an area of approximately 30 hectares across 29 fields.

1.1.3 The geophysical survey is being undertaken as part of a staged approach of archaeological investigations into the scheme. The survey forms part of the requirements laid out by the Welsh Government in their tender documents concerning the scheme. The results will inform an ongoing Environmental Impact Assessment for the project.

1.1.4 A Specification for the programme of geophysical survey work was prepared at the request of Richards Moorehead and Laing Ltd (Appendix II). It provided information on the methodology to be employed by AW during a geophysical survey of the site. The Specification was submitted to, and approved by, Dyfed Archaeological Trust – Development Management (DAT-DM), who have been employed as archaeological curators to the scheme. A subsequent Method Statement was also produced by AW detailing the methodology to be employed during the survey work. This was also submitted to DAT-DM prior to the commencement of the survey work.

1.1.5 The work was managed by Phil Poucher, Project Manager, and the site work was undertaken by Jerry Bond, Daniel Moore, Steven Cole, Jennifer Muller, Christian Lindesay, Jack Griffiths, Victoria Alexander, and Fred Craig. The AW Project Number is 2552 and the Site Code LVP/19/GEO.

1.2 Site Description and Geology

1.2.1 The site covers an area across a large number of agricultural fields of pasture and arable land, largely bounded by hedgerows, lying between the roundabout

at Penblewin to the east and the road junction at Redstone Cross to the west. The total area for detailed magnetometry survey amounts to *circa* 30ha in approximately 29 fields (Figure 2).

1.2.2 Two route options are being considered, northern and southern. The northern route leaves Penblewin roundabout (SN 12005 16645) and curves around to re-enter the A40 west of the Redstone junction just south of Sodstone House (SN 10349 16053). This route runs along a ridge of higher ground that runs approximately east to west, falling away at the western end slightly. Land falls away to the south into small stream valleys and on into an undulating landscape cut by larger east – west orientated streams and small rivers. The landscape falls away more prominently to the north into a wooded east – west orientated tributary stream for the Eastern Cleddau River to the west. The top of the ridgeline immediately to the north offers views northward towards the Preseli Hills. This route crosses fields of improved pasture, two farm access tracks and a local road (B4313) at the western end. It also runs in relatively close proximity to the Redstone Cross barrow group (SN11015 16415), a scheduled ancient monument (PE154).

1.2.3 The southern route leaves Penblewin roundabout (SN 12005 16645) and passes south of the Redstone junction before re-joining the A40 (SN 10481 16036). This takes a lower route, and passes across south-facing slopes and through an area of low-lying wetter ground around the head of a local watercourse, to the south of Blackmoor Hill Farm. The route then rises slightly, through a small wooded area, crossing the B4313 to the south of the Redstone junction, and across another small stream valley before re-joining the A40. The landscape rises to the north and undulates to the south, as described above.

1.2.4 The underlying bedrock of the area largely comprises mudstones of the Slade and Redhill formation, merging with mudstones of the Mydrim Shales formation closer to Redstone Cross, and an outcrop of limestone and argillaceous rocks of the Llandeilo Flags formation to the south of the A40. This is partly overlain by a strip of Till – diamicton, towards Redstone Cross (BGS 2019).

1.3 Archaeological and Historical Background

1.3.1 A detailed archaeological and historical background to the survey area will be provided in an associated desk-based assessment, currently in preparation (Maynard, forthcoming).

1.3.2 The Redstone Cross barrow group (SAM PE154) comprises two round barrows, spread by ploughing. The barrows are likely to be Bronze Age in date,

representing burial mounds and a potential focus for ritual activity. The barrows, and surrounding Scheduled Area, lie outside the survey area, but a short distance to the north lies a standing stone (PRN 47438), still extant but lying in a separate field. The exact provenance of this stone is unclear, but standing stones were used as markers and associated with ritual activity in the Bronze Age. Another standing stone is marked on 18th century maps at Redstone Cross, presumably how it got its name, but this appears to have been moved by the 19th century. The northern route follows a ridge that has the potential for early settlement. The southern option passes through an area that could easily contain burnt mounds, another characteristic Bronze Age feature which are typical of this type of wet terrain.

1.3.3 Other than the standing stone there are no records of existing sites within the survey area, other than place-name evidence from the mid-19th century tithe map. A number of later post-medieval cottage and farmstead sites are recorded in the area, and shown on historic mapping. The known examples are however, found on the margins of the existing A40, or to the north, so may not extend into either route option.

2 Aims and Objectives

2.1 Geophysical Survey

2.1.1 The geophysical survey was undertaken in order to:

- Locate and describe archaeological features that may be present within the development area. The archaeological work was designed to attempt to elucidate the presence or absence of archaeological material that might be affected by the scheme, in particular its character, distribution, extent and relative significance.
- Provide sub-surface data to inform any future on-site works.

3 Methodology

3.1 Geophysical Survey

3.1.1 A Bartington Grad601 gradiometer was used to undertake the survey. Previous research has shown that fired, or cut and backfilled archaeological features such as kilns and hearths, ditches and pits often have an anomalously higher magnetic susceptibility than the surrounding subsoil due to burning and biological

processes. Differences in magnetic susceptibility within the subsoil and archaeological features can be detected as changing magnetic flux by an instrument such as a gradiometer. Data from this may be mapped at closely spaced regular intervals, to produce an image that may be interpreted to locate buried archaeological features (Clark, 1997, Aspinall *et al*, 2011).

3.1.2 Relatively level fields of low pasture provide ideal locations for this type of survey. Generally the surface of the fields were relatively uniform, allowing rapid traverses and readings to be taken at consistent heights above the ground surface, and the upper plough-soil is generally both neither deep enough to mask features cutting into the underlying subsoil, and unlikely to contain a significant amount of material that could interfere with the magnetic readings. There were however some areas where vegetation proved inaccessible, or ground conditions proved too wet, but these were relatively limited over the scheme as a whole. The underlying geology of largely mudstone is also unlikely to provide a strong magnetic response that could distort the readings.

3.1.3 Detailed survey was carried out in grids of 30m x 30m and 20m x 20m along parallel traverses spaced at 1m intervals, recording data points spaced at 0.25m intervals to a maximum instrument sensitivity of 0.1nT in accordance with Historic England Guidelines. The survey mode was set to bi-directional (traverses walked alternately south-north/north-south or east-west/west-east). At regular intervals the data was downloaded in the field onto a laptop computer for storage and assessment. The location of the survey area was surveyed using a Geomax GPS Rover unit.

3.1.4 Four of the fields were not accessible to be surveyed. Two of the fields, SG7 and SG12, contained woodland and other vegetation that created too many obstacles for access; information about the land owner was not available for Field NG7 and therefore access was not agreed; and the land owner of NG14 did not give access to that particular field.

3.2 Data Processing and Presentation

3.2.1 Following the completion of the detailed survey, processing and analysis took place using the TerraSurveyor software package. After downloading, the results were plotted in 2D. The most typical method of visualising the data is as a greyscale image. In a greyscale, each data point is represented as a shade of grey, from black to white at either extreme of the data range. A number of standard operations (including destriping and occasionally destaggering) were carried out to process the data. The mean level of each traverse of data was reduced to zero and all grids matched so that there were no differences between background levels. The data was then analysed using a variety of parameters

and styles and the most useful of these were saved as *JPEG images and displayed using Adobe Illustrator software. Due to the presence of strong magnetic anomalies, the data displayed was clipped to a range of between +/-3 nT to +/-10 nT dependent on the survey results, to allow finer details to be discerned. The results of the survey were then overlaid onto a digital map of the study area. This was then used to produce interpretation figures (Figures 3 – 14).

3.2.2 All works were undertaken in accordance with the CIfA's Standards and Guidance for a geophysical survey (2014) and current Health and Safety legislation.

4 Geophysical Survey Results

The results are described on a field-by-field basis, with those fields along the northern route described first (labelled with the prefix NG), and the southern route described second (labelled with the prefix SG).

Northern Route

4.1 Field NG1 (Figures 3 & 4)

4.1.1 Field NG1 comprised a relatively level field containing long grass to be cut for silage, with a slight southward slope and a lower area in the southwest corner where the ground became wetter and vegetation denser. The survey area was bounded on the north and west by banks with trees and hedges. To the south and east it was bounded by metallic fencing, providing a stronger reading on the survey results. The weather was generally overcast with occasional rain.

4.1.2 The southern half of the field had a much stronger, dipolar response in general compared to the northern half of the field. This could be due to geological factors, or due to a spread of magnetic debris representing ground disturbance, possibly from ploughing taking place here and churning up the soil. In fact, there are faint patterns of magnetically positive linear anomalies running east-west which could be plough marks NG1(1). There is the potential for these stronger results to mask some of the more subtle archaeological features in this area.

4.1.3 Within the southern part of the field was a dipolar circular feature with a diameter of approximately 16m NG1(2). There is an apparent break in the circle on its south-east side, approximately 3.5m wide, which could be representative of an enclosure or roundhouse gully, the readings themselves suggest an infilled ditch. The strength of response from NG1(2) stands out in this part of the field. There are a variety of possibilities for this, it may be that the ditch is relatively deeply cut, or that the feature is contemporary with or later than the surrounding background disturbance. However, the clarity is most likely to come from the magnetic properties of the infilling soil itself, simply returning a higher reading than surrounding features making it stand out within the survey results rather than being indicative of depth or relative stratigraphy. Immediately to the south-south-east of this feature was a faint, partial curvilinear feature with another north-south linear going through it, both with just positive responses NG1(3). This may represent the partial remains of another circular feature. The presence of these features does indicate the potential for the stronger background results across the southern part of the site to mask further, more subtle, archaeological features in this area.

4.1.4 Also in the southern section of the field was another series of positive linear readings, in the south-east corner of the field NG1(4). One single linear anomaly orientated north-south extended 15m into the survey, and this formed a right angle with two parallel linear anomalies running east-west for about 25m. These anomalies would appear to be part of the same feature, but only a small part of this feature was visible in the survey, as the rest of it extended towards the Penblewin roundabout. Therefore, a full interpretation of it is not possible.

4.1.5 Halfway up the field, running east-west through the length of the field, is another slightly dipolar linear anomaly NG1(5). It shows signs of being a possible field boundary due to the sections where parallel linear features are apparent. The earliest detailed historic map, the 1841 parish tithe map, does not show any sign of a field boundary here, neither do subsequent maps, so it is very likely an earlier boundary. Interestingly, the boundary does not line up with the visibly disturbed ground, so either the two are not related and from different periods, or the visible change is more geological and entirely unrelated to the former boundary.

4.1.6 At the north-eastern end of the field was a series of slightly dipolar anomalies with very little negative associated response, including a sub-circular feature NG1(6) and a sub-rectangular enclosure NG1(7) with another possible feature inside of it NG1(8), some or all of which may be of archaeological significance. The sub-circular feature NG1(6) was approximately 12m wide (east-west) x 15m long (north-south), with possible gaps in the line, mostly notably at the northern end where slightly higher readings suggest a defined terminus to the linear readings and potential entrance. The nearby sub-rectangular feature NG1(7) extended into the survey from the north and east, running approximately 20m north-south, then turned 90 degrees east for 40m. There is no clear opening, although the line does become less distinct for a small segment along the east – west linear arrangement, but this does also appear to align with the current field entrance and may therefore be the result of the passage of farm machinery. Another positive feature sits in the northern-most section of this NG1(8), potentially representing an area of activity, although it must also be noted that this does lie adjacent to the field entrance, and may therefore be the result of modern activity around that entrance.

4.1.7 An indistinct slightly negative linear anomaly NG1(9) crosses the centre of the field running roughly northwest to southeast. The fainter response, and more irregular nature, makes this more uncertain as an archaeological feature. No field boundary is marked on any historic mapping along this route.

4.2 Field NG2 (Figures 3 & 4)

4.2.1 NG2 comprised a field of improved pasture, close to the top of the ridgeline with the ground sloping gradually down to the north. The field was bounded by hedgerows, infilled with post-and-wire fencing. There were no limitations, and only the southern end of the field needed surveying. The weather conditions were windy with mixed sun and clouds.

4.2.2 The field had an obvious separation between the east and west sides, with the negative and positive linear response from a former field boundary running through the centre of the field north-south NG2(1). To the east of this former boundary, which is apparent on historic maps at least until the 1964 OS Plan, the area is visibly different from the west side, with magnetic disturbance and shadows of what look like geological response NG2(2). There are a few discrete positive anomalies here NG2(3) which could be infilled, cut features, but it is unclear whether they are natural or anthropogenic. Some faint positive linear anomalies NG2(4) running north-east/south-west could be evidence of ploughing in this field, which would also explain the reason for the disturbed ground, although their orientation appears unusual.

4.2.3 To the west of the former boundary the response was much quieter. Within this area were a few discrete dipolar anomalies NG2(5). There are also a number of irregular, faint positive curvilinear anomalies NG2(6), it is unclear if these represent potential features of interest or are merely part of the background geological or soil responses.

4.3 Field NG3 (Figures 5 & 6)

4.3.1 NG3 comprised a field of improved pasture. The survey area was on a ridge, with the ground sloping gently both to the south and north. The field was bounded by mature hedgerows, infilled with post-and-wire fencing. A metallic gate gave access to the field from the east. Within the survey area were at least two electrical masts for overhead cables running north-east/south-west in the south-east part of the field. The weather was partly cloudy with occasional rain.

4.3.2 Most apparent within NG3 was the former field boundary NG3(1) at the western end, showing as a negative linear encompassed by an associated positive response on each side, with an offshoot to the west and clearly marked on historical maps from the 19th century up to 1964 on the OS Plan. Immediately to the east of the former boundary was a faint, positive linear NG3(2) running north-south, somewhat parallel to it. Its location would suggest it is related to the boundary in some manner, potentially a spread of banking material or

ploughing along the edge of the field. On the opposite side of the field boundary are further positive linear responses NG3(3), which given their location, would also appear to be part of related activity.

4.3.3 Across much of the survey are a number of relatively evenly spaced faint positive linear responses NG3(4), largely orientated NNW – SSE, in line with the field orientation. Further shorter responses are orientated NNE – SSW. Due to their position and regular spacing they are likely indicative of plough marks.

4.3.4 At the western of the site lies a curvilinear positive anomaly NG3(5). The irregular curvilinear nature of the feature would suggest a natural origin.

4.4 Field NG4 (Figures 5 & 6)

4.4.1 This comprised a field of improved pasture. The field was level, and was bounded by a mixture of hedgerows and metal fencing, preventing effective surveying up to the boundaries. A large, metallic shed in the south-east corner restricted surveying into that area. Weather conditions were sunny and mild.

4.4.2 The background geology appeared quite strongly throughout the surveyed area. Also apparent throughout most of the surveyed area were positive linear anomalies NG4(1) running slightly north-west/south-east and parallel to each other, indicating ploughing activity. There are also a series of more irregular curvilinear features NG4(2), running roughly east-west across the field. These features appear to continue into Field NG5, and are possibly also a continuation of NG3(5) in Field NG3, and appear likely to be geological in nature.

4.4.3 At the north-western corner of the field and at the western edge of the field were distinct areas with discrete dipolar readings NG4(3). Such strong anomalies can be caused by ferrous objects, and if the ground was as heavily ploughed as indicated by NG4(1) it is possible these ferrous features were spread through ploughing.

4.5 Field NG5 (Figures 5 & 6)

4.5.1 This comprised a relatively level field of improved pasture. It was bounded to the west and south by hedgerows infilled with post-and-wire fencing, and in the north-west corner was a metal cattle gate into Field NG6. Weather conditions were sunny and mild.

4.5.2 A series of weakly magnetic curvilinear variations were recorded throughout the survey area NG5(1). These striations would appear to correspond with other

curvilinear features NG4(2) in the field to the east and NG3(5) beyond, as well as features in the field to the west, and are likely to be the result of natural features, such dried up streams, changes in the soil or even underlying geology. Towards the southern half of the survey area, the background responses change quite significantly, indicating a difference in geology or soil type between the two areas. Although the current ground surface is level, this would suggest the underlying geology drops off to the south, allowing a greater build-up of less magnetically obvious soils above. This is also reflected in the ground conditions with boggier ground more apparent in the field immediately to the south. It is possible some of the more north – south orientated NG5(1) anomalies may be the result of ploughing activity, as faint negative anomalies suggest plough scars appear to extend into the deeper soils at the southern end of the field.

4.5.3 In the centre of the survey area is one circular linear anomaly NG5(2), negative in polarity, measuring approximately 8m in diameter. Negative responses such as this can occur where there is an earthen bank made of lower magnetic material related to the topsoil around it.

4.5.4 There are three, possibly four, potential discrete features of positive polarity with no associated negative response NG5(3). These are all located in the northern part of the survey area. Such responses can represent in-filled cut features, either archaeological in origin or natural depressions in either the geology, or caused by large vegetation or wildlife. Due to the varied geology of this area, they may be more likely to be natural features.

4.5.5 Towards the southern end of the survey area, just before the geology changes, is a discrete dipolar feature NG5(4). This is likely a ferrous object due to the strength of the response.

4.6 Field NG6 (Figures 5 & 6)

4.6.1 This comprised a field of relatively level, improved pasture grazed by livestock. The field was bounded by hedgerows, infilled with post and wire fencing. The ground was heavily waterlogged and trampled by livestock in south-east corner. Also in the south-east corner, the cattle gate had been broken off its hinges and was lying on ground. An upright stone, standing approximately 1.15m high, stands in the centre of the field. This is recorded as a possible Bronze Age standing stone in the regional Historic Environment Record (PRN 47438). Weather conditions were sunny and mild.

4.6.2 The standing stone is defined by an discrete area of magnetically negative responses NG6(1). Adjacent positive responses may represent area of cattle

trampling that was evident at ground level surrounding the stone, but equally further associated activity may be represented within the survey results surrounding the stone, but these are difficult to isolate from background geological features and ploughing activity. Approximately 5m to the east however was a faint, positive circular linear feature with no clear associated negative response NG6(2), measuring approximately 6-7m in diameter. This may represent an archaeological feature, potentially associated with the nearby standing stone.

4.6.3 Another linear feature stands out within this survey area, this one running north-south NG6(3) just to the east of NG6(2). This is a negative linear flanked by associated positive responses on each side, and would appear typical of a former field boundary, although similarly orientated plough marks are also apparent across the field and no corresponding field boundary is visible on historic map sources.

4.6.4 The plough marks show up as several positive linear features NG6(4), running north-west/south-east. Their regularity and position would suggest they are related to ploughing activity.

4.6.5 At the northern end of the survey area is a potential grouping of positive anomalies which are possibly in-filled, cut features NG6(5). They are grouped around the linear feature NG6(3), and some seem to be incorporated into the possible boundary itself. The provenance of these features is unclear, they could potential represent natural or geological activity as well as potential archaeological features.

4.6.6 At the southern end of the survey area is another series of positive anomalies with a slight negative associated response NG6(6). Again, the provenance of these features is unclear, but given the presence of more defined archaeological activity to the north and south they be of some significance.

4.6.7 A series of irregular curvilinear anomalies are apparent within this field, and these appear likely to represent a continuation of the seemingly natural features that have been identified in the two fields to the east. It is possible however that these anomalies, along with the general background geological responses, may disguise more subtle archaeological features in this area. The change in the underlying geology, apparent in the field to the east, is also apparent within this field, with an area of fewer magnetic variations in the southeast corner suggesting a greater build-up of soil as the underlying geology presumably falls away. This is also reflected at ground level with this area heavily waterlogged.

4.7 Field NG8 (Figures 5 & 6, Appendix I)

4.7.1. This comprised a field of improved pasture grazed by livestock. The relatively level field was bounded by hedgerows infilled with post-and-wire fencing. The only area of limitation was in the north-east corner, which was heavily waterlogged. At the eastern end of the survey area stand two Bronze Age round barrow burial mounds (PRNs 3717 & 3718), both are protected as Scheduled Ancient Monuments (PE154) and the necessary consent was granted by Cadw and the landowner prior to survey work. The larger (westernmost) of the two is a plough-spread mound approximately 28m in diameter, 0.7m high (PRN 3717), the smaller (PRN 3718) being approximately 20m in diameter and 0.4m high. Weather conditions were sunny and mild.

4.7.2 The larger of the two barrows (PRN 3717) is clearly visible as a circular feature NG8(1). A strong positive response defines a potential buried ditch, approximately 22.5m in diameter. Surrounding this is an approximately 5m wide area of mixed responses, but largely magnetically positive, less well-defined on the eastern side, potentially representing an outer bank or ditch. The interior of the feature is generally more magnetically negative than the surrounding background readings, likely representing the imported mound material itself. Given that this site likely represents a Bronze Age burial mound, discrete readings just to the south of the centre, and in the northern part of the central circle may indicate buried features within the mound. There is also the faint suggestion of a possible second circular feature within, potentially overlying, or being overlaid by the main barrow feature.

4.7.3 The smaller barrow (PRN 3718) is not as distinct in the readings, but is still visible as a sub-circular feature NG8(2). Strong responses along the western edge may define a ditch that is less well-defined but still identifiable as with magnetically positive responses to the north, east and south. This defines a sub-circular feature approximately 17.5m east – west by 18.5m north – south. The interior is slightly more magnetically negative than the background responses. There are a number of discrete features both with and surrounding this feature. Some may represent burial archaeological features, although there does appear to be a general spread of such readings across this part of the site.

4.7.4 It may be of note that these barrow sites lie on the edge of what the background readings suggest may be deeper soils, as was apparent in fields NG5 and NG6 to the northeast. To the northwest of the barrows the background readings are distinctly different NG8(3), with stronger bipolar results spread over an area approximately 55m east – west by 40m north – south. These results may represent the more visible background geology, but given the concentrated area it may represent an area of general archaeological activity, spread about through

ploughing activity, indeed a number of possible east – west orientated linear marks have the appearance of plough marks NG8(7).

4.7.5 Across the northern edge of this potential area of general activity are a number of circular features NG8(4). These features are defined by magnetically positive responses, potentially representing cut ditches or gullies. The two central features are approximately 10m to 12m in diameter, with a slightly larger sub-circular feature at the west end. To the east a fourth feature is indicated by a strong positive response, with associated negative 'shadow'. This may represent a pit, or potentially an area of concentrated heat activity such as a hearth or kiln.

4.7.6 Lying to the west of the barrows are four areas of potential archaeological activity, visible as shadowy areas of generally positive readings NG8(5). These responses were not very distinct from the background readings, and it is possible that they may represent geological features. However, given the presence of the known barrows in the vicinity, these features may represent plough-out areas of archaeological activity, potentially further former barrow mounds.

4.7.7 There are a number of further inconclusive features NG8(6), largely represented by magnetically negative responses throughout the survey area. Given the strength and clarity of the responses it is possible they are part of the background geological responses, however, some do appear potentially circular in nature and are given greater prominence due to the presence of known archaeological activity in the vicinity.

4.7.8 There are a number of linear features NG8(7) across the survey area, some orientated east – west, and others north – south. It is likely, as mentioned above, that these represent potential plough marks, given their similar alignment to the present field boundaries. One central north – south linear feature NG8(8) is very similar in appearance, but is defined as a former field boundary as it aligns with a boundary visible on historic mapping.

4.8 Field NG9 (Figures 7 & 8)

4.8.1 This comprised a field of improved pasture, relatively level with a slight slope down to the south towards the line of the A40. The field was bounded by hedgerows infilled with post-and-wire fencing. A large, metallic shed in the south-east corner of the survey area had to be avoided, but is apparent in the data where magnetic interference occurred when the machine got too close to it. In a similar vein, the southwest corner contained some metallic debris on the edge of the field, as well as a metallic enclosure just on the opposite side of the fence.

This also created a strong response in the data. The weather was sunny and mild.

4.8.2 A significant grouping of dipolar responses formed an area of magnetic debris NG9(1) at the northern edge of the survey area. This was located at the end of the field furthest from the farm house, and may be the result of a spread of thermoremnant material, such as fired clay (bricks, tiles etc) or burnt material (ash, charcoal etc). There is no indication as to a relative date, this may potentially be the result of a modern bonfire, and equally it may be an archaeological feature, for example a burnt mound.

4.8.3 Towards the southern end of the survey area was a positive linear feature flanked by a negative response NG9(2), indicative of former field boundaries. This theory is reinforced by historic map evidence of a former field boundary in this location at least up until the early 20th century.

4.8.4 Lying between NG9(1) and NG9(2) are series of very faint negative linear features, running north/north-west, south/south-east, in line with the present field boundaries and indicative of plough marks NG9(3). It is possible some, if not all, of these features continue south of NG9(2).

4.8.5 Throughout most of the survey area are patterns of curvilinear positive anomalies. The faintest and longest of these runs mostly north/south NG9(4). Its serpentine appearance suggests it may be natural in origin, potentially representing a paleochannel, or remnant of an inactive stream that has filled with soil over time. This is certainly possible as it follows the path of a tributary from the Cleddau Ddu which now stops just north of the site. Other positive curvilinear features NG9(5) with a stronger signal all lie to the west of NG9(4). It is uncertain what these features represent, as the responses appear relatively strong, with some features at the southern end giving the impression of rectangular enclosures, whereas other are more irregular and natural in appearance. This could either mean that they are natural, smaller channels connected to the potential paleochannel, or they could be anthropogenic in relation to the channel.

4.9 Field NG10 (Figures 7 & 8)

4.9.1 This comprised a field of improved pasture, lying immediately west of Redstone Farm. The ground was relatively level, with a slight northward slope. The field was bounded by hedgerows, infilled with post-and-wire fencing. A rolled-up bit of metal fencing in the south-east corner and a fenced off area with metal containers in the south-west corner limited the surveying. Modern metallic

interference is visible on the survey results as a dark area in the southwest corner, and a light area in the southeast corner. The weather was overcast but dry.

4.9.2 The entire field appeared heavily disturbed, with strong bipolar signals throughout that may represent the underlying geology. Also throughout the survey area were alternating positive and negative linear anomalies running east-west NG10(1), most notable in the northern half. Due to their regularity they are most likely signs of ploughing activity.

4.9.3 At the south-eastern end of the survey area are a series of faint, positive linear features NG10(2), generally running NNE to SSW. Though they are somewhat regularly spaced, their shape and direction hint at a possibly natural origin, and they would appear to align with elements of NG9(5) visible in the field to the east. It is possible therefore that they could represent drainage channels.

4.10 Field NG11 (Figures 7 & 8)

4.10.1 This comprised the south-eastern end of a field of improved pasture. The field was bounded by hedgerows infilled with post-and-wire fencing to the south and east, and metallic fencing bordering the west side of the survey area. The weather conditions were sunny and mild.

4.10.2 The disturbance throughout the field created a significant amount of 'noise', which again may be resulting from the background geology. However, there was a clear circular feature picked up as a strong, positive anomaly with an associated negative response NG11(1) at the eastern end of the survey area. This circular feature, approximately 15m in diameter, had an apparent break on its east side of approximately 4-5m wide, with what appears to be well-defined termini. Adjacent to NG11(1) immediately to the north was another strong positive anomaly NG11(2), which, because of its proximity to NG11(1) and because of the lack of any other anomalies within the field, suggest a possible relationship between the two.

4.10.3 At the southern edge of the survey area was a negative linear anomaly NG11(3) parallel to the field boundary. It is possible this linear represents some kind of service run, or given its alignment, is associated with the boundary itself. A similar feature can be seen running adjacent to the eastern field boundary NG11(4).

4.10.4 Also at the southern edge of the survey area, perpendicular to NG11(3) were a series of positive linear anomalies NG11(5). It is unclear if these are features of archaeological interest, or part of the background geology.

4.11 Field NG12 (Figures 7 & 8)

4.11.1 This comprised a large field of improved pasture. The field was relatively level, with a slight rise to the north. The field was bounded by hedgerows to the south, infilled with post-and-wire fencing, and by metal fencing to the west, both of which obscured readings taken in their vicinity. The weather was overcast but dry.

4.11.2 No clear archaeological features were identified within this survey area, although possible features are suggested.

4.11.3 A number of faint linear anomalies appeared in the centre and west side of the survey area. Regularly spaced positive linear features running roughly north-north-east/south-south-west NG12(1), in line with the western field boundary, indicate possible ploughing activity.

4.11.4 Perpendicular to NG12(1) are two linear features running somewhat parallel to each other, both towards the northern edge of the survey area NG12(2). These features run WNW-ENE, and though they do not appear representative of a field boundary, they do appear to continue features visible in the field to the west, which themselves run parallel to a former field boundary. A curvilinear feature in between the two may be associated with the northernmost line, although the irregular line may be an indication of a natural origin.

4.11.5 Towards the eastern end of the survey area are two discrete features of magnetically positive responses NG12(3) that may be archaeological in nature, although their irregular appearance is suggestive of natural features.

4.12 Field NG13 (Figures 7 & 8)

4.12.1 This comprised a field at the western edge of total surveyed fields. It was a fairly level pasture with a gentle downward slope towards the south on the approach to the A40. It was bounded by hedgerows on all sides, infilled with post-and-wire fencing. The field had been clearly used for grazing cattle, as evidenced by hoof marks throughout. The rough ground made surveying difficult and sometimes impossible at the edges of the field. The weather was sunny and warm.

4.12.2 The underlying geology is quite visible in the northern part of the field and markedly different from the southern half. However, this disturbance could also be related to activity here, of which there seems quite a lot. Two strong, negative linear anomalies flanked by positive readings appeared most clearly in the survey area. One runs north-north-east/south-south-west NG13(1) in the northern part of the field, and then stops where it meets the other in the centre of the field

running west-north-west/east-south-east NG13(2). Cutting across NG13(2), running in an east-west direction, is a faint positive linear anomaly with an associated negative response NG13(3). Extending southward from NG13(2), slightly offset from NG13(1), is a similar anomaly NG13(4), though less distinct. These features are characteristic of former field boundaries. An east - west boundary is visible on 19th and 20th century map sources, likely to correspond to either NG13(2) or NG13(3), the north – south offshoots would appear to have been removed prior to the 19th century mapping.

4.12.3 A faint positive, and slightly curvilinear, anomaly NG13(5) sits at the northern end of the field, and runs slightly north-west/south-east. The strength of readings and slight curvilinear nature suggests it may represent a natural depression, although it continues into Field NG12 where it is labelled as NG12(2).

4.12.4 A positive linear anomaly with an associated negative NG13(6) response runs west-north-west/east-south-east just south of NG13(5). This may represent the line of some modern service run, but the strength of response, and its alignment with NG13(2), suggests it could possibly be an in-filled, cut feature, such as a ditch. This linear appears to continue into Field NG12, and there it is referred to as NG12(3). Towards the eastern end of this linear is a dipolar anomaly in an L-shape NG13(7), which appears to sit on NG13(6). It is approximately 8m long on its longest side (east-west) and approximately 3m long on the shorter leg (north-south).

4.12.5 Two faint positive linear anomalies NG13(8) are just visible east of NG13(1) running north-west/south-east, and cutting across the line of NG13(5) and NG13(6). Though similar in size to the field boundaries, they lack the associated negative response in the middle which would indicate a bank, like other boundaries. Therefore, it may represent the line of a former trackway.

4.12.6 Running northwards off of NG13(2) are another pair of parallel positive linear features NG13(9), which fade out before running into NG13(6). Again, with the lack of associated negative response it is possible that these are cut, in-filled features, or possibly a track. An L-shaped offshoot runs to the west, appearing to cross the line of NG13(1). It is possibly they are associated with a series of small positive linear features with a negative response to one side NG13(10), that lie just to the east. These features are all orientated north-northwest – south-southeast, in line with the former field boundary NG13(2) (although occur on both sides of the boundary), are regularly spaced and grouped together tightly. Their alignment and spacing would suggest they represent plough marks, however their confinement to a relatively distinct area may indicate they represent different activity, although still potentially agricultural in nature.

4.12.7 Of note, the southern part of the field (south of NG13(2)) was relatively quiet and contained a general scatter of magnetic debris. One faint, negative linear running west-north-west/east-south-east NG13(11), could represent a place where the ground is built up, such as a slight bank, however, such regularly straight features such as this are often indicative of modern service runs.

Southern Route

4.13 Field SG1 (Figures 9 & 10)

4.13.1 Field SG1 lies immediately south-west of the Penblewin roundabout. It comprised of pasture, recently grazed by sheep, gently sloping towards the south and east. The field was bounded by hedgerows infilled with post-and-wire fencing to the north and east, and with post-and-wire fencing to the west. A cattle gate providing access was on the east side. Towards the west end of the survey area was a gulley that was unsuitable for surveying due to the sloping ground and vegetation build-up, and was therefore avoided. The weather was overcast but dry.

4.13.2 The survey results demonstrated changes in the background responses, likely resulting from the background geology becoming more prominent in the central part of the field.

4.13.3 Two positive linear features with associated negative responses at the north end ran east-west SG1(1), with a slight curve to the south in the middle. The curve of these features follows the contour of the ground, and yet because of their associated response they seem unlikely to be natural features. Their proximity to the A40 suggests a potential association, possibly as drainage, services or construction material. The features may also predate the road, potentially associated with ploughing activity visible on a similar orientation in field NG1 to the north, or potentially representing an earlier routeway predating the current line of the A40.

4.13.4 At the head of the gully along the western edge of the field is a potentially discrete area of dipolar responses SG1(2). There is little to distinguish this from the general background readings, but it may be of significance given its location at the head of the gully.

4.13.4 Running perpendicular to SG1(1) were a series of tightly knit, linear features SG1(3) of both positive and negative nature. These are aligned with the field boundaries and are likely indicative of ploughing activity.

4.14 Field SG2 (Figures 9 & 10)

4.14.1 This comprised a field of improved pasture with a slight slope down to the south and west. The field was bounded by hedgerows with post-and-wire fence infill except on the east side which was just post-and-wire fence. The weather was cloudy but dry.

4.14.2 Several linear anomalies were noted in the field. Two areas appearing shadowed due to a wider positive response SG2(1) could be natural features within the background geology due to natural water drainage down the slope. They were orientated WNW-ESE, roughly following the orientation of natural topography by running across the sloping ground.

4.14.3 On a similar orientation is another, stronger positive linear with only a slight associated negative response SG2(2). Starting from this linear, and running south from it, was a negative linear with two flanking positive anomalies. The way in which these two feature connect suggests a relationship. The roughly east – west aligned feature runs along the line of a former field boundary marked on the 1841 tithe map, the southern offshoot is not marked on the map and may be an earlier sub-division.

4.14.3 At the southern end of the survey area were several faint positive linear features with associated negative responses SG2(3). These ran east - west, and could be signs of ploughing activity. However, one in particular SG2(4) may be a continuation of a possible field boundary from Field SG3 to the west. An isolated discrete bipolar response SG2(5) in the northeast corner of the field may be of note, but the strength of response suggests a metallic item, often found to be of modern origin.

4.15 Field SG3 (Figures 9 & 10)

4.15.1 This comprised a field with tall grass, which was fairly level with a slope at the southern end towards the south. The field was bounded by hedgerows with post-and-wire infill. The southern edge of the survey area was bounded by post-and-wire fencing. Weather conditions were overcast but dry.

4.15.2 Crossing the central part of the field on an WNW-ESE orientation was a positive linear anomaly with an associated negative response SG3(1). This possibly continues into Field SG2 as anomaly SG2(4). The strength of the signal makes it unlikely to be metallic services, so potentially this could be an old boundary or drainage ditch.

4.15.3 On the southern edge of the field was a strong positive linear anomaly with a negative response SG3(2) running parallel to the fence line in a north-west/south-east direction, suggesting a connection with the modern fenceline.

4.15.4 Several other fainter positive linear features appeared SG3(3), running north-south. This may be evidence of ploughing activity, but because they appear to stop at SG3(1), it is possible they could represent previous small field divisions.

4.16 Field SG4 (Figures 9 & 10)

4.16.1 This field of improved pasture had a steep slope to the south, and was bounded by hedgerows to the west, scrub to the south and post-and-wire fencing to the north. The ground underfoot was very uneven towards the top of the hill due to deep ridges along the length of the hill; this made the upper part of the field unsuitable for surveying. The furthest south part of the survey area contained a steep drop-off into vegetation, also making this unsuitable for surveying. Weather conditions were partly cloudy and dry.

4.16.2 No features of specific interest were identified within the surveyed area. A series of high responses of linear anomalies SG4(1) could be agricultural, such as plough marks or even ruts worn into the ground by livestock walking across the hill.

4.17 Field SG5 (Figures 9 & 10)

4.17.1 This field of improved pasture had a moderate slope down to the south. A steeper drop-off at the southern-most end made surveying to the edge impossible. The conditions were dry and bright.

4.17.2 Although a scatter of positive discrete responses are visible throughout the survey area these may be caused by natural depressions and no features of specific interest were identified.

4.18 Field SG6 (Figures 9 & 10)

4.18.1 This large, flat field of pasture occupied an area of lower ground to the south of the A40. The low-lying nature of the field indicated it could become water-logged, which was reflected in the nature of the vegetation, but the ground proved suitable to walkover at the time of surveying. The field was bounded by a combination of dense scrub and hedgerows with post-and-wire infill. A small

watercourse/drain ran along the western end of the survey area. Weather conditions were dry and bright, damp underfoot.

4.18.2 Regular, faint linear features SG6(1) running throughout the entire survey area show evidence of ploughing and/or drainage channels, also visible to the naked eye. A scatter of discrete dipolar anomalies as well as positive anomalies along the lines of the plough marks are likely resultant of the former ploughing. No other features of specific interest were identified within the surveyed area.

4.19 Field SG8 (Figures 11 & 12)

4.19.1 This large, flat field occupied an area of lower ground to the south of the A40. The field was bounded by a combination of trees and hedgerows with post-and-wire infill, with an area of woodland and dense scrub to east. The field was waterlogged in several places with reeds growing throughout, making survey challenging in certain areas.

4.19.2 The waterlogged nature of the field is reflected in the results, with a greater build-up of soil noted in the general lack of background responses. Three discrete anomalies SG8(1) of a similar size and regularly spaced were noted at the southern edge of the survey area may be of potential interest given their potential alignment. Similar strong bipolar responses however have been found to represent relatively modern metallic items in the upper soil. No other features of specific interest were identified within the surveyed area.

4.20 Field SG9 (Figures 11 & 12)

4.20.1 This large field of improved pasture was bounded by hedgerows with post-and-wire infill, and post-and-wire fencing to the north. The land sloped gently to the north. Weather conditions were bright and dry.

4.20.2 A number of discrete positive responses are visible throughout the surveyed area, but there is little positive indication that these are anthropogenic in nature, therefore no specific features of interest are highlighted.

4.21 Field SG10 (Figures 11 & 12)

4.21.1 This area represented a relatively large, low-lying field of rough pasture. At the time of the survey the edges of the field were thick with overgrown scrub and

thick areas of reeds, especially at the north-western edge. This made surveying to the edge of the field not possible. Weather conditions were bright and dry.

4.21.2 At the northern edge of the field was an unusually formed, strong bipolar anomaly SG10(1), radial in its form, with linear sections radiating from the centre. This could possibly have been caused by lightning, in consequence leaving a mark referred to as 'lightning-induced remanent magnetism' (LIRM) (Jones and Maki, 2005).

4.21.3 A general spread of discrete anomalies area noted across the field, particularly along the southeast edge of the survey area, but there is little to indicate that these are of specific archaeological interest.

4.22 Field SG11 (Figures 11 & 12)

4.22.1 This was an irregularly shaped field of improved pasture. The field was bounded by mature hedgerows infilled with post-and-wire fencing, although the hedgerows had become overgrown and lined with scrub, preventing surveying up to the edge of the survey area. Conditions were dry and bright.

4.22.2 At the north-west corner of the survey area, the ends of several positive and negative linear anomalies SG11(1) are clearly visible, with fainter responses indicating that they continued throughout the survey area. These linear anomalies are visible at surface level within the field as prominent ploughing ridge and furrows.

4.22.3 A spread of discrete dipolar responses SG11(2) along the eastern edge of the survey area potentially represent a spread of magnetic/metallic debris in the plough soil.

4.23 Field SG13 (Figures 13 & 14)

4.23.1 This was a large field of improved pasture. It was a flat field, although sloping off at the south-eastern end, bordered by hedgerows, with the property boundary to Blaenmarlais to the south. This field contained some areas of rubbish heaps, including a pile of wood in one part of the survey area that had to be dummied, hay bales and a tractor and other pieces of metal in other parts of the field. The weather conditions were bright and sunny.

4.23.2 The field showed quite a spread of dipolar material throughout the survey area, leaving vague positive linear anomalies running north-west/south-east as possible plough marks SG13(1).

4.23.3 At the east end of the survey area was a positive linear features SG13(2). This linear ran parallel to the SG13(1), but was much more distinct. Given the alignment with the field boundaries and presumed plough marks, this may represent an agricultural drainage feature.

4.23.4 At the northern end of SG13(2) was a distinctive negative linear flanked by positive responses SG13(3). This was visible at surface level as vehicle tracks entering the field from the field gate.

4.23.5 Spread across the survey area are a series of relatively faint linear responses SG13(4). These are likely to be geological in nature.

4.35.6 Offset from the centre of the field is an area, or spread SG13(5) of responses that appear slightly stronger and more dipolar than the general background responses across the field. There is no clear form to this feature however, it may simply represent variations within the plough soil.

4.35.7 Prior to the survey a potential circular feature of interest had been identified within this field from aerial photography. However, there is no clear evidence of such a feature within the survey results.

4.24 Field SG14 (Figures 13 & 14)

4.24.1 This field sloped toward the south-west towards a deep gully that formed the western boundary. The field was bounded by hedgerows and post-and-wire fencing, with electric fencing running in front. A fallen metal fence ran north – south through part of the area. The electric fence also bordered a deep gully on the west side of the survey area. Conditions were mixed with showers and sun.

4.24.2 The most distinctive feature was a curvi-linear spread of positive results SG14(1) across the northern end of the field. The inconsistent and irregular nature of the feature would suggest it represents a natural feature, such as a former stream line or changes in the geology.

4.24.3 A number of negative linear features SG14(2), somewhat parallel to each other, follow the contours of the ground in a northeast – southwest direction. It is possible these are marks from agricultural activity.

4.24.4 A stronger negative linear feature SG14(3), flanked by positive responses, runs in a northeast – southwest direction along the southern end of the field, with a southward turn at its western end. This appears more distinctive than the potential ploughing activity, and may mark the line of a former boundary. No boundary is marked on historic map sources at this location. There are linear

features SG14(4) aligned with it to the south, and seemingly contained with SG14(3).

4.24.5 A small area of dipolar responses SG14(5) lie close to the eastern field boundary. Although indistinct, such responses could originate from a spread of heat-affected material, such as charcoal.

4.25 Field SG15 (Figures 13 & 14)

4.25.1 This was relatively large field of improved pasture, although only the northern part of the field was surveyed. The boundaries comprised hedgerows infilled with post-and-wire fencing, and ground sloped gradually to the south, increasing in gradient down a gully that ran northeast – southwest and formed the field boundary. The long grass in the field made surveying challenging especially when walking downhill. The weather was sunny and warm.

4.25.2 There was a general scatter of dipolar anomalies, which is common on farmed land where debris has been spread. Amongst this, however, was a concentrated area of positive anomalies with a slight negative response grouped together at the eastern end of the survey area SG15(1). Though it is unclear what these represent, their grouping together may suggest something deliberate.

4.25.3 One negative linear flanked by two positive linear responses SG15(2) shows a former field boundary which was visible on 19th century mapping up until the 1907 OS Plan.

5 Interpretation and Discussion

5.1.1 Although ground conditions, in particular areas of waterlogging, undergrowth and woodland, prevented a full survey of the entire development area, a large area was surveyed. Background geological responses may serve to mask some more subtle features, however after standard processing techniques were used potential features were identified across many of the surveyed areas, which suggests that significant archaeological remains have not been missed. Geophysical surveys such as this will not however identify all potential archaeological features, and more intrusive archaeological investigations would be required to test the potential interpretations highlighted below.

The Northern Route

Natural features

5.1.2 Background geological responses were picked up in most fields throughout the northern route, perhaps not surprising given the location of these surveys areas close to the top of the ridgeline through this area, which is likely to have resulted in thinner soils. The strength of the response from the background geology appears relatively strong in places, which raises the potential for it to mask some of the more subtle archaeological features in this area.

5.1.3 A number of natural features appear to have been identified within these results, perhaps of most note around the area of the known Bronze Age round barrows (fields NG5, NG6 and NG8). A distinct change in the results suggests an area of deeper soils immediately to the east of the barrows, potentially more fertile ground, or potentially, as can still be seen in the field to the east of the barrows, an area of more waterlogged ground or where water may collect.

5.1.4 A number of smaller channels are visible within the geology, particularly evident in fields NG4, NG5 and NG6, as well as NG9 and NG10, but also less distinct within NG1 and NG2 to the east, and NG11, NG12 and NG13 to the west. Within NG9 in particular the line of a former palaeochannel may have been identified (NG9(4)), running roughly north – south, and backed-up by an area of potentially deeper soils to the east within NG9 and NG8. This may be of particular significance given the presence of Bronze Age activity close by, and may be both a factor in the siting of the nearby barrows, but also affect the interpretation of features in its vicinity.

Archaeological Features

5.1.5 A number of relatively clear, and potentially significant, features of archaeological interest were identified along the northern route, these are highlighted on the interpretation plans in red. Fields NG1, NG6, NG8, NG9 and NG11 were of particular interest in their potential for archaeological features.

5.1.6 The most visible area of archaeological activity lies in the centre of the northern route, where two Bronze Age round barrows are visible at surface level within Field NG8. The larger of the two barrows is very distinct within the survey results, with external ditches and internal mound material apparent. There is also the suggestion of a second circular feature within it, which if a true archaeological feature could suggest a pre-existing site. Potential internal features also suggests the possibility of burial features surviving within and surrounding the mound. The smaller of the two mounds is less visible, likely a result of ploughing activity and erosion, but the lack of obvious responses also indicates that other similar ploughed-out features could be difficult to spot within the survey results.

5.1.7 These two barrows are protected as Scheduled Ancient Monuments, and lie off the proposed route, but the survey area was included to give context to activity in the surrounding area. A series of circular features lie off to the northwest, potentially representing smaller outlying barrows, or possible structures, pits and other activity. They also lie within an area of bipolar responses that suggest general archaeological activity. The presence of plough marks within it would suggest this has been spread, but highlights an area of particular archaeological interest, as finding evidence of activity surrounding Bronze Age barrows is relatively unusual. Given the presence of archaeological activity, and also the lack of obvious responses for the smaller barrow, a series of less distinct responses to the west may represent ploughed out archaeological features, potentially further barrow remains.

5.1.8 Archaeological activity also clearly extends beyond the limit of this field. To the west in field NG9 an area of bipolar responses likely represents a spread of heat-affected material. It is possible that this represents little more than the site of a modern bonfire, but given the presence of Bronze Age activity, and the possibility of a former stream channel, this may represent the site of a burnt mound. Such features are common indicators of Bronze Age activity, where water was heated, often by using heated stones, leaving behind a mound of heat-affected stone and charcoal. To the north, in field NG6, lies a standing stone. This stone has clearly been used as a rubbing stone by cattle, and many such stones throughout Pembrokeshire were erected for such purposes in the post-medieval period, however the inter-visibility with the barrows to the south, and the presence of a

small circular feature in the survey results to the east, suggests this may be part of the concentration of potential Bronze Age activity in this area.

5.1.9 These remains would also appear to be part of a wider landscape of potential Bronze Age activity as well. To the east, circular features identified within field NG1 may represent another cluster of prehistoric activity. The larger of the two features (NG1(2)) could potentially be another barrow site, or enclosure. There are suggestions of further circular features adjacent to it (NG1(3)), and, as with field NG8, these lie in an area where there is a spread of most distinct background bipolar responses. In this location the extent would appear to represent geological material, but it may be masking further circular features and discrete features in the vicinity. A detached circular feature to the northeast would appear potentially structural, given the size and possible defined termini on the defining circular ditch. L-shaped linear features in the northeast and southeast corners of the field have the appearance of enclosure ditches, potentially associated with the possible prehistoric activity, but given their location could also be focused on the roads that pass through the area, and therefore later, potential post-medieval, in date (although neither appear on mapping from the mid-19th century onwards).

5.1.10 Another potential prehistoric site also lies at the western end of the route. In field NG11 a circular feature, potentially representing a structural feature or enclosure, would appear similar to the potential Bronze Age activity suggested elsewhere, although no clear cluster of activity is identified here.

Potential Archaeological Features

5.1.11 Throughout the survey area a variety of potential features are identified in every field, highlighted on the interpretation plans in yellow. Some of these features, largely due to their location, may represent potential features associated with the more defined prehistoric archaeology, and these have been discussed above, particularly with fields NG1, NG6, NG8 and NG9.

5.1.12 A large number of linear features, generally irregular in nature, are also visible in Fields NG2, NG9, NG10 and NG11, and also to some extent within NG12. They are most apparent when the background geology is more visible, and may therefore be more likely to represent natural channels. Some of the linear features in fields NG12 and NG13 appear more regular in nature and potentially therefore more artificial. These may represent a series of earlier field boundaries, although they (NG12(2), NG13(5) & NG13(6)) do also appear to follow the general alignment of the background geology, and feature NG13(11) has the appearance of a modern service run or field drain. Feature NG13(9) however,

when combined with features NG13(10) may indicate an area of archaeological activity, although the nature of that activity is uncertain.

5.1.13 A number of discrete features are also highlighted throughout the survey area. Generally, other than features identified in Field NG8 discussed above, there is no obvious pattern to these discrete features and interpretation is difficult. Some may represent buried archaeological features, but equally many could represent features present in the ploughsoil. Features with strong bipolar responses, such as NG4(3), are typically found to be relatively modern metallic items within the plough soil.

Field Boundaries and Plough Marks

5.1.14 Strong linear anomalies that were possible former field boundaries appeared in Fields NG1, NG2, NG3, NG6, NG8, NG9 and NG13, and are highlighted in blue on the interpretation plans. Cross referencing with historic maps, including the tithe maps of the 1840s, and Ordnance Survey maps from the 1880s onward, confirmed these boundaries within fields NG2, NG3, NG8, NG9 and one of the boundaries in NG13. The remaining boundaries in NG13, NG6 and NG1 are therefore likely to predate this mapping evidence.

5.1.15 Field boundaries sometimes appeared as positive linear responses flanked by negative responses but at other times vice versa. As these responses varied and these boundaries are no longer extant, it is difficult to determine why these boundaries produced different readings. Boundaries in this area currently constitute a bank with slight ditches on either side, which would likely produce the negative linear anomalies flanked by positive responses.

5.1.16 Regular linear marks appeared in most fields, including Fields NG1, NG2, NG3, NG4, NG6, NG8, NG9, NG10 and NG13. The linearity, regular spacing and alignment with present field boundaries all suggest these represent plough marks.

The Southern Route

Natural features

5.1.17 Background geological responses are picked up in greater prominence at the eastern and western ends of the southern route, which corresponds with the visible topography, with lower-lying, potentially waterlogged ground in the centre. This can be seen by the generally 'quieter' background responses for fields SG6 through to SG11.

5.1.18 As with the northern route a number of natural features appear to have been identified, although less distinct and numerous. To the east features like SG2(1) appear to represent folds in the falling topography, whilst to the west SG14(1) is more likely to represent a former stream channel. A series of short linear features SG13(4) in Field SG13 would appear to continue a pattern of natural geological features visible in fields to the north (NG9, NG10, NG11).

5.1.19 Of interest, but not of archaeological value, feature SG10(1) has been interpreted as the remnants of a lightning strike.

Potential Archaeological Features

5.1.20 Unlike the northern route areas of distinct archaeological potential were not as apparent along this southern route, although a number of potential archaeological features have been highlighted, shown on the interpretation plans in yellow.

5.1.21 These do not appear to point to large areas of potential activity, but largely instead relate to more individual features along the route. At the eastern end field SG1 contains a linear feature SG1(1), which may be of some interest given the apparent cluster of possible prehistoric archaeological remains in the nearby field to the north of the A40. Similarly SG1(2), although relatively indistinct in itself, its location at the head of a gully, near potential prehistoric activity to the north suggests it has potential.

5.1.22 Individual discrete features are picked up throughout the survey area, a few are highlighted as being of potential interest, such as SG2(5), SG8(1) and SG11(2), but it is difficult to provide any more detailed interpretation of them.

5.1.23 Towards the western end of the route, in fields SG13, SG14 and SG15 there are spreads of readings that appear slightly distinct from the general background responses, potentially representing areas of archaeological activity. These features are however of uncertain origin. Within SG13 a general spread of

readings SG13(5) have been highlighted, although they form no coherent pattern and the edges are uncertain, it is possible therefore that this represents little more than localised changes in the magnetic properties of the soil. Within SG14 is a small spread of dipolar responses SG14(5), somewhat reminiscent to NG9(1) in the northern route, a potential prehistoric burnt mound, and may represent burnt material. The spread is not extensive, the readings are only a slight variation on the background and it is located on the edge of the field, it could therefore simply represent a modern bonfire deposit, but an archaeological origin cannot be dismissed. Within SG14 lie a spread of relatively strong dipolar responses at the eastern end of the field. These feature do appear to be concentrated along the northern edge of the field, and the strength of the responses may suggest metallic material, often found to be relatively recent in date, therefore this would appear more likely to be associated with modern boundary activity.

Field Boundaries and Plough Marks

5.1.24 There are a number of linear features spread throughout the southern route that have the appearance of either field boundaries, or ploughmarks.

5.1.25 Probable field boundaries are highlighted in blue (with the exception of SG13(3), which could be related to visible agricultural vehicle tracks). At the eastern end of the scheme two such features are shown in field SG2, labelled as SG2(2) and SG2(4). SG2(2) corresponds with a field boundary visible on the tithe map from the 1840s, seemingly removed by the end of the century as they do not appear on Ordnance Survey mapping from 1889 on. SG2(4) is not visible on any maps, but the similarity would suggest it also represents a field boundary, presumably therefore pre-dating the earliest maps of the 1840s. This also continues into the adjoining field (SG3) as SG3(1), again seemingly predating the maps. A series of linear features to the north SG3(3) appear to terminate at this former field boundary, suggesting further earlier field subdivisions. SG3(2), given its alignment, is likely to be modern in origin, associated with modern boundary that currently defines the southern edge of this field.

5.1.26 At the western end of the route a former field boundary is visible in field SG15, labelled as SG15(2), which is visible on the tithe map and Ordnance Survey mapping up until 1907. Within the field SG14 to the east a field boundary is suggested by linear feature SG14(3), backed up by the presence of similarly aligned probable plough marks SG14(4). Given its location close to the current southern boundary, and the southward turn at the western end, it would seem likely that it predated the current boundary. However, no such boundary is visible on any of the historic mapping, and the line of the current southern boundary

appears consistently on all historic mapping, suggesting it has been in place for some time.

5.1.27 The plough marks SG14(4) are a common feature of the survey results, highlighted in green, and are largely identifiable as linear readings that are aligned to the field boundaries that contain them. Within SG14 further linear striations SG14(2) follow the line of the western boundary, running along the general topography of the field. Similar marks are visible in field SG13 (SG13(1)), SG11 (SG11(1)), SG6 (SG6(1)), SG4 (SG4(1)), SG2 (SG2(3)) and SG1 (SG1(3)). These marks are also visible on the surface in both field SG6, where they are likely to represent drainage channel cut into the boggier ground, and in field SG11. Within the latter field they are visible as ridge and furrow marks.

6 Conclusion

6.1 Between April and August 2019 Archaeology Wales carried out a geophysical survey on the site of a proposed road improvement scheme of the A40 between Penblewin Roundabout and Redstone Cross, near Llanddewi Velfrey, Pembrokeshire. Two alternate routes were surveyed, a route to the north of the current A40, and another to the south. The proposed development area currently consists of a large number of agricultural fields of pasture and arable land, largely bounded by hedgerows. The site covers an area of approximately 30 hectares across 29 fields.

6.2 The survey of the northern route picked out a number of areas of potentially significant archaeological interest, located within Fields NG1, NG6, NG8, NG9 and NG11. Field NG8 in the centre of the route is of particular note, containing the Scheduled remains of two Bronze Age round barrows. Although the barrows themselves lie off the proposed route, the survey results suggest a variety of potential associated archaeological activity spread through Field NG8 and into field NG6 to the north, and potentially into Field NG9 to the west. Similar archaeological activity, potentially prehistoric in date, was also revealed within Field NG1 at the eastern end of the route, and in field NG11 at the western end of the route. It is likely further archaeological mitigation may be required in these areas prior to development works commencing, in order to better understand the date, function, condition and importance of these remains.

6.3 Alongside the more distinct archaeological remains described above, a large number of features of uncertain origin, but potentially archaeological in nature were also revealed in Fields NG2, NG9, NG10 and NG11, and to some extent within

NG12. Although their interpretation is uncertain, these features may require some form of archaeological mitigation to ensure they are investigation and appropriately recorded if they are to be disturbed through potential development. Field boundaries, other identified features, and areas adjacent to possible archaeological features may be investigated via an archaeological watching brief during development works.

6.4 The survey of the southern route did not identify any distinct features of significant archaeological importance. It did however identify features of uncertain origin but potential archaeological interest spread throughout the route within Fields SG1, SG2, SG8, SG11, SG13, SG14 and SG15. Although their interpretation is uncertain, these features may require some form of archaeological mitigation to ensure they are investigation and appropriately recorded if they are to be disturbed through potential development. Field boundaries, other identified features, and areas adjacent to possible archaeological features may be investigated via an archaeological watching brief during development works.

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Ordnance Survey	1889	*County Series map, 1st edition 1:2500*
Ordnance Survey	1907	*County Series map, 2nd edition 1:2500*
Ordnance Survey	1970	*1:2500 Plan*

Photo 1: Field NG1, looking north across survey area of long grass

Photo 2: Field NG2, looking north across the survey area, with the Preseli’s in the background.

Photo 3: Field NG3, looking south across the survey area, with Blackmoor Hill lying on the A40 visible on the right.

Photo 4: Field NG4, looking northeast across the survey area.

Photo 5: Field NG5, looking NNW across the survey area.

Photo 6: Field NG6, showing the standing stone (PRN 47438).

Photo 7: Field NG8, looking northeast, showing the two Scheduled round barrows (SAM PE154) to the right of the surveyor.

Photo 8: Field NG9, looking SSE across the survey area, with Redstone Farm in the background.

Photo 9: Field NG11, looking northeast.

Photo 10: Field NG13, looking southwest. The lorry identifies the line of the A40 to the left.

Photo 11: Field SG3, looking west along the southern edge.

Photo 12: Field SG12, looking west along the northern edge of the field.

Photo 13: Field SG8, looking southwest across the semi-waterlogged area.

Photo 14: Field SG9, looking east, showing the visible plough/drainage lines.

Photo 15: Field SG10, looking northeast.

Photo 16: Field SG11, looking southeast.

Photo 17: Field SG13, looking southeast across the survey area, and area of possible circular feature identified from aerial photography (but not visible on the survey results).

Photo 18: Field SG14, view north towards Redstone Cottages, showing internal abandoned field boundary.

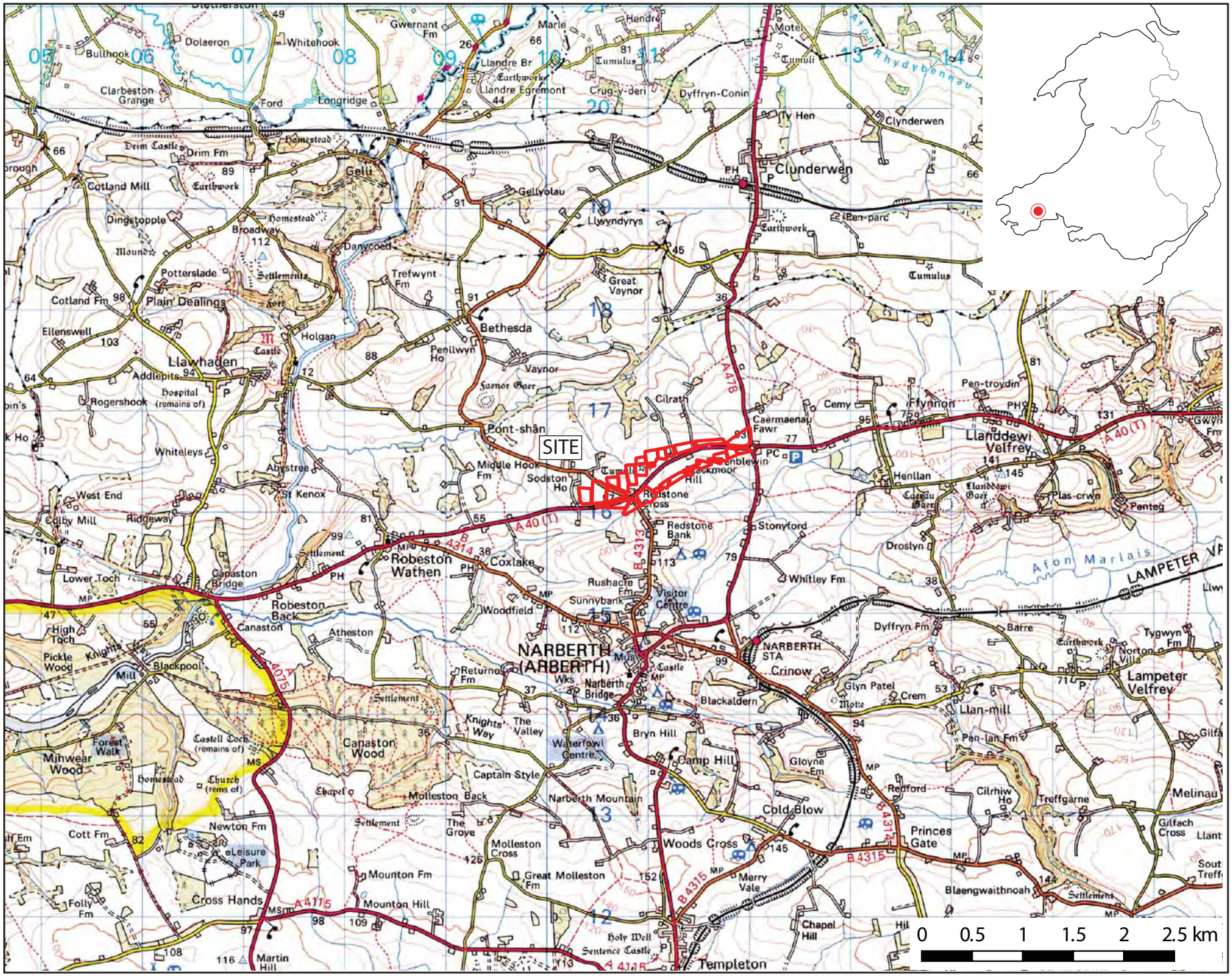


Figure 1: Location map, 1:50,000 @ A4

ARCHAEOLOGY WALES
Revealing the past, informing the future

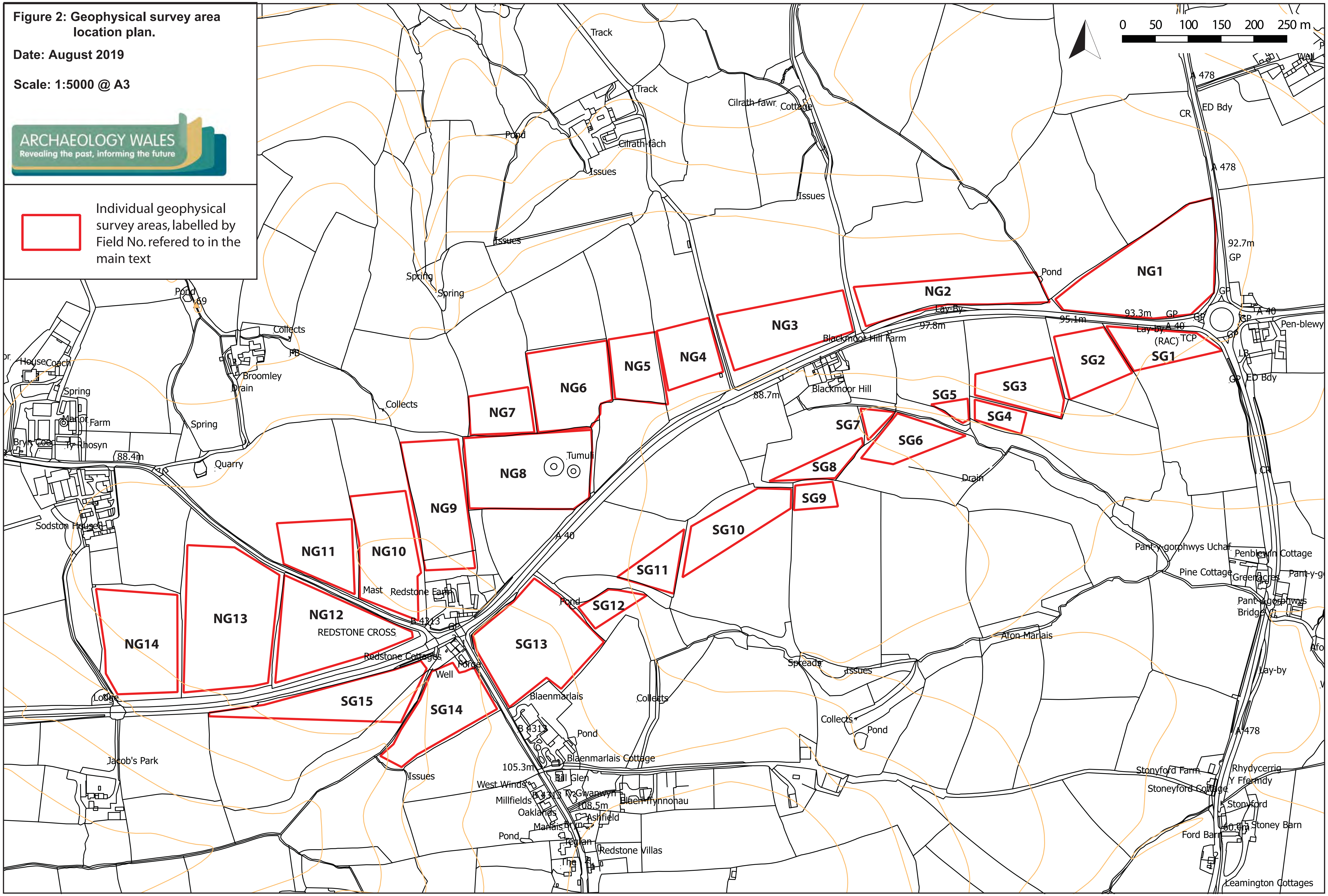
Figure 2: Geophysical survey area location plan.

Date: August 2019

Scale: 1:5000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

Individual geophysical survey areas, labelled by Field No. refered to in the main text



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SG12
SG13
SG14
SG15
Track
Cilrath fawr
Cottage
Cilrath-fâch
Pond
Issues
Spring
Collects
Broomley
Drain
Coach House
Manor Farm
Bryn Coch
Ty-Rhosyn
88.4m
Quarry
Sodston House
Lodge
Jacob's Park
Tumuli
Mast
Redstone Farm
REDSTONE CROSS
Redstone Cottages
B 4313
GP
Forge
Well
A 40
Blackmoor Hill Farm
Blackmoor Hill
88.7m
97.8m
95.1m
93.3m
92.7m
Lay-By
Lay-by
(RAC) TCP
A 478
CR
ED Bdy
Pen-blewyn
LB
Pant-y-gorphwys Uchaf
Penblewyn Cottage
Pine Cottage
Greenacres
Pant-y-gorphwys Bridge
Afon Marlais
Spreads
Blaenmarlais
Blaenmarlais Cottage
105.3m
West Winds
Millfields
Oaklands
Bil Glen
Ty Gwanwyn
108.5m
Blaenffynnonau
Ashfield
Marlais
Tegfan
Redstone Villas
Stonyford Farm
Rhydycerrig
Y Ffermdy
Stoneyford Cottage
Stonyford
Stoney Barn
Ford Barn
60.6m
Leamington Cottages

0 20 40 60 80 100 m 1:2,000

ED Bdy

CR

A 478

Issues

NG1

NG2

NG3

92.7m

GP

Pond

Lay-By

95.1m

97.8m

GP

A 40

GP

GP

A 40

Pen-blewyn

Lay-by
(RAC)

TCP

GP

LB

Blackmoor Hill Farm

Blackmoor Hill

Figure 3: Geophysical survey results along the northern route. Part 1 of 3.

1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Issues

NG2

NG3

NG1

NG2(1)
NG2(2)
NG2(3)
NG2(4)
NG2(5)
NG2(6)

NG1(1)
NG1(2)
NG1(3)
NG1(4)
NG1(5)
NG1(6)
NG1(7)
NG1(8)
NG1(9)

Pond

Lay-By

97.8m

95.1m

93.3m

Blackmoor Hill Farm

Blackmoor Hill

ED Bdy

CR

A 478

92.7m

GP

A 40

Lay-by
(RAC)

TCP

Pen-blewyn

LB

Figure 4: Geophysical survey results along the northern route, overlaid with interpretation. Part 1 of 3.
1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Issues

Issues

Spring

NG2

NG3

NG4

NG5

NG6

NG8

NG9

97.8m

Blackmoor Hill Farm

Blackmoor Hill

88.7m

A 40

Figure 5: Geophysical survey results along the northern route. Part 2 of 3.

1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Issues

Issues

Spring

NG2

NG3

NG4

NG5

NG6

NG8

NG9

NG3(1) NG3(2) NG3(3) NG3(4) NG3(5)

NG4(1) NG4(2) NG4(3)

NG5(1) NG5(2) NG5(3) NG5(4)

NG6(1) NG6(2) NG6(3) NG6(4) NG6(5) NG6(6)

NG8(1) NG8(2) NG8(3) NG8(4) NG8(5) NG8(6) NG8(7) NG8(8)

97.8m

Blackmoor Hill Farm

Blackmoor Hill

88.7m

A 40

Figure 6: Geophysical survey results along the northern route, overlaid with interpretation. Part 2 of 3. 1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Drain

Collects

Manor Farm

Spring

88.4m

Quarry (disused)

NG6

NG8

NG10

NG11

NG13

NG9

A 40

Redstone Farm

Pond

B 4313

GP

REDSTONE CROSS

NG12

2

1

Redstone Cottages

Forge

Well

Lodge

Figure 7: Geophysical survey results along the northern route. Part 3 of 3.

1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Manor Farm

Spring

Drain

Collects

88.4m

Quarry (disused)

NG6

NG10

NG11

NG13

NG9

NG12

A 40

B 4313

Pond

GP

REDSTONE CROSS

Redstone Cottages

Forge

Well

Lodge

NG9(1)
NG9(3)
NG9(5)
NG9(2)
NG9(4)
NG10(1)
NG10(2)
NG11(4)
NG11(2)
NG11(1)
NG11(3)
NG11(5)
NG13(1)
NG13(5)
NG13(8)
NG13(6)
NG13(7)
NG13(2)
NG13(9)
NG13(10)
NG13(3)
NG13(11)
NG13(4)
NG12(2)
NG12(3)
NG12(1)

Figure 8: Geophysical survey results along the northern route, overlaid with interpretation. Part 3 of 3. 1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Pond

Lay-By

97.8m

95.1m

92.7m

GP

A 40

Lay-by

TCP

Blackmoor Hill Farm

Blackmoor Hill

Pen-blewyn

LB

ED Bdy

CR

SG1

SG2

SG3

SG4

SG5

SG6

SG7

SG8

SG9

Drain

Figure 9: Geophysical survey results along the southern route. Part 1 of 3.

1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

Figure 10: Geophysical survey results along the southern route, overlaid with interpretation. Part 1 of 3. 1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Lay-By

97.8m

Blackmoor Hill Farm

Blackmoor Hill

88.7m

SG3

SG5

SG4

SG7

SG6

SG8

Drain

Tumuli

SG9

A 40

SG11

SG10

Pond

SG12

SG13

Spreads

Figure 11: Geophysical survey results along the southern route. Part 2 of 3.

1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

Lay-By

97.8m

Blackmoor Hill Farm

Blackmoor Hill

88.7m

SG3

SG5

SG4

SG7

SG6

SG8

SG8(1)

Drain

Tumuli

SG10(1)

SG9

SG10

A 40

SG11

SG11(2)

SG11(1)

Pond

SG12

SG13

Spreads

Figure 12: Geophysical survey results along the southern route, overlaid with interpretation. Part 2 of 3.
1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

A 40

SG11

SG10

Mast

Redstone Farm

Pond

SG12

B 4313

GP

REDSTONE CROSS

SG13

2

1

Redstone Cottages

Forge

Well

SG15

SG14

Blaenmarlais

Collects

B 4313

Pond

Blaenmarlais Cottage

105.5m

Issues

Bill Glen

West Winds

Ty Gwanwyn

B 4313

Millfields

Strathmore

Oaklands

108.5m

Ashfield

Bryn

Marlais

109.5m

Pond

Figure 13: Geophysical survey results along the southern route. Part 3 of 3

1:2000 @ A3

ARCHAEOLOGY WALES
Revealing the past, informing the future

0 20 40 60 80 100 m 1:2,000

A 40

SG11

SG10

SG12

SG13

SG15

SG14

Mast

Redstone Farm

B 4313

REDSTONE CROSS

GP

Redstone Cottages

Forge

Well

Pond

Collects

Blaenmarlais

Pond

Blaenmarlais Cottage

105.3m

Issues

Bill Glen

West Winds

Ty Gwanwyn

B 4313

Millfields

Strathmore

Oaklands

108.5m

Ashfield

Marlais

Bryn

109.5m

Pond

SG13(1)
SG13(2)
SG13(3)
SG13(4)
SG13(5)
SG14(1)
SG14(2)
SG14(3)
SG14(4)
SG14(5)
SG15(1)
SG15(2)

Figure 14: Geophysical survey results along the southern route, overlaid with interpretation. Part 3 of 3. 1:2000 @ A3

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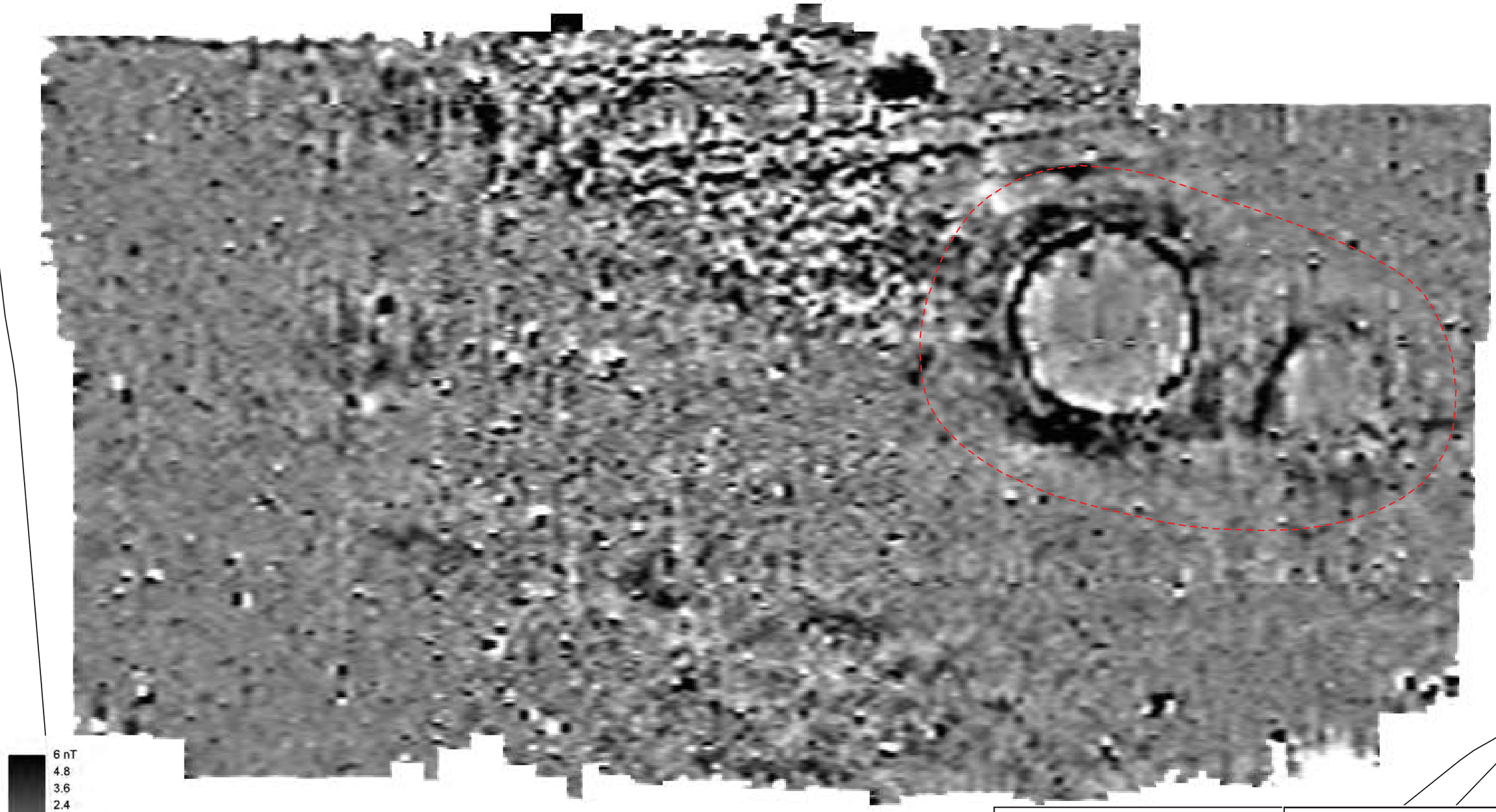
Archaeology Wales

APPENDIX I: Geophysical survey results of PE154

Waterlogged area unsuitable for surveying



6 nT
4.8
3.6
2.4
1.2
0
-1.2
-2.4
-3.6
-4.8
-6 nT

0m 50m

1:500 @ A3

N

Appendix I-1: Geophysical survey results of the Redstone Cross Round Barrows PE154 presented as a grayscale plot.

Extent of Scheduled area in red

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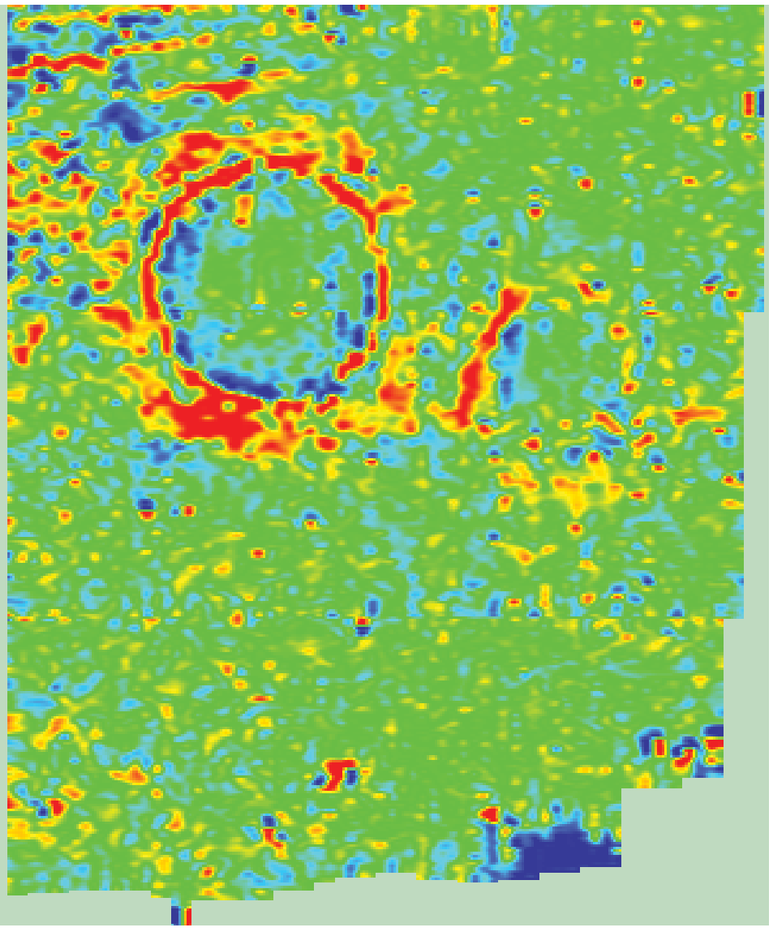
Results clipped to +/-10nT

Results clipped to +/-5nT



Results clipped to +/-5nT

0m 50m

1:600 @ A3

Appendix I-2: Geophysical survey results of the Redstone Cross Round Barrows PE154, presented with differing clipped boundaries and colours.

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Archaeology Wales

APPENDIX II:
Specification

1 INTRODUCTION

1.1 Project background

This specification has been prepared to guide the work undertaken for a programme of archaeological geophysical survey. This will be carried out on the line of the proposed A40 Penblewin to Redstone Junction improvement in Pembrokeshire. This is a continuation of the planned A40 Llanddewi Velfrey to Penblewin improvements.

The assessment is part of a staged approach of archaeological investigations that are being carried out as part of the environmental impact assessment for the project.

The proposed works include approximately 30ha. of detailed geophysical survey to be carried out across the site.

1.2 Site description

The site is underlain directly by a solid geology of mudstones of the Slade and Redhill; Portfield; and Haverford Formations. There is one narrow strip of glaciofluvial deposits, while some of the drainage running away from the site contains Till- diamicton, although this is outside the boundary of the site. (http://www.bgs.ac.uk/data/mapViewers/: accessed May 2017).

Two route options are being considered, northern and southern. The northern route leaves Penblewin roundabout (SN 12005 16645) and curves around to re-enter the A40 west of the Redstone junction just south of Sodstone House (SN 10349 16053). The potential route is just over 50m north of the Redstone Cross barrow group (SN11015 16415), a scheduled ancient monument (PE154). The southern route, leaves the roundabout and passes south of the Redstone junction, before rejoining the A40. Although this is slightly shorter than the northern option, it passes through an area of damp low ground with at least four water courses.

2 ARCHAEOLOGICAL BACKGROUND

Beside the scheduled barrow group, no archaeological features are known on either route option. The north option is a ridge which has a potential for early settlement. The south option passes through an area that could easily contain burnt mounds which are typical of this type of wet terrain. In the vicinity of either route there a number of cottage sites shown on historic mapping. The known examples are however, found on the margins of the existing A40, so may not extend into either route option.

3 PROJECT OBJECTIVES

3.1 General Objectives

The general survey objectives are detailed below:

- to investigate the archaeological potential of the site;
- assess the presence /absence of potential archaeological anomalies that might be present;
- provide evidence to establish the potential of key target areas that could be investigated by trial trench evaluation;
- to determine the level of risk that the archaeological resource would present to the proposed development;

- to inform the layout of further reconnaissance or evaluation fieldwork or to aid the determination of a suitable mitigation works specification and programme, as necessary.

3.2 The vicinity of the scheduled barrow group is the area of greatest potential as there may be features associated with the barrows. For this reason, a wider swathe has been selected in this area due to the presence of the nationally important sites in this area. It is intended to approach Cadw for permission to conduct a survey over the scheduled barrows, in order to present a thorough picture of the environment in this area. It is not known at this time whether Cadw would approve of this. At present, this work is excluded from the scope of works.

4 SCOPE OF WORKS

The total area for detailed magnetometry survey amounts to *c* 30ha in approximately 29 fields. The survey areas are divided into the north (NG) and south (SG) groups. The north group consists of 20.7399 ha with 8.2531 in the south group.

If significant archaeological anomalies are detected or inferred during the survey, then areas might be extended, but only after agreement by the Client.

It may be necessary for the Contractor to undertake a preliminary assessment of ground conditions prior to the commencement of the fieldwork. The Contractor will notify the Client of any areas that in their opinion are unsuitable for survey. Where areas are covered by high crops, or inaccessible for other reasons, the intention is to re-schedule them for a time when access is possible.

Table 1 Survey Areas

Plot (north)	Area (ha)	Plot (south)	Area (ha)
NG1	2.5876	SG1	0.6871
NG2	1.2798	SG2	0.7995
NG3	1.4681	SG3	0.8012
NG4	0.7482	SG4	0.2431
NG5	0.7679	SG5	0.1151
NG6	1.4150	SG6	0.1233
NG7	0.6028	SG7	0.6060
NG8	1.4528	SG8	0.3242
NG9	1.6101	SG9	0.2342
NG10	1.5420	SG10	0.9432
NG11	0.9634	SG11	0.4418
NG12	1.7974	SG12	0.5018
NG13	2.7796	SG13	0.5655
NG14	1.7252	SG14	0.5018
		SG15	1.3653
North	***20.7399***	***South***	***8.2531***
Total Area 28.9920ha			

5 WORKS SPECIFICATION

5.1 General Works

All survey work will be carried out in accordance with this Specification and current

good practice (English Heritage 2008, Geophysical Survey in Archaeological Field Evaluation), and the Standard and Guidance for archaeological geophysical survey prepared by the Chartered Institute for Archaeologists (CIfA 2014), and the CIfA Code of Conduct (CIfA 2014); and other current and relevant best practice and standards and guidance (refer to Appendix 1).

The Contractor shall prepare and submit a Method Statement for the works prior to commencement of the fieldwork for approval.

The survey(s) will be undertaken by an experienced operator to provide consistent results regarding pattern recognition and provide initial screening of noise resulting from recent ferrous disturbance and local magnetic pollution.

During the survey a record should be made of surface conditions and sources of modern geophysical interference that might have a bearing on subsequent interpretation of field data.

The survey grid/transects must be established by electronic means using a survey-grade GPS (English Heritage, 2003) or equivalent metric survey device accurately tied to the Ordnance Survey National Grid. This should be internally accurate to ±100 mm, and the grid locatable on the Ordnance Survey 1:2500 map. An estimate of the precision of survey control is to be included in the Method Statement and it will also address how the survey transects will be laid out. If appropriate the Contractor must ensure that any survey stations are tied into permanent landscapes features recorded on the latest Ordnance Survey edition to enable the accurate relocation of archaeological anomalies detected by survey.

5.2 Specific Works

Detailed magnetometer survey will be carried out over the designated survey area using either a Geoscan FM 36 Fluxgate Gradiometer or a Bartington GRAD 601 Fluxgate Gradiometer (or similar electronic instrument). Readings should be taken at 4 readings per metre at 1m traverses within a 1m grid system.

If appropriate, the data should be downloaded at regular intervals on-site into a laptop computer for initial processing and storage. This will ultimately be transferred to a desktop computer for further processing, interpretation and archiving. Geoplot v.3 software (or comparable) will be used to interpolate the data to form an array of regularly spaced values at 0.25m x 1.0m intervals. Continuous tone greyscale images of raw data and an x/y trace plot will also be produced. Palette bars relating the greyscale intensities to anomaly values in ohms will be included with the images.

The raw and processed data should be presented in the report. The processed drawings should be accurately located and presented in relation to the OS base plan and the survey markers should be accurately plotted to aid in the laying out of subsequent evaluation or excavation areas. Interpretation plots shall be included in the report.

5.3 Data processing

The processing of datasets will be concurrent with the fieldwork and immediately after completion of fieldwork the processing of the remaining data will be completed.

6 COMPLETION OF FIELDWORK

The Contractor shall prepare and submit a Completion Statement to the Client within one working day of completing the survey.

The survey areas will be left in a tidy and workman-like condition and the Contractor will ensure that all materials brought onto site are removed.

7 MONITORING, PROGRESS REPORTS & MEETINGS

The archaeological geophysical survey will be subject to monitoring visits by the Client who will have unrestricted access to the site, site records or any other information. The work will be inspected to ensure that it is being carried out to the required standards and that it will achieve the stated objectives.

Verbal progress reports will be provided to the Client upon request. In addition, progress meetings between the Client the Contractor and any other third party, may be held on site during the works.

8 REPORTING

An Interim Statement of the results of the fieldwork will be prepared and submitted within 2 working days of the completion of the fieldwork.

A fieldwork report will be submitted in draft within 2 weeks of the completion of fieldwork. The preparation of the survey archive and fieldwork report will be undertaken in accordance with this Archaeological Design and relevant archaeological standards and national guidelines (refer to Appendix 1). The report will include the following

- a non-technical summary;
- site location;
- archaeological and historical background;
- full detailed methodology;
- aims and objectives;
- results (to include full description, assessment of condition, quality and significance of the results);
- general and detailed plans showing the location of the results and identifying any areas unsuitable for survey, accurately positioned on an OS base map (to a known scale commensurate with the objectives of the survey);
- colour/grey scale plots to aid interpretation. The plots will be contoured (if appropriate) to allow trends to be shown superimposed over data without obscuring it;
- an interpretative plot(s);
- an assessment of potential with recommendations for further survey;
- images to illustrate the survey work in progress;
- publication proposals if warranted; and
- a cross-referenced index of the project archive.

The report will comment on the potential for extrapolating the results onto adjacent areas.

An electronic copy of the draft report and drawing/figures will be submitted to the Client who may forward a copy to third parties. This will include the Project Archaeological Curator.

Two bound copies, one unbound master-copy and a digital version of the finalised report will be submitted within 1 week of the receipt of comments on the draft report. The digital report shall comprise a CD containing a complete version of the report in PDF format and separate digital text (in Microsoft Word format) and CAD mapping files (in ESRI GIS or AutoCAD format) and any other illustrations or plates (in appropriate format).

A final report of the survey will also be sent to the regional HER within six months of completion, in accordance with CIfA standard and guidance (2016).

9 RESOURCES AND TIMETABLE

All archaeological personnel involved in the project should be suitably qualified and experienced professionals. The Contractor shall provide the Client with staff CV's of the project manager, site supervisor and site assistants' CV's. All site assistants should have an appropriate understanding of fieldwork procedures.

The fieldwork programme will commence in April 2019, once permission to carry out the survey has been obtained and the survey will be completed at the earliest opportunity. Repeat visits to the site may be required to take advantage of areas where silage crops have been removed.

The Client will inform the Contractor of the start date for the works and the Contractor will provide the Client with a programme for the works (fieldwork and reporting) within 2 days of the start date.

10 ARCHIVE PREPARATION AND DEPOSITION

The archive of finds and records generated during the fieldwork will be kept secure at all stages of the project. All records and materials produced will be quantified, ordered, indexed and internally consistent. The archive will be produced to the standards outlined by English Heritage MoRPHE Guidelines (English Heritage 2006; Brown 2007).

The Contractor will, prior to the start of fieldwork, liaise with an appropriate accredited repository to obtain agreement in principle to accept the documentary, digital and photographic archive for long-term storage. The Contractor will be responsible for identifying any specific requirements or policies of the recipient repository in respect of the archive, and for adhering to those requirements.

Archaeological material recovered from fieldwork is irreplaceable and data recorded during fieldwork can and should be copied and additionally held securely in a separate location in line with current best practice until it can be deposited in the recipient repository (English Heritage 2011).

The deposition of the archive forms the final stage for each phase of development at the application site. The Contractor shall provide the Client with copies of communication with the accredited repository and written confirmation of the deposition of the archive. The Client will deal with the transfer of ownership and copyright issues.

The archive should be prepared in line with national guidelines (NPAAW, 2017).

11 CONFIDENTIALLY AND PUBLICITY

The archaeological works may attract the interest of the public and the press. All communication regarding this project is to be directed through the Client. The

Contractor will refer all inquiries to the Client without making any unauthorised statements or comments.

The Contractor will not disseminate information or images associated with the project for publicity or information purposes without the prior written consent of the Client.

12 COPYRIGHT

The Contractor shall assign copyright in all reports, documentation and images produced as part of this project to the Client. The Contractor shall retain the right to be identified as the author or originator of the material. This applies to all aspects of the project. It is the responsibility of the Contractor to obtain such rights from sub- contracted specialists.

The Contractor may apply in writing to use or disseminate any of the project archive or documentation (including images). Such permission will not be unreasonably withheld.

The results of the archaeological works shall be submitted to the Client, the Welsh government and its advisors by the Client and will ultimately be made available for public access.

13 ACCESS ARRANGEMENTS AND SITE INFORMATION

Access to the site to carry out archaeological investigations will be arranged / organised by the Client.

Should the Contractor require adjustment to the location of fieldwork interventions or works areas due to local conditions, this shall be agreed with the Client prior to its implementation.

14 INSURANCES AND HEALTH AND SAFETY

The Contractor will provide the Client with details of their public and professional indemnity insurance cover.

The Contractor will have their own Health and Safety policies compiled using national guidelines, which conform to all relevant Health and Safety legislation and best practice. A copy of the Contractor's Health and Safety policy will be submitted along with their tender to the Client, who will forward on to the Client.

The Contractor shall prepare Risk Assessments and a project specific Health and Safety Plan and submit these to the Client for approval prior to the commencement of the fieldwork. If amendments are required to the Risk Assessment during the works the Client and any other interested party must be provided with the revised document at the earliest opportunity.

The Contractor shall be responsible for identifying any buried or overhead services and taking the necessary precautions to avoid damage to such services, prior to the fieldwork.

15 GENERAL PROVISIONS

The Contractor will undertake the works in accordance with the specifications issued by the Client and in any subsequent written variations. No variation from, or changes to, the specification will occur except by prior agreement with the Client.

The site will be left in a tidy and workman-like condition and the Contractor will ensure that all materials brought onto site are removed.

The Contractor shall make the minimum of disturbance during the fieldwork and will avoid any unnecessary damage. If appropriate, access for temporary parking and the location of site welfare shall be agreed with the Contractor prior to the commencement of the fieldwork. The provision of welfare facilities shall be the responsibility of the Contractor.

16 REFERENCES

ADS, 2002, *Geophysical Data in Archaeology: A Guide to Good Practice.*

Archaeological Data Service, 2002.

Brown, D.H. 2007, *Archaeological Archives: A guide to best practice in*

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English Heritage, 2003, *Where on Earth Are We? The Global Positioning System (GPS) in archaeological field survey*. English Heritage (London)

English Heritage, 2006, *Management of Research Projects in the Historic Environment. The MoRPHE Project Managers' Guide.* English Heritage (Swindon)

English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation. English Heritage Research and Professional Services Guidelines No 1 (second* edition). English Heritage (Swindon)

English Heritage, 2011, *Safeguarding Archaeological Information. Procedures for minimising risk to undeposited archaeological archives* (draft guidance)

http://www.bgs.ac.uk/data/mapViewers/

NPAAW , 2017. *The National Standard and Guidance to Best Practise for Collecting and Depositing Archaeological Archives in Wales.* National Panel For Archaeological Archives in Wales, 2017.

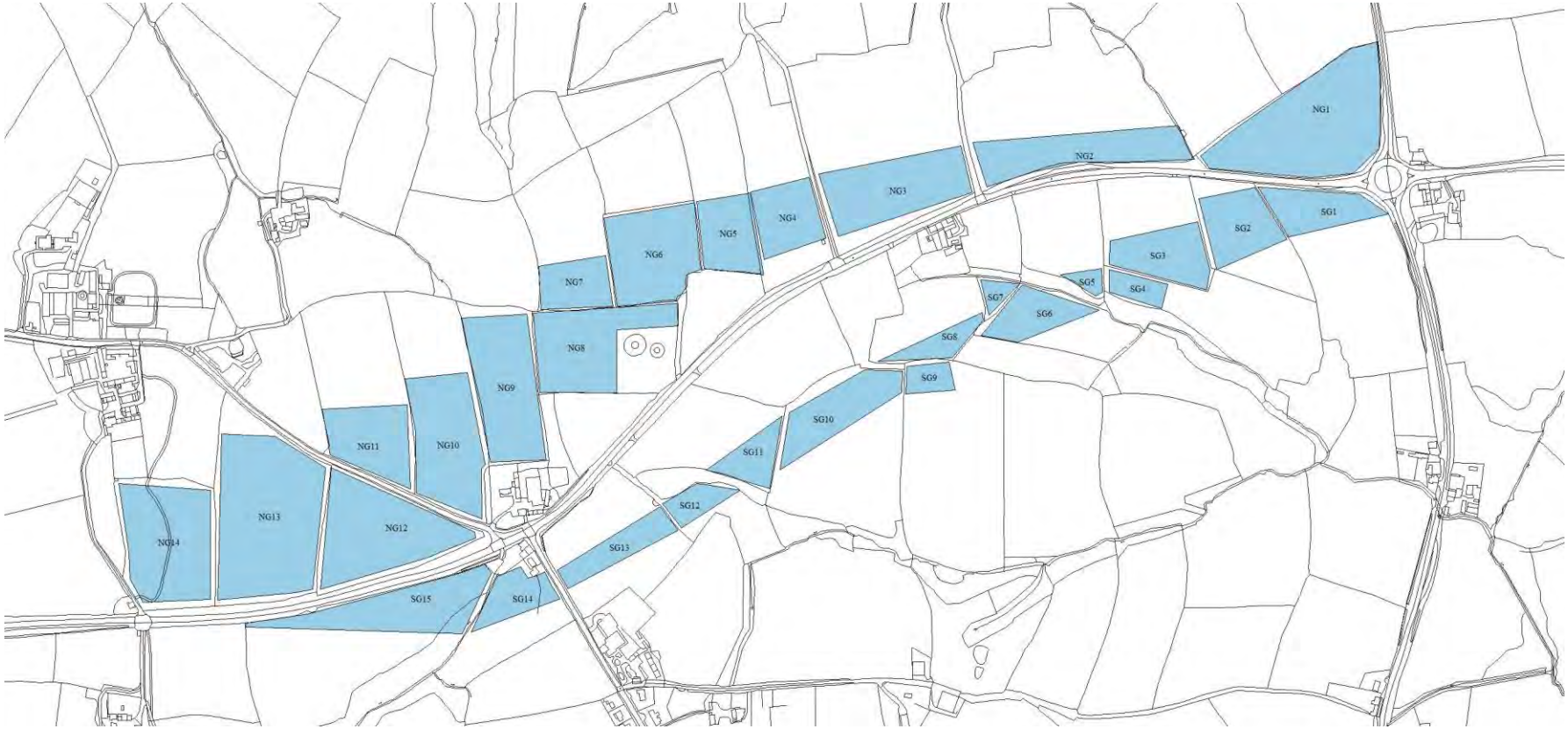

Figure 1 A40 Penblewin to Redstone Junction Geophysical survey areas. NTS.

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APPENDIX III:
Archive Cover Sheet

ARCHIVE COVER SHEET

A40 Penblewin to Redston Cross, Pembrokeshire

Site Name:	A40 Llanddewi Velfrey
Site Code:	LVP/18/GEO
PRN:	3717 (Round barrow), 3718 (round barrow) 47438 (standing stone)
NPRN:	-
SAM:	PE154
Other Ref No:	-
NGR:	NGR SN 1112 1641
Site Type:	Agricultural fields
Project Type:	Geophysical Survey
Project Manager:	Philip Poucher
Project Dates:	April 2019 - September 2019
Categories Present:	-
Location of Original Archive:	AW
Location of duplicate Archives:	RCAHMW, Aberystwyth
Number of Finds Boxes:	-
Location of Finds:	-
Museum Reference:	-
Copyright:	AW
Restrictions to access:	None

Archaeology Wales

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9 High Street, Newtown, Powys, SY16 2NY

Desk Based Assessment

A40 Penblewin to Redstone Cross Improvement

Landsker Archaeology Ltd.

Desk Based Assessment

Project 1901

www.landskerarchaeology.co.uk

Contents

A40 Penblewin to Redstone Cross Improvement
Desk Based Assessment

1. Summary

Ystyrir bod gwelliant arfaethedig yr A40 Penblewin i Redstone yma yn asesiad desg o wybodaeth archeolegol dros hyd y 1.8km o'r prosiect. Mae'r astudiaeth hwn yn cynnwys yr holl wybodaeth sy'n hysbys am yr ardal

Mae'r cynllun yn gorwedd yn plwyf Arberth, Sir Benfro. O fewn yr ardal astudio 500m ar bob ochr i ffin y Cynllun, nodwyd 51 o asedau. O'r rhain, ceir 7 o asedau o fewn ffin y Cynllun ac fe allent gael eu heffeithio'n ffisegol. Mae weddill y 44 o asedau y tu allan i'r Cynllun ac ni ddylid effeithio arnynt.

The proposed A40 Penblewin to Redstone improvement is considered here as a desk based assessment of archaeological information on the 1.8km length of the project. The study includes all the information known for the area

The scheme lies within the parish of Narberth, Pembrokeshire. Within the 500m study area on either side of the Scheme boundary, 51 assets were identified. Of these, 7 assets are found within the Scheme boundary and are potentially physically impacted. The remaining 44 assets are outside the Scheme and should not be impacted.

2. Introduction

The Welsh Government has commissioned improvements to the A40 between Penblewin and Redstone Cross. This consists of a new build section running from Penblewin roundabout, south of the existing A40 and Redstone Cross, before re-joining the A40 to the south of Sodston House, a distance of 1.8km (figure 1).

Landsker Archaeology Ltd. was asked by RML to undertake the Desk Based Assessment and supply other archaeological advice to the project. This document forms the specification for undertaking the Desk Based Assessment. Dyfed Archaeological Trust – Development Management (DAT-DM) are the regional curators acting for Cadw and the local planning authorities.

The project is a continuation of the proposed A40 Llanddewi Velfrey to Penblewin Improvements just to the east. The same design team and assessment is being used for both projects. It is intended the both projects will be constructed as one scheme.

The overall aims of the project are to understand the nature of archaeological deposits on the site and determine the effect of the proposed development on that archaeological resource.

The project code is Landsker Archaeology P1901.

3. Field Procedures

The study area for historic asset collection was the land take and a corridor 500m beyond the boundary of the proposed Scheme. Where linear or historic landscape features extend beyond the 500m area, the study area was extended in order to provide sufficient context for the understanding of such features.

The route of the proposed improvement was walked on foot in the Spring of 2019 with additional visits during the Autumn to examine areas affected by the project geotechnical investigation in September and October. Although the walk through survey was focussed on the physical extent of the project, visits were made to adjacent locations of interest and to fully understand the setting of monuments outside the project limits. Locational information was collected using a Trimble R1 GNSS unit, capable of recording points of interest to an accuracy of one metre. This information was then uploaded to a GIS.

For designated heritage assets that could be affected as a result of significant change within their settings (e.g. scheduled monuments and listed buildings), the study area included all such assets within a zone of 3km.

Full coverage of the regional HER for the main study area was acquired from the Dyfed Archaeological Trust (DAT), together with details of defined Historic Landscape Character Areas. Information regarding scheduled monuments, listed buildings and Registered Parks, Gardens and Landscapes of Special Historic Interest was obtained from Cadw and from published sources.

A fluxgate gradiometer survey was undertaken over most of the Scheme. The areas were selected for survey on the basis of scheme design and impact; the land use effect on magnetic survey; and overall archaeological potential (Archaeology Wales, 2019).

The LiDAR information contained in the Lle website (lle.gov.wales) was examined and used to provide information on earthworks and topography across the study area.

Available satellite imagery covering the Scheme was acquired from commercial suppliers and examined along with other historic aerial photographs. Historic aerial photographs were examined following a search of data held by the APU of the Welsh Government in Cardiff. A series of RAF vertical photographs from 1946 were geo-referenced and placed on the project GIS.

Limitations

All readily available data required for the assessment were acquired and examined. A key limitation is the presence or absence of buried archaeological remains within the Scheme boundary. Remote sensing methodologies (LiDAR, satellite imaging and geophysical survey) were utilised in order to gain as much information as possible at this stage of potential evidence.

No intrusive archaeological investigation has been undertaken. The assessment of value of each site is based on documentary and site visit information. The actual value of each site may be re-assessed following ground investigation that may give additional information.

4. Desk Based Assessment

The study used available printed and library material including historic map sources. Secondary sources such as published reports were used. Information was gathered for an area encompassing the Scheme defined limits and a wider zone up to 500m from either side of the Scheme boundary. Designated sites (scheduled monuments and listed buildings) were collected for a buffer zone up to 3km wide from the project boundaries

The following sources were examined
The regional Historic Environment Record (HER) held by Dyfed Archaeological Trust
Lists at the National Monuments Record for Wales contained on the Coflein database
Lists of Listed Buildings maintained by Cadw
Lists of Scheduled Monuments maintained by Cadw.
The regional Historic Environment Record (HER) held by Dyfed Archaeological Trust
The NRW LANDMAP website information on Conservation Areas and Historic Landscape Areas
Historic aerial photographs, both vertical and oblique held by the NMR.
Lidar sources contained on the Lle.gov.wales website.

5. Results and Discussion

Baseline Environment

The archaeological and cultural heritage assets contained within the area covered by the route option is varied. Most assets are from the last two hundred years, with a range of sites in the area stretching back through the medieval to the Prehistoric period. A Gazetteer of historical assets in the 500m study area is shown in Table 2. Table 3 shows the sites with an identified impact.

The known archaeological evidence with a brief historical baseline for a 5km zone around the Scheme is presented below. Details of sites identified in the 500m study area are included identified by a reference number in brackets, e.g. (**63**). The site numbering sequence follows on from the previous study of the A40 Llanddewi Velfrey to Penblewin (Landsker, 2018), as some of the sites are considered in both studies.

A summary list of sites with an impact and suggested further assessment actions is presented in Table 1.

Site location

The site covers an area of agricultural fields of pasture land, largely bounded by hedgerows, lying between the roundabout at Penblewin to the east (SN 1200 1666) and the area south of Sodston (SN 1039 1604), north of Narberth.

The scheme curves to the south of the existing A40, through largely agricultural land, across a low lying valley. The western part of the scheme rises over the ridge followed by the Redstone to Narberth road, before dropping on to lower land and merging with the existing A40 carriageway south of Sodston.

The underlying bedrock of the area comprises mudstones of the Slade and Redhill; Portfield; and Haverfordwest Formations. (BGS 2017).*Geology*

The underlying bedrock of the area comprises mudstones of the Slade and Redhill; Portfield; and Haverfordwest Formations. This is partly overlain in one narrow strip by glacio-fluvial deposits, with Till – diamicton, running along some of the drainage channels to the north (BGS 2017).

The NRW LANDMAP Geological Landscape Polygon.shp,(accessed at http://lle.gov.wales) gives the following information for the 500m study area:
Narberth - Llanddewi Velfrey PMBRKGL195
Lowland scarp and dip-slope dominated terrain. Prominent block with steep scarp surrounding the N, W and SW of Lampeter Vale and formed of Ordovician and Silurian slates, the latter with thin sandstone bands, Dissected by steep-side cwms, most prominently on the N side. Sedimentary Silurian Sandstone. Slate. Includes nationally important proposed geological SSSI at Pengawse Hill (Ordovician stratigraphy).

Palaeo-environmental potential

A large area of low-lying ground is found where the drainage runs southeastward towards Pant y Gorphwys bridge. There is an area of peat here (**128**) that may contain information of relevance to the palaeo-environmental understanding of the area.

The project area also lies at the southern limit of the potential glacial erratic train carried southeastward from the igneous extrusions along the Preseli ridge (Strahan *et al*., 1914). It is possible that glacial erratics may be found within the Scheme during deep excavations. It is also possible that glacial deposits may be encountered within the Scheme working. Recording any such features should be undertaken during the monitoring of construction work on the road.

Landscape

The NRW LANDMAP Historic Landscape Polygon.shp,(accessed at http://lle.gov.wales) gives the following information for the 500m study area:

Robeston Wathen PMBRKHL 46205.
Robeston Wathen is a small, well-defined lowland aspect area (5.435 sq km), representing the village of Robeston Wathen and its medieval open field system. It is a landscape of medium-sized, fairly regular enclosures co-axial on, and crossed by, the A40 trunk road. Those enclosures around the village of Robeston Wathen, have demonstrable origins as medieval strip fields, while field morphology in the remainder of the area suggests similar origins.

The moderate value assigned to this area reflects its character as a well-preserved but by no means unique post-medieval fieldscape and associated nucleated settlement offering some potential for further research, particularly with regard to the prehistoric landscape.

The area is west of the Redstone Road, towards Robeston Wathen.

Llanddewi Velfrey PMBRKHL46206.
Llanddewi Velfrey is a large aspect area (24.23 sq km) of lowland hills and valleys. It comprises all field types, but they are mainly medium-sized and regular. Stands of woodland, particularly in the valleys, lend the area a wooded aspect, while the steep slopes at east end of area are

cloaked in deciduous woodland. The area is crossed by a number of major roads including the A40 trunk road.

This multi-period landscape has been assigned an overall value of high based on the diversity of its archaeological remains and built heritage, including two substantial Iron Age defended enclosures, a well-preserved Georgian gentry house (Panteg) and an important Grade II Listed garden (Blackaldern).

The area is east of the Redstone Road, towards Llanddewi Velfrey.

Hedgerow Regulations 1997

The majority of hedgerows on site formed parts of a field system pre-dating the Inclosure Acts (Criterion 5). Therefore, it is considered that they meet the archaeology and history criteria of the Hedgerow Regulations 1997, as important hedgerows. Using GIS information matched to rectified tithe map information, the following can be assessed as the impact can be assessed as follows: 15 hedges with a combined total length of 998m.

Palaeolithic and Mesolithic (to 4000 BC)

There is only limited evidence for occupation during the various Palaeolithic periods in Wales. What is known comes from deposits on the coast of Pembrokeshire and Gower. The post-glacial Mesolithic, continued a similar economy and probably used this area. Evidence for this period, however, is also limited and found mostly in coastal locations in Pembrokeshire.

No assets of this period are identified within the 500m study area.

Neolithic (4000 BC to 2200 BC)

Local evidence for the Neolithic is limited to a couple of isolated findspots and the Llan burial chamber in Lampeter Velfrey. During the construction of the A477 Redberth to Sageston bypass, a Neolithic settlement consisting of numerous stakeholes and other features associated with burning was excavated (Page, 2002). During construction of the A40 Robeston Wathen, excavations at Canaston Bridge recorded early Neolithic material and possible pits and postholes (Day and Meek, 2016). Similar evidence for prehistoric sites including those of a Neolithic date, can be expected to be located, although their location is difficult to predict (Griffiths, 2017).

No sites of this period have been identified within the 500m study area.

Bronze Age (2500 BC to 700 BC)

Evidence of Bronze Age use of the area is shown by large numbers of round barrows. These are often found in concentrations such as Redstone west of the study area. These represent a belief in the afterlife shown by the burials within them. Bronze Age society was relatively mobile, with burial sites being a fixed point in the landscape, located on relatively high points. Five round or ring barrows, designated as Scheduled Ancient Monuments in the surrounding area (outside the 500m study area).

Evidence of domestic use of the area is shown by the frequent discovery of burnt mounds. These are collections of burnt fire shattered stone in a matrix of charcoal rich soil. They are typically found in close association with springs or small watercourses. Radiocarbon dating

normally shows them to be of Bronze Age date, although some are earlier and they can be as late as the Post-Roman era. On excavation, these features are usually associated with a small water-filled trough. Experimental archaeology shows that the water can be brought to boiling point by dropping heated stones into the troughs. This can then be used for cooking or possibly, some form of sauna. These sites are very common Wales, Ireland and Scotland.

Six assets are assumed to be of this period. These are **126**, **133** and **141**, circular features identified by geophysical survey; **135** and **136**, the Redstone Cross scheduled ancient monument barrows and **134**, the standing stone north of the barrows, which is a potential Prehistoric site.

Iron Age (800 BC to AD 43)

This period is characterised by a more settled economy featuring defended enclosures. These often contained houses that were enclosed by a defensive bank and ditch. Some were formed by building an earth bank across the end of a ridge to create a promontory fort. There are several of these, west of the study area, using the ridges along the meanders of the East Cleddau River Valley (for example, Williams and Mytum, 1998). There are many other similar enclosures known only from cropmarks in the area. The economy of these people is thought to be based on herds of cattle and sheep which required protection. Although these sites originate in the Iron Age, many continue to be used through the Roman period and it is likely that some continued even into the post-Roman period.

No sites of this period have been identified within the 500m study area.

Roman (AD 43 to AD 410)

The most obvious evidence of Roman activity in the study area is the line of a road running west from Whitland along the north side of the study area. This was well-constructed with evidence of two periods of construction. It can be traced towards the Roman fort at Wiston, just outside the study area. Though the road is likely to have had its origins in the military period, it indicates strong interest in west Wales. No other sites of Roman date were identified. Some of the Iron Age sites, adjacent to the wider study area, contain excavated evidence of Roman date. This is typical and is probably repeated in similar sites in the study area.

No sites of this period have been identified within the 500m study area.

Early Medieval (AD 410 to AD 1066)

Evidence of the adoption of Christianity can be seen in the inscribed crosses found in several locations dating to the early medieval. Domestic settlement probably continued or re-established itself in the defended enclosures, although new centres of settlement probably began, possibly in the locations used by later farms and, consequently, are difficult to identify.

No sites of this period have been identified within the 500m study area.

Medieval (1066 to 1540)

Llanddewi Velfrey, Lampeter Velfrey and Crinow were part of the commote of Efelffre, a pre-Norman territorial unit, which was the origin of the suffix Velfrey.

The medieval period is characterised by castles and churches with associated settlement that signified a settled landscape with a developed farming system. To the east was Whitland Abbey, which has strong associations with Hywel Dda as he drew up his laws here around 940. It functioned as a Cistercian monastery between the 12th and 16th centuries.

The period saw the early development of market towns such as Narberth, and some of the larger villages began to develop such as Lampeter Velfrey, Clunderwen and Llandissilio. The villages were set in a landscape of long rectangular fields, parts of which can be seen in the present-day landscape (**63**).

There are no assets directly identified to this period, the field system (**63**) almost certainly has origins in the period, but no elements can be directly identified to that date.

Post-medieval (1540-1901)

The strong social and cultural division of west Wales, the Landsker line, probably was at its strongest in this period. Though it originates from the settlement of Flemings in South Pembrokeshire in the 12th century, the clearest evidence for the linguistic provision comes from names, records and civil transactions of the later period. The study area is north of the Landsker division and in the Welsh speaking area.

Communication routes became prominent across the area in this period. The line of the A40 was adopted as a turnpike between Whitland and Penblewin operated by the Whitland Trust (**39**). A later development was the railway line from Carmarthen to Haverfordwest, erected in 1854, north of the study area. Whitland was the junction for lines to Pembroke Dock, Tenby, Fishguard and Cardigan. The station became a marshalling yard and was a focal point in the transport of agricultural products to industrial areas. The construction of a milk processing factory gave a huge impetus to the development of the town. This was in contrast the town of Narberth, isolated from both the A40 and the railway, leading to a slower growth.

Within the 500m study area, 33 assets were identified from this period (**38-40, 56, 63, 130, 131, 137, 139, 140, 143-151, 153-163, 166, 168, 169**).

Features of Unknown Date

There are a number of assets identified as ‘unknown’ date. Two, if they are confirmed as archaeological features, are most likely to be on Bronze Age date (**132** and **138**), while there are three other features that could presumably also be associated with this period (**142, 165** and **167**). The remaining features cannot be confirmed as archaeological sites. More as areas of potential information (**61, 64, 127, 129, 152** and **164**).

Physical impact

Within the 500m buffer zone on either side of the Scheme boundaries, identified as the study area, 51 sites were identified. 44 sites are not physically impacted by the Scheme, 7 sites are within the project boundary and appear to be physically impacted. The sites with an impact are summarised in Table 1, with a more detailed discussion in Table 3.

There is a high potential that intrusive works on either option may uncover previously unrecognised archaeological deposits. The potential impact on previously unrecorded archaeology has not been quantified at this stage, but is likely to be adverse.

6. Post-fieldwork methodology

Archiving

The archaeological document archive will include all reports, fieldwork records, notebooks, plans, photographs and digital records as defined in *Management of Archaeological Projects* para 5.4 and Appendix 3 (English Heritage, 1991).

The project archive will conform to the conditions for the acceptance of project archives for long term storage outlined in The National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales 2017.

This action will be completed following receipt of comments and is planned for 1 July 2020.

7. Conclusions

The desk based assessment has identified a range of site within the study area. These range from the bronze age through field systems with their origin in the medieval and on to dwellings of post medieval date.

The primary feature found through the study area is the line of the turnpike trust road (**39**), which may follow a long established route, now used as the A40.

The geophysical survey identified a large number of features that may be of archaeological origin. A high proportion of these appear to align with field boundaries that have since been removed. The nature of these features will need to be examined through a programme of intrusive fieldwork to identify the nature of any archaeological features present here. The scale and extent of this programme of work will need to be agreed with the Dyfed Archaeological Trust-Development Management. A summary list of suggested actions is presented in Table 1.

Table 1. Summary of impacted sites and suggested further action

Site	Description	Action
39	Turnpike trust road, St Clears to Canaston Bridge	Recording of any features exposed during construction watching brief.
56	Standing building on the north side of the A40 at Penblewin.	Building recording to level 2 standard (Historic England, 2016).
63	Field system	Basic recording during construction.
64	Possible enclosure.	Evaluation trenching to determine nature and age of the feature, followed by further mitigation excavation as required.
127	Undulating ground southwest of roundabout.	Recording of any features exposed during construction watching brief.
128	Peat deposit.	Recording of any features exposed during construction watching brief. Possible palaeo-environmental sampling of the deposit if it appears suitable.
131	Lane on tithe map.	Recording of any features exposed during construction watching brief.
138	Circular cropmark on Google Earth.	Evaluation trenching to determine nature and age of the feature, followed by further mitigation excavation as required.
146	Blaen Marlais House Listed Building II.	Monitoring of the condition of the building during construction and ensuring correct use of mitigation landscaping materials.
147	Blaen Marlais Barn Listed Building II.	Monitoring of the condition of the building during construction and ensuring correct use of mitigation landscaping materials.

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9. Gazetteers

Table 2. All identified sites within the 500m study area.

ID	Type	Date	Name	Source	Impact	Easting	Northing
38	Quarry	Post Medieval		DAT HER 19532	No Change	211971	216887
39	Toll road	Post Medieval	St Clears to Canaston Bridge	DAT HER 108733	Negligible	211000	216000
40	Farmstead	Post Medieval	Penblewin	DAT HER 48583	No Change	212080	216620
56	Standing building	Post Medieval	Penblewin	DBA 56	Major	212057	216659
61	Earthwork	Unknown		DAT HER 115039	No Change	212120	216520
63	Field system	Post Medieval		DBA 63	Minor	219200	216500
64	Rectangular Feature	Unknown		Geophysical survey 1	Major	211976	216660
126	Circular features	Bronze Age		Geophysical survey 3	Negligible	211887	216686
127	Undulating ground SW of roundabout	Unknown		DBA 15	Negligible	211971	216605
128	Peat deposit	Unknown		DBA 128	Negligible	211596	216470
129	Linear feature	Unknown		Geophysical survey 4	No Change	211311	216615
130	Cottage; Building; Pottery finds	Post Medieval	Cilrath Fach	DAT HER 23468, 46955, Surface finds	No Change	211309	216551
131	Lane on Tithe Map	Post Medieval		DBA 13	Negligible	211284	216451
132	Circular feature 10m diameter	Unknown		DBA 12	No Change	211100	216314
133	Circular feature	Bronze Age		Geophysical survey 5	No Change	211026	216549
134	Standing stone	Bronze Age		DAT HER 47438	No Change	211022	216554
135	Round barrow SAM	Bronze Age	Redstone Cross	Cadw PE154	No Change	211015	216416
136	Round barrow SAM	Bronze Age	Redstone Cross	Cadw PE154	No Change	211000	216420
137	Pond? OS 25 inch 1892	Post Medieval		DBA 18	No Change	211762	216661
138	Circular cropmark on Google Earth	Unknown		DBA 138	Major	210967	216106
139	Searchlight battery	Post Medieval		DAT HER 111271	No Change	210300	216420
140	Tithe map farmhouse	Post Medieval	Redstone Farm	DAT HER 48586	No Change	210850	216220
141	Circular feature	Bronze Age		Geophysical survey 8	No Change	210669	216290
142	Standing stone on 1772 estate map	Post Medieval	Redstone	DBA 142	No Change	210843	216165
143	Building on Tithe map	Post Medieval		DAT HER 48587	No Change	210850	216140

ID	Type	Date	Name	Source	Impact	Easting	Northing
144	Well	Post Medieval		DAT HER 52689	No Change	210824	216110
145	Sodston House	Post Medieval	Sodston	Cadw 6538	No Change	210297	216314
146	Dwelling listed building	Post Medieval	Blaen Marlais	Cadw 6508	Negligible	210972	216010
147	Barn listed building	Post Medieval	Blaen Marlais	Cadw 6509	Negligible	211000	215998
148	Quaker's Meeting House	Post Medieval	Redstone	DBA 148	No Change	211029	215919
149	Sodston Manor	Post Medieval	Sodston	Cadw 6540	No Change	210209	216556
150	Coach House & Stables	Post Medieval	Sodston	Cadw 6539	No Change	210293	216347
151	Bridge	Post Medieval	Pant y Gorphwys	DAT HER 19568	No Change	212090	216180
152	Rectangular Feature	Unknown		Geophysical survey 2	No Change	211976	216793
153	Building on Tithe Map (Field 1235)	Post Medieval		DBA 153	No Change	211949	216415
154	Cottage; Well; Cottage; Cottage; Quarry	Post Medieval	Cilrath Fawr	DAT HER 48124; 48215; 48216; 48217; 48218	No Change	211490	216810
155	House Tithe Map	Post Medieval	Blackmoor Hill	DAT HER 48584	No Change	211410	216570
156	Field name on Tithe map	Post Medieval	Millgetch (?)	DAT HER 48841	No Change	211370	216720
157	Cottage Tithe Map	Post Medieval	Blackmoor Hill	DAT HER 48585	No Change	211360	216550
158	Dwelling listed building	Post Medieval	Blaen Ffynnonau	Cadw 6506	No Change	211145	215923
159	Stable listed building	Post Medieval	Blaen Ffynnonau	Cadw 6507	No Change	211145	215914
160	Field name on Tithe map	Post Medieval	Vilgage	DAT HER 48842	No Change	211110	216470
161	Outbuilding	Post Medieval	Blaen Ffynnonau	DAT HER 114739	No Change	211100	215900
162	Quarry	Post Medieval		DAT HER 46952	No Change	211030	215770
163	Quarry	Post Medieval		DAT HER 46953	No Change	210960	215850
164	Rectangular Feature	Unknown		Geophysical survey 9	No Change	210959	216444
165	Circular feature	Bronze Age		Geophysical survey 6	No Change	210943	216377
166	Field name on Tithe map	Post Medieval	Worglodd	DAT HER 48843	No Change	210940	216310
167	Circular feature	Bronze Age		Geophysical survey 7	No Change	210827	216445
168	Quarry	Post Medieval		DAT HER 46951	No Change	210630	215760
169	Quarry	Post Medieval		DAT HER 19572	No Change	210470	216410

Table 3. Description of historical assets directly affected by construction activity

Site no.:	39
NGR:	212061 216641
Source:	DAT HER 24218
Description:	Turnpike trust road. A toll bar was recorded at Penblewin.
Impact:	Moderate. The character of the original road was totally changed by later road improvements. There are sections of an earlier road alignment in various areas, in the Redstone area and in the lay-by, west of Penblewin. These may follow the line of the original turnpike but have been transformed by road improvements. There are no structures indicating a toll bar at Penblewin. This area has also seen large scale disturbance from works relating to the roundabout. (Figures 2, 4, 5, 6).
Recommended Action:	Recording of any features exposed during construction watching brief.
Site no.:	56
NGR:	212057 216659
Source:	DBA
Description:	Standing building on the north side of the A40 at Penblewin. The tithe map shows a single enclosure here, while the first edition Ordnance Survey shows several buildings forming a rectangle. The 1946 RAF vertical photograph shows that the southern building has been removed as part of road widening. Building walls extant, but totally derelict and overgrown with trees. (Figures 2, 4, 5, 6, 11, 12).
Impact:	Major. The Scheme will result in total demolition of structures in this area.
Recommended Action:	Building recording to level 2 standard (Historic England, 2016).
Site no.:	63
NGR:	Found throughout the project.
Source:	DBA
Description:	Field system that extends to the parishes to the north. The origin of the system may be from the early medieval period, but has continued to be used with modifications through to the present day. The features comply with the criterion used to describe important hedgerows as described in the Hedgerow Regulations 1997. (Figures 2, 5, 6).
Impact:	Minor. Small components of the field system will be removed to allow construction. The bulk of the field system will continue to exist and form a living component of the landscape.
Recommended Action:	Basic recording during construction.
Site no.:	64
NGR:	211976 216660
Source:	Geophysical survey NG1(4)

Description:	Possible enclosure. (Figures 2, 5).
Impact:	Major. The bulk of the recorded features will be removed by construction activity.
Recommended Action:	Evaluation trenching to determine nature and age of the feature, followed by further mitigation excavation as required.
Site no.:	127
NGR:	211971 216605
Source:	DBA
Description:	Undulating ground southwest of roundabout. Of unknown origin, maybe the result of road construction activity associated with the adjacent roundabout. (Figure 5).
Impact:	Negligible: a small portion of the area will be impacted by construction.
Recommended Action:	Recording of any features exposed during construction watching brief.
Site no.:	128
NGR:	211596 216470
Source:	DBA
Description:	Peat deposit exposed on the edge of a small stream. This appears to be very thin, perhaps 20cm thick. The full extent of this area is unclear, although the field to the south is a gently sloping poorly drained area. (Figures 2, 5).
Impact:	Negligible
Recommended Action:	Recording of any features exposed during construction watching brief. Possible palaeo-environmental sampling of the deposit if it appears suitable.
Site no.:	131
NGR:	213110 216830
Source:	DBA
Description:	Lane on tithe map. This is a part of the wider landscape of field boundaries (Site 63) and should be considered with that. Much of the lane shown on the tithe map has been removed and now only survives as a single denuded hedge bank. (Figures 2, 4).
Impact:	Negligible
Recommended Action:	Recording of any features exposed during construction watching brief.
Site no.:	138
NGR:	210967 216106
Source:	DBA
Description:	Circular cropmark on Google Earth. This is shown on a single image on Google Earth for 19 April 2009. No other sources indicate any features of interest here. The land use is extensive grassland. Toby Driver of RCHAM(W) has viewed the image and believes it is the result of slurry spreading, supported by the apparent tractor track leading away to the north (pers com).

	(Figures 6, 8).
Impact:	Major. The feature will be entirely removed by the cutting of a route for the road to pass under the line of the existing Redstone Cross road.
Recommended Action:	Evaluation trenching to determine nature and age of the feature, followed by further mitigation excavation as required.
Site no.:	146
NGR:	210972 216010
Source:	Cadw 6508
Description:	Blaen Marlais House Listed Building grade II
Impact:	Negligible. The road will be contained in a cutting to the north of the site. The road itself and vehicles travelling on it, will not be visible due to the depth of the cutting. Noise from vehicles will be more obvious than currently, but will be reduced by adsorption through planting vegetation on the slope of the cutting and presence of the 10 foot high wall. (Figures 6, 8, 9, 10).
Recommended Action:	Monitoring of the condition of the building during construction and ensuring correct use of mitigation landscaping materials.
Site no.:	147
NGR:	211000 215998
Source:	Cadw 6509
Description:	Blaen Marlais Barn Listed Building grade II. The barn lies south of the main building and has limited views of the areas through which the new road will pass. (Figures 6, 10).
Impact:	Negligible. There will be no physical impact on the structure, or enclosing walls. The impact of the Scheme on the setting of the asset is considered to be negligible and the significance of effects assessed as being neutral or slight.
Recommended Action:	Monitoring of the condition of the building during construction and ensuring correct use of mitigation landscaping materials.

Figure 1 Project Limit Outline.

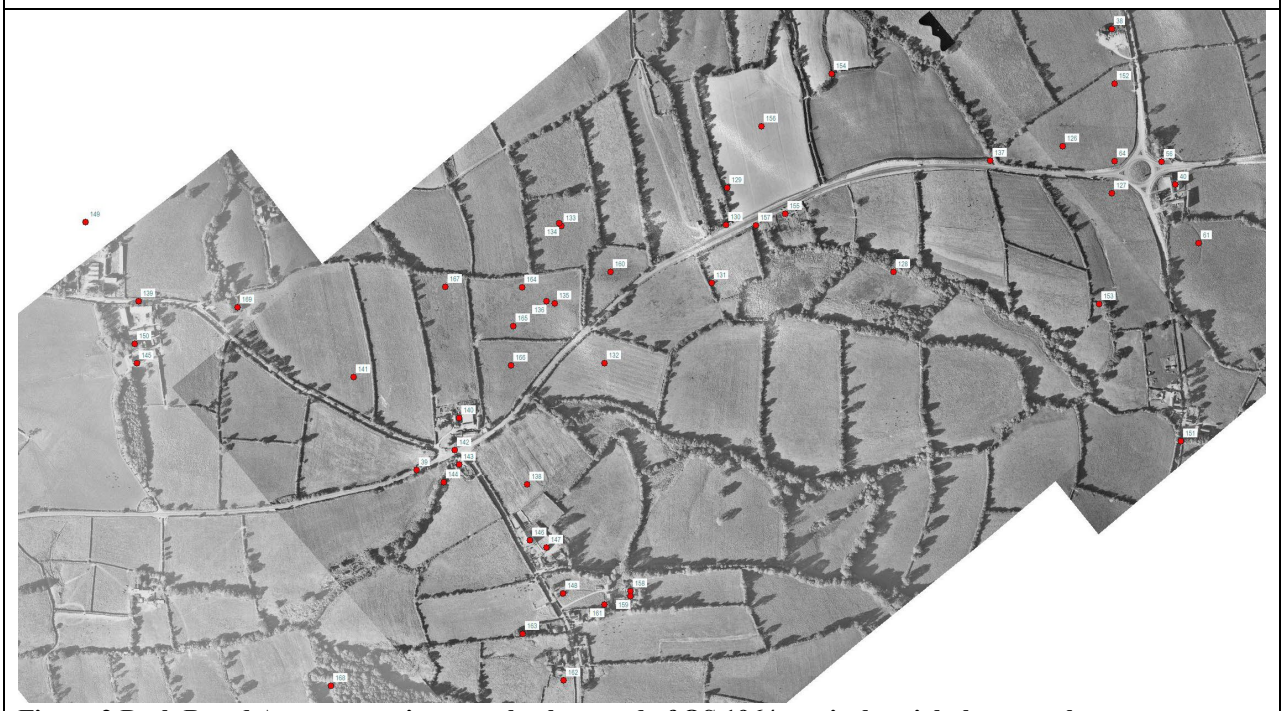

Figure 2 Desk Based Assessment sites over background of OS 1964 vertical aerial photograph.

Figure 3 Rectified image of part 1772 Redstone estate map (Pembrokeshire Archives HDX/40/1), overlain with DBA sites.

Figure 4 Rectified 1840 Narberth tithe map, overlain with DBA sites.

Figure 5 East limit of project, Penblewin. Rectified 1964 OS vertical aerial photograph, overlain with DBA sites 40, 56, 61, 64, 126, 127, 128, 152.

Figure 6 West limit of project, Redstone Cross. Rectified OS 1964 vertical aerial photograph, overlain with DBA sites 39, 132, 138, 140-144, 146, 147, 166.

Figure 7 Site 132, possible circular feature on satellite image.

Figure 8 Site 138, circular feature on satellite image.

Figure 9 Site 146, Blaen Marlais House, view from north.

Figure 10 Site 147 Blaen Marlais House, Site 147 barn at Blaen Marlais to rear, view from northeast.

Figure 11 Site 56 Farmstead, north side of road at Penblewin.

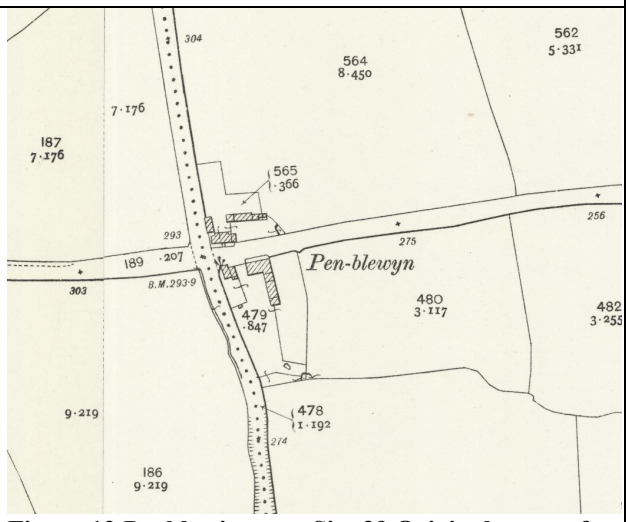

Figure 12 Penblewin area. Site 39 Original route of road, Site 40 Penblewin Farm, Site 56 Farmstead. Source OS 1889.

10. Appendices

11. Appendix 1 Aerial photographs

List of aerial photographs

Vertical Photographs				
WO No	**Sortie**	**Date**	**Org**	**Print**
4604	106G UK 1625	07/07/1946	RAF	2203-2210, 5217-5222
4619	106G UK 1423	15/04/1946	RAF	4058-4061, 3058-3061
4633	106G UK 1472	04/05/1946	RAF	4366-4370, 3375-3379
6418	OS 64 2210	23/09/1964	Ordnance Survey	
6956	58 RAF 9679	10/06/1969	RAF	119-120
7187	OS 71 336	07/07/1971	Ordnance Survey	117-119
8160	39 RAF 5699	27/08/1981	RAF	31
8301	JA Story	06/06/1983	JAStory (NRSC)	5783, 28-32
8720	OS 87 086	04/07/1987	Ordnance Survey	
9635	OS 96 065	03/05/1996	Ordnance Survey	54-60
200029	Getmapping	01/01/2000	Getmapping	
200901	Nextperspectives	01/01/2009	Nextpersepctives	
201301	Nextperspectives	01/01/2013	Bluesky	

12. Appendix 2 Tithe map field names

Tithe map field names. Source: Narberth Tithe Apportionment 1840.

Parish	No.	Name	Comment
Narberth	927	Garden with cottage	
Narberth	928	Wood	In Scheme, DBA Site 64
Narberth	929	upper field	
Narberth	1204	Eastern Park	
Narberth	1205	Willow bed	
Narberth	1206	Moor	
Narberth	1207	Park dan Ty	
Narberth	1208	Garden	
Narberth	1209	House buildings	Contains DBA Sites 146, 147
Narberth	1210	Well Park	In Scheme, contains DBA Site 138, 126
Narberth	1211	House and field	
Narberth	1212	Llain	In Scheme
Narberth	1213	Field	
Narberth	1214	(X)idling isha	In Scheme
Narberth	1215	(X)idling u ucha	Contains DBA Site 132
Narberth	1216	Slang Moor	
Narberth	1217	Little Slangs	
Narberth	1219	Upper Midline	In Scheme
Narberth	1220	Upper Moor	
Narberth	1221	Lower Moor	In Scheme
Narberth	1222	Lower Midline	In Scheme, contains DBA Site 128
Narberth	1235	Cottage and garden	DBA Site 153
Narberth	1236		In Scheme, contain DBA Site 127
Narberth	1237	Big field	In Scheme
Narberth	1238	Lower field	In Scheme
Narberth	1239		
Narberth	1240	Upper Big field	In Scheme
Narberth	1268	Millgetch	
Narberth	1269	Croft	
Narberth	1270	Croft fach	
Narberth	1274	Park yet wen	
Narberth	1275	Park fynnon	
Narberth	1278	Park Pant	
Narberth	1293	Llian	
Narberth	1294	Cottages	Contains DBA Site 130
Narberth	1295	Big field	
Narberth	1297	Vilgage	DBA Site 160
Narberth	1298	Vilgage	DBA Site 160
Narberth	1299	Park H(X)n path	Contains DBA Sites 133, 135, 136
Narberth	1300	Woiglodd	DBA Site 166
Narberth	1301	Leys	
Narberth	1301	House	Contains DBA Site 140
Narberth	1302	Parker with Cefn idlaw	
Narberth	1303	Park bach	
Narberth	1304	Llallelb Park	Contains DBA Site 134
Narberth	1305	Park Ffynnon	
Narberth	1306	Three corner field	
Narberth	1307	Red Stone field	
Narberth	1308	Leys	
Narberth	1308	Leys	
Narberth	1350	Meadow	
Narberth	1351	Pasture	
Narberth	1352	Meadow	

Parish	No.	Name	Comment
Narberth	1352	Meadow	
Narberth	1353	Meadow	In Scheme
Narberth	1357	Field	In Scheme
Narberth	1357	Field	
Narberth	1408	Field	In Scheme
Narberth	1409	Quarry Park	
Narberth	1410		In Scheme
Narberth	1412	Park Gwely	
Narberth	1440	Field	
Narberth	1607	Cottage	
Narberth	1608	House	
Narberth	1609	Field behind house	
Narberth	1610	Middle Park	
Narberth	1611	Big Park	
Narberth	1612	Moor	

13. Appendix 3 Designated sites

Name	Cadw Ref	Status	Easting	Northing	500m Study Area
Ffynnon Baptist Chapel	6056	LBII	213648	216898	
Pen Llwyn House	6071	LBII	208859	217683	
Vaynor Gaer	6072	LBII	209805	217513	
Robeston Wathen Church	6092	LBII	208450	215746	
Narbeth Castle	6473	LBII*	210978	214392	
Milestone by entrance to New Cemetery	6474	LBII	210945	214427	
Parish Church of St Andrew	6475	LBII	210839	214425	
Plas Farmhouse	6476	LBII	210836	214467	
The Coach & Horses Inn	6477	LBII	210904	214797	
NO.2 HIGH STREET	6478	LBII	210901	214790	
NO.3 HIGH STREET	6479	LBII	210900	214784	
The Golden Sheaf	6480	LBII	210932	214643	
Town Hall	6481	LBII	210926	214622	
Pencraig	6482	LBII	210906	214627	
Howell Williams Solicitor; County of Pembroke Sherriff's Office	6483	LBII	210903	214635	
National Westminster Bank	6484	LBII	210900	214643	
Bethesda Baptist Chapel	6485	LBII	210861	214668	
Gates to Bathesda Chapel	6486	LBII	210895	214678	
Hugh H Morgan	6487	LBII	210966	214616	
Megna Indian Takeaway	6488	LBII	210982	214617	
Pillar Box	6489	LBII	210997	214606	
Whispers	6490	LBII	210997	214585	
Olieme House	6491	LBII	211006	214584	
NO.14 MARKET SQUARE	6492	LBII	210959	214573	
Anthony Maxwell - Photographer	6493	LBII	210953	214585	
Anthony Maxwell - Photographer	6494	LBII	210949	214590	
War Memorial	6495	LBII	210972	214596	
Telephone Call-box by War Memorial	6496	LBII	210975	214582	
Lamp Standard by War Memorial	6497	LBII	210975	214586	
The Rutzen Arms P.H.	6499	LBII	211005	214511	
Hill House (Chestnut Tree Lodge)	6500	LBII	210883	214816	
The Emporium	6501	LBII	210894	214813	
Bloomfield	6502	LBII	211001	215080	
Bloomfield Terrace	6503	LBII	210901	215062	
Bloomfield Terrace	6504	LBII	210907	215069	
NO.21 NORTHFIELD ROAD	6505	LBII	210891	215047	
Blaen Ffynnonau	6506	LBII	211145	215923	Site 158
Stable attached to Blaen Ffynnonau	6507	LBII	211145	215914	Site 159

Name	Cadw Ref	Status	Easting	Northing	500m Study Area
Blaen Marlais	6508	LBII	210972	216010	Site 146
Barn in Grounds of Blaen Marlais	6509	LBII	211000	215998	Site 147
Barclay's Bank	6510	LBII	211022	214645	
Old Bank House	6511	LBII	211032	214651	
Staunton House	6512	LBII	211040	214658	
Llwynon	6513	LBII	211052	214634	
Annexe adjoining No.61 (Llwynon)	6514	LBII	211059	214634	
G.Badham & Sons	6515	LBII	211036	214634	
Animal Kitchen	6516	LBII	210912	214797	
Greenway Farm	6517	LBII	211656	214662	
Cartshed adjoining Greenway Farm	6518	LBII	211653	214653	
Stable adjoining Greenway Farm	6519	LBII	211653	214649	
Byre at Greenway Farm	6520	LBII	211639	214670	
Outhouse at Greenway Farm	6521	LBII	211640	214662	
Tabernacle United Reformed Church	6522	LBII	211080	214630	
Schoolroom to Tabernacle United Reformed Church	6523	LBII	211083	214611	
Blackaldern	6524	LBII	211961	214204	
Coach House at Blackaldern	6525	LBII	211933	214206	
Parish Boundary Stone	6526	LBII	212107	214395	
Milestone on Lane leading off A478 to Cold Blow	6527	LBII	211454	213274	
Cilfrath Fach	6528	LBII	211090	216922	
Cowhouse at Cilrath Fach	6529	LBII	211057	216939	
Lofted Cowhouse at Cilrath Fach	6530	LBII	211076	216950	
Stable at Cilrath Fach	6531	LBII	211091	216959	
Barn at Cilrath Fach	6532	LBII	211095	216949	
Milestone	6533	LBII	209994	215130	
Parc Glas	6534	LBII	212854	214359	
Parish Church of St Teilo	6535	LBII	212755	214375	
Milestone	6536	LBII	211953	214528	
Pont Shan	6537	LBII	209383	216824	
Sodstone House	6538	LBII	210297	216314	Site 145
Coach House & Stables at Sodstone House	6539	LBII	210293	216347	Site 150
Sodstone Manor	6540	LBII	210209	216556	Site 150
The Former Courthouse	6558	LBII	210974	214546	
Bethesda Congregational Chapel	18797	LBII	209081	217912	
Pont Shân	18798	LBII	209383	216827	
Robeston House	18800	LBII	208510	215776	
Rock Well	18801	LBII	208438	215925	
Allensbank	18974	LBII	211202	213321	
St. David's Parish Church	18982	LBII	214392	215870	

Name	Cadw Ref	Status	Easting	Northing	500m Study Area
War Memorial	18983	LBII	214766	216897	
Crinow and Lampeter Velfrey Parish Boundary Stone	18998	LBII	212908	214039	
Grondre House	82467	LBII	211211	217923	
The Old Pharmacy	87564	LBII	210988	214620	
Earthworks SE of Clyn-Derwen	CM065	SAM	212322	218940	
Narberth Castle	PE040	SAM	210985	214394	
Llanddewi Gaer	PE086	SAM	214449	216075	
Vaynor Gaer	PE115	SAM	209425	217114	
Redstone Cross Round Barrows	PE154	SAM	211015	216416	Site 135, 136
Caerau Gaer	PE176	SAM	213985	216102	
Bush Inn Camp	PE182	SAM	207633	215536	
Clyn Pattel Motte & Bailey	PE412	SAM	212833	214178	
Iron Age Hillslope Enclosure in Canaston Wood	PE413	SAM	208863	214093	
Llangwathan Castle Mound	PE434	SAM	213405	215294	
Blackaldern park and garden	27 (PEM)	PGW	211904	214177	

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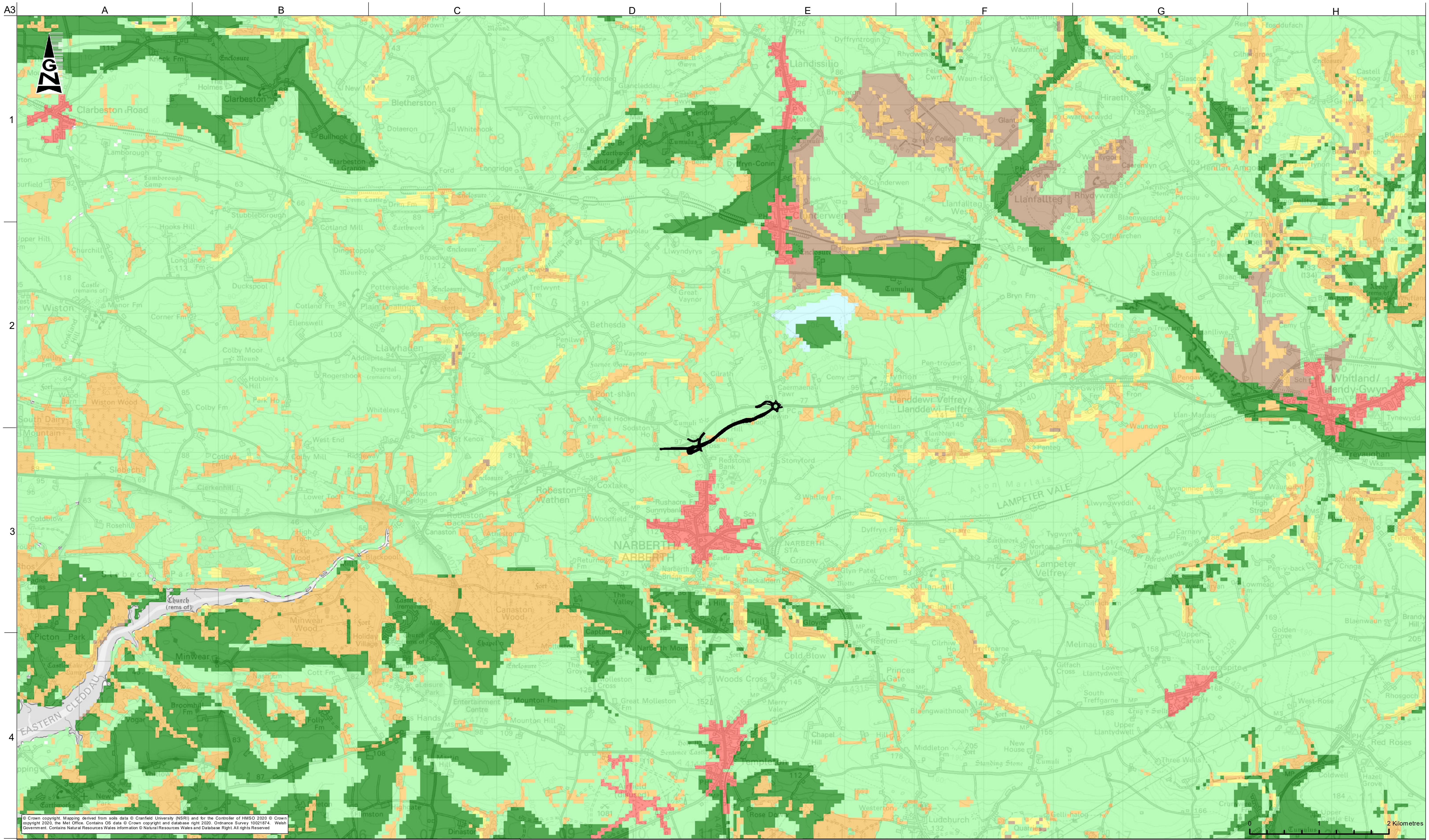

LEGEND

PREDICITIVE AGRICULTURAL LAND CLASSIFICATION (VERSION 2)

- GRADE 1
- GRADE 2
- GRADE 3A
- GRADE 3B
- GRADE 4
- GRADE 5
- NON
- URBAN
- PROPOSED ALIGNMENT

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction	None
Maintenance / Cleaning	None
Use	None
Decommissioning / Demolition	None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	22/06/20	FIRST ISSUE	AC	GJ	RC	GD

Project Title

A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client

Llywodraeth Cymru
Welsh Government

ARCADIS

MOTT MACDONALD

Delivery Team

ARUP

RICHARDS MOOREHEAD & LAING LTD
PLANNING | LANDSCAPE | ENVIRONMENT

Drawing Title

FIGURE 12.1
PREDICITIVE AGRICULTURAL LAND CLASSIFICATION

Suitability

S4 SUITABLE FOR STAGE APPROVAL

Scale at A3 1:50,000

Rev	By	Chkd	Appd	Auth
P01	AC	GJ	RC	GD
	Date 22/06/20	Date 22/06/20	Date 22/06/20	Date 22/06/20

Name

A40PRC - ARP - EGN - SWI - DR - LE - 0008

Project | Originator | Volume | Location | Type | Role | Number

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 13.1 Air Quality Legislation and Guidance

A40PRC-ARP-EAC-SWI-RP-LE-0017

P02 | S3

07/02/20

Appendix 13 Contents

Tables

1 Appendix 13.1 Relevant Guidance and Legislation

1.1 European Legislation

European Air Quality Management

1.1.1 The Council Directive (2008/50/EC)[1] on Ambient Air Quality and Cleaner Air for Europe sets out a range of mandatory Limit Values (LV) for different pollutants including nitrogen dioxide (NO_2) and particulate matter less than 10 microns (PM_{10}) in diameter, the key traffic related pollutants. The Directive consolidated previous air quality directives (apart from the Fourth Daughter Directive), setting Limit Values or Target Values for the concentrations of specific air pollutants and providing a new regulatory framework for particulate matter less than 2.5µm in diameter ($PM_{2.5}$). It also allows Member States to apply to postpone attainment deadlines. The Directive was transposed into national legislation in Wales by the Air Quality Standards (Wales) Regulations 2010 (WSI 2010 No. 1433).

1.2 National Legislation

Environment Act 1995

1.2.1 Part IV of the Environment Act 1995[2] places a duty on Welsh Ministers for the Environment to develop, implement and maintain an air quality strategy with the aim of reducing atmospheric emissions and improving air quality. The National Air Quality Strategy (NAQS) for England, Scotland, Wales and Northern Ireland provides the framework for ensuring compliance with air quality limit values based on a combination of international, national and local measures to reduce emissions and improve air quality. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of local air quality management and declare Air Quality Management Areas (AQMAs) where necessary.

1.2.2 England has produced a new Clean Air Strategy in 2019[3] which is

[1] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.
[2] Environment Act 1995, Chapter 25, Part IV Air Quality
[3] https://www.gov.uk/government/publications/clean-air-strategy-2019

discussed further in section 1.2.3 and 1.2.4, Wales plan to produce an updated strategy in 2019.

Air Quality (Wales) Regulations 2000 and Air Quality (Wales) (Amendment) Regulations 2002

1.2.3 The Air Quality (Wales) Regulations[4] as amended in 2002[5] bring the air quality objectives into Welsh law. These are discussed further in sections 1.2.4 and 1.2.5.

Air Quality Objectives and Limit Values

1.2.4 Some pollutants have standards expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment i.e. effects occur (long-term) after a prolonged period of exposure to elevated concentrations, and others have standards expressed as 24-hour, 1-hour or 15-minute average concentrations (short-term) due to the acute way in which they affect health or the natural environment i.e. after a relatively short period of exposure. Some pollutants have standards expressed in terms of both long-term and short-term concentrations. Table 1 sets out the EU air quality limit values and national air quality objectives for the pollutants relevant to this study (NO_2 and PM_{10}).

1.2.5 In most cases, the air quality limit values and air quality objectives have the same pollutant concentration threshold and date for compliance. The key difference is that Welsh Ministers are required under European Law to ensure compliance with the air quality limit values whereas local authorities are only obliged under national legislation to undertake best efforts to comply with the air quality objectives. To assist local authorities in demonstrating best efforts, the Environment Act 1995 requires that when carrying out their local air quality management functions, local authorities shall have regard to guidance issued by Welsh Ministers.

[4] Welsh Government (2000), Air Quality (Wales) Regulations
[5] Welsh Government (2002), Air Quality (Wales) (Amendment) Regulations

Table 1 UK and EU air quality standards

Pollutant	Averaging period	Limit value/objective
Nitrogen dioxide (NO2)	1 hour mean	200µg/m3, not to be exceeded more than 18 times a year (99.79th percentile)
	Annual mean	40µg/m3
Fine Particulate Matter (PM10)	Daily mean	50µg/m3, not to be exceeded more than 35 times a year (90.4th percentile)
	Annual mean	40µg/m3

Well-being of Future Generations (Wales) Act 2015

1.2.6 The Well-being of Future Generations Act[6] has several well-being goals that are to be achieved through implementation of sustainable development. Changes in air quality can have an impact on the health of ecological habitats and humans, as such, the goals to create 'a resilient Wales' and 'a healthier Wales' apply.

1.2.7 National indicators have been set for Welsh Ministers to understand the progress being made to achieving the well-being goals. One of these national indicators relates to concentrations of NO_2 in the air. The Well-being of Future Generations Act aims to reduce pollution exposure by assessing a weighted population average to NO_2 on an annual basis.

Planning Policy Wales, Edition 10

1.2.8 The 10th edition of Planning Policy Wales[7] (PPW10) was published in December 2018. It sets out land-use and planning policy for Wales. The new planning policy incorporates principles derived from the Well-being of Future Generations (Wales) Act 2015.

1.2.9 The policy document is set out into themes, with air quality predominantly addressed in the Distinctive and Natural Places theme. Section 6.7 of PPW10, Air Quality and Soundscape, highlights the importance that air quality has in creating a positive experience of

[6] Welsh Government (2015) Well-being of Future Generations (Wales) Act
[7] Welsh Government (2018) Planning Policy Wales Edition 10 (PPW10)

place, public health, amenity and well-being. Specific reference is made to the contribution the planning system should make to achieving a healthier Wales through reducing population exposure to air pollution, while also tackling high pollution hotspots. Additionally, it states that preventing the creation of any new, or worsening of existing, air quality pollution problems is important.

Tackling Roadside Nitrogen Dioxide Concentrations in Wales – Welsh Supplemental Air Quality Plan (2018)

1.2.10 The Welsh Supplemental Plan[8] was produced by the Welsh Government in response to the 2017 UK air quality plan[9]. The plan sets out measures aimed at addressing air quality issues primarily along the strategic road network in Wales and local authority areas that are predicted to still be exceeding the NO_2 limit values. The measures include a number of 50mph speed limits on sections of the road network that are predicted to still be exceeding the annual mean limit value for NO_2 and working with selected local authorities (Cardiff Council) to produce their own air quality assessments and plans to address air quality issues. The measures are designed to achieve compliance with the limit value as early as 2020.

Clean Air Strategy 2019

1.2.11 The Clean Air Strategy[10] addresses emissions of air quality from a number of sources, including transport and provides measures that are being taken to either create new legislation or fund new projects that will help to reduce emissions from the transport sector.

1.2.12 Measures that effect road transport include working to ensure that the sale of new conventional petrol and diesel engine cars and vans ends by 2040, the introduction of new legislation to allow manufacturers to be compelled to recall vehicles for failures in their emission control systems, research into reducing non-exhaust emission of particulate matter, and action on using cleaner modes of transport for passenger and freight transport which include air quality.

[8] Welsh Government (2018), Tackling Roadside Nitrogen Dioxide Concentrations in Wales.
[9] UK Government (2017), UK plan for tackling roadside nitrogen dioxide concentrations.
[10] UK Government (2019), Clean Air Strategy.

One Wales: Connecting the Nation- The Wales Transport Strategy (2008)

1.2.13 The Transport Strategy for Wales[11] recognises that transport can be a key contributor to air pollution and consequently have an impact on human health and ecological habitats. It acknowledges that in order to improve air quality, emissions from transport will have to reduce.

1.2.14 The strategy sets out actions designed to make sustainable travel easier to achieve with the consequence that emissions attributed to transport will be reduced. These measures increasing an integrated transport system that supports closer working between public transport providers, supporting the development of sustainable travel towns, and supporting the creation of regional transport plans.

1.3 Local Planning Policy

1.3.1 The study area of the air quality assessment, as discussed in the air quality chapter, is located in the area of Pembrokeshire County Council (PCC). Planning Policy relating to air quality developed by PCC is outlined below.

Pembrokeshire County Council Local Development Plan 2013-2021

1.3.2 Policies from the Pembrokeshire County Council (PCC) Local Development Plan 2013-2021[12] relevant to air quality include:

GN1: General Development Policy, Point 2: developments will be permitted where they will not result in a significant detrimental impact on local air quality; and

GN3: Infrastructure and New Development: provision must be made for mitigation of potential adverse impacts on air quality.

Local Air Quality Management Policy and Technical Guidance

1.3.3 The 2016 policy guidance document from Defra, LAQM.PG(16)[13], provides additional guidance on the links between transport and air

[11] Welsh Government (2008), One Wales: Connecting the Nation – The Wales Transport Strategy.
[12] Pembrokeshire County Council (2013) Pembrokeshire County Council Local Development Plan: Planning Pembrokeshire's Future.
[13] Defra (2016) Local Air Quality Management Policy Guidance. LAQM.PG(16)

quality. LAQM.PG(16) describes how road transport contributes to local air pollution and how transport measures may bring improvements in air quality. Key transport-related government initiatives are set out, including regulatory measures and standards to reduce vehicle emissions and improve fuels, tax-based measures and the development of an integrated transport strategy.

1.3.4 LAQM.PG(16) also provides guidance on the links between air quality and the land-use planning system. The guidance advises that air quality considerations should be integrated into the planning process at the earliest stage and is intended to aid local authorities in developing action plans to deal with specific air quality problems and create strategies to improve air quality. It summarises the main ways in which the land-use planning system can help deliver compliance with the air quality objectives.

1.3.5 LAQM.TG(16)[14] provides guidance to local authorities and air quality practitioners on all levels of air quality modelling and assessment. Where relevant this guidance has been considered.

Design Manual for Roads and Bridges

1.3.6 The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 1: HA207/07[15] provides guidance for the assessment of air quality from road schemes. This guidance will be used to identify the Scheme's study area.

1.3.7 It should be noted DMRB and associated IANs have not yet been adopted in Wales, however, it is considered that DMRB and these IANs reflect current best practice guidance and as there is no suitable Welsh equivalent guidance, these were used to inform the proposed method of assessment where applicable.

1.3.8 The DMRB guidance was updated in December 2019, following the assessment carried out for this scheme. The updated DMRB guidance[16] does not contain any new guidance which would alter the conclusions of this air quality assessment.

[14] Defra (2016) Local Air Quality Management Technical Guidance. LAQM.TG(16)
[15] Highways Agency, (2007) Design Manual For Roads and Bridges Volume 11, Section 3, Part 1 Air Quality HA207/07
[16] Highways Agency, (2019) Design Manual For Roads and Bridges Volume 11, Section 3, Part 1 Air Quality LA 105

EPUK/IAQM Land-Use Planning and Development Control

1.3.9 The 2017 Land-Use Planning & Development Control guidance document[17] produced by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) provides a framework for professionals operating in the planning system to provide a means of reaching sound decisions, regarding the air quality implications of development proposals. The guidance will be used to assess the significance of the Scheme.

Dust Guidance

1.3.10 Dust is the generic term used in the British Standard document BS 6069 (Part Two)[18] to describe particulate matter in the size range 1–75 µm in diameter. Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Under provisions of the Environmental Protection Act 1990, dust nuisance is defined as a statutory nuisance.

1.3.11 There are currently no formal standards or guidelines for what constitutes dust nuisance in the UK, nor are formal dust deposition standards specified. This reflects the uncertainties in dust monitoring technology and the highly subjective relationship between deposition events, surface soiling and the perception of such events as a nuisance. In law, complaints about excessive dust deposition would have to be investigated by the local planning authority and any complaint upheld for a statutory nuisance to occur. However, dust deposition is generally managed by suitable on-site practices and mitigation rather than by the determination of statutory nuisance and/or prosecution or enforcement notice(s).

1.3.12 The IAQM has published guidance[19] on the assessment of dust from demolition and construction. This provides a risk-based qualitative approach for determining the potential for dust impacts during the construction phase of the Scheme.

[17] EPUK/IAQM, (2017) Land-Use Planning & Development Control: Planning for Air Quality
[18] British Standards Institute (1983), BS6069: Part 2 1983, ISO 4225-1994, Characterisation of air quality
[19] IAQM (2016) Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)

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ES Appendix 13.2 Air Quality Traffic data

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Appendix 13.2 Contents

Tables

Appendix 13.2 – Traffic Data

Table 13.1 Baseline and Do Minimum traffic data

Road ID	Base 2017			DM 2022			DM2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
1	11224	5.9	80	11575	5.7	80	13022	5.2	78
2	11956	5.7	70	12254	5.6	67	13864	5.0	66
3	11825	5.3	57	472	3.0	61	542	2.6	61
4	12452	5.2	61	1053	5.5	54	1175	5.0	54
5	12023	5.7	79	12323	5.6	79	13940	5.0	78
6	12226	5.2	81	116	0.6	87	130	0.5	87
7	12017	5.3	58	633	4.9	63	694	4.5	63
8	12059	5.3	47	697	2.9	46	791	2.5	45
9	11810	5.4	85	12223	5.2	84	14082	4.7	83
10	11903	5.7	82	12201	5.6	82	13805	5.0	81
11	11747	5.4	87	12160	5.2	87	14006	4.7	86
12	12167	5.5	42	12658	5.3	41	14235	4.8	39
13	11767	5.4	80	12177	5.2	80	14026	4.7	79
14	163	3.6	20	163	3.6	20	183	3.3	20
15	3226	2.0	20	3795	1.9	20	4212	1.8	20
16	1694	1.1	20	1824	1.1	20	2030	1.0	20
17	4259	2.7	50	4309	2.7	50	4920	2.4	50
18	6025	4.9	65	6110	4.9	60	6829	4.4	60
19	926	6.1	20	940	6.0	20	1049	5.5	20

Road ID	Base 2017			DM 2022			DM2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
20	855	0.4	36	856	0.4	39	959	0.4	39
21	242	3.0	20	258	3.0	20	291	2.8	20
22	46	0.0	48	46	0.0	48	51	0.0	48
23	67	3.3	28	54	4.2	27	60	4.2	27
24	97	1.9	47	97	1.8	47	110	1.7	47
25	58	2.2	40	47	2.6	43	53	2.3	43
26	11883	5.3	78	12251	5.2	82	14106	4.7	81
27	11883	5.3	58	519	3.0	45	595	2.6	45
28	12007	5.3	83	12513	5.1	79	14370	4.6	78
29	7091	4.6	20	5931	4.7	20	6697	4.2	20
30	6124	5.2	50	1053	5.5	50	1175	5.0	50
31	6327	5.3	50	6110	4.9	50	6829	4.4	50
32	6025	4.9	50	4309	2.7	57	4920	2.4	56
33	4259	2.7	59	4180	2.7	63	4774	2.4	63
34	4131	2.7	63	4501	2.5	62	5131	2.3	62
35	4451	2.6	62	1319	4.3	20	1470	3.9	20
36	1282	4.4	20	1319	4.3	43	1470	3.9	43
37	1282	4.4	43	3904	3.0	38	4380	2.7	38
38	3827	3.0	38	2907	3.1	32	3241	2.8	32
39	2845	3.1	32	4302	2.6	39	4780	2.4	39
40	4244	2.6	39	3342	1.2	20	3736	1.1	20
41	3247	1.3	20	3342	1.2	43	3736	1.1	43
42	3247	1.3	43	6701	1.8	20	7453	1.7	20

Road ID	Base 2017			DM 2022			DM2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
43	6556	1.9	20	6363	1.7	20	7040	1.6	20
44	6023	1.8	20	5859	1.8	20	6474	1.6	20
45	5521	1.8	20	6522	1.7	20	7217	1.6	20
46	6181	1.8	20	6491	1.9	20	7249	1.8	20
47	6172	2.0	20	6281	1.4	20	6973	1.3	20
48	6123	1.4	20	5184	1.6	20	5742	1.4	20
49	5030	1.6	20	5886	1.5	20	6540	1.3	20
50	5577	1.5	20	6688	1.5	20	7441	1.3	20
51	6374	1.5	20	3695	1.4	20	4073	1.3	20
52	3123	1.6	20	6183	1.6	20	6862	1.4	20
53	6023	1.6	20	6561	1.4	20	7297	1.3	20
54	6251	1.4	20	4277	1.8	20	4713	1.6	20
55	4216	1.8	20	4277	1.8	39	4713	1.6	38
56	4216	1.8	39	1936	1.9	48	2079	1.7	48
57	1905	2.4	48	2469	1.7	62	2666	1.5	62
58	2447	2.1	62	2469	1.7	50	2666	1.5	50
59	2447	2.1	50	3695	1.4	37	4073	1.3	36
60	3123	1.6	37	2373	1.9	47	2641	1.8	46
61	2218	2.0	47	3299	1.8	46	3643	1.7	45
62	2832	1.9	46	2599	2.3	56	2888	2.1	56
63	2268	2.3	56	1824	1.1	44	2030	1.0	43
64	1694	1.1	44	13190	5.1	50	14715	4.6	50
65	12852	5.3	50	11575	5.7	77	13022	5.2	76

Road ID	Base 2017			DM 2022			DM2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
66	11224	5.9	77	11575	5.7	50	13022	5.2	50
67	11224	5.9	50	13190	5.1	81	14715	4.6	80
68	12852	5.3	81	7098	3.9	20	7926	3.5	20
69	6915	4.1	20	1160	3.1	50	1301	2.8	50
70	1138	3.1	50	12254	5.6	50	13864	5.0	50
71	11956	5.7	50	856	0.4	20	959	0.4	20
72	855	0.4	20	12251	5.2	50	14106	4.7	50
73				6149	3.4	20	7079	3.0	20
74				51	0.0	20	57	0.0	20
75				519	3.0	20	595	2.6	20
76				11775	5.2	69	13558	4.7	68
77				11775	5.2	50	13558	4.7	50
78				11775	5.2	87	13558	4.7	86
79				11775	5.2	78	13558	4.7	76
80				633	4.9	20	694	4.5	20
81				12407	5.1	66	14252	4.6	64
82				12513	5.1	78	14370	4.6	77
83				12513	5.1	50	14370	4.6	50

Appendix 13.2 – Traffic Data –Do Something

Table 13.2 Do Something traffic data

Road ID	DS 2022			DS2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
1	11565	5.7	78	13038	5.1	77
2	2145	2.1	54	2473	1.9	54
3	472	3.0	61	542	2.6	61
4	1053	5.5	54	1175	5.0	54
5	2217	2.4	62	2550	2.1	61
6	116	0.6	87	130	0.5	87
7	633	4.9	63	694	4.5	63
8	697	2.9	46	791	2.5	45
9	12223	5.2	84	14082	4.7	83
10	2093	2.1	64	2414	1.9	64
11	12160	5.2	87	14006	4.7	86
12	1824	1.1	64	2030	1.0	64
13	12177	5.2	80	14026	4.7	79
14	163	3.6	20	183	3.3	20
15	3253	2.2	53	3586	2.1	53
16	1824	1.1	20	2030	1.0	20
17	4260	2.7	50	4853	2.5	50
18	6110	4.9	61	6829	4.4	61
19	940	6.0	20	1049	5.5	20
20	856	0.4	39	959	0.4	39

Road ID	DS 2022			DS2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
21	258	3.0	20	291	2.8	20
22	46	0.0	48	51	0.0	48
23	54	4.2	27	60	4.2	27
24	97	1.8	47	110	1.7	47
25	47	2.6	43	53	2.3	43
26	12251	5.2	82	14106	4.7	81
27	519	3.0	45	595	2.6	45
28	12513	5.1	79	14370	4.6	78
29	3392	4	20	3833	3	20
30	1053	5.5	50	1175	5.0	50
31	6110	4.9	50	6829	4.4	50
32	4260	2.7	56	4853	2.5	55
33	4131	2.7	63	4708	2.5	63
34	4452	2.6	62	5065	2.3	62
35	1319	4.3	20	1470	3.9	20
36	1319	4.3	43	1470	3.9	43
37	3828	3.0	38	4339	2.8	38
38	2893	3.1	32	3222	2.9	32
39	4349	2.6	39	4783	2.4	39
40	3342	1.2	20	3736	1.1	20
41	3342	1.2	43	3736	1.1	43
42	6749	1.8	20	7456	1.7	20
43	6440	1.7	20	7059	1.6	20
44	5937	1.7	20	6494	1.6	20

Road ID	DS 2022			DS2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
45	6600	1.7	20	7236	1.6	20
46	6491	1.9	20	7249	1.8	20
47	6358	1.4	20	6993	1.3	20
48	5262	1.5	20	5762	1.4	20
49	5914	1.5	20	6556	1.3	20
50	6716	1.5	20	7456	1.3	20
51	3791	1.4	20	4124	1.3	20
52	6260	1.5	20	6882	1.4	20
53	6589	1.4	20	7313	1.3	20
54	4287	1.8	20	4696	1.7	20
55	4287	1.8	39	4696	1.7	38
56	1917	1.9	48	2079	1.7	48
57	2422	1.7	62	2681	1.5	62
58	2422	1.7	50	2681	1.5	50
59	3791	1.4	37	4124	1.3	36
60	2470	1.9	46	2692	1.7	46
61	3395	1.7	46	3694	1.6	45
62	2690	2.2	55	2925	2.1	55
63	1824	1.1	48	2030	1.0	48
64	13190	5.1	50	14715	4.6	50
65	11565	5.7	77	13038	5.1	76
66	11565	5.7	50	13038	5.1	50
67	13190	5.1	81	14715	4.6	80
68	7084	4	20	7934	4	20

Road ID	DS 2022			DS2037		
	24 hr AADT	% HGV	Speed (kph)	24 hr AADT	% HGV	Speed (kph)
69	1160	3.1	50	1301	2.8	50
70	2145	2.1	50	2473	1.9	50
71	856	0.4	20	959	0.4	20
72	12251	5.2	50	14106	4.7	50
73	6149	3	20	7079	3	20
74	51	0.0	20	57	0.0	20
75	519	3.0	20	595	2.6	20
76	11775	5.2	69	13558	4.7	68
77	11775	5.2	50	13558	4.7	50
78	11775	5.2	87	13558	4.7	86
79	11775	5.2	78	13558	4.7	76
80	633	4.9	20	694	4.5	20
81	12407	5.1	66	14252	4.6	64
82	12513	5.1	78	14370	4.6	77
83	12513	5.1	50	14370	4.6	50
84	1824	1.1	20	2030	1.0	20
85	1506	1.7	20	1651	1.5	20
86	1506	1.7	20	1651	1.5	20
87	10059	6.3	50	11387	5.7	50
88	10059	6.3	79	11387	5.7	78
89	10059	6.3	77	11387	5.7	76

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ES Appendix 14.1 Glossary of Noise and Vibration Terminology

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Appendix 14.1 – Glossary of noise and vibration terminology

Decibel

1.1.1 The ratio of sound pressures, which we can hear, is a ratio of 10^6 (one million: one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L_p) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

dB(A)

1.1.2 The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

1.1.3 In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{A10}, L_{A90}, and L_{Aeq} for the 'A' weighted equivalent continuous noise level.

Equivalent continuous sound level

1.1.4 Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

Statistical noise levels

1.1.5 For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for ten per cent of the time period under consideration, has been adopted in this country for the assessment of road traffic noise. The L_{90}, the level exceeded for ninety per cent of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for one per cent of the time, is representative of the

maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T), is normally included, e.g. $dBL_{A10, 5min}$ or $dBL_{A90, 8hr}$.

Maximum noise level

1.1.6 This is generally expressed as the maximum A-weighted noise level (L_{Amax}) and represents the maximum instantaneous noise level that occurred with the monitoring period. Certain assessment criteria recommend maximum noise levels to avoid disturbance as well as limits for longer-term averaged noise exposures.

Frequency

1.1.7 The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kHz, e.g. 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes, the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

Sound pressure level

1.1.8 The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

1.1.9 The sound pressure level (L_p) is 10 times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10^{-5}Pa (the threshold of hearing).

1.1.10 Thus L_p (dB) = 10 log $(P1/P_{ref})^2$ where P_{ref}, the lowest pressure detectable by the ear, is 0.00002 pascals (i.e. 2x10^{-5} Pa).

1.1.11 The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB(A) or more and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

Vibration

1.1.12 Vibration may be expressed in terms of displacement, velocity and acceleration. Velocity and acceleration are most commonly used when assessing structure borne noise or human comfort issues respectively. Vibration amplitude may be quantified as a peak value, or as a root mean squared (rms) value.

1.1.13 Vibration amplitude can be expressed as an engineering unit value e.g. 1 mms^{-1} or as a ratio on a logarithmic scale in decibels:

1.1.14 Vibration velocity level, dB = 20 log (V/V_{ref}) (where the preferred reference level, V_{ref}, for vibration velocity = 10^{-9} ms^{-1}).

1.1.15 The decibel approach has advantages for manipulation and comparison of data.

Typical noise levels

1.1.16 Some typical noise levels are given below.

Table 14 1 Typical noise levels

Noise level, dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

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ES Appendix 14.2 Baseline Noise Survey Results

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14.2 Baseline noise survey results

Measurement procedure

Site Location

14.2.1 Arup undertook noise surveys to determine the existing noise climate around the proposed A40 improvement scheme between Penblewin and Redstone Cross. Attended noise measurements were taken by Neil Allso of Arup on the 16th of October 2019. A long-term measurement was also taken with a sound level meter over a 7-day period from 12th November 2019 to 19th November 2019 at location G (Caermaenau Fawr).

Measurement Locations

14.2.2 Measurements were taken at seven locations which are shown on Figure 14.1 and listed below:

a) Location A (attended) – at the southern side of Sodston Lodge
b) Location B (attended) – at the western side of 1 Redstone Cottages, outside the gate which leads to the yard.
c) Location C (attended) – at the north eastern side of Blaenmarlais Care Home
d) Location D (attended) – at the southern side of Blackmoor Hill, at top of southern slope.
e) Location E (attended) – at the western side of Pant-Y-Gorphwys Uchaf.
f) Location F (attended) – at the western side of Penblewin Farm, outside the courtyard.
g) Location G (unattended logger) – at the southern side of Caermaenau Fawr

Attended survey period

14.2.3 Attended measurements were taken on 16th October 2019 between 10:00 and 17:45 hrs. See paragraph 14.2.7 for more details.

Survey methodology

14.2.4 The measurements were made with the measurement microphone mounted using a tripod 1.2m – 1.5m above ground level with the microphone diaphragm parallel to the ground. Measurements were taken at least 3.5m from any nearby reflecting surfaces, excluding the ground, to measure free-field noise levels.

14.2.5 The measurement locations were chosen to provide typical ambient noise levels at representative noise sensitive receptors around the proposed Scheme.

14.2.6 The weather conditions during the survey were within the limits specified in BS7445-1:2003. The weather was mild and dry with high cloud base and mainly light winds, with wind speeds up to $3ms^{-1}$.

Survey method

14.2.7 Attended measurements at locations A to F followed the shortened measurement procedure described in CRTN to obtain an estimate of the value of the acoustic parameter $L_{A10,18hr}$. Three fifteen-minute measurements were taken, during three consecutive hours between 10:00 hrs and 17:45 hrs on normal weekday. One measurement at Location F is beyond the CRTN shortened measurement hours of 10:00 and 17:00 hrs whilst one measurement at Location E is slightly beyond these hours. The measurements are considered suitable and representative however as the results appear generally consistent with the other measurements at these locations.

14.2.8 For each noise measurement, the noise climate, temperature, wind speed and direction, and the measured noise levels were all recorded and noted. The meter was set to record the L_{Aeq}, L_{Amin}, L_{AFmax}, L_{A10} and L_{A90} indices.

14.2.9 Measurements at Location G were taken by an unattended logger at the southern side of Caermaenau Fawr between 14:00 on 12th November and 14:00 on 19th November 2019. The logger was set to record the L_{Aeq}, L_{Amin}, L_{AFmax}, $L_{A1,}$ $L_{A10,}$ L_{A50} $L_{A90,}$ and L_{A99} indices every 1

minute. It is considered that this data is appropriate to represent the ambient noise levels.

Measurement equipment

14.2.10 Measurements were carried out using equipment as detailed in Table 1. The sound level meters and microphones are Class 1, conforming to BS EN 61672-1: 2003. The calibration of the sound level meters, pre-amplifier and microphone chains were checked before and after use, to confirm that there was no significant drift in meter response at the calibrator frequency and level. All sound level meters used for this survey are regularly calibrated and this calibration is traceable to international standards.

Table 1 Measurement equipment used for the survey

Measurement Equipment	Manufacturer	Type Number	Serial Number
Class 1 sound level meter	Norsonic (for attended measurements)	140	1405202
½" diameter condenser microphone	Norsonic	1225	151245
Pre-amplifier	Norsonic	1209	15264
Sound pressure calibrator	Norsonic	1251	33554
Class 1 sound level meter	Rion (Logger)	NL-52	00231671
½" diameter condenser microphone	Rion	UC-59	04716
Preamplifier	Rion	NH-25	21615
Calibrator	Rion	NC-74	34336008

Measurement observations

14.2.11 During attended measurements at Locations A to D the dominant noise source was road traffic on the A40. Other notable noise sources included wildlife (e.g. birds) and sporadic wind noise. At locations E and F the dominant noise source was road traffic on the A478, which runs perpendicular to the A40. Noise sources at the unattended logger location at location G was road traffic on the A40 and A478.

Measurements results

Noise survey results summary

Measured noise levels at all locations are summarised in Table 2 and

Location	Sound level, dB (free field)			
	$L_{A10,18h}$[1]	Range of $L_{A10,15min}$	Range of $L_{A90,15min}$	Range of $L_{Aeq,15min}$
A	71	72-73	46-48	67-68
B	65	66-67	48-52	62-63
C	53	53-54	44-45	50-51
D	61	62-63	51-54	59-60
E	73	74	41-47	69
F	67	68-69	53-55	63-64

Notes:

[1] $L_{A10,18hr}$ values are derived as the arithmetic average of the three consecutive $L_{A10,1hr}$ values (based on 15-minute samples) for each location minus 1dB(A). This is according to the CRTN methodology for the shortened measurement procedure.

14.2.12 Table 3 below.

Table 2 Summary of attended measurements

Location	**Sound level, dB (free field)**			
	$L_{A10,18h}$[1]	**Range of $L_{A10,15min}$**	**Range of $L_{A90,15min}$**	**Range of $L_{Aeq,15min}$**
A	71	72-73	46-48	67-68
B	65	66-67	48-52	62-63
C	53	53-54	44-45	50-51
D	61	62-63	51-54	59-60
E	73	74	41-47	69
F	67	68-69	53-55	63-64

Notes:

[1] $L_{A10,18hr}$ values are derived as the arithmetic average of the three consecutive $L_{A10,1hr}$ values (based on 15-minute samples) for each location minus 1dB(A). This is according to the CRTN methodology for the shortened measurement procedure.

Table 3 Summary of logger measurements taken at Location G

Time period	**Sound level, dB (free field)**			
	L_{Aeq}	**$L_{A10,18hr}$**	**L_{A10} average**	**L_{A90} average**
Day (0700-1900)	48	44	46	41
Evening (1900-2300)	42		41	36
Night (2300-0700)	39		37	30

Notes:

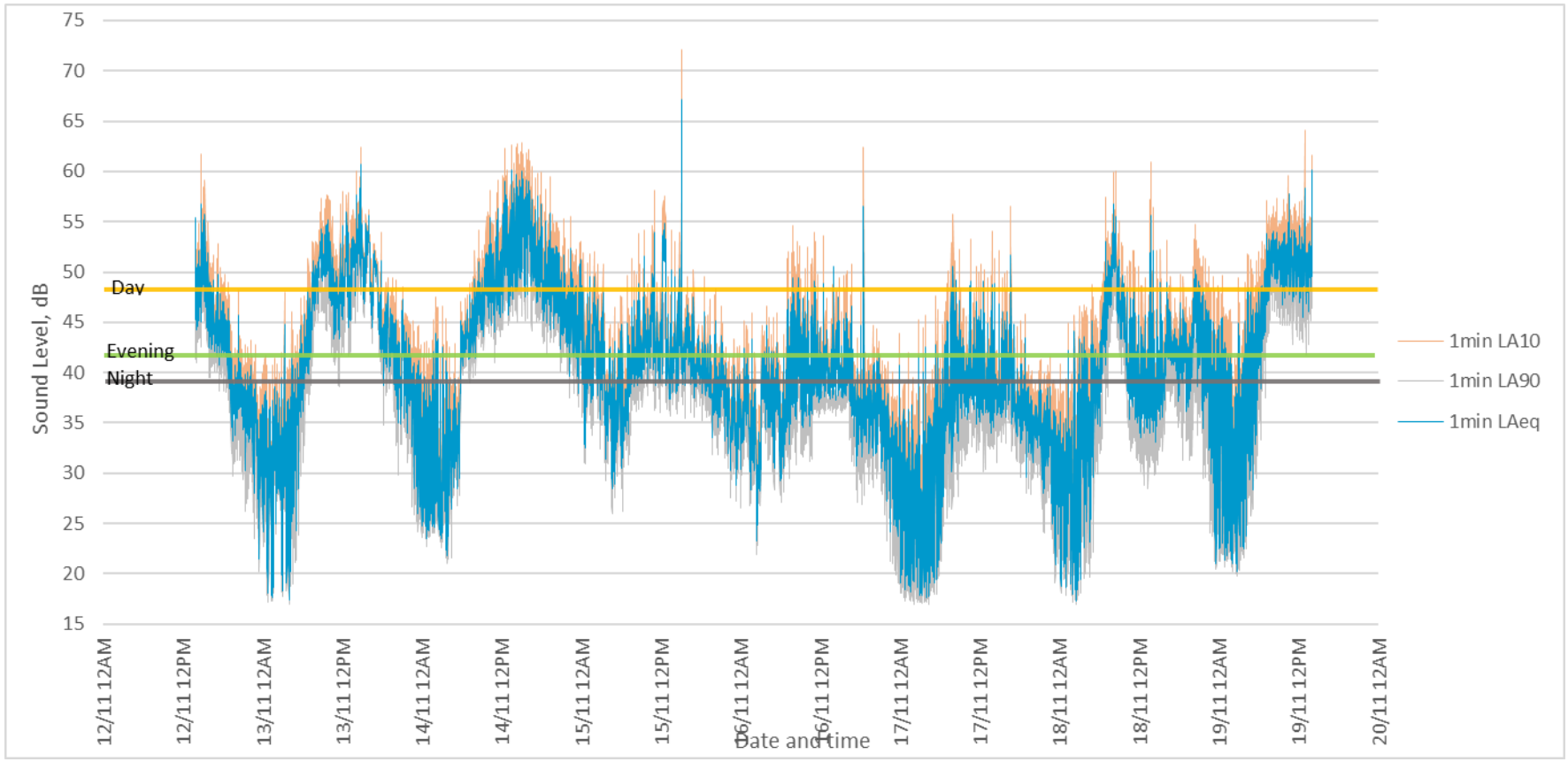
Overall L_{Aeq} values are the logarithmic (energy) average of the measurements for the respective time periods

The $L_{A10,18hr}$ was estimated from the arithmetic average of the $L_{A10,1min}$ values for the period 0600-2400 hours

The L_{A10} and L_{A90} values were calculated from the arithmetic average of the $L_{A10,1min}$ and $L_{A90,1min}$ respectively for each time period

Figure 1 Logged measurements at Location G

Overall L_{Aeq} values marked on the graph are the logarithmic (energy) average of the measurements for the respective time periods over the entire survey period



Full survey results at attended survey locations

Table 4 Attended measurement results at **Location A** - at the southern side of Sodston Lodge, on path adjacent to façade.

Date	Time		Wind		Noise Level, dB					Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
16/09/2019	10:11	10:25	0.3	West	68	81	42	73	48	Road traffic noise from A40 dominant. ~31 vehicles per minute Good weather. High cloud base
16/09/2019	11:15	11:30	1.5	West	67	87	41	72	48	Road traffic noise from A40 dominant. Free-flowing traffic 29 vehicles per minute.
16/09/2019	12:16	12:31	2.3	West	67	82	37	72	46	Road traffic noise from A40 dominant. 26 vehicles per minute.

Table 5 Attended measurement results at **Location B** - at the western side of 1 Redstone Cottages, outside gate to yard.

Date	Time		Wind		Noise Level, dB					Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
16/09/2019	10:35	10:50	1.5	West	63	75	43	67	52	Road traffic noise from A40 dominant. Free-flowing traffic, 25 vehicles per minute.
16/09/2019	11:35	11:50	1.6	West	62	78	45	66	51	Free-flowing traffic, 24 vehicles per minute, mix of goods vehicles and cars.
16/09/2019	12:38	12:53	1.0	West	62	79	40	66	48	23 vehicles per minute.

Table 6 Attended measurement results at **Location C** - at the north eastern side of Blaenmarlais Care Home, at raised bank.

Date	**Time**		**Wind**		**Noise Level, dB**					**Comments**
	Start	**Finish**	**Speed (ms^{-1})**	**Direction**	**L_{Aeq}**	**L_{Amax}**	**L_{Amin}**	**L_{A10}**	**L_{A90}**	
16/09/2019	10:55	11:10	1.6	West	51	62	41	54	45	Road traffic noise from A40 dominant.
16/09/2019	11:55	12:10	2.4	West	50	65	38	53	45	Road traffic noise from A40 dominant but distant. Wildlife and wind noise audible.
16/09/2019	13:00	13:15	1.6	West	51	63	38	54	44	Road traffic noise from A40 dominant. Scattered clouds.

Table 7 Attended measurement results at **Location D** - at the southern side of Blackmoor Hill, at top of southern slope.

Date	**Time**		**Wind**		**Noise Level, dB**					**Comments**
	Start	**Finish**	**Speed (ms^{-1})**	**Direction**	**L_{Aeq}**	**L_{Amax}**	**L_{Amin}**	**L_{A10}**	**L_{A90}**	
16/09/2019	14:17	14:32	1.9	West	60	73	40	63	51	Road traffic noise from A40 dominant.
16/09/2019	15:25	15:40	1.6	West	59	71	44	62	52	Road traffic noise from A40 dominant.
16/09/2019	16:31	16:46	1.0	West	59	69	45	62	54	Road traffic noise from A40 dominant.

Table 8 Attended measurement results at **Location E** - at the western side of Pant-Y-Gorphwys Uchaf, in line with building façade.

Date	Time		Wind		Noise Level, dB					Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
16/09/2019	14:38	14:53	2.1	West	69	85	36	74	41	Road traffic noise from A478 dominant. Located alongside A478 perpendicular to A40.
16/09/2019	15:50	16:05	0.9	West	69	86	36	74	41	Road traffic noise from A478 dominant. 19 vehicles per minute on A478. A40 not audible.
16/09/2019	16:53	17:08	1.0	West	69	83	37	74	47	Free-flowing traffic on A478, 26 vehicles per minute.

Table 9 Attended measurement results at **Location F** - at the western side of Penblewin Farm, outside courtyard at grassy bank.

Date	Time		Wind		Noise Level, dB					Comments
	Start	Finish	Speed (ms^{-1})	Direction	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}	
16/09/2019	14:58	15:13	2.1	West	64	78	49	68	53	Road traffic noise from A40 dominant, A478 clearly audible. 26 vehicles per minute.
16/09/2019	16:09	16:24	1.2	West	63	78	48	68	54	Road traffic noise from A40 dominant but A478 clearly audible. 26 vehicles per minute.
16/09/2019	17:30	17:45	1.2	West	64	76	52	69	55	Road traffic noise from A478 dominant, busy traffic on A40. 26 vehicles per minute.

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ES Appendix 14.3 Construction Noise and Vibration Data

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Appendix 14.3 – Construction Noise and Vibration Data

1.1 Construction noise and vibration data

Noise assessment assumed equipment

1.1.1 Details of the equipment assumed in the construction noise assessment is provided in Table 14.1. Information regarding the likely number and type of equipment to be used, percentage on-time and activities was derived from previous information obtained and used to undertake the Llanddewi Velfry to Penblewin section of the A40. Sound power levels for representative equipment was obtained from BS 5228-1 where available or from an alternative suitable source.

Table 14.1 Assumed equipment for each activity of the construction process

Ref	Activity Name	Activity Sub-name (if applicable)	Equipment	Number	% on-time	L_w (dB(A))	Source
A	Site Clearance & Mobilisation	Tree felling - Chainsaws	Chain Saw	2	10	114	BS522 Table D 2-14
		Tree felling - Excavators	Tracked Excavator	2	40	106	BS5228 Table C 2-3
		Chipping	Tracked Chipper - trimmed hardwood	2	10	120	HSE[1] Type F of Table 3
		Grubbing	Dozer	1	20	106	BS5228 Table C 2-13
B	Earthworks	Excavation Works	Tracked Excavator	2	60	106	BS5228 Table C 2-3
		Bulldozing	Dozer	1	60	106	BS5228 Table C 2-13

Ref	Activity Name	Activity Sub-name (if applicable)	Equipment	Number	% on-time	L_w (dB(A))	Source
		Fill transportation	Articulated Dump Truck (Tipping Fill)	2	60	109	BS5228 Table C 5-16
		Roller	Roller	1	60	101	BS5228 Table C 2-38
		Fill transportation	Articulated Dump Truck (Tipping Fill)	1	60	108	BS5228 Table C 2-34
		Compaction works	Roller	1	60	101	BS5228 Table C 2-38
C	Drainage	Excavator	Tracked Excavator	1	40	106	BS5228 Table C 2-3
		Fill transportation	Dumper	1	40	104	BS5228 Table C 4-4
		Compaction works	Vibratory Roller	1	40	103	BS5228 Table C 5-20
D	Structures	Excavation & Backfill Works	Tracked Excavator	1	40	101	BS5228 Table C 2-24
		Excavation & Backfill Works	Dumper	1	40	104	BS5228 Table C 4-4
		Compaction works	Vibratory Roller	1	40	103	BS5228 Table C 5-20
		Formwork & Reinforcement - Crain	Mobile Telescopic Crain	1	40	99	BS5228 Table C 4-41
		Formwork & Reinforcement - Concrete Pump	Concrete Mixer Truck (Discharging) & Concrete Pump (Pumping)	1	40	103	BS5228 Table C 4-28
		Formwork & Reinforcement - Lorries	Large Lorry Concrete Mixer	1	40	105	BS5228 Table C 4-21
		Formwork & Reinforcement - Lorries	Large Lorry Concrete Mixer	1	40	105	BS5228 Table C 4-21

Ref	Activity Name	Activity Sub-name (if applicable)	Equipment	Number	% on-time	L_w (dB(A))	Source
E	Pavement	Pavement works	Backhoe Mounted Hydraulic Breaker	1	20	116	BS5228 Table C 5-16
		Materials transportation	Lorry	1	40	108	BS5228 Table C 2-34
		Compaction	Vibratory Roller	1	20	103	BS5228 Table C 5-20
		Pavement works	Asphalt Paver + Tipper Lorry	1	20	105	BS5228 Table C 5-31
		Road Sweeper	Road Sweeper	1	20	104	BS5228 Table C 4-90

Vibration assessment assumed equipment

1.1.2 Details of the equipment assumed in the construction vibration assessment is provided in Table 14.2. Important operational information required to undertake vibration predictions of the vibratory rollers likely to be used for the compaction works, was obtained from technical specifications available on Bomag's website, a well-known leading manufacturer of this type of plant. This information is presented in Table 14.2 below.

Table 14.2 Possible compactor equipment, key variables and related construction activity

Equipment (Bomag)	**Number of vibrating drums, N_d**	**Amplitude low/high* frequency operation, A, mm**	**Width of drum, L_d, m**	**Activity**
BW 124 DH, single drum roller 4 tonnes	1	1.7 / 0.85	1.6	Drainage, backfill (structures)
BW 216 DH-5, single drum roller 18 tonnes	1	2.1 / 1.1	2.13	Earthworks, pavement
Parameter ranges: N_d – 1 (maximum number of vibrating rollers); A – 0.85 to 2.1mm; L_d – Width of drum, 1.6 to 2.13m. * The amplitude for low frequency operation has been assumed in the assessment to provide a worst case				

Construction Schedule

1.1.3 Detailed information regarding the schedule and durations of each of the stages of construction works, is not currently available at this time, until a Principle Contractor has been appointed. For this reason, the assessment undertaken has only been able to deal specifically with the 'worst case' noise and vibration levels likely to be generated at the closest pass bys to the nearest noise sensitive receptors, as discussed in section 5.5.6 of the main ES report.

Predicted construction noise levels at receptors

1.1.4 The results of the 'worst case' construction noise calculations for each stage at each receptor can be seen in Table 14.4.

Table 14.3 Predicted 'worst case' construction façade noise level, $dBL_{Aeq,daytime}$

Receptor	Construction Stage				
	a	b	c	d	e
Jacobs Park (Assessment Location 3)	63	61	56	-	61
Sodston Lodge (Assessment Location 5)	77	74	73	-	77
Redstone Farm Cottage (Assessment Location 9)	84	79	77	61	81
Redstone Cottages (Assessment Location 10)	86	75	82	70	86
Blaenmarlais Care Home (Assessment Location 13)	76	74	67	67	75
Blackmoor Hill (Assessment Location 26)	63	60	55	-	60
Pant-Y-Gorphwys Uchaf (Assessment Location 30)	53	51	46	-	60
Penblewin Farm (Assessment Location 31)	77	71	71	-	60
Caermaenau Fawr (Assessment Location 33)	54	52	46	-	49

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ES Appendix 14.4 Operational Noise Results

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Appendix 14.4: Operational Noise Results

Predicted noise levels at dwellings – Daytime $L_{A10,18hr}$

1.1.1 Results are listed in post-code order followed by alphabetical order based on the address.

Table 14.1 Daytime $L_{A10,18hr}$ predicted noise levels

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
1	Coach House & Sodston Manor, Sodston	45.9	46.3	46.0	46.4	0.1	0.4	0.5	2
2	Sodston Manor Farm and Ivy Court Cottage	54.0	54.5	54.5	55.0	0.5	0.5	1.0	6
3	Jacobs Park Farm	56.7	57.0	56.2	56.5	-0.5	0.3	-0.2	2
4	Sodston House & Farm Cottage, Sodston	49.4	49.7	49.2	49.6	-0.2	0.3	0.2	2
5	Sodston Lodge, Sodston	69.3	69.6	69.3	69.6	0.0	0.3	0.3	1
6	Broomley, Sodston	44.3	44.6	43.9	44.3	-0.4	0.3	0.0	1
7	Redstone Farm	56.1	56.4	52.5	52.8	-3.6	0.3	-3.3	1

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
8	2 Redstone Cottages	64.2	64.5	58.2	58.6	-6.0	0.3	-5.6	1
9	Redstone Farm Cottage	66.6	66.9	57.5	57.9	-9.1	0.3	-8.7	1
10	1 Redstone Cottages	68.6	68.9	57.5	57.9	-11.1	0.3	-10.7	1
11	Strathmore, West Winds, Oaklands, and Millfields, Redstone Road	59.7	60.1	59.6	60.0	-0.1	0.4	0.3	4
12	Maes Yr Awel, Redstone Road	49.9	50.2	49.8	50.1	-0.1	0.3	0.2	2
13	Blaenmarlais Care Home, Redstone Road	50.4	50.7	52.5	52.8	2.1	0.3	2.4	1
14	Blaenmarlais Cottage and Gill Glen, Redstone Road	46.7	47.1	46.9	47.2	0.2	0.4	0.5	2
15	Tegfan, Brynmarlais, and The Green, Redstone Road	53.0	53.4	53.2	53.5	0.2	0.4	0.5	4
16	1, 3, and 4 Blaenmarlais Mews, Redstone Road	49.7	50.0	52.2	52.6	2.5	0.3	2.9	3
17	Redstone House, Ashfield Farm, and Ty Gwanwyn, Redstone Road	47.7	48.0	49.7	50.0	2.0	0.3	2.3	3
18	Redstone Villas, Redstone Road	45.7	46.1	47.2	47.5	1.5	0.4	1.8	3

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
19	Poplars Court, Redstone Road	50.2	50.6	50.2	50.6	0.0	0.4	0.4	1
20	Green Meadows Farm, Mill House, Moonlight, Noble Court, Sunlight House, and Redstone Mill, Redstone Road	53.0	53.3	53.1	53.5	0.1	0.3	0.5	7
21	Cilrath Fach Farm	42.9	43.2	41.0	41.3	-1.9	0.3	-1.6	3
22	Blaenffynnonau Farm, Redstone Road	48.3	48.6	50.6	50.9	2.3	0.3	2.6	2
23	Courtlands, Redstone Road	43.8	44.2	43.8	44.2	0.0	0.4	0.4	1
24	Cilrath Fawr Cottage	44.1	44.4	41.4	41.8	-2.7	0.3	-2.3	1
25	1 and 2 Blackmoor Hill	74.1	74.4	63.2	64.1	-10.9	0.3	-10.0	2
26	Blackmoor Hill	55.2	55.6	56.8	57.2	1.6	0.4	2.0	1
29	Rhyd Y Cerrig, Stoneyford	46.7	47.1	46.9	47.4	0.2	0.4	0.7	1
30	Whitsun Brook, Pantygorphwys Uchaf, Penblewin Cottage, and Pine Cottage, Stoneyford	62.4	62.9	62.5	63.0	0.1	0.5	0.6	4
31	Penblewin Farm, Llanddewi Velfrey	58.7	59.0	58.8	59.2	0.1	0.3	0.5	1

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
32	Pantygorphwys Farmhouse, Stoneyford	64.1	64.6	64.2	64.7	0.1	0.5	0.6	1
33	Caermaenau Fawr	48.5	48.9	48.4	48.8	-0.1	0.4	0.3	1

Predicted noise levels at dwellings – Night-time L_{night}

Table 14.2 Night-time L_{night} predicted noise levels

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
1	Coach House & Sodston Manor, Sodston	37.5	37.9	37.6	38.0	0.1	0.4	0.5	2
2	Sodston Manor Farm and Ivy Court Cottage	44.8	45.3	45.3	45.7	0.5	0.5	0.9	6
3	Jacobs Park Farm	47.3	47.5	46.8	47.1	-0.5	0.2	-0.2	2

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
4	Sodston House & Farm Cottage, Sodston	40.7	41.0	40.5	40.9	-0.2	0.3	0.2	2
5	Sodston Lodge, Sodston	58.6	58.9	58.6	58.9	0.0	0.3	0.3	1
6	Broomley, Sodston	36.1	36.4	35.7	36.1	-0.4	0.3	0.0	1
7	Redstone Farm	46.7	47.0	43.5	43.7	-3.2	0.3	-3.0	1
8	2 Redstone Cottages	54.0	54.3	48.6	49.0	-5.4	0.3	-5.0	1
9	Redstone Farm Cottage	56.2	56.4	48.0	48.3	-8.2	0.2	-7.9	1
10	1 Redstone Cottages	58.0	58.2	48.0	48.3	-10.0	0.2	-9.7	1
11	Strathmore, West Winds, Oaklands, and Millfields, Redstone Road	50.0	50.3	49.9	50.2	-0.1	0.3	0.2	4
12	Maes Yr Awel, Redstone Road	41.1	41.4	41.0	41.3	-0.1	0.3	0.2	2
13	Blaenmarlais Care Home, Redstone Road	41.6	41.9	43.5	43.7	1.9	0.3	2.1	1
14	Blaenmarlais Cottage and Gill Glen, Redstone Road	38.3	38.6	38.4	38.7	0.1	0.3	0.4	2
15	Tegfan, Brynmarlais, and The Green, Redstone Road	43.9	44.3	44.1	44.4	0.2	0.4	0.5	4

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
16	1, 3, and 4 Blaenmarlais Mews, Redstone Road	41.0	41.2	43.2	43.6	2.2	0.2	2.6	3
17	Redstone House, Ashfield Farm, and Ty Gwanwyn, Redstone Road	39.2	39.4	41.0	41.2	1.8	0.2	2.0	3
18	Redstone Villas, Redstone Road	37.4	37.7	38.7	39.0	1.3	0.3	1.6	3
19	Poplars Court, Redstone Road	41.4	41.8	41.4	41.8	0.0	0.4	0.4	1
20	Green Meadows Farm, Mill House, Moonlight, Noble Court, Sunlight House, and Redstone Mill, Redstone Road	43.9	44.2	44.0	44.4	0.1	0.3	0.5	7
21	Cilrath Fach Farm	34.8	35.1	33.1	33.4	-1.7	0.3	-1.4	3
22	Blaenffynnonau Farm, Redstone Road	39.7	40.0	41.8	42.0	2.1	0.3	2.3	2
23	Courtlands, Redstone Road	35.6	36.0	35.6	36.0	0.0	0.4	0.4	1
24	Cilrath Fawr Cottage	35.9	36.2	33.5	33.8	-2.4	0.3	-2.1	1
25	1 and 2 Blackmoor Hill	62.9	63.2	53.1	53.9	-9.8	0.3	-9.0	2
26	Blackmoor Hill	45.9	46.3	47.3	47.7	1.4	0.4	1.8	1

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)	No. of Dwellings at location
29	Rhyd Y Cerrig, Stoneyford	38.3	38.6	38.4	38.9	0.1	0.3	0.6	1
30	Whitsun Brook, Pantygorphwys Uchaf, Penblewin Cottage, and Pine Cottage, Stoneyford	52.4	52.8	52.5	52.9	0.1	0.4	0.5	4
31	Penblewin Farm, Llanddewi Velfrey	49.1	49.3	49.1	49.5	0.0	0.2	0.4	1
32	Pantygorphwys Farmhouse, Stoneyford	53.9	54.4	54.0	54.5	0.1	0.5	0.6	1
33	Caermaenau Fawr	39.9	40.2	39.8	40.1	-0.1	0.3	0.2	1

Predicted noise levels at other sensitive receptors

Table 14.3 Daytime $L_{A10,18hr}$ predicted noise levels

Assessment Location ID	Address	Do-Minimum Baseline Year (2022)	Do-Minimum Future Year (2037)	Do-Something Baseline Year (2022)	Do-Something Future Year (2037)	Short Term Noise Change (Baseline Year)	Long Term DM Noise Change (Baseline Year to Future Year)	Long Term DS Noise Change (DM Baseline Year to DS Future Year)
1	Castle School, Sodston Manor, Sodston	45.9	46.3	46.0	46.4	0.1	0.4	0.5
20	Noble Court Holiday Park, Redstone Road	53.0	53.3	53.1	53.5	0.1	0.3	0.5
27	Public Rights of Way SP27/1/1 - Footpath	70.2	70.5	59.9	60.7	-10.3	0.3	-9.5
28	Public Rights of Way SP19/32/1 - Footpath	68.9	69.3	69.0	69.4	0.1	0.4	0.5
34	Public Rights of Way SP19/31/3 - Footpath	51.5	51.9	51.5	51.9	0.0	0.4	0.4
35	Public Rights of Way SP27/2/1 - Bridleway	61.9	62.4	61.9	62.3	0.0	0.5	0.4

Welsh Government

A40 Penblewin to Redstone Cross Improvements

Walking, Cycling and Horse-Riding Assessment Report

A40PRC-ARP-ENM-SWI-RP-C-0001

P04 | S4

05/06/20

Contents

1 The Project

1.1 Purpose of this report

1.1.1 The aims of this Walking, Cycling and Horse-Riding (WCHR) Assessment Report for the A40 Penblewin to Redstone Cross Improvements (the "Scheme") are:

a) To gain an appropriate understanding of all the relevant existing facilities for pedestrians, cyclists and equestrians in the local area

b) To provide background users with information that can be referred to throughout the design process and

c) To identify opportunities for improvement for users.

1.1.2 This WCHR Report has been undertaken in accordance with HD42/17 – Walking, Cycling and Horse-Riding Assessment and Review. This Assessment Report concludes with the identification of opportunities for improvement for consideration by the wider design team throughout the design process.

1.1.3 This assessment of Walking, Cycling and Horse-Riding (WCHR) is the first part of a two-stage process and takes place during preliminary design. For the second stage, the assessment will feed into the review that continues throughout the detailed design of the project.

1.2 Project history

1.2.1 In December 2004, the Minister announced the publication of his Addendum to the 2002 Trunk Road Forward Programme (TRFP) and this included two major single carriageway improvement Schemes for the A40 west of St Clears. The improvements would provide a 2+1 carriageway configuration between Penblewin and Redstone Cross, allowing overtaking on the two-lane sections, and prohibited overtaking in the one-lane sections.

1.3 The problems

1.3.1 The following problems have been identified in collaboration with the A40 Llanddewi Velfrey to Penblewin Improvements Scheme and early public engagement for the A40 Penblewin to Redstone Cross Improvements Scheme:

1. The A40 mainline and Redstone Cross Junction is substandard
2. Limited overtaking opportunities lead to poor journey time reliability and driver frustration.
3. Occasional convoys of heavy goods vehicles from the ferry ports and slow moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.
4. Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey time unreliability, which is exacerbated with limited overtaking opportunities.
5. There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road.
6. A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.
7. A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

1.4 Scheme objectives

1.4.1 A number of strategic transport planning objectives have been developed iteratively during the previous A40 Improvement Schemes, and specifically the A40 Llanddewi Velfrey to Penblewin. During the early stages of the A40 Penblewin to Redstone Cross Improvements Key Stage 3, these objectives were refreshed to consider both the strategic and local transport planning aspects for the Redstone Cross Area. The Scheme objectives are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To improve the Redstone Cross Junction safety (and perceived safety) and reduce the number and severity of A40 mainline collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a Scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

1.5 Study Area

1.5.1 Drawing A40PRC-ARP-ENM-SWI-DR-C-0002 in Appendix A shows the study area for this assessment. The Lead Assessor has set a 5km assessment area, based on the guidance given in HD42/17.

1.6 Site Visit

1.6.1 A site visit was conducted on 7 August 2019. The site visit consisted of walking along pedestrian, cycling and equestrian routes in the local area and driving through areas of interest in the wider study area. Notes made during the visit recorded the apparent level of use, condition / suitability of each route and potential improvements. The weather was overcast and dry. Paths were largely dry although there were damp areas due to rain from the previous day.

1.6.2 Photographs taken during the site visit support the text in this report, to help illustrate any potential issues that the proposed Scheme may have an impact on.

2 Scheme Description

2.1 Overview

2.1.1 The Scheme would provide a 2+1 carriageway configuration between Penblewin and Redstone Cross, allowing overtaking on the two-lane sections, and prohibited overtaking in the one-lane sections. Appendix A contains the Scheme General Arrangement Drawing.

2.1.2 For the purposes of identifying geographic locations, the Scheme is divided into four areas as follows (east to west):

- Penblewin Roundabout
- Penblewin Roundabout to Redstone Road overbridge
- B4313 Redstone Road overbridge
- A40 - B4313 Link (West access/egress)

2.2 Penblewin Roundabout

2.2.1 Penblewin Roundabout is located on the eastern section of the Scheme. The enlarged roundabout (subject to the A40 Llanddewi Velfrey to Penblewin Improvements) will provide access to the proposed A40 via a south-west exit. An additional exit, north of the proposed A40 exit, will provide access to the existing A40 road that will be detrunked as part of the Scheme.

2.3 Penblewin Roundabout to Redstone Cross overbridge

2.3.1 The proposed A40 mainline leads in a generally south-westerly direction from Penblewin Roundabout, passing through agricultural land to the south of the existing A40. It would primarily be on embankment.

2.3.2 As the A40 approaches B4313 Redstone Road, the route curves in a western direction such that the A40 passes north of Blaenmarlais Care Home. The A40 would at this point be in a cutting, going underneath the B4313 Redstone Road. The proposed route converges with the existing A40 trunk road at the entrance to Jacob's Park.

2.4 B4313 Redstone Road overbridge

2.4.1 The proposed overbridge would cross the A40 mainline directly north of Blaenmarlais Care Home. The proposed bridge would maintain connectivity between Narberth and Bethesda, as well as residential / agricultural property located along the proposed A40.

2.4.2 A new 3m wide combined cycleway / footpath would be provided along the overbridge on its eastern side.

2.5 A40 - B4313 Link (West access / egress)

2.5.1 A new link road would provide west access / egress from the A40 to the existing Redstone Cross Road (B4313). The link road would leave the B4313 via a simple T-junction located opposite Blaenmarlais Care Home. The proposed link road would follow a south-westerly direction and then curve to a westerly direction to run parallel to the proposed A40 trunk road.

2.5.2 The link road would not be accessible from the proposed westbound A40. Instead, traffic travelling westbound along the A40 and heading to Narberth town centre would be directed via the A478 southern arm of the Penblewin Roundabout.

2.5.3 The link road would be accessible from the eastbound A40 via a ghost-island to allow for a safe right turn. The proposed A40 would only be accessible westbound (not eastbound) from the link road due to the insertion of a left-out only junction.

2.6 Public Rights of Way (PRoWs) Descriptions

2.6.1 Two PRoWs exist in the immediate vicinity of the Scheme. Neither would be directly affected by the Scheme.

2.6.2 There is one public footpath, SP27/1/1, that meets with the A40. Refer to Figure 1. Starting from a point directly west of the eastbound layby located west of Penblewin Roundabout, it leads in a generally northerly direction up a lane leading to Cilrath-fawr. From Cilrath-fawr, it leads in a generally north-easterly direction to meet with the A478 south of Bryn Hill. There are no other PRoW connections with this footpath.

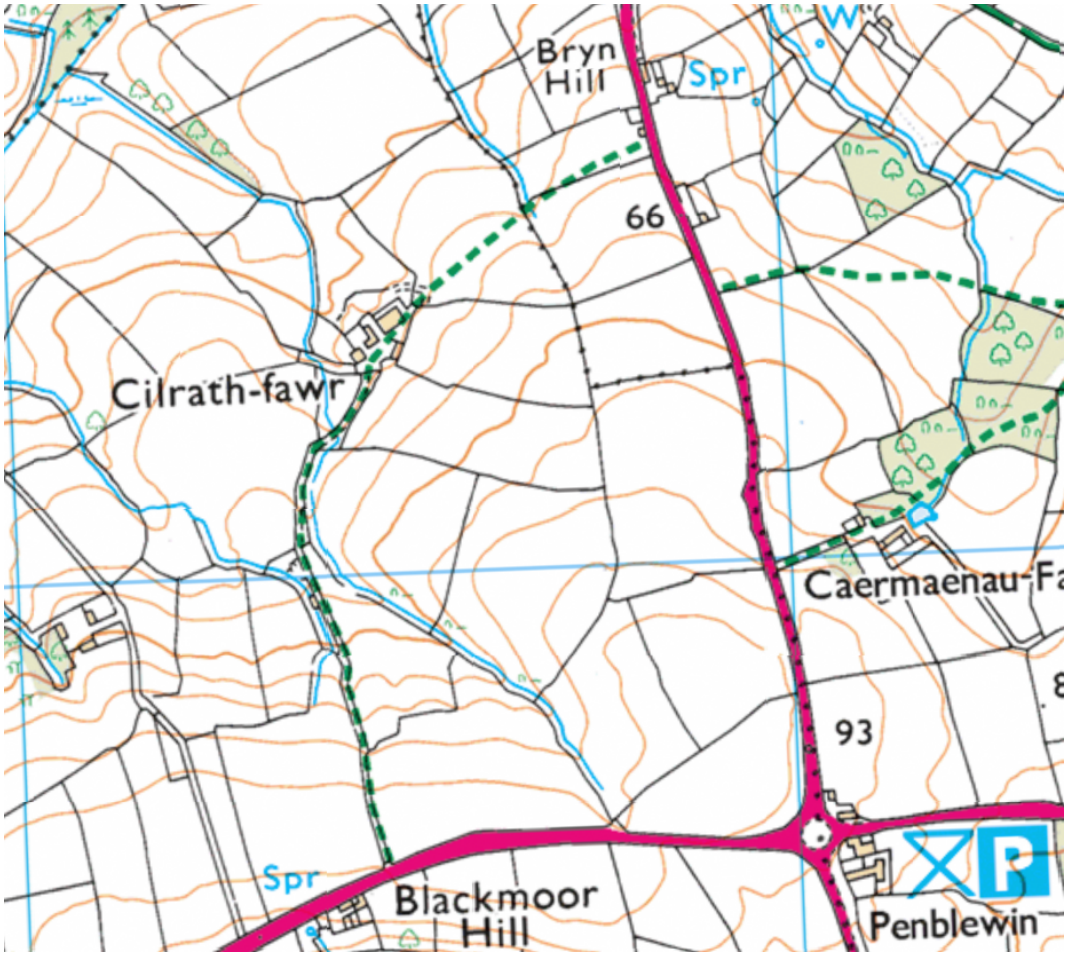

Figure 1: Image of route of footpath SP27/1/1 (Image courtesy of Ordnance Mapping)

2.6.3 There is one bridleway, SP27/2/1, which is located immediately south of the proposed Scheme. Refer to Figure 2. Leading in an easterly direction, this route leaves the B4313 Redstone Road immediately south of Blaenmarlais Care Home. It leads in an easterly direction along a gravel track that leads to Blaenffynnonau Farm. From Blaenffynnonau Farm, the bridleway continues in an easterly direction to meet with the A478. Whilst there is no designated crossing over the A478, the bridleway continues in a generally north-easterly direction, terminating at Henllan Farm (where is joins an unclassified road).

Figure 2: Image of route of bridleway SP27/2/1 (Image courtesy of Ordnance Mapping)

3 Policy and Legislation Review

3.1 Overview

3.1.1 This section provides an overview of the WCHR policies and strategies, at both a national and local level, relevant to the study area.

3.2 National Policy and Legislation

People, Places, Futures – The Wales Spatial Plan (2008)

3.2.1 The Wales Spatial Plan (WSP) is the 20-year plan for sustainable development in Wales. It was updated in 2008 and provides the 'overarching framework and integration tool for Wales.' It underpins the future improvement of regional and national strategic planning for transport.

3.2.2 One of the key challenges identified within the WSP is to integrate sustainable transport solutions with community and development planning to improve accessibility.

Wales Transport Strategy – One Wales: Connecting the Nation (2008)

3.2.3 The Wales Transport Strategy (WTS), One Wales: Connecting the Nation, was published in 2008 with the intention of promoting sustainable transport networks that safeguard the environment, while strengthening Wales' economic and social life.

3.2.4 The transport strategy identifies a series of high-level sustainable transport themes. The Scheme has addressed the transport strategy by improving the transport system and promoting the use of healthy forms of travel through WCHR routes.

3.2.5 Additionally, the strategy outlines the aspiration to reduce the impact of transport on greenhouse gas emissions. Within the strategy, a set of specific long-term outcomes factored by transport were identified. The proposed Scheme contributes to a selection of these targets including; safety and security of travel, reliable transport system, visitor attractions, such as open spaces, and healthy lifestyles.

Active Travel (Wales) Act (2013) and Active Travel Action Plan (2014)

3.2.6 The Active Travel (Wales) Act gained royal assent on 4 November 2013. It legislates for the provision of travel routes designed for cycling and walking and in particular, makes provision:

1. For approved maps of existing active travel routes and related facilities in a local authority's area
2. For approved integrated network maps of the new and improved active travel routes and related facilities needed to create integrated networks of active travel routes and related facilities in a local authority's area
3. Requiring local authorities to have regard to integrated network maps in preparing transport policies and to secure that there are new and improved active travel routes and related facilities
4. Requiring the Welsh Ministers to report on active travel in Wales
5. Requiring the Welsh Ministers and local authorities, in the performance of functions under the Highways Act 1980, to take reasonable steps to enhance the provision made for walkers and cyclists and to have regard to the needs of walkers and cyclists in the exercise of certain other functions and
6. Requiring the Welsh Ministers and local authorities to exercise their functions under the Act to promote active travel journeys and secure new and improved active travel routes and related facilities.

3.2.7 The Act created new duties for local authorities in Wales and the Welsh Ministers. It also gives the Welsh Ministers the power to issue guidance on the location, nature and condition of active travel routes and facilities to ensure they are suitable for use. Such guidance was published in the form of guidance notes.

3.2.8 Welsh Ministers have identified built-up areas with a population greater than 2,000 people in which the Active Travel Act would apply. Narberth is named as such and is located within the WCHR study area. Beyond the extent of the study area, Haverfordwest, St. Clears, Tenby and Saundersfoot are the named settlements in close proximity to the study area.

3.2.9 The Design Guidance relating to the Active Travel (Wales) Act 2013 sets out guidance for those involved in the planning, design, approval,

construction and maintenance of Active Travel routes and associated facilities in Wales. This aims to inform the development of a network of walking and cycling routes that serve a variety of purposes and connect key locations such as workplaces, hospitals, schools and shopping areas.

3.2.10 The Design Guidance document is intended to ensure that the requirements of the Active Travel Act are applied consistently and appropriately. Advice in the guidance must be considered when designing active travel routes on trunk roads. The active travel Design Guidance would primarily influence the A40 Llanddewi Velfrey to Penblewin Scheme by informing the design of crossings and related WCHR facilities. Where designers consider that compliance with the advice contained in this design guidance would conflict with a mandatory clause in the Design Manual for Roads and Bridges (DMRB), this should be addressed through the Welsh Government's departures process.

3.2.11 For all non-trunk road networks, the Design Guidance must be considered by local authorities when designing active travel routes even where this conflicts with the current local authority design standards.

Planning Policy Wales, Edition 10 (2018)

3.2.12 Planning Policy Wales Edition 10 (PPW10) sets out the planning system and contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales.

3.2.13 Section 4.1 of PPW10 refers to the Welsh Government's aims to maximise sustainable forms of transport through walking, cycling and public transport. The Scheme has addressed this policy by improving and introducing new WCHR routes to minimise the need to travel by vehicle .

3.2.14 In the context of transport schemes, PPW10 recognises that a prosperous Wales can be promoted through the development of modern and connected infrastructure and that in order for cohesive communities to be created, they need to be well-connected.

3.2.15 PPW10 notes the key role transport infrastructure such as trunk roads

and motorways play for national and international connectivity. Access to jobs and services through shorter, more efficient and sustainable journeys should be enabled through the planning system; with new infrastructure as a means of achieving this.

3.3 Local Policy

3.3.1 Local Planning Authorities in Wales must prepare a prescribed collection of comments which set out planning policies in their local authority area in accordance with The Town and Country Planning (Local Development Plan) (Wales) Regulations 2005. The following described documents are those which contain guidance relevant to WCHR in relation to this Scheme.

Local Development Plans

3.3.2 The Planning and Compulsory Purchase Act 2004 requires each local planning authority in Wales to prepare a Local Development Plan (LDP, the Plan), with the objective of contributing to the achievement of sustainable development.

South West Wales Local Transport Plan 2015-2020

3.3.3 The Local Transport Plan policies coincides with sections of the Active Travel Act. These include improving walking and cycling links within and between settlements, a focus on sustainable travel behaviour and creating sustainable travel alternatives to single car occupancy.

3.3.4 The Local Transport Plan schemes in the vicinity of the WCHR study area include:

- Haverfordwest to Narberth Cycle Route - The proposed 19km route will run from Narberth to Haverfordwest. This route is currently more suitable for mountain bike users, however, has the potential for all WCHR paths. This PRoW is part of a larger project to connect Narberth and Haverfordwest to the existing National Cycle Network (NCN) route. The route will be accessible westbound from Townmoor Car Park, Narberth.
- Active Travel Act Schemes - Schemes to be worked up through consultation process (including Narberth) - delivery 2015-2020

- Active Travel Act Schemes - continued progress on the development of Schemes (including Schemes in Narberth) - delivery 2020-2030
- Access Improvements to Railway Stations – Walking, cycling and public transport improvements to the county's rail stations.

PRoW Improvement Plans

3.3.5 The Active Travel (Wales) Act 2013 requires every local authority to prepare a Rights of Way Improvements Plan (ROWIP) to extend and improve the connectivity of routes and improve local awareness of the PRoW Network. The Welsh Government highlights that the ROWIPs should assess the extent to which PRoWs meet present and future needs, and the opportunities provided by local PRoW for exercise and outdoor recreation.

3.3.6 The Scheme has proposed an Active Travel Route on the existing A40. This will provide future opportunities for WCHR between Penblewin Roundabout and Narberth.

Pembrokeshire ROWIP

3.3.7 The second Pembrokeshire Rights of Way Improvement Plan (RoWIP2) identifies, prioritises and plans for improvements to the rights of way network in Pembrokeshire. Part 1 of the plan involves an assessment of local rights of way. This assesses the extent to which the network: meets existing and future user needs, ability to serve those with special needs and the role of providing opportunities for public access and countryside recreation.

3.3.8 Table 1 below shows the components of the Pembrokeshire PRoW network, currently 2,612.7km (1,623.1 miles) long.

Table 1 Characteristics of the PRoW network in Pembrokeshire

Types of route	Pembrokeshire (all routes)	Management delegated to the National Park Authority	Managed by Pembrokeshire County Council
Footpaths	2080.5km 79.6% of the network	831.5km	1249km
Bridleways	506.7km 19.4% of the network	187km	319.7km
Restricted Byways (formerly known as Roads Used as Public Paths)	4.1km 0.2% of the network	2.6km	1.5km
Byways Open to All Traffic (BOATs)	21.4km 0.8% of the network	9.8km	11.6km

3.3.9 Part 2 of the plan is a statement of action. This summarises the main conclusions from the ROWIP Assessments, Background Documents and Report on Key Issues and the Way Forward. Six objectives for the ROWIP action plan were set that would guide the long-term management and development of the rights of way network. They are:

1. Objective A – to maintain an accessible network of public paths
2. Objective B – to provide a more continuous network that meets the requirements of all users
3. Objective C – to work with the highways and construction section of the County Council to develop a safer network of paths with regard to the road network
4. Objective D – to improve legal procedures for recording, protecting and changing PRoW
5. Objective E – to achieve greater community, user group and volunteer involvement in the improvement and management of public paths and
6. Objective F – to increase the awareness and use of countryside access opportunities afforded by public paths and access land through promotion and information provision.

3.3.10 The Scheme Objectives align to national, regional and local transport planning policies in terms of supporting economic growth, connectivity, accessibility and complementing sustainable travel including walking and cycling for local trips. These objectives encourage the development of links for Active Travel and align with the Well-being of Future Generations (Wales) Act 2015 goals.

3.3.11 The policies detailed above are considered in the development of the Scheme specific opportunities for WCHR that are set out in Section 10 of this report.

4 Collision Data

4.1 Traffic Collision Overview

4.1.1 All personal injury collisions on public roads that are reported to the police are recorded using the STATS19 collision reporting form. Information on collision data within a study area specific to this project was obtained for a five-year period between 2013 and 2018, the most recent timeframe for which data is available.

4.1.2 The collision reports include the following information:

a) Collision year
b) Collision reference
c) Number of vehicles involved
d) Number of casualties
e) Maximum severity of injuries
f) Severity of injury to each individual casualty
g) Date of the collision
h) Time of the collision
i) Collision location
j) A brief description of the incident
k) Type of road and speed limit
l) Whether incident occurred in darkness or daylight
m) Weather conditions
n) Road surface condition and
o) Details regarding vehicles involved including vehicle type, direction of travel, whether any skidding occurred and whether the vehicle exited the carriageway.

4.1.3 The Initial Traffic and Accident Data Report, (document A40PRC-ARP-VTR-M02-RP-TR-0001) presents the details of all collisions within the traffic study period of 2013-2015. The traffic study area covers the A40 carriageway from a point 20m west of Redstone Cross to a point 20m east of the Penblewin Roundabout. The reason for extending the study area slightly beyond the start and end junctions is to ensure that all accidents associated with those junctions are captured in the analysis.

4.2 WCHR Collision Data

4.2.1 There were no Personal Injury Accidents (PIAs) involving WCHRs within the traffic study area over the ten-year period from 2008 to 2018.

4.2.2 Additional data for the 5km WCHR Assessment study area was obtained from www.crashmap.co.uk ("Crashmap")1. Crashmap uses data collected by the police about road traffic collisions. The data is approved by the National Statistics Authority and reported on by the Department of Transport each year.

4.2.3 This data was obtained for the period 2014-2018. Table 3 summarises the collision data for the 5km WCHR study area.

Table 3 - Summary of WCHR Study Area Accident Data

	Accidents			Casualties		
Users	**Fatal**	**Serious**	**Slight**	**Fatal**	**Serious**	**Slight**
Walkers	-	1	3	-	1	3
Cyclists	-	1	2	-	1	2
Horse-Riders	-	-	-	-	-	-

4.2.4 The accident resulting in a serious accident for a pedestrian occurred in Narberth town centre. The slight accidents involving pedestrians occurred in: Narberth town centre, on the A478 (at junction leading to 'Hideaway Camping') and in Clunderwen.

4.2.5 50% of collisions with pedestrians occurred in Narberth town centre. Narberth town centre is an urban area with narrow one-way streets and high traffic volumes, especially during the summer months. All these conditions increase the risk of WCHR collisions, as shown from the data obtained.

4.2.6 The accident resulting in a serious accident for a cyclist occurred on the B4314 Station Road, at its junction with Kiln Park Road. One of the slight accidents involving cyclists occurred on the B4314 leading from the A40 into Narberth (opposite Woodfield Nursing Home). The other occurred in Robeston Wathen.

[1] Crashmap. 2011. Available at: https://www.crashmap.co.uk/. [accessed 10 March 2020].

5 Public Transport

5.1 Accessibility

5.1.1 The availability and convenience of access to the start/end points of public transport journeys forms a key consideration in the context of a WCHR assessment.

5.1.2 Maintaining accessibility to public transport services is critical in ensuring communities can access key local facilities. It also ensures that there are viable alternatives to car use for journeys that may be regarded as too far or too hazardous to be undertaken in their entirety by WCHR.

5.2 National Rail

5.2.1 The railway lines and stations located within the 5km WCHR study area are listed in Table 44.

Table 4- Railway stations within the 5km Study Area

Station	National Rail Line
Clunderwen	West Wales Line - Milford Haven & Fishguard branches
Narberth	West Wales Line - Pembroke branch

5.2.2 These stations offer direct rail services to Carmarthen and Swansea, where connections may be made to travel further afield.

Figure 3: Narberth Station WCHR Signage

5.2.3 Both Narberth and Clunderwen are request stops2. Nine services a day serve Narberth in both directions, whilst 15 serve Clunderwen.

5.2.4 Narberth train station offers a cycle parking facility. None of the stations listed in Table 44 offer welfare facilities.

5.2.5 Whilst routes are well signposted (example shown in Figure 3), Narberth train station is 1.6km from the centre of Narberth. It is accessible from Narberth town centre along the B4314. However, this journey is inconvenient and unattractive to pedestrians due to the high volume fast traffic and lack of footway provision.

5.3 Bus Services

5.3.1 5.3.1 A single scheduled bus service operated by Taf Valley Coaches serves the town of Narberth. This is the 322-service which operates between Carmarthen and Haverfordwest via St Clears, Whitland and Narberth[3]. There are three bus stops located within Narberth: the Redstone Cross Junction, Narberth primary school (old disused) and opposite the Farmers Arms Public House4. However, there are no bus stop signs or shelters at the Farmers Arms bus stop, as shown in Figure 4. This service operates three times a day, with a fourth daily service operating a limited route between Glangwili Hospital and Haverfordwest.

[2] Trainline. 2020. Available at [illegible]o-pembrokeshire. [accessed 10 March 2020]
[3] Bysia Cwm Taf Valley Coac[illegible]e_tables.php. [accessed 10 March 2020]
[4] Google maps. 2020. Availab[illegible]n/@51.7991359,-4.7438587,16z/data=!4m5!3m4!1s0x48692b584694d6e9:0x3c71e504edcd3978!8m2!3d51.799763!4d-4.744008!5m1!1e2. [accessed 10 March 2020]

Figure 4: Example of lack of signage for bus stop location (opposite Farmers Arms)

5.3.2 5.3.2 Connections further afield may be made from Haverfordwest or Carmarthen. National Express operate a once daily service between Haverfordwest and London, also calling at Carmarthen. Whilst the 322-service timetable enables for travel from Narberth to Haverfordwest/Carmarthen to London, scheduled bus times do not align for the return journey.

6 Trip Generators

6.1 Trip Generators

6.1.1 The surrounding area within the WCHR study area is primarily agricultural, however there are small pockets of urban areas, such as the towns of Narberth and Robeston Wathen

6.1.2 There are a wide variety of trip generators within the WCHR study area, which can generally be categorised as follows:

a) Places of Worship

b) Post Offices, Shops and Shopping Centres

c) Hospitals, Medical Surgeries

d) Restaurants, Cafés, Takeaways and Public Houses

e) Bus Stops and Stations

f) Railway Stations

g) Schools, Colleges, Nurseries, Playgroups and Community Centres

h) Leisure Centres and Sports Facilities Parks and Recreational Areas

i) Offices and Industrial Employment Sites

j) Allotments

k) Tourist sites, monuments and viewpoints.

6.1.3 Drawing A40PRC-ARP-ENM-SWI-DR-C-0001 (included in Appendix C) shows the locations of all established trip generators within the study area.

6.1.4 As expected, there is a greater density of trip generators within the more urban areas, such as Narberth, when compared to the surrounding rural areas. A number of clusters surround small settlement areas such as: Robeston Wathen, Clynderwen, Llanddewi Velfrey, Templeton and Llawhaden. Major tourist attractions in the local area include: Oakwood Theme Park, Bluestone National Park Resort, Herons Brook Retreat and Llawhaden Castle.

6.1.5 Table 5 lists the trip generators considered to attract most WCHRs

within the immediate vicinity of the Scheme.

Table 5 – Trip generators within the immediate vicinity of the Scheme

Trip Generators	
Caravan Park	Rugby/Football Club
Community centre	Farmers Arms Bus stop
CK Supermarket Narberth	Restaurants/Public House
Narberth School	Narberth Castle
Narberth Police station	Narberth Museum
Train station	St Andrews Church

6.1.6 No known future trip generators are planned within the immediate vicinity of the study area.

7 Site Visit

7.1.1 A site visit was undertaken on Wednesday 7 August between 10:00am and 3:00pm during daylight hours. The site visit took the form of walking along available WCHR facilities within the immediate vicinity of the Scheme. Other WCHR facilities within the WCHR study area were also visited during the site visit.

7.1.2 The weather during the site visit was warm and dry. However, it was evident that it had rained recently from the condition of the agricultural land.

7.1.3 The existing A40 from Penblewin Roundabout to Redstone Cross Junction did not include any WCHR facilities. An overgrown grass verge bordered both the westbound and eastbound ranging in width from ~1m to ~2m. The exclusion of safe footways and the high volume of high-speed traffic created an intimidating atmosphere for pedestrians.

7.1.4 The volume and speed of traffic along the A40 discourages cyclists. There were no dedicated cycle routes along the A40 or within the existing WCHR study area.

7.1.5 The site visit determined that there were no dedicated pedestrian crossing facilities on the road networks in the WCHR study area despite the presence of footways both northbound and southbound on the B4313 and the A478.

7.1.6 The primary findings of the site visit for public footpath SP27/1/1 were as follows:

a) Public footpath SP27/1/1 is located north of the existing A40 and runs in a north-south direction. The southern end coincided with the vehicular access to Cilrath-fawr Farm. There were no pedestrian footways along the A40 westbound or eastbound from the Penblewin Roundabout or Redstone Cross Junction. This made access to the footpath via the A40 unattractive without a vehicle. The footpath was not signposted, and knowledge of the route would be unknown without an Ordnance Survey map. The footpath to Cilrath-fawr Farm was in good condition and consisted of a gravel base, as shown in Figure 5.

Figure 5: Intersection of existing A40 and footpath SP27/1/1

b) Public footpath SP27/1/1 continues along agricultural land north of the farm with no engineered surfacing.
c) The northern end of the public footpath SP27/1/1 meets the A478. A steel gateway enabled access through the hedge however no public footpath sign was witnessed.
d) No (or very narrow) verges existed along the A478 at the point where public footpath SP27/1/1 meets the A478.

7.1.7 The primary findings of the site visit for public bridleway SP27/2/1 were as follows:

e) Public bridleway SP27/2/1 is located between the B4313 and A478 and generally runs in a west-east direction. The bridleway was signposted at its western end (Figure 6) and was accessible from the B4313.

Figure 6: Bridleway SP27/2/1 signpost leading from B4313 Redstone Road

f) The footway along the B4313 was generally very narrow and overgrown, as shown in Figure 7. The footway width reduced as the distance from Narberth town centre increased. The footway extended to Redstone Cross Junction.

Figure 7: Footway along the B4313 Redstone Road

g) Bridleway SP27/2/1 continues on a gravel access track from the west which is in a good condition. The access track is the entrance

to Blaenffynnonau Farm and was considered suitable for use by pedestrians, horses and mountain bikes, as shown in Figure 8.

Figure 8: Bridleway SP27/2/1 leading to Blaenffynnonau Farm

h) The SP27/2/1 bridleway narrows just east of the Blaenffynonau Farm. At some sections east of the farm, the bridleway was slightly overgrown, but still in generally good condition (as shown in Figure 9). There was no evidence along the track of recent use by horses, cyclists or pedestrians.

Figure 9: Bridleway SP27/2/1 east of Blaenffynnonau Farm

e) The SP27/2/1 bridleway joins the A478 at its eastern end. The bridleway surfacing is well-kept grassland as shown in Figure 9. The good condition suggests the route is not frequently used due to the lack of WCHR tracks.

Figure 10: Bridleway SP27/2/1 - grassed path leading to A478

g) Bridleway gates existed along the SP27/2/1 bridleway and were in good condition. The gate at the eastern end is shown in Figure 11. However, the gate at Blaenffynnonau Farm had been tied to restrict access. This made accessibility for cyclists and equestrian riders more difficult.

Figure 11: Bridleway SP27/2/1 – gate at eastern end

Figure 12: Bridleway SP27/2/1 – signpost at eastern end

8 Consultation with Key Stakeholders

8.1 Scheme Public Consultation

8.1.1 A Public Consultation was undertaken between 26 July and 20 September 2019 to seek views on the proposed improvements. This consultation provided the opportunity for views to be shared on:

- The initial preferred solution
- Enhancements that could be made to the preferred solution and
- Active travel measures that could be potentially incorporated.

8.1.2 A Consultation Outcome Report (A40PRC-ARP-HGN-M02-RP-D-0004) was prepared which outlines the responses to the Consultation.

8.1.3 It was evident from the Consultation Outcome Report that there was overall support for cycling, walking and horse-riding improvements. The key suggestions raised in relation to potential improvements to Active Travel Measures are summarised below:

- Resurface potholes
- Incorporate active travel provision along the existing A40
- Provide more walking routes
- Provide a segregated bridleway
- Ensure that the proposed bridge is sufficiently wide for active travel
- Reduce speed limits on the existing A40 and through Narberth
- Improvements aimed at those with mobility impairments
- The Scheme will provide enhancements for active travel users e.g. by removing the Redstone Cross junction
- Did not see how improvements to active travel could be incorporated
- Improvements should integrate with other planned active travel improvements in the area.

8.2 Public Information Exhibitions

8.2.1 A number of Public Information Exhibitions (PIEs) were undertaken; the purpose of which were to engage with the local community regarding the Scheme development of A40 Penblewin to Redstone Cross Improvements. The PIEs were open to the public and key stakeholders were invited to encourage participation

8.2.2 Table 6 provides an overview of each PIE. Further detail about the April 2019 event is provided in the A40 April Public Information Exhibition Report (document A40PRC-ARP-HGN-M02-RP-D-0001). Further detail about the May 2019 event is provided in the A40 May Public Information Exhibition Report (document A40PRC-ARP-HGN-M02-RP-D-0002). Further detail about the September 2019 consultation can be found in the Consultation Outcome Report (A40PRC-ARP-HGN-M02-RP-D-0004).

Table 6 - Exhibition Information

Date	Location	Opening Times	Attendance	Attendance/ Hour
10 April 19	Llanddewi Velfrey Village Hall	2pm - 8pm	34	5.6
11 April 19	Llanddewi Velfrey Village Hall	10am - 8pm	61	6.1
30 May 19	Bloomfield House Community Centre	12pm - 8pm	170	21.25
2 Sept 19	Queens Hall, Narberth	10am – 8pm	108	13.5

8.2.3 Responses were received at each exhibition in relation to WCHRs. The feedback identified that WCHR provision was of interest to a number of local residents, and feedback was generally positive regarding the proposals in relation to Active Travel.

8.3 Pembrokeshire County Council

8.3.1 Pembrokeshire County Council (PCC) were consulted on the proposals for the A40 Penblewin to Redstone Cross Improvements through the development. Meetings were held on 24 May 2019 and 21 October 2019.

8.3.2 PCC are aiming to develop a strategic 17km Active Travel route

connecting Narberth and Haverfordwest; two key settlements within the county.

8.3.3 PCC expressed support for the Scheme proposals given that there are opportunities to connect into this Active Travel route to provide further Active Travel provision between Narberth and to Llanddewi Velfrey and onwards to Whitland.

8.4 Sustrans

8.4.1 Sustrans were consulted as part of the Scheme public consultation through email correspondence. Whilst Sustrans were not in favour of the Scheme and saw little evidence of provision of Active Travel routes, it is acknowledged that the information provided to them (scheme boards and information from the May PIE) did not show much detail of definitive Active Travel proposals. Further engagement with Sustrans post planning submission is intended to discuss further scheme development.

9 Survey Data

9.1.1 The lead assessor has defined the A40 Penblewin to Redstone Cross as a 'large' Scheme as defined in HD42/17. As such, the Assessment stage includes the collation and analysis of walking, cycling and horse-riding user survey data. HD42/17 states that "where it does not already exist, this data shall be obtained to include usage figures for pedestrians, cyclists and horse-riders".

9.1.2 Survey data is available for some of the PRoW routes included within the study area, as reported in the Walking, Cycling and Horse-Riding Assessment Report[5] for Llanddewi Velfrey. Of the 10 survey locations, only one site recorded any walking, cycling and horse-riding activity (Llanddewi Velfrey Village)

9.1.3 No users were encountered on any of the PRoW routes during the site visit of the Redstone Cross area on the 9 August 2019.

9.1.4 The proposed Scheme does not sever or divert any PRoW. The predicted usage of the PRoW network in the vicinity are such that the recorded statistics from the surveys would bring minimal benefit.

9.1.5 An opportunity to undertake usage surveys in advance of any potential Public Local Inquiry is available should objections to the Scheme be submitted in relation to usage of / effects on Public Rights of Way. A further advantage of this approach would be that surveys could be undertaken during the Spring / Summer months when increased daylight hours would allow longer surveys to be undertaken.

[5] Document A40LVP-ARP-ENM-SWI-RP-TR-0002.

10 User Opportunities

10.1.1 This section highlights opportunities relevant to the highway Scheme that the wider project team should consider throughout the progression of the Scheme design. This is in addition to any further opportunities that may arise through the ongoing development of the design.

10.1.2 Six opportunities were identified during this WCHR Assessment that could improve the service offered to WCHRs:

Strategic Opportunities

1. Maintain existing PRoW and WCHR east-west route connectivity between Narberth and Llanddewi Velfrey within the study area
2. Facilitate Pembrokeshire County Council's aspirations to create an east / west Active Travel Route between Haverfordwest and Whitland
3. Promote the use of existing WCHR routes by consolidating and improving attractiveness, safety and environmental quality
4. Provide clear signage to assist locating bridleways and footpaths. This includes regular signs along the route in addition to signs at the start/end of such routes.

Pedestrian and Cyclist Opportunities

5. Promote the use of the detrunked A40 from Penblewin Roundabout to Redstone Cross Junction for pedestrians and cyclists.

Equestrian Opportunities

6. Maintain and improve the equestrian route SP27/2/1. Encourage the use of this bridleway to provide connectivity between Narberth and Llanddewi Velfrey.

10.1.3 In the context of the specific opportunities set out above, all facilities directly provided by the Scheme would, within reason, be accessible, attractive for use, coherent, comfortable, convenient, direct, and safe for users to use. All of these parameters should be considered in the overall context of the provision being made, and pre-existent on the surrounding network.

11 Walking, Cycling & Horse-Riding Assessment Team Statement

11.1.1 As Lead Assessor, I confirm that this WCHR Assessment Report has been compiled in accordance with DMRB HD 42/17 (apart from the omissions regarding survey data as explained in Section 9 of this report) and thus contains the appropriate information for the wider design team. The WCHR Assessment was undertaken by the following Assessment and Review Team:

Walking, Cycling & Horse-Riding Lead Assessor

Simon Westwood CEng MICE MSc MEarthSc

Senior Engineer

Arup

Signed:

Date: 05/06/2020

Walking, Cycling & Horse-Riding Assessor

Geraint Jones CEng MICE MEng

Engineer

Arup

Signed:

Date: 05/06/2020

11.1.2 As design team leader, I confirm that the assessment has been undertaken at the appropriate stage of Scheme development and that the wider design team has been involved in the process.

11.1.3 I confirm that in my professional opinion the appointed Lead Assessor has the appropriate experience for the role, making reference to the expected competencies contained in HD 42/17.

Design Team Leader

Tom Edwards CEng MICE MCIHT MEng

Senior Engineer

Arup

Signed:

Date: 05/06/2020

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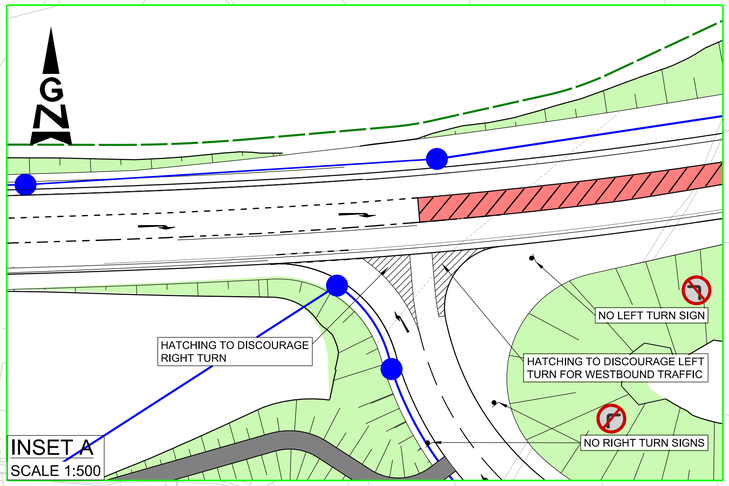
Appendix A – General Arrangement Drawing

Scheme General Arrangement Drawing



BETHESDA
SODSTON HOUSE
B4313
SODSTON LODGE
HAVERFORDWEST
EXISTING A40 TRUNK ROAD
PROPOSED 1.2m DIAMETER CULVERT TO EXISTING WATERCOURSE
JACOB'S PARK
ATTENUATION POND A
ACCESS TO ATTENUATION POND A
EXISTING A40 TO BE STOPPED UP
REFER TO INSET A
REDSTONE CROSS JUNCTION TO B4313 CONNECTOR ROAD
REDSTONE FARM
REDSTONE CROSS JUNCTION
BWTHYNNOD MAENCOCH REDSTONE CROSS COTTAGES
ACCESS TO ATTENUATION POND D
ATTENUATION POND D (LOCAL AUTHORITY)
ATTENUATION POND C (LOCAL AUTHORITY)
B4313 TIE-IN TO A40
SBR 420
3x3m BOX CULVERTS FOR WATERCOURSE AND BAT CROSSING
NOISE BUNDING
EXISTING OVERHEAD POWER CABLES
TREE-LINE ENHANCEMENT FOR BAT FLIGHT LINES
TUMULI (BARROWS) SCHEDULED ANCIENT MONUMENT (SAM)
EXISTING A40 TRUNK ROAD (TO BE DETRUNKED)
WS2 +1 CARRIAGEWAY - WESTBOUND OVERTAKING (CH0+580 TO CH1+779)
FFERM BLACKMOOR HILL BLACKMOOR HILL FARM
ACCESS TO POND AND FIELD
LANDSCAPE AREAS
PROPOSED 1.2m DIAMETER CULVERT
LANDSCAPE AREA
SBR 840
PROPOSED ENVIRONMENTAL MITIGATION CULVERT
MS4 SIGN RELOCATED
NOISE BUNDING
LANDSCAPE AREA
REDSTONE ROAD OVERBRIDGE SBR-0572
B4313 REDSTONE ROAD TO DETRUNKED A40
B4313 NARBERTH
SP27/1/1
SP27/2/1
DETRUNKED A40 TO PENBLEWIN ROUNDABOUT
LANDSCAPING AREA. TO BE RETURNED TO THE LAND OWNER.
LANDSCAPE AREA
LANDSCAPE AREA
LANDSCAPE AREA
ATTENUATION POND B
LANDSCAPE AREA
SBR 1150
2x3m BOX CULVERTS FOR BAT AND CATTLE CROSSING
PROPOSED 1.2m DIAMETER CULVERT TO EXISTING WATERCOURSE
BLACKMOOR HILL FARM UNDERPASS SBR-1380 FOR FARM ACCESS, WATER COURSE AND BAT CROSSING
CYLCHFAN PENBLEWIN PENBLEWIN ROUNDABOUT
ATTENUATION POND E
ACCESS TO ATTENUATION POND E
A40 LLANDDEWI VELFREY TO PENBLEWIN IMPROVEMENTS. FOR DETAILS REFER TO DRAWING A40LVP-ARP-HGN-SWI-DR-D-0001
A 478
0+000.000
0+100.000
0+200.000
0+300.000
0+400.000
0+500.000
0+600.000
0+700.000
0+800.000
0+900.000
1+000.000
1+100.000
1+200.000
1+300.000
1+400.000
1+500.000
1+600.000
1+700.000
1+779.145

LEGEND:

- HIGHWAY BOUNDARY
- CPO BOUNDARY
- SITE EXTENTS (LICENCE OR EASEMENT)
- P.R.O.W - EXISTING
- EXISTING CULVERT
- PROPOSED CULVERT
- HIGHWAY DRAINAGE
- CUT OFF DITCH
- SIGN (INDICATIVE) REFER TO SIGN DRAWINGS
- WATER TREATMENT AREAS
- EXISTING OVERHEAD POWER LINES
- EARTHWORK EMBANKMENT
- EARTHWORK CUTTING
- TYPICAL CROSS SECTIONS (REFER TO DRAWING A40PRC-ARP-HML-SWI-DR-D-0025)

GENERAL NOTES:

1. ALL DIMENSIONS IN METRES UNLESS NOTED OTHERWISE.
2. ONLY WRITTEN DIMENSIONS SHALL BE USED, DO NOT SCALE.
3. ALL EARTHWORKS (EMBANKMENTS AND CUTTINGS) 1:2 UNLESS OTHERWISE STATED.
4. REFER TO DRAWINGS A40PRC-RML-ELS-SWI-DR-LE-0001 AND 0002 FOR PROPOSED LANDSCAPING DETAILS

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction

*Existing overhead power cables (11KV) require diversion.
*Water main (HP) within Redstone Cross road verge requires temporary and permanent diversion.
*Refer to Statutory Utilities Report.

Maintenance / Cleaning

NONE

Use

NONE

Decommissioning / Demolition

NONE

Rev	Date	Description	By	Chkd	Appd	Auth
---	---	---	---	---	---	---
---	---	---	---	---	---	---
---	---	---	---	---	---	---
P01	17/09/19	FIRST ISSUE	DS	AJ	TE	GD
P02	25/10/19	UPDATED FOLLOWING WG COMMENTS	HJ	AJ	TE	GD
P03	10/12/19	UPDATED FOLLOWING COMMENTS	HJ	AJ	GD	GD
P04	12/02/20	FOR REVIEW AND COMMENT	DS	RC	RC	---
P05	26/02/20	FOR REVIEW AND COMMENT	DS	RC	RC	GD
P06	21/04/20	FOR REVIEW AND COMMENT	DS	GJ	RC	GD
P07	08/06/20	FOR REVIEW AND COMMENT	DS	GJ	TE	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS

Drawing Title
GENERAL ARRANGEMENT

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

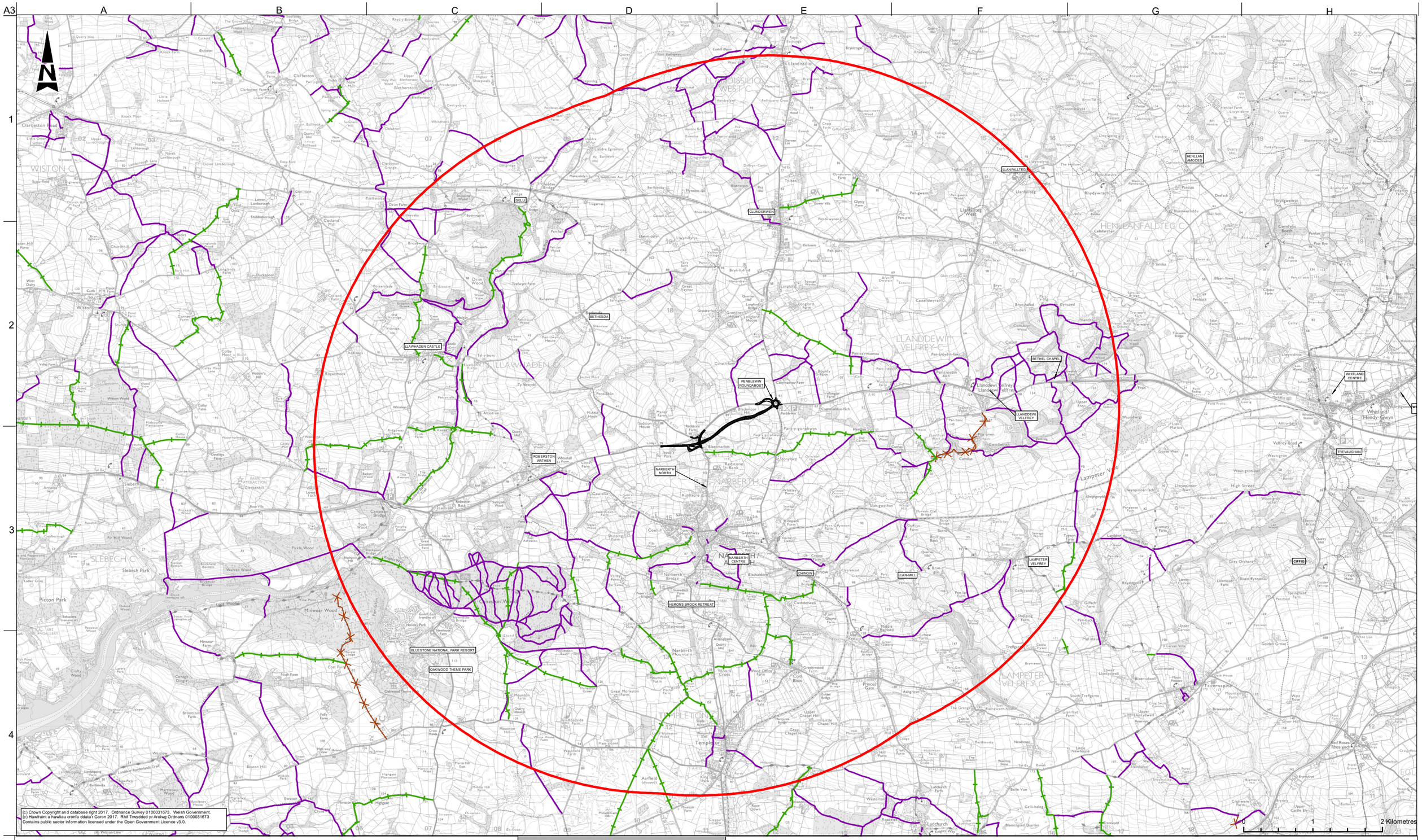
Scale at A1 1:2500

Rev	By	Chkd	Appd	Auth
P07	DS	GJ	TE	GD
	Date 08/06/20	Date 08/06/20	Date 08/06/20	Date 08/06/20

Name
A40PRC - ARP - HML - SWI - DR - D - 0002
Project | Originator | Volume | Location | Type | Role | Number

Appendix B - WCHR Study Area

WCHR Study Area - A40PRC-ARP-ENM-SWI-DR-C-0002



LEGEND

- PROPOSED PRELIMINARY HIGHWAY DESIGN
- STUDY AREA BOUNDARY - 5KM FROM SCHEME
- FOOTPATH
- BRIDLEWAY
- RESTRICTED BYWAY
- BYWAY OPEN TO ALL TRAFFIC

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	26/11/19	FIRST ISSUE	AC	GJ	TE	GD

Project Title
A40 LLANDDEWI VELFREY TO PENBLEWIN IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARCADIS
MOTT MACDONALD
ARUP
RICHARDS PARTNERSHIP

Drawing Title
PUBLIC RIGHTS OF WAY

Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A3
1:50,000

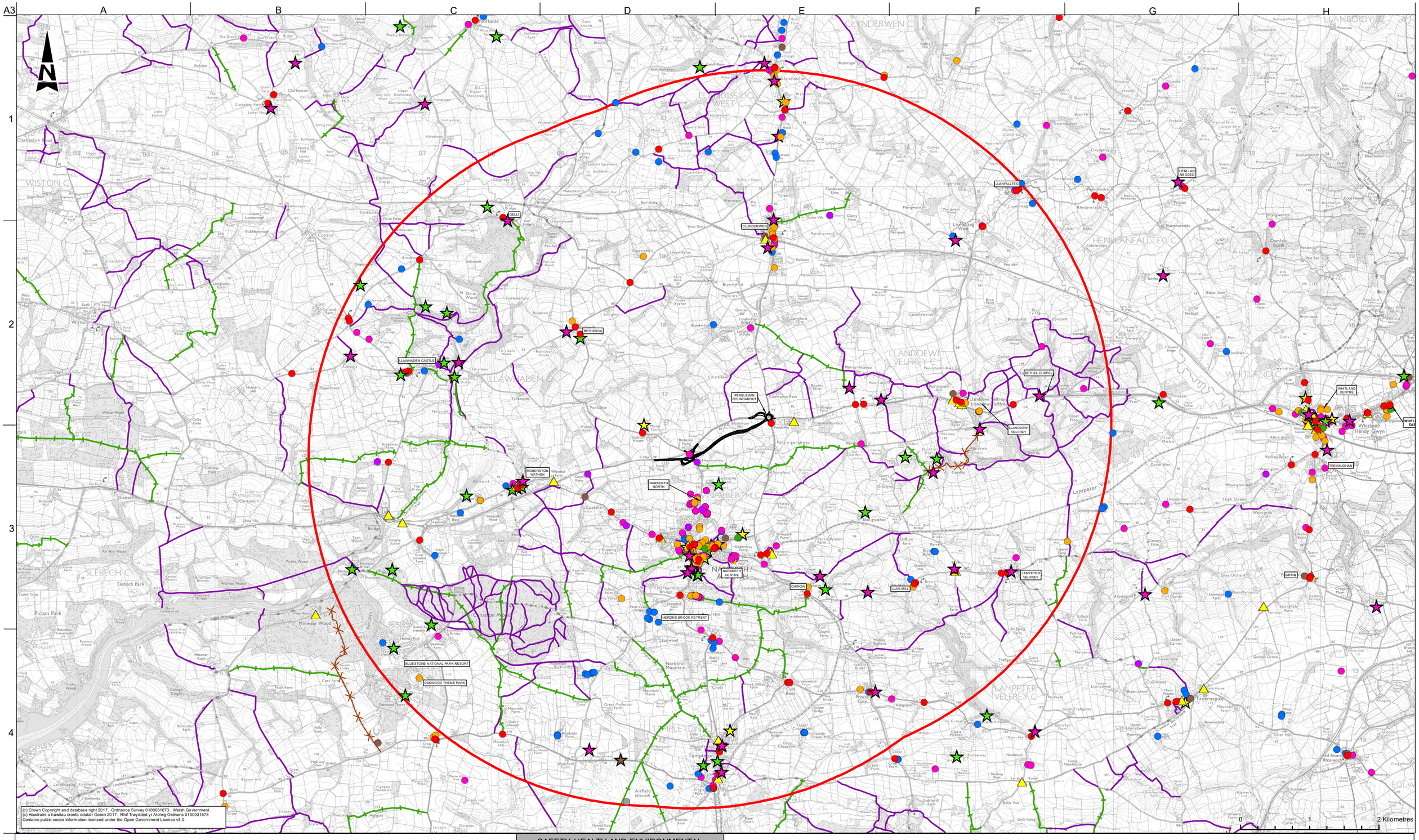
Rev	By	Chkd	Appd	Auth
P02	AC	GJ	TE	GD
	Date 26/11/19	Date 26/11/19	Date 26/11/19	Date 26/11/19

Name
A40PRC - ARP - ENM - SWI - DR - C - 0002

Project	Originator	Volume	Location	Type	Role	Number

Appendix C – Trip Generators

Trip Generators - A40PRC-ARP-ENM-SWI-DR-C-0001



LEGEND

- STUDY AREA BOUNDARY - 5KM FROM SCHEME
- PROPOSED PRELIMINARY HIGHWAY DESIGN

PUBLIC RIGHTS OF WAY

- FOOTPATH
- BRIDLEWAY
- RESTRICTED BYWAY
- BYWAY OPEN TO ALL TRAFFIC

- PLACES OF WORK
- RECREATION
- HEALTH CARE
- ACCOMDATION
- BUS STOP/ TRANSPORT STATION
- POLICE/ AMBULANCE/ FIRE STATION
- RESTAURANT/ PUBLIC HOUSE
- POST OFFICE/ POST BOX/ TELPHONE BOX
- MILITARY
- TOURIST ATTRACTIION
- SCHOOLS
- EQUESTRIAN FACILITIES
- PLACES OF WORSHIP

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction	None
Maintenance / Cleaning	None
Use	None
Decommissioning / Demolition	None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	26/11/19	FIRST ISSUE	AC	GJ	TE	GD

Project Title
A40 LLANDDEWI VELFREY TO PENBLEWIN IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS PARTNERSHIP

Drawing Title
TRIP GENERATORS

Suitability
S3 | SUITABLE FOR REVIEW & COMMENT

Scale at A3
1:50,000

Rev	By	Chkd	Appd	Auth
P02	AC	GJ	TE	GD
	Date 26/11/19	Date 26/11/19	Date 26/11/19	Date 26/11/19

Name
A40PRC - ARP - ENM - SWI - DR - C - 0001

Project	Originator	Volume	Location	Type	Role	Number

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 17.1 Population and Health Baseline

A40PRC-ARP-EGN-SWI-RP-LE-0001

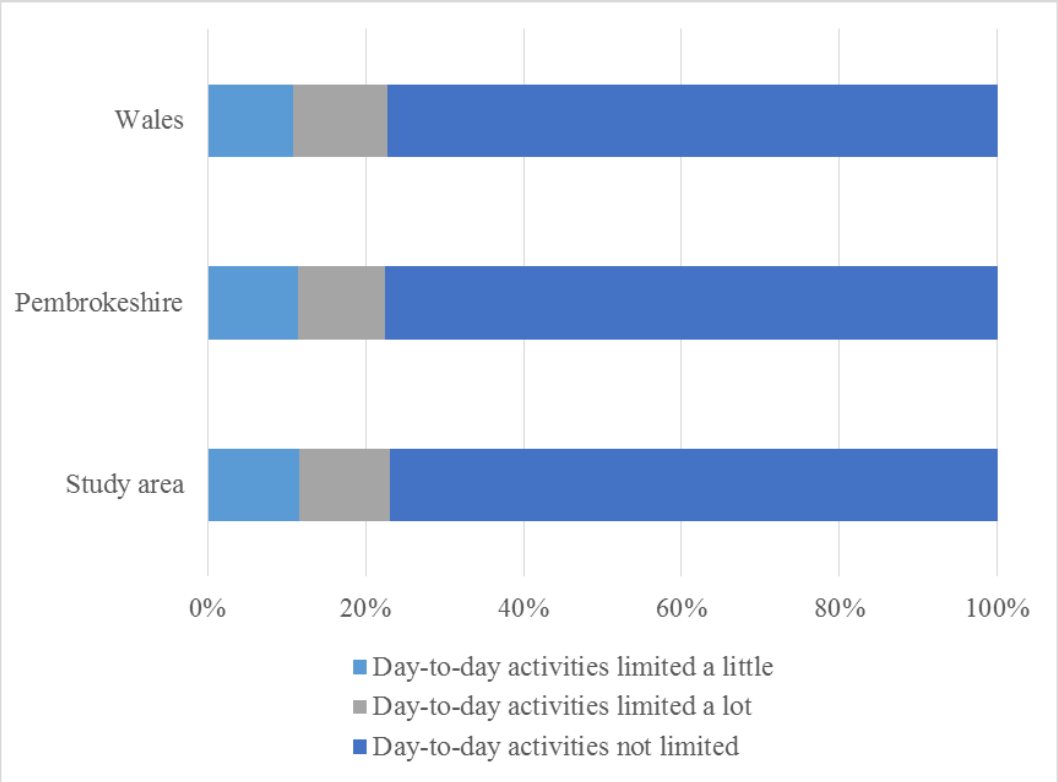
P01 | S3

10/12/19

Contents

Tables

Charts



1 Population

1.1 Local demography

1.1.1 Local demography encompasses a range of parameters that help to define the composition of a given population. These include the size of the population, age profile, gender split, ethnicity and inward/outward migration. This provides a basis for understanding local circumstance and can provide an insight as to how this may change over time and the subsequent link with health outcomes. For example, the health requirements of an ageing population are different to those of a younger demographic.

Population density

1.1.2 The scheme is located in a rural area with low population density, with fewer than 190 people per square kilometre. The nearest settlement is the small town of Narberth, with other centres of population located at Haverfordwest, Milford Haven, Pembroke Dock, Pembroke, and Tenby.

Population structure

1.1.3 Population estimates for the UK for mid-2016 (the latest estimate available at the time of writing) can be used to illustrate the age profile and gender split of the area surrounding the proposed scheme[1]. This information is only available at local authority level, and so data is presented for Pembrokeshire rather than the local study area. The gender split in Wales is 49% of the population male and 51% female. The gender distribution in Pembrokeshire is also 49% male and 51% female.

Chart 1 provides a detailed age profile of Pembrokeshire in comparison with Wales. This shows that Pembrokeshire has an older population than the Welsh average, with higher proportions of residents in groups aged 50 and over, and smaller proportions of residents in younger age groups. The older age profile of Pembrokeshire is an important consideration for the health and equalities assessments. Age is one of the nine protected characteristics defined in the Equality Act 2010, and increased age can be related to

[1] ONS (2017), Population Estimates for UK, England and Wales, Scotland and Northern Ireland: Mid-2016.

an increasing requirement for healthcare services and changes to well-being and mobility.

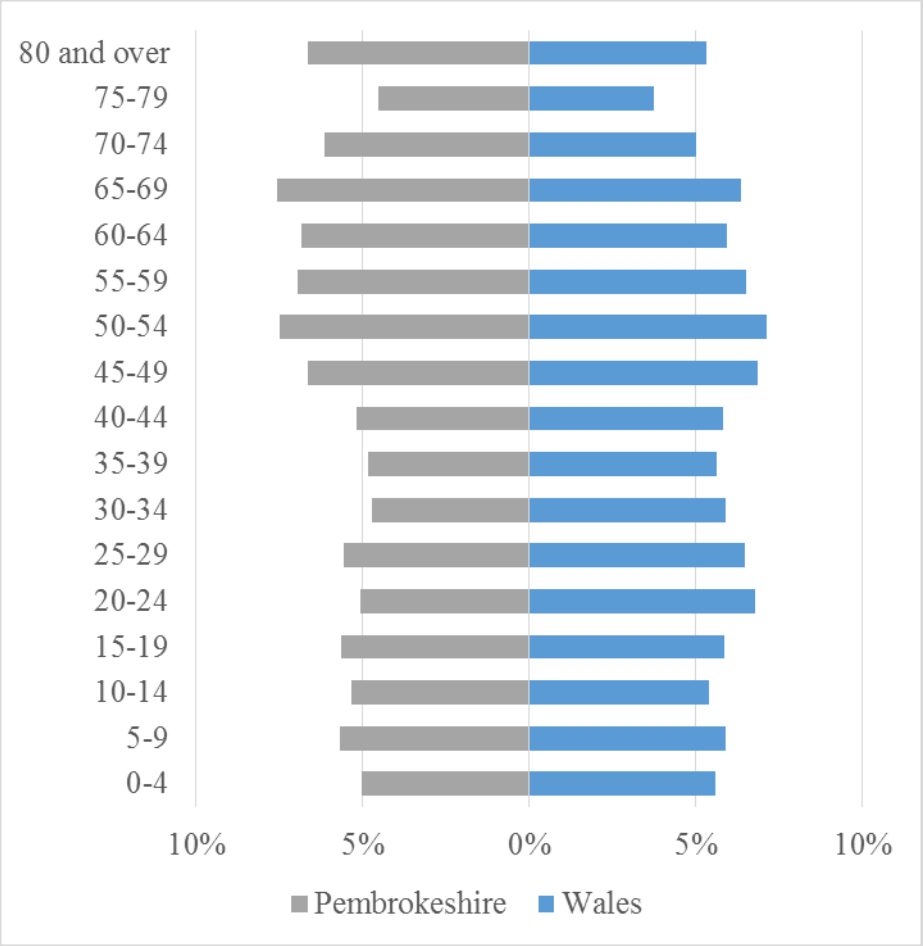


Chart 1 Age structure, Pembrokeshire compared to Wales (Source: ONS (2017), Population Estimates for UK, England and Wales, Scotland and Northern Ireland: Mid-2016).

Welsh language skills

1.1.4 More than half of residents of the study can either understand spoken Welsh, or can speak, read or write Welsh. This is higher than both the average for Pembrokeshire (45.0%) and for Wales (44.1%). Chart 2 shows these percentages.

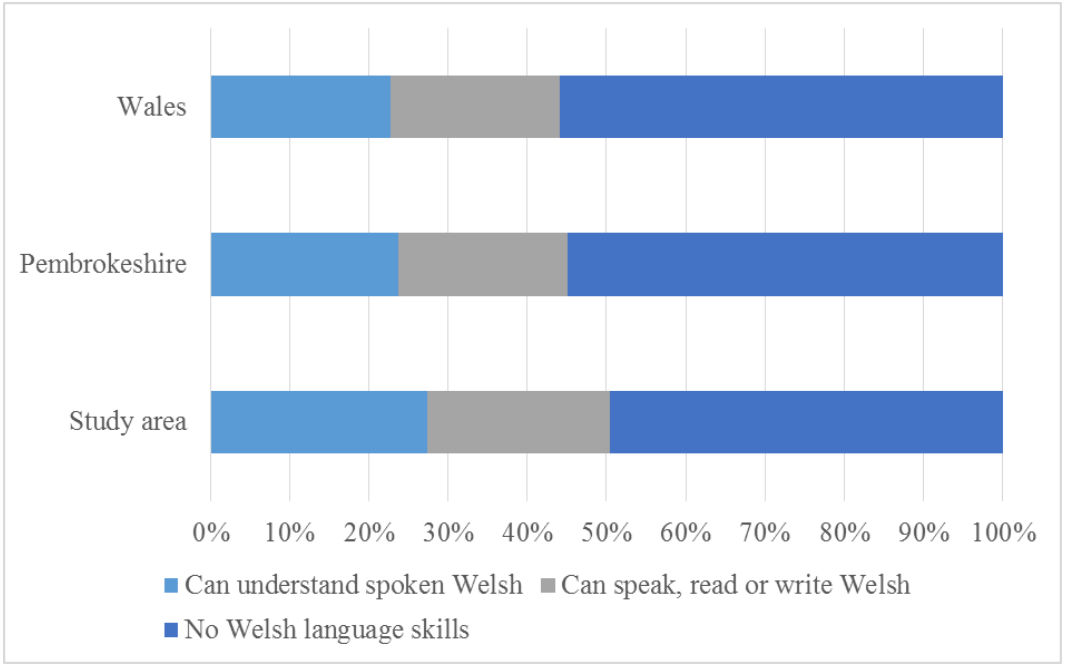


Chart 2 Welsh language skills (Source: ONS, Census 2011)

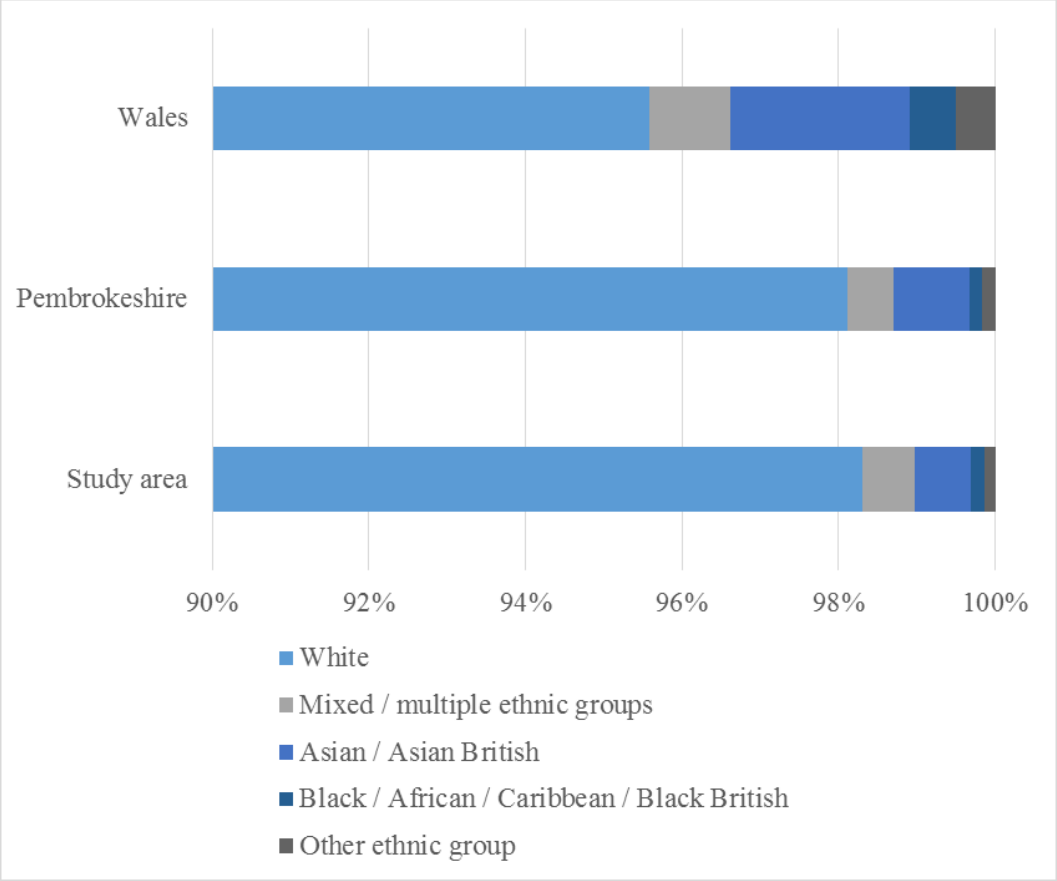
Migration and population change

1.1.5 ONS migration statistics published as part of the Mid-Year Population Estimates show that in the year ending June 2016, Wales overall recorded a net inflow of internal migrants from other regions of the UK of 3,379, and a net inflow of international migrants of 9,676. Overall (accounting for births and deaths as well as migration flows), the population of Wales increased by 14,064, or 0.5% between 2015 and 2016.

1.1.6 Over the same period, Pembrokeshire recorded a net inflow of 730 internal migrants, and a net inflow of 99 international migrants. Overall, the population of the county increased by 390, or 0.4%. This is a slightly lower rate of population increase than that recorded across Wales as a whole.

Ethnicity

1.1.7 Data from the 2011 census indicates that ethnic diversity is lower in Pembrokeshire and in the local study area than the average for Wales[2]. As shown in Chart 3, over 98% of the population in these groups is



from White ethnic groups, with smaller proportions of residents from mixed, Asian, and Black ethnic backgrounds. Across Wales, just under 96% of residents are from White ethnic groups, with 2.3% from Asian ethnic groups, 1% from mixed or multiple ethnic groups, and less than 1% from Black or other ethnic groups.

Chart 3 Ethnicity by broad ethnic groups (Source: Census 2011)

Religion

1.1.8 The 2011 census indicates that the study area and Pembrokeshire both record a higher than average proportion of residents who give their religion as Christian, and smaller than average proportions from most other religious groups – as shown in Chart 4. In the study area, 63.4% of people consider themselves Christian, compared with 63.0% in Pembrokeshire and 57.6% for Wales as a whole.

[2] ONS (2012), Census 2011.

1.1.9 Across Wales, the largest religious minority group is Muslim, with Muslims accounting for 1.5% of the total population. In both the study area and Pembrokeshire, 0.3% of residents give their faith as Muslim. Other religious minority groups each account for less than 1% of the population of the study area and Pembrokeshire.

1.1.10 The proportion of residents who say they have no religion is lower in the study area and in Pembrokeshire than the Welsh average. However, there are slightly higher than average proportions belonging to "other" religions (0.7% in the study area and 0.5% in Pembrokeshire, compared with 0.4% across Wales), and the proportion of residents who chose not to state their religion is also slightly above average in both areas.

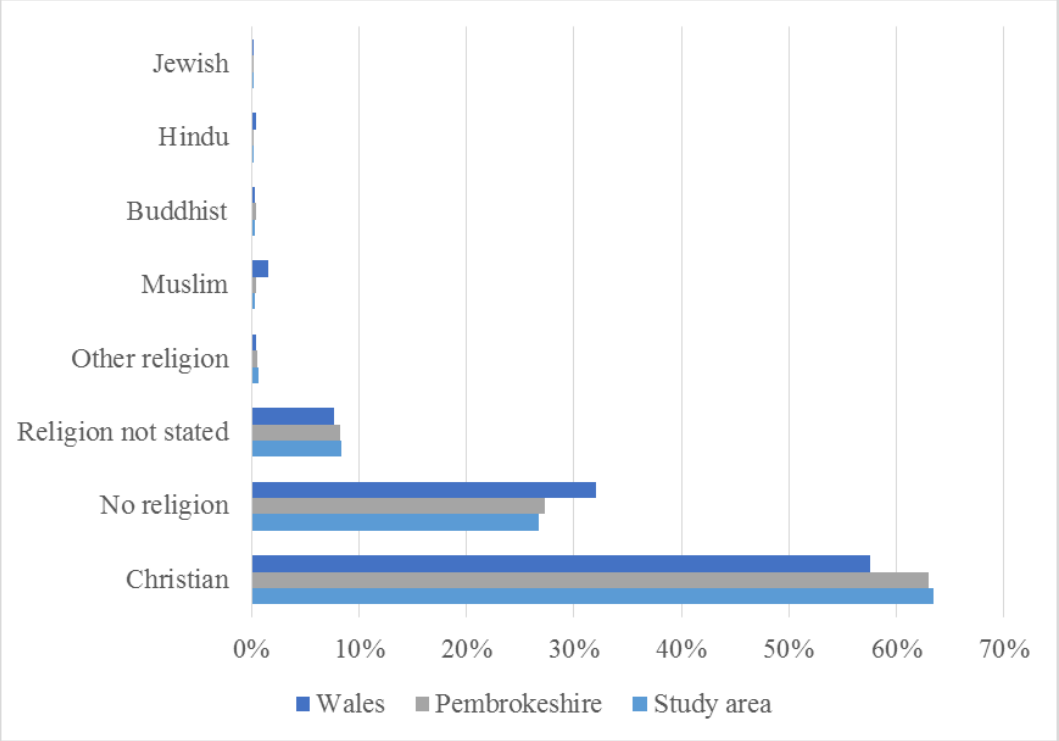


Chart 4 Religion (Source: ONS, Census 2011)

Education

1.1.11 Chart 5 illustrates 2011 census data for highest qualification levels attained by working-age residents of the study area and of Pembrokeshire, in comparison with Wales.

1.1.12 This indicates that the study area has a relatively highly-skilled population, with a higher than average proportion of residents with Level 4 qualifications (equivalent to a bachelor's degree) or above (29.3% compared with 24.5% for Wales). There is also a smaller than

average proportion of residents with no formal qualifications (22.9% compared with 25.9% for Wales).

1.1.13 The figures for Pembrokeshire are broadly in line with the Welsh averages.

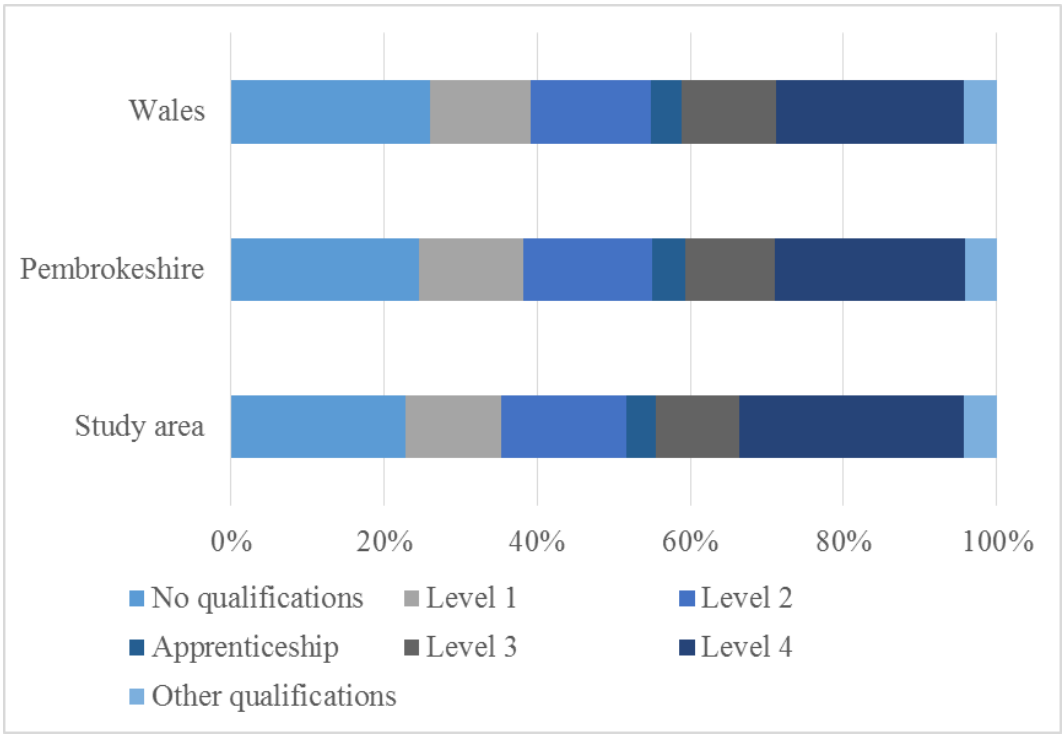


Chart 5 Educational Attainment (Source: ONS, Census 2011)

Disability

1.1.14 Chart 6 uses census 2011 data and illustrates the proportion of the population that experiences a long-term illness or disability that limits their day-to-day activities either a little or a lot. The proportion of residents of the study area who report a limiting long-term illness or disability is 23.1%, including 11.5% whose illness or disability limits them a lot. This is slightly higher than the Welsh average of 22.7%, and 10.8% whose illness or disability limits them a lot.

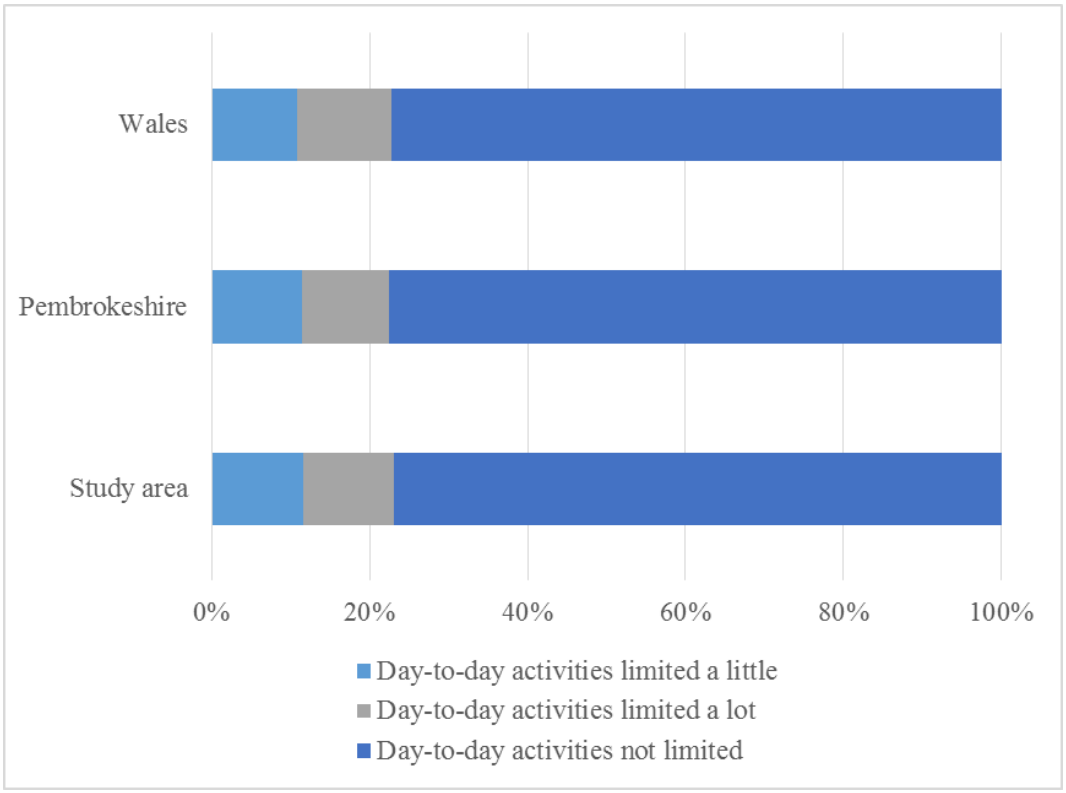


Chart 6 Limiting long-term illness or disability (Source: ONS, Census 2011)

1.2 Economic activity

Industry of Employment

1.2.1 The Annual Population Survey (APS) provides up-to-date information on employment and labour market activity3. This information is not available for individual wards, and so data is presented for Pembrokeshire rather than for the local study area. Chart 7 uses data from the 2017 APS and compares employment by sector in Pembrokeshire with the average for Wales.

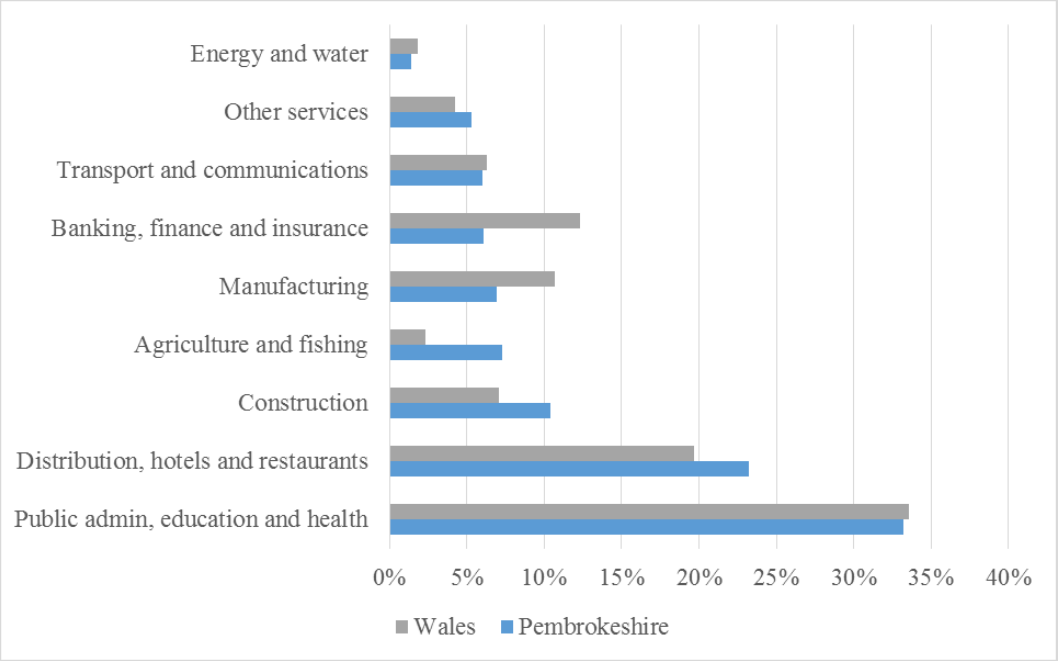
1.2.2 The largest sectors by employment in Pembrokeshire are public administration, education and health; and distribution, hotels and restaurants. This is in line with the pattern for Wales, although the proportion working in distribution, hotels and restaurants is higher than the Welsh average, reflecting the importance of the tourism industry to the local economy.

1.2.3 Pembrokeshire records considerably smaller proportions of residents employed in manufacturing, and in banking, finance and insurance than

[3] ONS (2017), Annual Population Survey, June 2017- June 2017.

the Welsh average. Employment in agriculture and fishing, and in the construction sector is above average. Agriculture and fishing accounts for 7.3% of all employment in the county, and construction for 10.4%.

Chart 7 Employment by sector (Source: ONS, Annual Population Survey 2017)



Employment and unemployment

1.2.4 Chart 8 uses data from the 2011 census to compare employment, unemployment and economic inactivity in the study area and in Pembrokeshire with the average for Wales. This shows that the proportion of residents who are employed either part-time or full-time, is slightly lower in the study area and in Pembrokeshire than across Wales. There is, however, a higher than average proportion of residents who are self-employed, at 16.7% in the study area and 13.5% in Pembrokeshire compared with 8.6% in Wales.

1.2.5 The proportion of residents who are retired is above average in the study area and Pembrokeshire, and the proportion who are students is below average. This reflects the age profile of the area. The proportion who are long-term sick or disabled is slightly lower than average, at 4.5% in the study area and 5.3% in Pembrokeshire, compared with 6.3% across Wales.

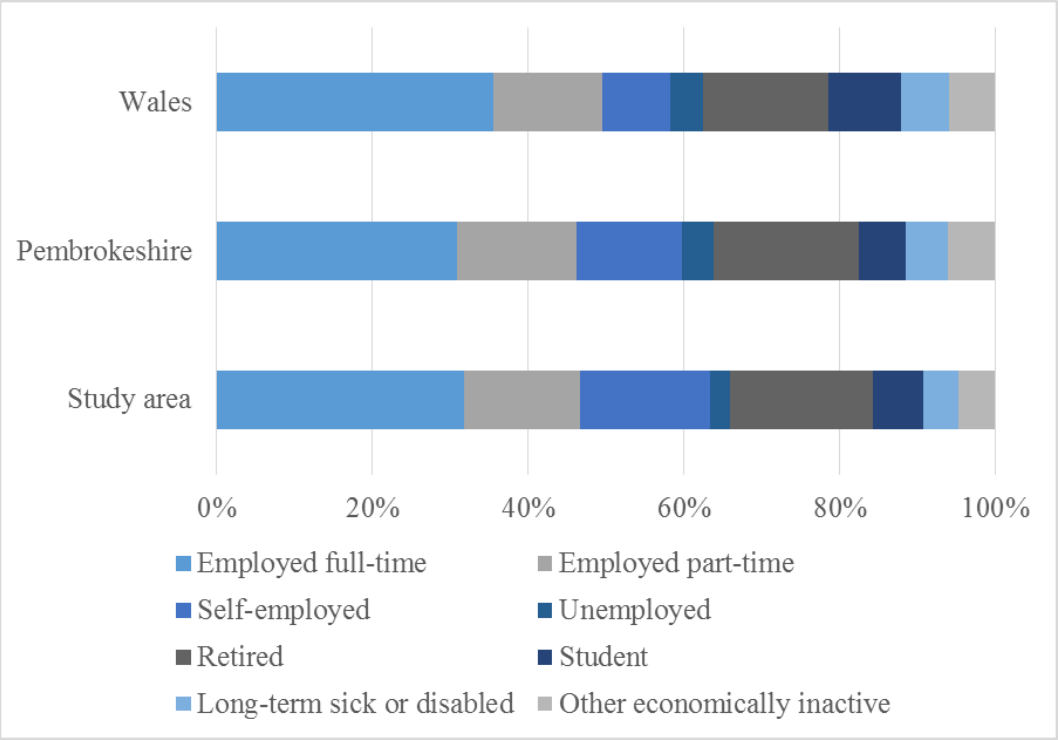


Chart 8 Economic Activity (Source: ONS, Census 2011)

1.2.6 According to the census data, unemployment is 2.6% in the study area, compared to 4% in Pembrokeshire and 4.3% across Wales. However, APS data can be used to provide a more up-to-date understanding of the unemployment rate at a local authority level.

1.2.7 Chart 9 uses APS data to illustrate the change in unemployment rate in Pembrokeshire and in Wales over the decade to 2017. Over this period, unemployment in Pembrokeshire has followed a similar pattern to the national average, however, has remained consistently lower than average. The latest data demonstrates that the unemployment rate in 2017 is 3.6% in Pembrokeshire, compared with 4.9% across Wales.

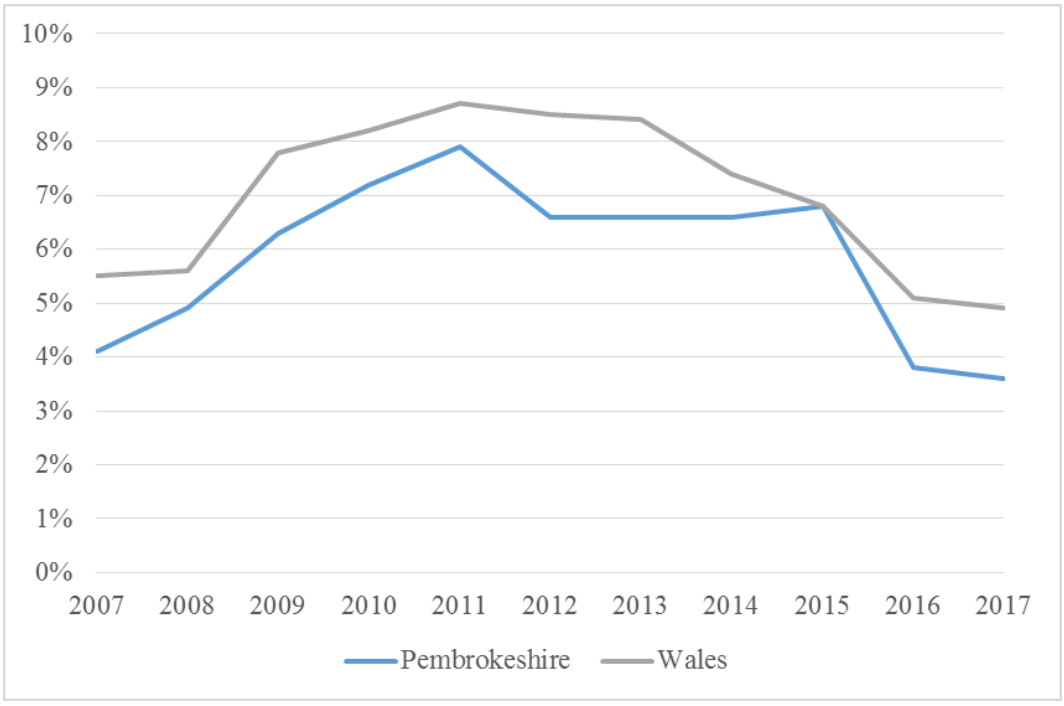


Chart 9 Percentage of working-age adults unemployed, 2007-2017 (Source: ONS, Annual Population Survey 2017)

1.2.8 Claimant count data, which records the proportion of the workforce who are in receipt of out-of-work benefits, can also be used as a measure of unemployment and is available at ward level[4]. Chart 10 illustrates this data by sex for each of the wards in the local study area, in comparison with Pembrokeshire and Wales.

1.2.9 This shows that the claimant count is higher for men than for women across all areas. It also indicates that the proportion of people who are out of work and claiming benefits in the Lampeter Velfrey and Narberth Rural wards is considerably below the average for Pembrokeshire and for Wales. In Narberth ward, which includes the town of Narberth, it is slightly higher than average, particularly compared to Wales.

[4] Office for National Statistics (2017), Claimant Count, September 2017.

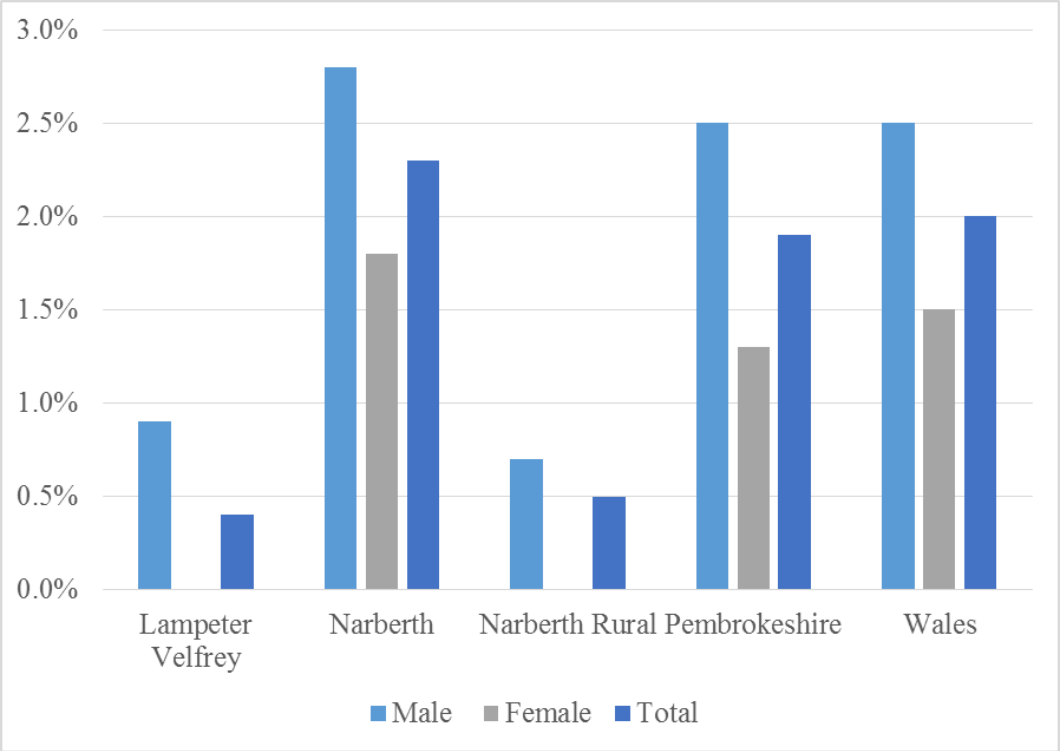


Chart 10 Claimant count by sex (Source: ONS, September 2017)

Deprivation

1.2.10 The Welsh Government's Welsh Index of Multiple Deprivation (WIMD) measures deprivation across eight 'domains'. These include: income; employment; health; education; access to services; community safety; physical environment; and housing. The WIMD ranks the 1,909 Lower Super Output Areas (LSOAs) in Wales against each of these domains[5].

1.2.11 Deprivation within each domain is established using national statistics, such as rates of violence and burglary (crime); people claiming income support (income) or Jobseekers' Allowance (JSA) (employment); homelessness, access to owner-occupation, and distance to services such as GP surgery, school or shops (barriers to housing and services); air quality and road traffic accidents (outdoor living environment); and many other indicators.

1.2.12 Collectively, these indicators of the relative deprivation of a community (expressed through factors relating to individuals, such as rate of disability and employment, and through factors of the living environment, including crime and access to services) strongly influence

[5] Statistics Wales (2014), Welsh Index of Multiple Deprivation.

health and well-being. Certain protected characteristics groups can also be more likely to experience deprivation. Scores for deprivation therefore offer a useful way to show a summary profile of the community and characterise the urban fabric of the areas in which this Scheme is located in a way that focuses on the residents' needs and barriers to good health and well-being, and the potential for equality effects.

1.2.13 Chart 11 illustrates multiple deprivation for the Carmarthenshire LSOA for the Scheme area. Deprivation values are split equally into five quintiles, with the first quintile representing the 20% most deprived LSOAs in Wales, and the fifth quintile representing the 20% least deprived LSOAs in Wales.

1.2.14 Pembrokeshire is generally an area of relatively low multiple deprivation. Deprivation is concentrated in Pembroke, Pembroke Dock, Milford Haven, and Haverfordwest, where there are several LSOAs that fall into the 20% most deprived in Wales. The Monkton area to the west of Pembroke town centre, and the Llanion 1 area on the eastern side of Pembroke Dock, both rank within the 100 most deprived LSOAs in Wales.

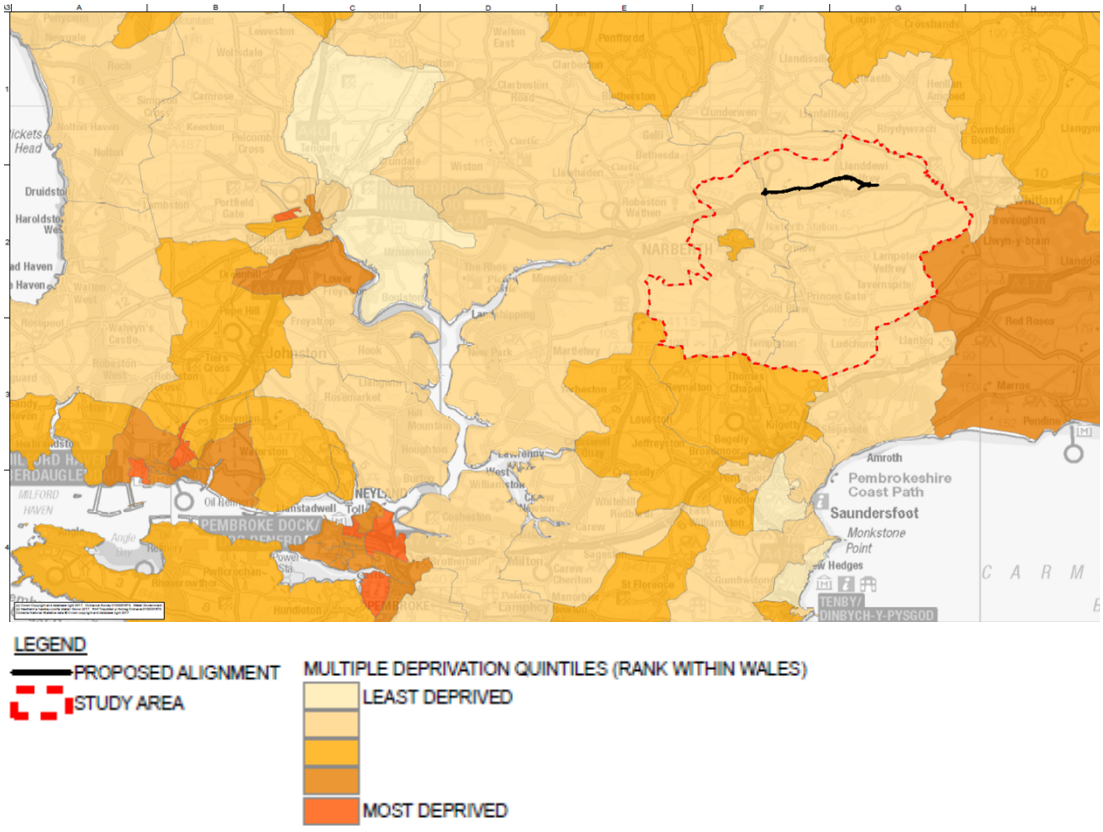


Chart 11 Multiple Index of Deprivation and Quintiles within Wales

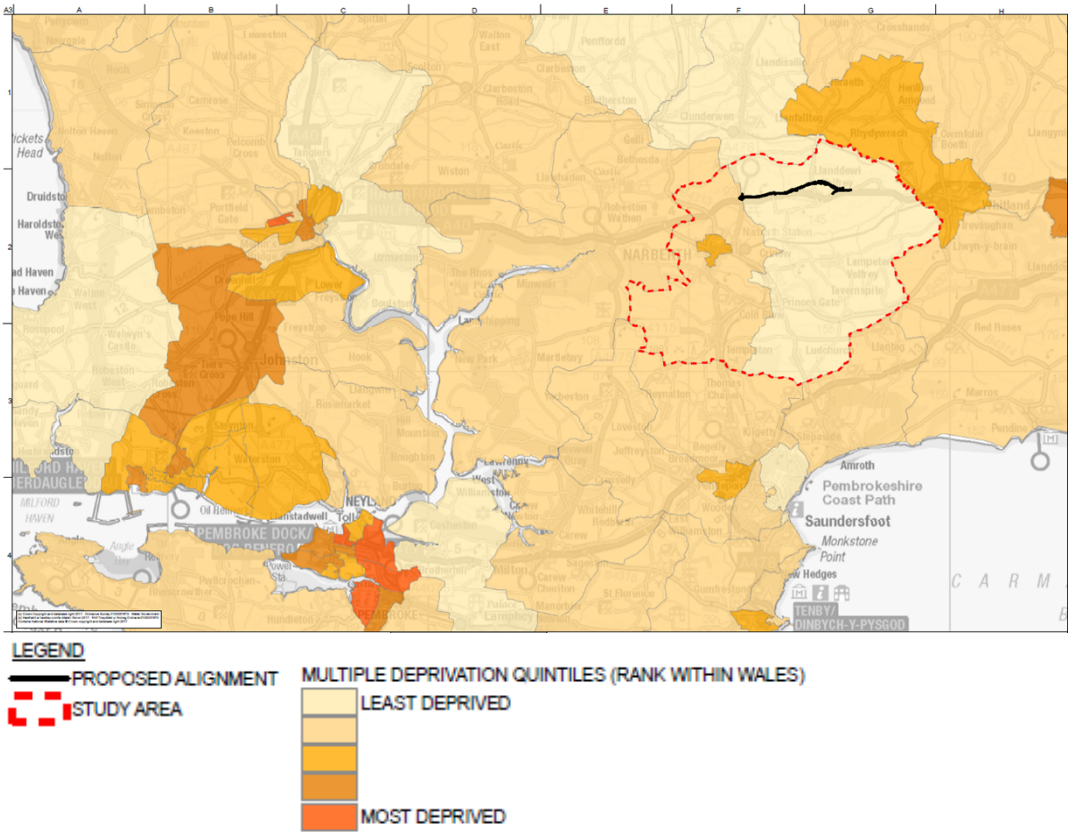


Chart 12 Health Deprivation, Quintiles with Wales

2 Health

Life expectancy and mortality

2.1.1 Over the period from 2008-2014, the life expectancy at birth for both males and females in Wales has steadily increased. This pattern is also reflected in Pembrokeshire, where life expectancy for males has increased from 78.2 to 79.7, and for females from 82.3 to 83.2. Life expectancy for both males and females is higher in Pembrokeshire than the average across Wales as shown in Table 1.

Table 1 Life expectancy at birth (Source: NHS Wales Informatics Service, Health Maps Wales)

		2008-2010	2009-2011	2010-2012	2011-2013	2012-2014
Wales	Males	77.7	78.1	78.3	78.4	78.6
	Females	81.9	82.3	82.3	82.4	82.5
Pembrokeshire	Males	78.2	78.8	79.4	79.3	79.7
	Females	82.3	82.7	82.5	82.8	83.2

2.1.2 The all-cause mortality rate is lower in Pembrokeshire than across Wales. The mortality rate in Pembrokeshire is 941.2 deaths per 100,000 population, compared with 1,045.7 deaths per 100,000 population for Wales. The mortality rate has decreased over the period 2010-2016 in both Pembrokeshire and Wales as shown in Table 2.

Table 2 All-cause mortality rate per 100,000 population (Source NHS Wales Informatics Service, Health Maps Wales)

	2010	2011	2012	2013	2014	2015	2016
Wales	1,080.0	1,034.8	1,050.8	1,059.8	1,016.9	1,064.4	1,045.7
Pembrokeshire	1,018.8	965.0	978.4	978.9	912.1	1,024.0	941.2

Cancer

2.1.3 In 2016, the incidence of cancer in Wales was 613.2 per 100,000 population. In Pembrokeshire, the incidence was lower at 595.1 per 100,000 population. The incidence of cancer in both Wales and Pembrokeshire is lower in 2016 than the figure recorded in 2012, however, there is fluctuation in both Wales and Pembrokeshire in the period between 2012-2016.

2.1.4 The mortality rate from cancer in 2017 was lower in Wales than Pembrokeshire, at 278.3 deaths per 100,000 population compared to 294.7 deaths per 100,000 population. There is fluctuation in the mortality rate between 2012 and 2017, as displayed in Table 3.

Table 3 Cancer incidence and mortality rates per 100,000 population (Source: NHS Wales Informatics Service, Health Maps Wales). *Data on the incidence of cancer has not been published for 2017 by the NHS Wales Informatics Service.

		2012	2013	2014	2015	2016	2017
Incidence	Wales	615.6	643.1	636.0	616.1	613.2	*
	Pembrokeshire	694.4	659.6	611.9	650.2	595.1	*
Mortality rate	Wales	289.0	286.2	289.1	278.4	279.2	278.3
	Pembrokeshire	283.2	293.1	255.1	256.8	278.1	294.7

Respiratory disease

2.1.5 In 2017/2018, the rate of hospital admissions for respiratory diseases was considerably lower in Pembrokeshire than across Wales, with fluctuation in hospital admissions experienced across Wales and Pembrokeshire between 2012 and 2018. Hospital admissions were lower in Pembrokeshire than Wales between 2012-2018.

2.1.6 Over the same period, the mortality rate from respiratory diseases has also remained consistently lower in Pembrokeshire than in Wales. In 2015/2016, there were 139 deaths per 100,000 population in Pembrokeshire, compared with 171.3 per 100,000 population in Wales. Mortality rates have fluctuated considerably in both Wales and Pembrokeshire over the period 2012-2018, with no clear pattern emerging in either area as shown in Table 4.

Table 4 Hospital admissions and mortality rate per 100,000 population: all respiratory diseases (Source: NHS Wales Informatics Service, Health Maps Wales)

	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Hospital Admissions						
Wales	1518.2	1485.4	1598.1	1718.7	1792.2	1798.2
Pembrokeshire	1333.0	1314.5	1418.1	1502.5	1639.2	1586.9
	2012	2013	2014	2015	2016	2017
Mortality Rate						
Wales	153.9	164.9	144.0	171.3	160.8	155.9
Pembrokeshire	119.3	128.3	92.9	139.1	113.1	120.5

Cardiovascular disease

2.1.7 Links have been established between cardiovascular disease and poor health behaviour, lifestyle choice and relative socio-economic deprivation. Comparisons of the mortality rates and hospital admission rates for all cardiovascular disease, presented in Table 5, demonstrates that hospital admissions have generally decreased between 2012 and 2018.

Table 5 Hospital admissions and mortality rate per 100,000 population: all cardiovascular diseases (Source: NHS Wales Informatics Service, Health Maps Wales)

	2012/2013	**2013/2014**	**2014/2015**	**2015/2016**	**2016/2017**	**2017/2018**
Hospital Admissions						
Wales	1876.9	1897.1	1839.9	1828.2	1684.3	1574.7
Pembrokeshire	1874.0	1756.1	1870.0	1866.8	1640.4	1617.0
	2012	2013	2014	2015	2016	2017
Mortality Rate						
Wales	310.2	307.5	284.7	289.2	273.3	261.7
Pembrokeshire	317.8	297.4	281.0	287.8	240.6	260.3

2.1.8 From Table 6, data for acute myocardial infarction (heart attacks) shows that hospital admissions between the period of 2012 and 2018 are higher in Pembrokeshire than Wales. However, the rate of mortality for acute myocardial infarction is overall lower in Pembrokeshire than Wales. In 2017, the death rate for acute myocardial infarction was 35.2 per 100,000 people in Pembrokeshire compared to 43.8 in Wales.

2.1.9 The hospital admission rate and mortality rates are the highest for cases of coronary heart disease compared to the other cardiovascular diseases displayed in Table 6. Hospital incidence of coronary heart disease are mainly higher in Wales than Pembrokeshire. However, the mortality rate from coronary heart disease peaks at 144.1 in Wales in 2012 per 100,00 population and 157.1 per 100,00 population in 2012.

2.1.10 Hospital admissions from strokes are marginally higher in Pembrokeshire than Wales between 2012 and 2018, with incidences peaking at 233.0 cases per 100,000 population in Pembrokeshire in 2012/2013. The mortality rate from strokes is higher in Wales than Pembrokeshire, peaking between 2012-2018 at 77.2 cases per 100,000 population in 2012.

Table 6 Hospital admissions and mortality rate per 100,00 population: acute myocardial infarction, coronary heart disease and stroke (Source: NHS Wales Informatics Services, Health Maps Wales)

Acute myocardial infarction	**2012/2013**	**2013/2014**	**2014/2015**	**2015/2016**	**2016/2017**	**2017/2018**
Hospital admissions						
Wales	146.5	151.1	135.8	147.7	150.3	149.8
Pembrokeshire	225.4	166.8	180.7	217.2	199.1	187.4
	2012	2013	2014	2015	2016	2017
Mortality rate						
Wales	47.1	47.7	44.0	47.4	43.4	43.8
Pembrokeshire	47.7	29.2	29.8	33.7	35.5	35.2
Coronary heart disease	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Hospital admissions						
Wales	544.0	525.1	490.5	491.0	471.3	443.0
Pembrokeshire	543.0	416.8	429.8	527.0	466.2	434.7
	2012	2013	2014	2015	2016	2017
Mortality rate						
Wales	144.1	143.6	126.4	130.6	121.6	118.4
Pembrokeshire	157.1	137.3	136.5	133.1	112.8	116.3
Stroke	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Hospital admissions						
Wales	197.0	208.0	201.0	200.0	198.0	185.0
Pembrokeshire	233.0	211.0	201.0	207.0	208.0	189.0
	2012	2013	2014	2015	2016	2017
Mortality rate						
Wales	77.2	75.6	75.1	69.9	66.7	59.9
Pembrokeshire	77.3	71.5	64.5	59.0	49.4	52.4

Access to health services

2.1.11 The Hywel Dda University Health Board provides health care for Carmarthenshire, Ceredigion and Pembrokeshire. As of September 2016, there were 390,590 registered patients within the Hywel Dda University Health Board area. There was a total of 243 General Practitioners (excluding locums, GP registrars and GP retainers), with

an average list size of 1,607 patients[6].

2.1.12 There are four general hospitals within the Hywel Dda University area, located at Aberystwyth, Llanelli, Carmarthen and Haverfordwest. There are also a number of community hospitals, including in Haverfordwest, Tenby and Pembroke Dock, as well as minor injuries units, health centres, and mental health services[7].

2.1.13 The Scheme does not directly impact upon health care services. It does, however, have potential implications for access, accessibility and response time to facilities.

2.2 Transport and travel

2.2.1 Chart 13 uses data from the 2011 census and indicates that car, taxi or motorbike is by some distance the most common mode of transport used by residents of the study area to travel to work. This is in line with the pattern for Pembrokeshire and for Wales. The proportion who travel to work by public transport modes is lower than average in both the study area and in Pembrokeshire, reflecting the rural nature of the area. There is a higher than average proportion of people who work from home (12.1% in the study area and 9.7% in Pembrokeshire, compared with 5.4% for Wales).

[6] Statistics Wales (2017), Statistical First Release: GPs in Wales, 2006-2016.
[7] Hywel Dda University Health Board: http://www.wales.nhs.uk/sitesplus/862/page/42912

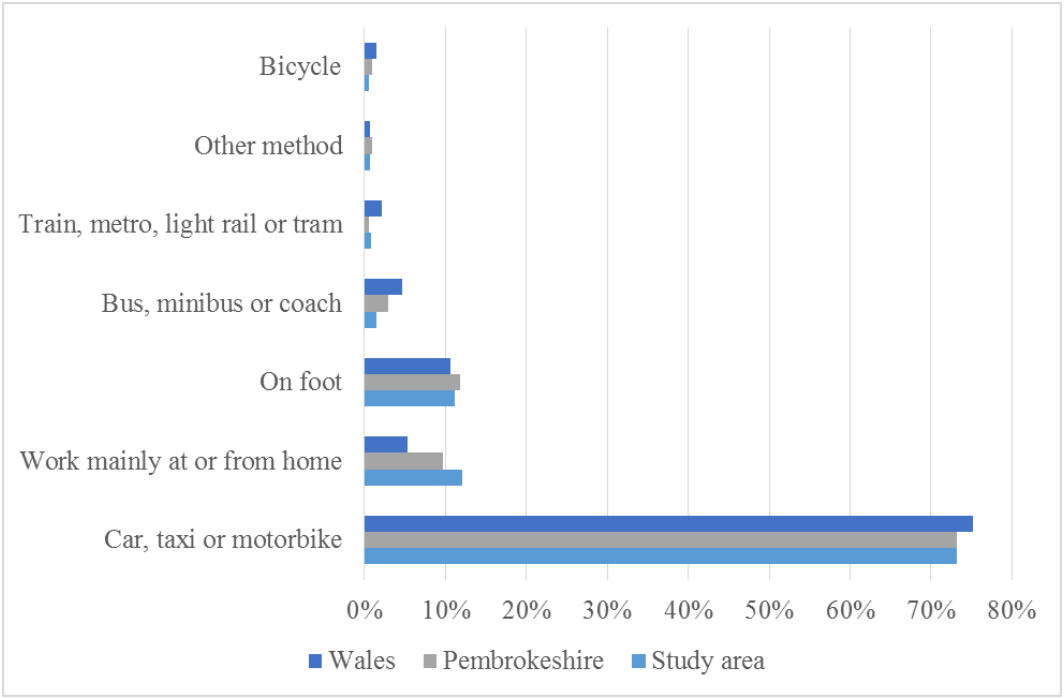


Chart 13 Method of travel to work (Source: ONS, Census 2011)

2.2.2 Chart 14 also uses census data and shows that car and van availability is higher in the study area and in Pembrokeshire than across Wales. The proportion of households who do not have access to a car or van is 13.3% in the study area, compared with 17.9% in Pembrokeshire and 22.9% in Wales. Again, it is likely that this reflects the rural nature of the area, and the relative lack of availability of public transport in comparison to more urban areas.

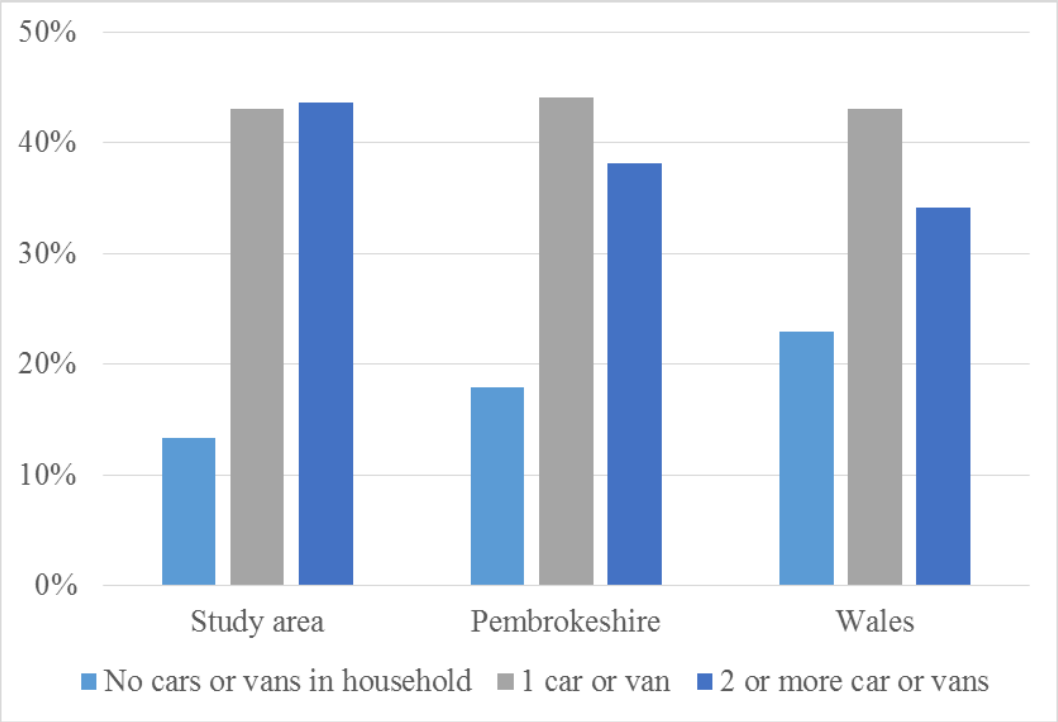


Chart 14 Car and van availability (Source: ONS, Census 2011)

2.3 Health behaviour and lifestyle

2.3.1 Poor health behaviour can have a wide-ranging influence on overall health and well-being. Elements such as diet and the level of physical activity a person undertakes, and also the degree of risk-taking behaviour, alcohol consumption and smoking, are directly correlated with a range of adverse health outcomes.

Alcohol

2.3.2 Alcohol consumption is a key health concern and a major cause of illness in Wales, with around 1,500 deaths attributable to alcohol each year (1 in 20 of all deaths)[8].

2.3.3 Data produced by the National Survey for Wales highlighted that 18% of adults surveyed reported drinking above weekly guidelines (men were twice as likely to drink above the weekly guideline than women). Data for 2016/17 shows that, in the Hywel Dda University Health Board area, 22% of adults report alcohol consumption above 14 units per week. The figure for Pembrokeshire is also 22%, above the Welsh average of 20%. Of local authorities across Wales, only

[8] Public Health Wales Observatory (2014), Alcohol and health in Wales 2014: Wales profile.

Monmouthshire (28%), Vale of Glamorgan (27%) and Carmarthenshire (23%) recorded higher rates[9].

2.3.4 Data for 2017/2018, produced by the NHS Informatics Surveys demonstrates that alcohol attributable admissions 313.9 per 100,000 population for males in Wales[10]. Alcohol specific admission rates in Pembrokeshire in 2017/2018 totalled 490.1 cases per 100,000 population. The number of individuals admitted with alcohol-attributable cases in the Hywel Dda University Health Board accounted for 1106.4 per 100,000 population in 2017/2018.

2.3.5 Alcohol-attributable mortality rates demonstrate that between 2015-2017, Hywel Dda University Health Board had 51.6 alcohol-attributable deaths per 100,000 population (3-year average), compared to the Welsh average of 52.9 deaths per 100,000 population (3-year average). Pembrokeshire had a rate of 51.5 deaths per 100,000 population between 2015-2017, below the national average. Powys (44.6 deaths per 100,000 population, 3-year average), Ceredigion (50.2 deaths per 100,000 population (3-year average), the Vale of Glamorgan (50.8 deaths per 100,000 population, 3-year average), Torfaen (51.4 deaths per 100,000 population, 3-year average), Monmouthshire (44.8 deaths per 100,000 population, 3-year average) and Cardiff (50.8 deaths per 100,000 population, 3-year average) are all lower than the number of attributable deaths in Pembrokeshire.

2.3.6 Public Health Wales states that mortality and hospital admissions associated with alcohol are strongly related to deprivation levels, where rates in the most deprived areas in Wales are significantly higher than those of the least deprived areas. Furthermore, there has been no improvement in the disparity in mortality rates between the most and least deprived areas over time[11].

Smoking

2.3.7 Data from Statistics Wales highlights 1 in 5 adults reported that they currently smoke in 2018 (21% male and 17% female). Smoking was most common among adults aged 25-34 years[12], and cigarette use among middle-aged adults and older declined with age. Adults aged 75 and over were less likely to smoke cigarettes or use e-cigarettes than

[9] Statistics for Wales (2017), National Survey for Wales – Population health: health-related lifestyle (adults), 2016-2017.
[10] Public Health Wales Observatory. Mortality due to Alcohol-specific and Attributable Conditions. Health Maps Wales
[11] Public Health Wales Observatory (2014), Alcohol and health in Wales 2014: Wales profile.
[12] Statistics for Wales (2018). National Survey for Wales 2017-2018. Population health – Lifestyle

adults of any other age[12].

2.3.8 The National Survey for Wales found that, in 2016/17, 19% of adults in Wales aged 16 and over identified themselves as a current smoker. The figure was slightly higher for Hywel Dda (20%) and Pembrokeshire (21%). Of local authorities across Wales, only Blaenau Gwent (22%) recorded a higher rate of smokers[13].

2.3.9 In terms of smoking-attributable hospital admissions, the rate in Hywel Dda was, in 2013-15, below the Welsh average at 1,297 per 100,000 population compared with 1,478. In Pembrokeshire, it was 1,309, above the figure for Hwyel Dda but still below average. Smoking-attributable mortality rates were also below average in both Hywel Dda and Pembrokeshire, at 257 and 250 per 100,000 population respectively compared with 290 for Wales[14].

2.3.10 There is an association between higher rates of smoking and factors such as age, socio-economic group, deprivation, housing and education. Smoking rates tend to be greatest in the most deprived areas of Wales and caused around one third of the inequality in mortality between the least and most deprived areas. Rates of deaths from smoking are falling in part due to increasing restrictions on smoking; however, socio-economic inequalities are increasing due to faster reductions in the least deprived areas, compared to the most deprived.

Obesity and physical activity

2.3.11 Being overweight (with a body mass index of 25–30) or obese (with a body mass index greater than 30) increases the risk of a range of adverse health outcomes including cardiovascular disease, diabetes, and hypertension.

2.3.12 The National Survey for Wales collects data regarding levels of physical activity and obesity throughout Wales. Data for 2018/19 indicates that, in Wales overall, 59% of adults aged 16 and over are classed as overweight, with 23% classed as obese. 53% of people reported that they met the recommended exercise guidelines (a minimum of 150 active minutes per week), with 33% reporting that they were active for less than 30 minutes per week. Only 24% reported that they ate the recommended five portions of fruit and vegetables per

[13] Statistics for Wales (2017), National Survey for Wales – Population health: health-related lifestyle (adults), 2016-2017.
[14] Public Health Wales Observatory (2017), Smoking-attributable mortality and hospital admissions.

day[15].

2.3.13 In Hywel Dda, the proportion of adults who are overweight and obese is in line with the Welsh average. In Pembrokeshire, however, it is above average, with 63% of adults classed as overweight, including 23% who are classed as obese. A higher than average proportion of adults in both Pembrokeshire (63%) and Hwyel Dda (62%) meet the recommended level of physical activity, and the proportion of adults who are active for less than 30 minutes per week is below average in both areas. In Pembrokeshire, 31% of adults reported that they ate the recommended five portions of fruit and vegetables per day, above the national average[16].

Crime and antisocial behaviour

2.3.14 Crime and the perception of high crime rates can have an influence on mental health and well-being.

2.3.15 Pembrokeshire is covered by the Dyfed Powys police force area. Statistics from Her Majesty's Inspector of Constabulary and Fire and Rescue Services (HMICFRS) crime and policing comparator show that, in 2014, there were 36 crimes per 1,000 people in Dyfed Powys, considerably lower than the average for England and Wales (62 crimes per 1,000 population)[17].

2.3.16 Crime rates in 2014 were lower in Dyfed Powys than the national average for all categories of crime, with the exception of drugs offences and antisocial behaviour. The rate of drug offences was 6 crimes per 1,000 population compared with 3 per 1,000 population for Wales, and there were 50 incidences of antisocial behaviour per 1,000 population compared with 48 for Wales.

Community and health profile summary

2.3.17 The Scheme is located in a rural area with low population density, and lower than average rates of ethnic and religious diversity. Pembrokeshire has an older population than the Welsh average, with higher proportions of residents in groups aged 50 and over, and smaller proportions of residents in younger age groups. This is reflected in a

[15] Statistics for Wales (2019), National Survey for Wales – Population health: health-related lifestyle (adults), 2016-2017.
[16] Statistics for Wales (2017), National Survey for Wales – Population health: health-related lifestyle (adults), 2016-2017.
[17] HMICFRS (2015), Crime and Policing Comparator data, December 2011/12/13/14.

higher than average proportion of residents who are retired.

2.3.18 Unemployment is low, and the workforce is relatively highly skilled, particularly in the local study area where the proportion of working-age residents with a degree-level qualification is above the national average. The largest sector for employment is administration, education and health; and distribution, hotels and restaurants. This is in line with the pattern for Wales, although the proportion working in distribution, hotels and restaurants is higher than the Welsh average, reflecting the importance of the tourism industry to the local economy. Deprivation in Pembrokeshire is low with pockets of higher deprivation in urban areas including Pembroke, Pembroke Dock, Milford Haven and Haverfordwest.

2.3.19 Health deprivation is also low across the study area, with some pockets of higher deprivation. Life expectancy in Pembrokeshire is above the average for Wales, and mortality rates – including from cancer, respiratory and cardiovascular diseases – are lower than average. There are higher than average levels of alcohol consumption and smoking. The proportion of adults who are overweight or obese is slightly higher than average, although a higher than average proportion of adults meet the recommended level of physical activity. Crime is generally low, with the exception of antisocial behaviour and drugs offences where there are higher rates than the figures for England and Wales.

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 18.1 Carbon Assessment Assumptions

A40PRC-ARP-EGN-SWI-RP-LE-0002

P03 | S3

25/03/20

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Category	Element	Material	Category	Assumptions
Pavements	Sub-base - Mainline	Sub-base type 1 unbound mixture: in carriageway, hardshoulder and hardstrip	Pavement	1. Assume the subbase type 1 is equivalent to natural aggregate, 2. Assume the density of subbase type 1 is 2000 Kg/M3
Pavements	Sub-base - B4313 Overbridge	Sub-base type 1 unbound mixture: in carriageway, hardshoulder and hardstrip	Pavement	1. Assume the subbase type 1 is equivalent to natural aggregate, 2. Assume the density of subbase type 1 is 2000 Kg/M3
Pavements	Sub-base - Westbound link to mainline	Sub-base type 1 unbound mixture: in carriageway, hardshoulder and hardstrip	Pavement	1. Assume the subbase type 1 is equivalent to natural aggregate, 2. Assume the density of subbase type 1 is 2000 Kg/M3
Pavements	Sub-base - Tie-in to B4313 Overbridge	Sub-base type 1 unbound mixture: in carriageway, hardshoulder and hardstrip	Pavement	1. Assume the subbase type 1 is equivalent to natural aggregate, 2. Assume the density of subbase type 1 is 2000 Kg/M3
Pavements	Sub-base - Tie-in to Penblewin roundabout	Sub-base type 1 unbound mixture: in carriageway, hardshoulder and hardstrip	Pavement	1. Assume the subbase type 1 is equivalent to natural aggregate, 2. Assume the density of subbase type 1 is 2000 Kg/M3
Pavements	Base - Mainline	Dense bitumen macadam (DBM50): In carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam ahas the same carbon factor as Asphalt, 6% binder content
Pavements	Base - B4313 Overbridge	Dense bitumen macadam (DBM50): In carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam ahas the same carbon factor as Asphalt, 6% binder content
Pavements	Base - Westbound link to mainline	Dense bitumen macadam (DBM50): In carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam ahas the same carbon factor as Asphalt, 6% binder content

Category	Element	Material	Category	Assumptions
Pavements	Base - Tie-in to B4313 Overbridge	Dense bitumen macadam (DBM50): In carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam has the same carbon factor as Asphalt, 6% binder content
Pavements	Base - Tie in to Penblewin roundabout	Dense bitumen macadam (DBM50): In carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam has the same carbon factor as Asphalt, 6% binder content
Pavements	Binder course - Mainline	Dense bitumen macadam (DBM50) in carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam has the same carbon factor as Asphalt, 6% binder content
Pavements	Binder course - B4313 Overbridge	Dense bitumen macadam (DBM50) in carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam has the same carbon factor as Asphalt, 6% binder content
Pavements	Binder course - Westbound link to mainline	Dense bitumen macadam (DBM50) in carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam has the same carbon factor as Asphalt, 6% binder content
Pavements	Binder course - Tie-in to B4313 Overbridge	Dense bitumen macadam (DBM50) in carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam has the same carbon factor as Asphalt, 6% binder content
Pavements	Binder course - Tie in to Penblewin roundabout	Dense bitumen macadam (DBM50) in carriageway hardshoulder and hardstrip	Pavement	1. Assume the density of dense bitumen macadam is 2300 Kg/m3 2. Assume the dense bitumen macadam has the same carbon factor as Asphalt, 6% binder content
Pavements	Surface course - Mainline	Close graded macadam - Thin - in carriageway, hardshoulder and hardstrip 10mm agg. 60PSV	Pavement	1. Assume the density of close bitumen macadam is 2300 Kg/m3 2. Assume that close graded macadam

Category	Element	Material	Category	Assumptions
				has the same carbon factor as Asphalt, 7% binder content
Pavements	Surface course - B4313 Overbridge	Close graded macadam - Thin - in carriageway, hardshoulder and hardstrip 10mm agg. 60PSV	Pavement	1. Assume the density of close bitumen macadam is 2300 Kg/m3 2. Assume that close graded macadam has the same carbon factor as Asphalt, 7% binder content
Pavements	Surface course - Westbound link to mainline	Close graded macadam - Thin - in carriageway, hardshoulder and hardstrip 10mm agg. 60PSV	Pavement	1. Assume the density of close bitumen macadam is 2300 Kg/m3 2. Assume that close graded macadam has the same carbon factor as Asphalt, 7% binder content
Pavements	Surface course - Tie-in to B4313 Overbridge	Close graded macadam - Thin - in carriageway, hardshoulder and hardstrip 10mm agg. 60PSV	Pavement	1. Assume the density of close bitumen macadam is 2300 Kg/m3 2. Assume that close graded macadam has the same carbon factor as Asphalt, 7% binder content
Pavements	Surface course - Tie-in to Penblewin roundabout	Close graded macadam - Thin - in carriageway, hardshoulder and hardstrip 10mm agg. 60PSV	Pavement	1. Assume the density of close bitumen macadam is 2300 Kg/m3 2. Assume that close graded macadam has the same carbon factor as Asphalt, 7% binder content
Barrier	Non-Central reserve	Road restraint system/safety barrier	Barrier/Fencing	1. Assume Steel RRS barrier, single sided -Carbon factor taken directly from the ICE V3: Steel > Hot dip galvanised Steel. Weight of barrier taken from supplier, including W3 beam, bolts and a 2m post spacing.
Materials	Kerbs - HB2	Precast Concrete	Barrier/Fencing	Carbon factor taken directly from the ICE V3: Concrete > Precast concrete paving (Blocks, Slabs, Channels and Kerbs). Dimensions of kerbs taken from supplier.

Category	Element	Material	Category	Assumptions
Materials	Fencing - Timber	Timber	Barrier/Fencing	Carbon factor taken from the ICE V3: Timber > Softwood no carbon storage. Alternative ICE carbon factors are presented for sustainable timber which may be used where a chain of custody of timber provides sufficient justification. Weight of fencing material per metre taken as an average from Specification for Highways Works - Volume 3 H series drawings 3 and 4 rail fencing with a calculated weight of 14.3kg per metre. Fittings and small miscellaneous items have been omitted due their relatively small contribution to the overall carbon emissions associated with fencing.
Materials	Structures	Concrete	Bridge	Factor for bridge taken from – "An environmental comparison of bridge forms," D.Collings (2006) – Proceedings of the Institution of Civil Engineers – Bridge engineering, 159. Bridge type used - girder/arch Average - 2457+4005/2 = 3231kgCo2e/m2
Materials	Drainage - manholes	Concrete	Drainage	Assume 900mm diameter, up to 3m depth
Materials	Drainage - gullies - pipework	Plastic	Drainage	Assume 100mm diameter
Maintenance	Pavement		Pavement	Assume surface course is replaced every 10 years of design life

Welsh Government

A40 Penblewin to Redstone Cross Improvements

ES Appendix 18.2 Climate Change Resiliance Assessment

A40PRC-ARP-EGN-SWI-RP-LE-0004

P02 | S3

10/02/20

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Climate change risk assessment

Project A40 - Penblewin to Redstone Cross Improvements

Time - frames 2020-2099

Risk ID	Climate hazard	Trend or Likelihood of Climate Hazard	Potential Climate Change Impact	Potential Climate Change Risk to Scheme	Construction/Operation Stage	Asset type	Existing or embedded mitigation measure	Result of mitigation measure on resilience	Hazard Impact		Risk rating	Proposed additional resilience measure (only if Risk Rating = Significant	Reference documenting relevant mitigation
									Likelihood	Consequence			
1	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increased number of hot days may increase impact to staff	Increased heat stress for staff, particularly for outdoor construction and maintenance workers.	Construction and Operation	H&S	To be incorporated within proposed maintenance regimes. These can be reviewed regularly to ensure H&S requirements within Welsh Government are met	Resilience achieved through monitoring and maintenance of asset	Low	Minor Adverse	NS		
2	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increased number of hot days may cause thermal expansion.	Increased risk of thermal expansion joints being pushed beyond their design capability, presenting a direct risk of damage to structures and assets (e.g. concrete joints).	Operation	Structures	This risk will be managed through the selection of suitable expansion joint material as well as through the proposed maintenance regimes for road surface.	Resilience achieved through monitoring and maintenance of asset	Very Low	Large Adverse	NS		The need to increase design temperature ranges for bridge expansion joints to be further explored
3	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increased number of hot days may lead to shrinkage of soil and drying out of vegetation.	Extended periods of hot, dry weather may lead to a risk of spontaneous grassland fires in vicinity of the route, affecting safety on the road.	Operation	Road Surface	Risk to be sufficiently mitigated through standard emergency procedures	Resilience achieved through standard measures already in place	Low	Moderate Adverse	NS		
4	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increase in number of hot days may impact the road surface increasing the danger to road users.	Asphalt surface may exhibit permanent deformation in long periods of hot, sunny conditions.	Operation	Road Surface	This risk will be managed through the selection of suitable road surface material as well as through the proposed maintenance regimes for road surface.	Resilience achieved through design and maintenance	High	Minor Adverse	NS		Potential to use asphalt with different specifications relating to temperature may be explored
5	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increase in number of hot days may impact the road surface increasing the danger to road users.	High temperatures increase the risk of surfacing rutting leading to water ponding in the ruts. Higher temperatures also increase the risk of reduced skid resistance due to fatting and chipping embedment. This increase the risk of vehicle accidents.	Operation	Road Surface	This risk will be managed through the selection of suitable road surface material as well as through the proposed maintenance regimes for road surface.	Resilience achieved through design and maintenance	Low	Large Adverse	NS		
6	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increased number of hot days may impact the bitumen binder hardening rate.	Inability to flex under traffic loads. Increased risk of road surface cracking and fretting with age.	Operation	Road Surface	This risk will be managed through the proposed maintenance regimes.	Resilience achieved through maintenance of the asset	Medium	Minor Adverse	NS		
7	High temperatures	Mean and maximum temperatures in winter and summer projected to	Increased number of hot days may impact the bitumen binder	Risk of being unable to lay road surface layers in hot weather.	Construction	Road Surface	Risk to be mitigated by following procedures detailed in the outline EMP	Resilience achieved through management plan monitoring environmental impacts	Low	Minor Adverse	NS		

		increase significantly	hardening rate.										
8	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increased impact of diesel spills.	Decreased viscosity in head leads to greater spreading of diesel in a smaller timeframe. Higher temperatures and increased number of hot, dry days increase the likelihood of ignition of this diesel leading to road and forest fires.	Operation	Road Surface	Risk to be sufficiently mitigated through proposed maintenance procedures	Resilience achieved through maintenance of the asset	Low	Large Adverse	NS		
9	High temperatures	Mean and maximum temperatures in winter and summer projected to increase significantly	Increased summer temperatures may impact on performance of electrical equipment.	Reduced efficiency and lifespan of LED luminaires.	Operation	Electrical Equipment	The impacts associated with increased ambient temperature to be absorbed within current maintenance procedures. Design life 100,000hours (~25 years).	Resilience already accounted for.	Medium	Minor Adverse	NS		
10	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Flooding of road surface.	Operation	Drainage	Attenuation ponds designed for 1/100 year event +20% for climate change (check performed for 40% increase) Climate change allowance in critical drainage areas increased to +40%	Resilience achieved through design	Very Low	Large Adverse	NS		
11	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Flooding of access roads and/or road infrastructure.	Operation	Drainage	Attenuation ponds designed for 1/100 year event +20% for climate change (check performed for 40% increase) Climate change allowance in critical drainage areas increased to +40%	Resilience achieved through design	Very Low	Large Adverse	NS		
12	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Increase risk of sewage overflow in floodwater causing damage and impacting health of maintenance workers.	Operation	Drainage	Attenuation ponds designed for 1/100 year event +20% for climate change (check performed for 40% increase) Climate change allowance in critical drainage areas increased to +40%	Resilience achieved through design	Very Low	Moderate Adverse	NS		
13	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Increased risk of scouring of culverts.	Operation	Drainage	Attenuation ponds designed for 1/100 year event +20% for climate change (check performed for 40% increase) Climate change allowance in critical drainage areas increased to +40%	Resilience achieved through design	Low	Minor Adverse	NS		
14	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Flooding causing damage to fibre optic cables running near to site.	Operation	Drainage	Attenuation ponds designed for 1/100 year event +20% for climate change (check performed for 40% increase) Climate change allowance in critical drainage areas increased to +40%	Resilience achieved through design	Very Low	Negligible	NS		

15	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Increased pore water pressure in embankments/cuttings.	Construction and Operation	Earthworks	To be mitigated through drainage design Risk likely to be absorbed by conservative assumptions made during design	Resilience achieved through design	Very Low	Very Large Adverse	NS		
16	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Increased erosion at toe of embankment.	Operation	Earthworks	To be mitigated through drainage design Risk likely to be absorbed by conservative assumptions made during design	Resilience achieved through design	Low	Large Adverse	NS		
17	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Water ingress to critical construction equipment.	Construction	Drainage	Drainage on site to be suitably managed, as specified within the outline EMP	Resilience achieved through management plan monitoring environmental impacts	Very Low	Minor Adverse	NS		
18	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Water ingress to signalling, lighting and other operational electrical equipment.	Operation	Electrical Equipment	Water tight cables housed in plastic ducts. No water ingress to underground cables.	Resilience achieved through design	Very Low	Minor Adverse	NS		
19	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Change in ground water level affecting earth pressures and foundation settlement causing possible large ground movement.	Operation	Drainage	To be mitigated through drainage design Risk likely to be absorbed by conservative assumptions made during design	Resilience achieved through design	Very Low	Very Large Adverse	NS		
20	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Increased risk of debris deposit from water seeping up to the surface through the pavement e.g. calcium sulphate leading to reduced skid resistance.	Operation	Road Surface	Weather and weather effects on traffic considered within pavement design	Resilience achieved through design	Low	Moderate Adverse	NS		
21	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Construction site flooding during construction phase, excavations flooded and site roads impassable. Safety risk of slips, trips and falls to construction workers.	Construction	Drainage	Drainage on site to be suitably managed, as specified within the outline EMP. H&S procedures to be further specified within the outline EMP	Resilience achieved through management plan monitoring environmental impacts	Low	Moderate Adverse	NS		
22	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased risk of flooding from river/streams, surface and groundwater sources.	Increased ground water level in winter may lead to flooding of underpasses.	Operation	Drainage	To be mitigated through drainage design	Resilience achieved through design	Low	Minor Adverse	NS		
23	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased soil moisture levels.	Increased risk of earthworks failure and landslides. Exacerbated by variance between high and low precipitation events and soil moisture levels. (The mark against noise barriers assumes that they are in the form of bunds).	Construction and Operation	Earthworks	To be mitigated through geotechnical and drainage design Risk likely to be absorbed by conservative assumptions made during design	Resilience achieved through design	Low	High	NS		
24	High precipitation	+5% (2020s) & +23% (2080s) in winter	Increase likelihood of debris and sediment run-off.	Reduced capacity of attenuation ponds due to sediment build-up.	Operation	Drainage	Risk to be mitigated through the monitoring and maintenance procedures specified	Resilience achieved through monitoring and	Medium	Minor Adverse	NS		

		precipitation rate.					for the relevant attenuation ponds.	maintenance of asset					
25	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increase likelihood of debris and sediment run-off.	Increased risk of debris washing into drainage gulleys, blocking them. A blockage may result in flooding and resulting effects.	Operation	Drainage	Mitigated through drainage design and monitoring and maintenance procedures proposed for drainage systems	Resilience achieved through design and monitoring and maintenance of asset	Low	Large Adverse	NS		
26	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increase in number of wet days may impact the damage to road surface	Increase stripping rate of the road surfaces	Operation	Road Surface	This risk will be managed through the proposed maintenance regimes for road surface.	Resilience achieved through maintenance	Low	Minor Adverse	NS		
27	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increase in number of wet days may impact the damage to road surface	Wetter surface may lead to reduced skid resistance	Operation	Road Surface	This risk will be managed through the selection of suitable road surface material as well as through the proposed maintenance regimes for road surface.	Resilience achieved through design and monitoring and maintenance of asset	Low	Large Adverse	NS		
28	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increase in number of wet days may impact the damage to road surface	Increased likelihood of potholing, rutting and cracking from moisture entering and remaining in road surfaces.	Operation	Road Surface	This risk will be managed through the proposed maintenance regimes for road surface.	Resilience achieved through maintenance	High	Minor Adverse	NS		
29	High precipitation	+5% (2020s) & +23% (2080s) in winter precipitation rate.	Increased flow of groundwater	Increased flow of groundwater causing accelerated weathering effects, weakening the embankment	Operation	Earthworks	Risk likely to be absorbed by conservative assumptions made during design	Resilience achieved through design	Very Low	Large Adverse	NS		
30	Low precipitation	-6% (2020s) and -37% (2080s) in summer precipitation rate.	Increased risk of soil shrinkage around foundations of structures.	Potential risk of soil shrinkage impacting foundations, including signal gantries, lighting pylons, bridges, other structures. Possible ground movement (check differential settlement due to different types of foundations)	Operation	Earthworks	Risk likely to be absorbed by conservative assumptions made during design	Resilience achieved through design	Very Low	Large Adverse	NS		
31	Low precipitation	-6% (2020s) and -37% (2080s) in summer precipitation rate.	Dry weather for extended periods of time could lead to increased desiccation of soils.	Reduced slope stability and potential earthworks failure during or immediately after summer storm events falling on desiccated soils. (The mark against noise barriers assumes that they are in the form of bunds).	Construction and Operation	Earthworks	Risk likely to be absorbed by conservative assumptions made during design	Resilience achieved through design	Low	Very Large Adverse	NS		
32	Low precipitation	-6% (2020s) and -37% (2080s) in summer precipitation rate.	Dry weather for extended periods of time could lead to increased desiccation of soils.	Earthing and thermal/electrical conductivity issues for high voltage or dynamically loaded cables - in typical ground conditions (i.e. near surface geology and subsoil), ground resistance and electrical and thermal conductivity of earthing arrays and high voltage cables are controlled by a range of factors including the presence of moisture (% water saturation) and temperature. As ground moisture decreases, conductivity also decreases and ground 'resistance' therefore increases.	Operation	Earthworks	High voltage cables largely overhead - suspended on pylon.	Resilience achieved through current methods in place.	Very Low	Minor Adverse	NS		

33	Low precipitation	-6% (2020s) and -37% (2080s) in summer precipitation rate.	Reduced inflow into attenuation ponds.	Anaerobic conditions may occur, risking die back of sediment collecting species, reducing attenuation pools functional capacity.	Operation	Drainage	Risk to be mitigated through the monitoring and maintenance procedures specified for the relevant attenuation ponds.	Resilience achieved through monitoring and maintenance of asset	Medium	Minor Adverse	NS		

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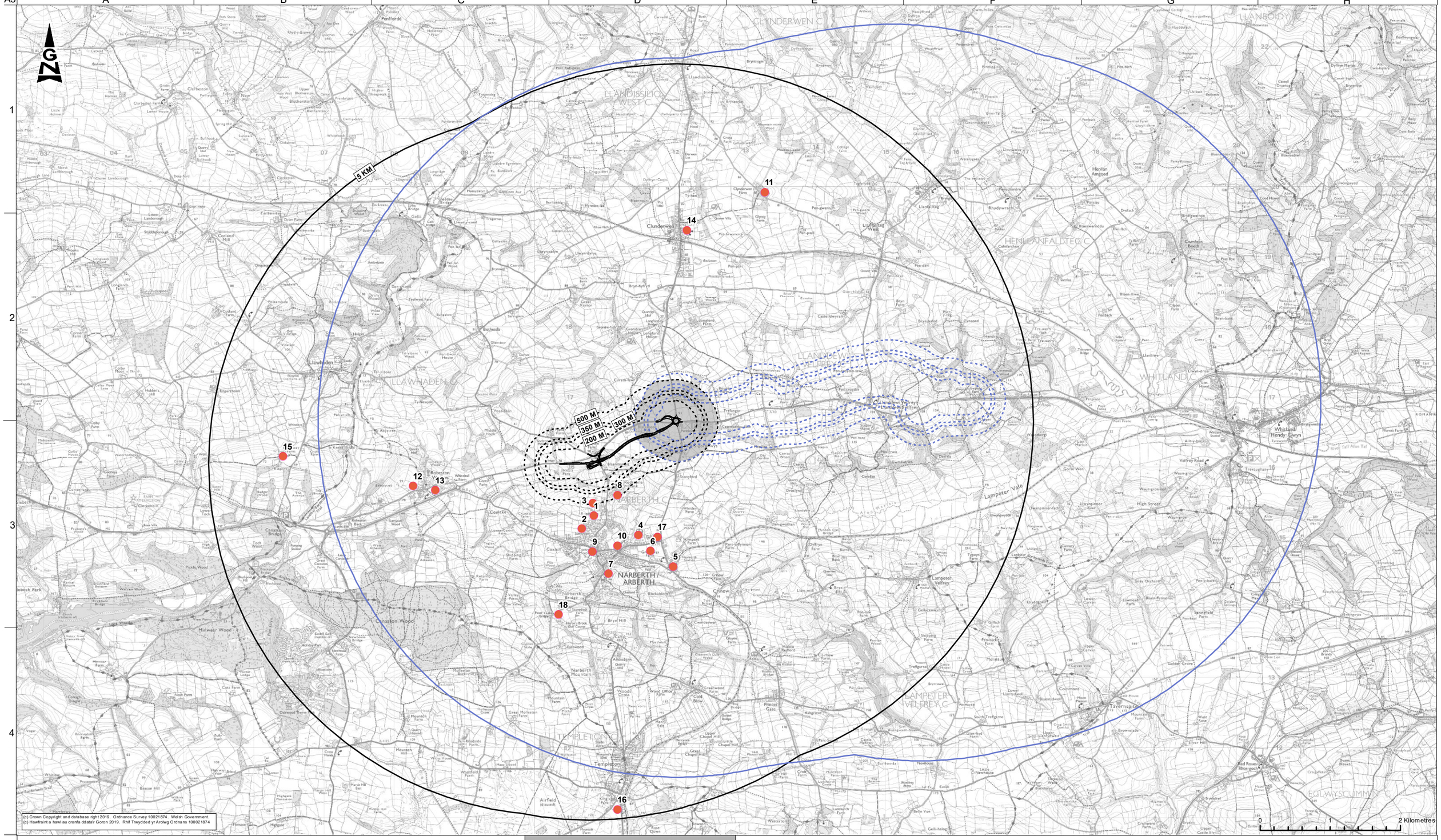


LEGEND

- MATRIX 1 SITES
- PROPOSED ALIGNMENT
- ZONES OF INFLUENCE (PRC SCHEME)
- ZONES OF INFLUENCE (LVP SCHEME)
- ZONES OF INFLUENCE OVERLAP BETWEEN TWO SCHEMES

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log)

Construction
None
Maintenance / Cleaning
None
Use
None
Decommissioning / Demolition
None

Rev.	Date	Description	By	Chkd	Appd	Auth
P01	23/06/20	FIRST ISSUE	AC	GJ	RC	GD

Project Title
A40 PENBLEWIN TO REDSTONE CROSS IMPROVEMENTS

Client
Llywodraeth Cymru
Welsh Government

Delivery Team
ARUP
ARCADIS
MOTT MACDONALD
RICHARDS

Drawing Title
FIGURE 19.1
ASSESSMENT OF CUMULATIVE EFFECTS

Suitability
S4 | SUITABLE FOR STAGE APPROVAL

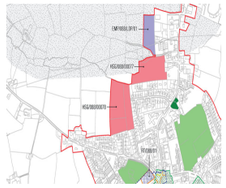
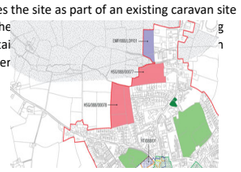
Scale at A3 1:50,000

Rev	By	Chkd	Appd	Auth
P01	AC	GJ	RC	GD
	Date 23/06/20	Date 23/06/20	Date 23/06/20	Date 23/06/20

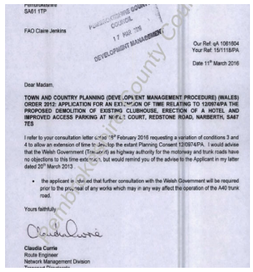
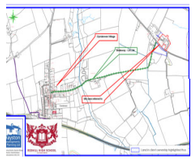
Name
A40PRC - ARP - EGN - SWI - DR - G - 0001
Project | Originator | Volume | Location | Type | Role | Number

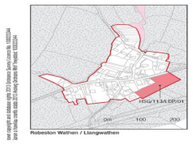
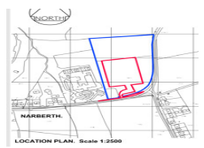
POTENTIAL MATRIX 1 SITES FOR PENBLEWIN SCHEME DRAFT

MATRIX 1 - IDENTIFICATION OF 'OTHER DEVELOPMENT ' FOR CEA A40 FOR PLANNING APPLICATIONS AND ALLOCATED SITES - AS AT JANUARY 2020

OTHER DEVELOPMENT' DETAILS						STAGE 1		STAGE 2				
SITE ID MAP REFERENCE	APPLICATION REFERENCE	BRIEF DESCRIPTION OF LOCATION	Grid Reference	Approximate Distance and direction from Scheme (Km)	Identify any related EIA SUBMISION	STATUS	TIER LEVEL (1-3 HIGHEST 1,LOWEST 3.)	WITHIN SPECIIFC /ALL ZONES OF INFLUENCE	PROGRESS TO STAGE 2?	Overlap in temporal scope	Is there potential to effect the same receptors	Other factors	Progress to Stage 3
1*	LDP allocation and planning permission for residential use; with supplementary guidance published.	**Land adjacent to Rushacre Farm, Narberth**. Pembrokeshire Council SPGuidance describes the site: bordered by mature hedgebank and trees, some of which have TPO's, bounded by residential estates to the south and east, employment land to the northeast.	E. 210842 N. 215314	0.800 south - nearest point, westerly end of Scheme.		LDP allocation for residential use (HSG/088/LDP/00077.Full Planning permission (code 09/0419/PA) granted March 2014 for 54 dwelllings, defined as ' major'. JHLS November 2019 confirms 1 u/c and 54 units remaining for completion in 5 years category. Pembrokeshire Council SPG highlights accees via Bloomfield Gardens only and SWTRA should be consulted prior to the submission of an application for potentail impacts at Redstone Cross (junction 40 with the Redstone Road). Also, reference to 25dph in planning appliction ref 18/0847/DC 19-Feb-2019. Part Refused/Part Approved. Discharge of conditions 2 (external materials), 4 (construction details of access link), 6 (construction phase	Level 1	Landscape; Nature Conservation.	y	Commencement of permission means time scale and impacts could occur, together with that of site 2.	Y	Construction traffic and assocaited env'l cumulative impacts	✓
2*	LDP allocation for residential use, with supplementary guidance.	**West of Bloomfield Garden, Narberth** 	E. 210668. N. 215128	0.900 south	Negative EIA SCREENING OPINION	LDP allocation for residential use -HSG/088/LDP/00078 .Currently, without the benefit of planning permission. JHLS November 2019 confirms 89 units remaining for completion in 5 years category. The Pembrokeshire Council site guidance highlights 3.58 ha site, slopes gently south to north, with some TPO's; traffic will affect a Trunck Road - Redstone Cross on A40; split access to Bloomfield Gardens ans Adams Drive but with no vehicular link through the site; SWTRA should be consulted prior to the submission of an appliaction;review imapct on Redstone Cross. Previous planning permisions include; for one half of the site, code 13/0588/PA, section 73 to vary conditions 3 & 4 of 06/0938/PA- for submission of reserved matters and commencement - approved 27/05/2016 with a **negative EIA Screening Opinion.** Outline originally approved 06/0938/PA. 	Level 1, on basis of prevvious permission and allocation, and adjacent to site 1..	Landscape; Nature Conservation.	Y	JHLS timeline, and numbers, together with site 1, indicates a potentail significant change..	y,if all developed together, within the Scheme planned timetable	Construction traffic and assocaited env'l cumulative impacts	✓
3*	Local Development Plan site allocation for **employment use**, with adopted site details, and part planning permission.	**Rushacre Enterprise Park, Narberth.** 	**E. 210827. N. 215495.**	0.600 south		LDP site allocation for employment use -EMP/088/LDP/01,Several planning applications: 12/0721/PA – extension to existing enterprise park – conditionally approved 01/05/13 16/0273/PA – variation of conditions 3 (to extend the timeframe for the submission of reserved matters) and 6 (to allow the northern plots to be developed) – relating to 12/0721/PA – conditionally approved 23/08/16 16/0733/PA – reserved matters (access) relating to 16/0273/PA – conditionally approved 20/12/16 16/0745/PA – B8 delivery office with associated access, car parking, operational yard and landscaping – conditionally approved 13/01/17 17/0262/NM – non-material amendment to 16/0745/PA – unconditionally approved 11/07/17 17/0517/PA – discharge of conditions 6 and 7 of 16/0745/PA – cancelled 29/08/17 Non - material amendment for 16/0745/PA approved 22/05/2018 code 16/0056/NM - which included the discharge of condition 6 attached to the original permission. Work commenced on site access, but no other development at present. Pembrokes[illegible]confirms traffic will affect the A40 Trunk Road and SWTRA should be consulted [illegible]e Road/A40 Junction and the local Highway Authority regarding impacts on the local  **18/0767/PA issued** [illegible] of a B2 building with the accompnying LPA report confirming the construction of a [illegible]rth of the site. The County Highways confirmed that *the* ***main access road into this*** [illegible]***plete, as it had to be for the newly opened Royal Mail depot*** . *The access is onto a* [illegible] *available opposite; and the layout for the vehicle workshops and parking within the security fencing of the plot appear satisfactory* .	Level 1 - despite limited part of the site developed.	Landscape; Nature Conservation; lies closely within 500 m ZOI.	Yes, but of limited temporal impact only.	Yes, but of limited l impact only.	Y	construction traffic and assocaited env'l cumulative impacts	✓
4*	Residential planning permission.	**Dingle Caravan Park, Jesse Road, Narberth**. LPA describes the site as part of an existing caravan site within the [illegible]g residentai [illegible]n access ser  	**E.211473. N. 215036.**	1.5KM south east		15/0060/PA issued 17-Feb-2016 for Major (Res Mttrs)Residential Development (33 units) with play area - application 08/0098/PA Proposal includes children's play space. JHLA 2019 confirms 33 units identified within 5 year category. Commencement of development confirmed 27/04/2018 under code 17/1173/CL .http://planning.pembrokeshire.gov.uk/AnitePublicDocs/00317195.pdfNM approved 04/09/2018	Level 1	Landscape; Nature Conservation.	Yes - in view of commencement and scale	yes, but limited, primarly on basis of site location.		construction traffic and assocaited env'l cumulative impacts	✓

OTHER DEVELOPMENT' DETAILS							STAGE 1	STAGE 2				
SITE ID MAP REFERENCE	APPLICATION REFERENCE	BRIEF DESCRIPTION OF LOCATION	Grid Reference	Approximate Distance and direction from Scheme (Km)	Identify any related EIA SUBMISION	STATUS	TIER LEVEL (1-3 HIGHEST 1,LOWEST 3.)	WITHIN SPECIIFC /ALL ZONES OF INFLUENCE	PROGRESS TO STAGE 2?	Overlap in temporal scope	Is there potential to effect the same receptors	Other factors	Progress to Stage 3
5	Planning permissions for residential.	**Land north west of Greenhill, Station Road, Narberth** 	**E. 211968. N. 214587.**	2.20km		Outline residential planning permission originally granted in 2015 (MAJOR) under code 13/0889/PA, with variations approved for planning conditions in May 2017, reference 16/1269/PA . Further amendments approved In June 2017, 17/0170/NM; Reserved matters refused in July 2017, 17/0129/PA. Planning application for reserved matters 17/0680/PA approved May 2017 , with further amendments and approvals issued. Non material amendments issued 19 October 2018, code 18/0732/NM; LPA report on17/0680 states **EIA negative decision i**ssued in 2014. JHLS 2019 confirms 6 units to be completed within next year (2020) and 13 units remaining for completion within 5 years category.	Level 1	Landscape; Nature Conservation.	No	Marginal	No	Commencement date and construction traffic will be controlled	x
6*	Residential planning permission	**Land off Jesse Road and Station Road, Narberth** 	**E.211648. N. 214812.**	1.6km south east	Negative EIA SCREENING OPINION	Outline residential planning permision approved in 2014 (12/0316/PA), with a **negative EIA Screening Opinio**n. Revisions to condiitons approved in 2016, code number 15/1044/PA. Reserved matters approved on the 11 September 2017 for **104 dwellings** (code 16/1242/PA), together with other works, including access. Discharge of conditions (code 17/0612/DC) Construction Traffic Management Plan (CTMP)) of Planning Permission 12/0316/PA. part approved/refused 1 November 2017. Planning permission code 16/1260/PA approved on 3 July 2017 for off site drainage works. Amended proposal for plot 99 submitted code 19/0434/PA as a Variation of condition 1 of outline planning permission ref. 15/1044/PA to allow a minor amendment to the approved plans (condition 1 of supplemental Reserved Matters Consent ref. 16/1242/PA that defines the approved plans).HLS 2019 confirms construction of a number of units, with 9 identified for the next year and remaining 63 units for completion in 5 years category.	Level 1 - 2019 imagery confirms commenced works for the site.	Landscape; Nature Conservation.	yes	Overlap in temporal scope and changes/additions to number of receptors in this locality.	Yes construction traffic and assocaited env'l cumulative impacts	Construction traffic and assocaited env'l cumulative impacts	✓
7	Residential planning permission	**Site south of Victoria Close, Narberth** 	**E.211048. N. 214488.**	1.7 south		Erection of an apartment building for 8 units 16/0530/DC and 09/0208/PA. Currentavailable aerial imagery (07/08/2018) indiactes no change in site features	Level 1	Landscape; Nature Conservation.	No - limited small scale relative to other developlments and the main project.	This is relatively mall scale development. Some distance away from the main Scheme.			x
8*	Planning permission for leisure.	**Noble Court Holiday Park, Redstone Road, Narberth.** 	**E. 211178. N. 215610**	0.650 south west	Negative EIA SCREENING OPINION	12/0971/PA & 972/PA AND 974/PA (this is in outline only). Various leisure developments including 53 static caravans and new hotel. Variation to conditons attached to 974 approved in 2016, to allow further time for commencement of development, code 15/1118/PA. **Negative Screening opinion issued 23/02/2016. Permission conditional for three years time sc nother renewal within the timescale or details submitted - overall within 5 yea** 	Level 1	Landscape; Nature Conservation; lies closely within 500 m ZOI.	Yes	Overlap in temporal scope and permant change in receports at the site.	Yes	Occupation of additional static caravans - change in receptors and background noise . Cosntruction traffic issues with potential impliactions if developed at same time.	✓

OTHER DEVELOPMENT' DETAILS						STAGE 1		STAGE 2				
SITE ID MAP REFERENCE	APPLICATION REFERENCE	BRIEF DESCRIPTION OF LOCATION	Grid Reference	Approximate Distance and direction from Scheme (Km)	Identify any related EIA SUBMISION	STATUS	TIER LEVEL (1-3 HIGHEST 1,LOWEST 3.)	WITHIN SPECIIFC /ALL ZONES OF INFLUENCE	PROGRESS TO STAGE 2?	Overlap in temporal scope	Is there potential to effect the same receptors	Other factors	Progress to Stage 3
9*	Planning permission for mixed development	**Former Narberth CP School,Moorfield Road, Narberth.**   	**E. 210818. N. 214801**	1.30 south west		Demolition of former school buildings and erection of convenience food-store, and other developments incluidng apartments granted in 2014, 14/0724/PA.. Variation to planning condiitons approved in 2016 under code no.15/1058/PA, subject to five years commencement period, subject to details.  SA61 1TP FAO Claire Jenkins DEVELOPMENT MANAGEMENT Our Ref: ph 10618/04 Your Ref: 15/1158/PA Date 11th March 2016 Dear Madam, TOWN AND COUNTRY PLANNING (DEVELOPMENT MANAGEMENT PROCEDURE) (WALES) ORDER 2012: APPLICATION FOR AN EXTENSION OF TIME RELATING TO 12/0074/PA THE PROPOSED DEMOLITION OF EXISTING CLUBHOUSE, ERECTION OF A HOTEL AND IMPROVED ACCESS PARKING AT W.R.U. COURT, REDSTONE ROAD, NARBERTH, SA67 7ES I refer to your consultation letter dated 18th February 2016 requesting a variation of conditions 3 and 4 to allow an extension of time to January the extent Planning Consent 12/0074/PA. I would advise that the Welsh Government (Transport) as highway authority for the motorway and trunk roads have no objections to this time extension, but would remind you of the advise to the Applicant in my letter dated 20th March 2013 ... the applicant is advised that further consultation with the Welsh Government will be required prior to the carrying out of any works which may in any way affect the operation of the A40 trunk road. Yours faithfully Claudia Currie Route Engineer Network Management Division	Level 1	Landscape; Nature Conservation.	Yes	Overlap in temporal scope	Yes	change of sensitivity in receptors and additional traffic activity in town centre point.	✓
10	Planning permission for recreational purposes, Narberth	**Narberth Rugby Club.** 	**E. 211175. N. 214883**	1.2 km south east		Planning permission code 18/0204/PA granted 02/08/2018 for replacement of natural surface playing field with 3G artificail sports pitch, etc on the 2 August 2018, subject to a pre- commencement planning condition.	Level 1. But review if commencement made	Landscape; Nature Conservation.	N - limited small scale relative to other developlments and the main project.				X
11	Planning permission for change of use into secondary school, Clynderwen.	**Clynderwen House, Clunderwen, Pembrokeshire** 	**E. 213280. N. 219927**	3.63 north east		Change of use of Clynderwen House to an Independent secondary school together with siting of new science block / canteen, new toilet block and highway improvements GRANTED 04/04/2018, with pre - commencement conditions. Condition 4 details approved under code 18/088/DC on the 15/06/2018. Aerial 2019 imagery indicates possible commmencement of works?	Level 1 - but review if commencement made.	Landscape; Nature Conservation.	N - limited small scale relative to other developlments and the main project.				X
12	Planning application (Welsh Government pending 'call in' list)	**Sunnyside farm, Robeston Wathen.** 	**E. 208262. N. 215731**	1.8 km west of the easterly end of the Scheme		Planning application 13/0458/PA for the retention of an agricultural building and silage and slurry pit. Welsh Government awaiting sight of LPA report. If a refusal of planing permission, then a subsequent enforcement proceess could take place.  	Level 2, given current decision process.	Landscape; Nature Conservation.	N -based on cuurent details for the site.				x
13	LDP residential allocation	**Land adjacent to B4314, Robeston Wathen** 	**E.208576 N.215675.**	1.75 west of westerly end		LDP allocation HSG/113 ldp/01 for 14 houses with 0.63ha	Level 2	Landscape; Nature Conservation.	N -based on cuurent details for the site.				x

OTHER DEVELOPMENT' DETAILS							STAGE 1	STAGE 2				
SITE ID MAP REFERENCE	APPLICATION REFERENCE	BRIEF DESCRIPTION OF LOCATION	Grid Reference	Approximate Distance and direction from Scheme (Km)	Identify any related EIA SUBMISION	STATUS	TIER LEVEL (1-3 HIGHEST 1,LOWEST 3.)	WITHIN SPECIIFC /ALL ZONES OF INFLUENCE	PROGRESS TO STAGE 2?	Overlap in temporal scope	Is there potential to effect the same receptors	Other factors	Progress to Stage 3
14	LDP allocation for residential.	**Land south of Clynderwen & Clarbeston Farmers** 	**E. 212169. N. 219380**	3.8km to north east		LDP allocation HSG/152/ ldp/01 for 28 houses with 0.96ha. Planning permission granted 5 /0166/PA 13-Dec-2016, major appllication, outline. Expired in 2019? Planning Application Ref 18/0835/PA for outline with acccess for consideration refused 15-Mar-2019. Extract from previous approval:	Lvele 2 -outside ZOI's and limited scale of new development? .	Landscape; Nature Conservation.	N - limited small scale relative to other developlments and the main project.				x
15	Residential care permission	**Ridgeway Nursing Home** 	**E. 206409. N. 216157.**	4 km to the west		Planning permission 16/0246/PA issued on the 03-Aug-2016 for renewal of previous planning application for extensions etc to existing site, granted under code 10/0549/PA, on basis of commencement made before September 2018. 18/0685/PA permission issued 18/12/2018 for a further 5 years - 18/12/2023. 	Level 1	Landscape; Nature Conservation.	N - limited small scale relative to other developlments and the main project.				x
16	Planning permission for residential development, Templeton	**Land adjoining A478, Templeton.** 	**E. 211178. N 211127**	5 km south		Planning applicationy, major category, code 18/0461/PA for residential development for 28 dwellings and associated engineering works.	Level 1	Landscape; Nature Conservation.	N - limited small scale relative to other developlments and the main project.				x
17*	Planning permission for recreational uses.	**Land adjoining Jesse Road.** 	**E. 211746 N. 215012**	1.5 south		New sport pitches granted 8/1149/PA in 24-May-2019, a major planniing application.	Level1	Landscape; Nature Conservation.	Y	Yes construction traffic and assocaited env'l cumulative impacts	y		✓
18	Planning permission for leisure use.	Heron's Brook Golf & Fishing Retreat, Narberth. 	**E. 210339. N. 213902**	2.20 south, west end of Scheme		18/0969/PA Decision Date:18-Feb-2019 Conditionally Approved Proposed 10 New Holiday Lodges	Level 1	Landscape; Nature Conservation.	N - limited small scale relative to other developlments and the main project.				X
19*	Transport Scheme - A40 - Llanddewi Velfrey to Penblewin.					The Scheme inlcudes 4.5 km length and currently awaiting a Public Inquiry stage. See https://gov.wales/a40-llanddewi-velfrey-penblewin-overview. Project status: Planned Region/county: South west Wales Start date: summer 2021 End date: autumn 2022	Level 2 - 1 if Public Inquiry outocme recommends approval for the Scheme.	All ZOI's	y	Yes construction traffic and assocaited env'l cumulative impacts	y	Construction traffic and assocaited env'l cumulative impacts	✓
19*	Transport Scheme - A40 - Llanddewi Velfrey to Penblewin.				The Scheme inlcudes 4.5 km length and currently awaiting a Public Inquiry stage. See https://gov.wales/a40-llanddewi-velfrey-penblewin-overview. Project status: Planned Region/county: South west Wales Start date: summer 2021 End date: autumn 2022	Level 2 - 1 if Public Inquiry outocme recommends approval for the Scheme.	All ZOI's	y	Yes construction traffic and assocaited env'l cumulative impacts	y	Construction traffic and assocaited env'l cumulative impacts	✓

MATRIX 2 - A40 Penblewin Cumulative Project Analysis. Short listed site descriptions and cumulative project analysis.

Site descriptions

	Matrix Map reference & address	Development type	Additional details	Location/distance from the Scheme site	Planning status	Related project EIA details	Potential in- combination effects (cross refe to table in Chapter text).	proposed mitigation, if applicable.
1	**1.Land adjacent to Rushacre Farm, Narberth.**	residential PP on greenfield site.	This development site represents the nearest new residential area, with planning permission, to the proposed Scheme. Potential impact on A40 junction highlighted during planning application consultation and responses, with access conditional with Bloomfield Gardens via Redstone Road, B4313 - Scheme commences just under 1 km form this point. Other properties lie between the site and the Scheme - including site map reference 8- Noble Court Holiday Park (site number 6 in this list) . Sites lies between sites 2 and 3, with similar infrastructure matters covered in Pembrokeshire SPG 2015 as sites 2 &3.	with access conditional with Bloomfield Gardens via Redstone Road, B4313 - Scheme commences just **under 1 km** From this point.	LDP allocation and planning permission for residential use - total of 54 units, with commencement made.	X	The site could be partially impacted by the construction and operational stages of the Scheme. In regards to ***materials :*** Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.	
2	**2.West of Bloomfield Gardens, Narberth**	residential on green field site.	JHLS confirms 89 units within the 5 years category for completion https://www.pembrokeshire.gov.uk/local-development-plan/joint-housing-land-availability-studies .Pembrokeshire SPG2015 indicates developer contributions to Water Treatment improvements and issues regarding sewerage.	0.900 south	LDP allocation for residential use with previous planning permissions issued for part of.	X	The site could be partially impacted by the construction and operational stages of the Scheme. In regards to **materials**: Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.	
3	**3.Rushacre Enterprise Park, Narberth**	employment on greenfield site	The development site represents the first new employment site development to the north of the town and nearest the Scheme. Pembrokeshire Council SPG confirms:	0.600 south	Permission included employments with previous planning permissions issued for part of site and commencement made with the construction of an access road into the main estate.	X	The site lies close the the ZOI 500 m study area boundary limit for the Scheme receptors. The site could be partially impacted by the construction and operational stages of the Scheme In regards to **materials**: Other projects in the area may also require the import of similar materials and have waste management or disposal requirements. SPG indicates WWWater Treatment overloaded, with improvements by 2015? And potential for contamination in surrounding land uses.	
4	**4.Dingle Caravan Park, Jesse Road, Narberth.**	residential PP	Although not a significant ' scale' of development, traffic implications and completion of timescale matters, given commencement of works for the permission.	1.5KM south east	Planning permission for 33 residential units, with a commencement.	X	The site could be partially impacted by the construction and operational stages of the Scheme In regards to **materials**: Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.	
5	**6.Land off Jesse Road and Station Road, Narberth**	residential PP	Remaining 63 units to be completed in 5 year category- see 2019 JHLS.	1.6km south east	Planning permission for residential developments for 104 units and play area, with remaining 63 units for completion within 20190 - 2024 .	X	The site could be partially impacted by the construction and operational stages of the Scheme In regards to **materials**: Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.	The Scheme CEMP to include; liaising with land/developers/communities at all stages of the Scheme. The final detailed Scheme should take account of Narberth future Waste Water Treatement Works if planned and near the Scheme timetable, were they to outfall in same location; mitigation for soil and agricultural measures to be included in the CEMP, along with areas fenced off and fencing retained at all stages of the construction to minimise the disturbance of and any associated temporary land take and land returned to original condition as soon as possible for agricultural use,for existing agricultural businesses.
6	**8.Noble Court Holiday Park, Redstone Road, Narberth**	leisure PP	The development site represents the first holiday site and first development site to the north of the town and nearest the Scheme - in close proximity to sites 1-5 in this matrix. Development start is limited to further details, which could be submitted as further extensions of time, at the time of this baseline.	0.650 south west	Additional/leisure development on existing site, to include new hotel.	X	The site lies close the the ZOI 500 m study area boundary limit for the Scheme receptors. The site could be partially impacted by the construction and operational stages of the Scheme In regards to m**aterials**: Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.	
7	**9.Former Narberth CP School, Moorfield Road, Narberth.**	mixed developmentPP	LDP review paper - makes reference to PCC request for residential and mixed use scope out, which could indicate ownership remains unchanged at the time. Pembrokeshire SPG indicates possible contamination issues if buildings demolished.	1.30 south west	Town centre site with building unoccupied	X	The site could be partially impacted by the construction and operational stages of the SchemeIn regards to **materials**: Other projects in the area may also require the import of simular materals and have waste managment or ddisposal requirements.	
8	**17.Land adjoining Jesse Road, Narberth.**	recreational PP	Major developlemnt	1.5 south	Greenfield site on easterly side of the town, adjacent to new school.	X	The site could be partially impacted by the construction and operational stages of the SchemeIn regards to **materials**: Other projects in the area may also require the import of simular materals and have waste managment or ddisposal requirements.	
9	**19.Transport Scheme – Llanddewi Velfrey to Penblewin**	Welsh Government Transport Scheme	The relationship with a number of Scheme specialist ZOI's s is identified.	The current Scheme adjoins the westerly end of the Llanddewi Scheme. In effect, the Scheme represents a continuation of the Llanddewi Scheme.	Transport Scheme awaiting Public Inquiry process	The accompanying EIA covers the full range of specialist chapters as none are scoped out.	Welsh Government timetabling of start of main works construction identified for summer 2021 and completed by autumn 2022. If both Schemes are approved and to commence construction within the same time period, potential for cumulative effects exists, At the time of the preparation of the ES for the Llanddewi Velfrey Scheme the current Scheme (for this ES) was not considered of relevant development status for the purposes of the baseline methodology for 'other developments'. In regards to the **water environment**: The overlapping receptor between the assessed scheme and the Llandewi Velfri scheme is the Afon Marlais. Both schemes affect unnamed tributaries of this river. With less than 1km watercourse length between the two outfalls, a cumulative **HEWRAT assessment*** has been completed for Pond E in the proposed scheme and Pond A in the Llandewi Velfrey scheme. Including the pollutant attenuation capacities for each pond, the proposed outfalls pass the HEWRAT model cumulative assessment and it is considered there will be no risk of short or long term water quality impacts. The combination of the impact of the scheme with the Llandewi Velfrey scheme is not anticipated to result in any additional impact than the significance ratings for the individual assessments due to distance and the low significance of impacts for each element in respective assessments. In regards to the **agricultural impacts,** The Scheme involves of the order of 13.6 ha (tbc) of agricultural land from farms for construction, of which 12.8 ha (tbc) is required permanently. The cumulative impact with the 27.4 ha to be taken from farms permanently by the Llanddewi Velfry to Penblewin improvements will be a loss of 40.2 ha of mostly Subgrade 3b with some Grade 4. This would, under LA 109, be a major impact on a receptor of mostly medium, some low, sensitivity. The overall cumulative impact would thus be of moderate adverse significance. In regards to **materials**: Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.	

*** Highways England Water Risk Assessment Tool**

COLOUR KEY	DEVELOPMENT TYPE
	Residential
	Employment
	Leisure
	Mixed
	Recreational
	Transport

PEMBROKESHIRE COUNCIL JHLS 2019 DETAILS :https://www.pembrokeshire.gov.uk/local-development-plan/joint-housing-land-availability-studies

A40 ES Topic		MATRIX 2: SHORT LISTED SITES 1 Land adjacent to	2 West of Bloomfield	3 Rushacre Enterprise	4 Dingle Caravan Park,	5 Land off Jesse Road and	6 Noble Court Holiday Park,	7 Former Narberth CP School,	8 Land adjoining Jesse	9 Transport Scheme –	Reasons/Justification/Notes
6	GEOLOGY & SOILS										Assessed as no significant cumulative impact.
											Assessed as no significant cumulative impact.
											Assessed as no significant cumulative impact.
											Assessed as no significant cumulative impact.
											Assessed as no significant cumulative impact.
											Assessed as no significant cumulative impact.
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											Assessed as no significant cumulative impact.
											Assessed as no significant cumulative impact.
7	ROAD DRAINAGE & WATER ENVIRONMENT										The combination of the impact is not anticipated to result in any additional impact than the significance ratings for the individual assessments due to distance and the low significance of impacts for each element in respective assessments
											The combination of the impact is not anticipated to result in any additional impact than the significance ratings for the individual assessments due to distance and the low significance of impacts for each element in respective assessments
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											the overlapping receptor between the assessed scheme and the Llandewi Velfri scheme is the Afon Marlais. Both schemes affect unnamed tributaries of this river. With less than 1km watercourse length between the two outfalls, a cumulative HEWRAT assessment* has been completed for Pond E in the proposed scheme and Pond A in the Llandewi Velfrey scheme. Including the pollutant attenuation capacities for each pond, the proposed outfalls pass the HEWRAT model cumulative assessment and it is considered there will be no risk of short or long term water quality impacts. The combination of the impact of the scheme with the Llandewi Velfrey scheme is not anticipated to result in any additional impact than the significance ratings for the individual assessments due to distance and the low significance of impacts for each element in respective assessments.
8	NATURE CONSERVATION										Planning application form states no protected/priority species and no designated sites to be impacted by the project. No Ecology report produced; no biodiversity constraints assumed. Therefore no cumulative effects.
											No Ecology report produced for this project therefore assumed no biodiversity constraints. Therefore no cumulative effects.
											Planning application form states no protected/priority species and no designated sites to be impacted by the works. Ecological constraints report states no impacts to roosting bats, and all hedgerows to be retained. Lighting recommendations to mitigate disturbance to bats included within ecological constraints report. No cumulative effects are anticipated from this project.
											No Ecology report, therefore assume no residual effects. No cumulative effects are anticipated from this project.
											Planning application form states no protected/priority species and no designated sites to be impacted by the works. Phase 1 report concludes
							?				Following an update to the Ecological and Protected Species Survey and subsequent Noble Court Ecology Report (January 2016), it was concluded by the County Ecologist and NRW that on the basis that all works are in accordance with the Ecology Report there are no biodiversity issues of concern. No cumulative effects are anticipated from this project.
											The Ecology Report concludes that with mitigation incorporated for the loss of a single common pipistrelle day roost, this proposal will have no
											8/1149/PA - NO MATCHING APPLICATION FOUND
										X	The cumulative biodiversity effects of the scheme in combination with the the adjacent transport scheme are as follows: [Note - it is assumed the
11	COMMUNITY & PRIVATE ASSETS										Assessed as no significant cumulative impact.
											Assessed as no significant cumulative impact.
											Agricultural - Unrelated so no cumulative impact
											Agricultural - Unrelated so no cumulative impact
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											Agricultural - Unrelated so no cumulative impact
										X	The Scheme involves of the order of 13.6 ha (tbc) of agricultural land from farms for construction, of which 12.8 ha (tbc) is required permanently.

9	LANDSCAPE & VISUAL									X	In relation to potential landscape impact: IAdditional minor adverse impact.**Slight negative.** Potential visual effect**.** No additional visual impact. Neutral. In relation to potential landscape impact:Additional minor adverse impact.**Slight negative**. Potential visual effect.No additional visual impact. Neutral In relation to potential landscape impact: No change. Neutral. Potential visual effect.No additional visual impact although development may be In relation to potential landscape impact: Additional negligible adverse impact. Neutral. Potential visual effect. No additional visual impact. Neutral. In relation to potential landscape impact:Neutral. Neutral. Potential visual effect. No additional visual impact. Neutral. In relation to potential landscape impact: Additional negligible adverse impact. Neutral. Potential visual effect. No additional visual impact. Neutral. In relation to potential landscape impact: No change. Neutral. Potential visual effect. No additional visual impact. Neutral. In relation to potential landscape impact: Additional negligible adverse impact. Neutral. Potential visual effect. No additional visual impact. Neutral. In relation to potential landscape impact:. Additional minor adverse impact to LCA9 Narberth Rural.**Slight negative**. Potential visual effect. In-combination impact moderate adverse. **Moderate negative**
10	ARCHAEOLOGY & CULTURAL										Assessed as no cumulative impact. Assessed as no cumulative impact. Assessed as no cumulative impact. Assessed as no cumulative impact. Assessed as no cumulative impact. Assessed as no cumulative impact. Assessed as no cumulative impact. Assessed as no cumulative impact. This is closely associated with this Scheme and there are a number of heritage assets that are jointly impacted by both projects, although it is not the case that the impact is more significant due to the proximity of the Schemes. These assets are 39, toll road, 56 building and 64, geophysical survey enclosure. The following heritage assets are also found in the joint study area, but do not suffer a cumulative impact from both: 38, quarry, 40 farmhouse, 61 cropmark, 65 geophysical survey enclosure, 66 geophysical survey enclosure, 100 tollgate, 125 house.
12	AIR QUALITY										Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Cumulative impacts from the Penblewin to Redstone Cross Improvements and the Llanddewi Velfrey Scheme plus any cumulative traffic growth will have been included in the traffic data provided.
13	NOISE & VIBRATION										Proximity of existing sensitive receptors identified for the Scheme mentioned Proximity of existing sensitive receptors identified for the Scheme mentioned Proximity of existing sensitive receptors identified for the Scheme mentioned Proximity of existing sensitive receptors identified for the Scheme mentioned Proximity of existing sensitive receptors identified for the Scheme mentioned
14	ALL TRAVELLERS										Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact. Assessed as no significant cumulative impact.
15	MATERIALS	X	X	X	X	X	X	X	X	X	**Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.** **Other projects in the area may also require the import of similar materials and have waste management or disposal requirements.**

16	**CLIMATE CHANGE**	**x**									***The IEMA guide to assessing greenhouse gas (GHG) emissions and evaluating their significance publishes the over-arching principle: “The GHG emissions from all projects will contribute to climate change; the largest inter-related cumulative environmental effects…as such any GHG emissions or reductions from a project might be considered to be significant…” . Therefore all developments with a net increase of GHG will cause a significant cumulative impact***
			x								***The IEMA guide to assessing greenhouse gas (GHG) emissions and evaluating their significance publishes the over-arching principle: “The GHG emissions from all projects will contribute to climate change; the largest inter-related cumulative environmental effects…as such any GHG emissions or reductions from a project might be considered to be significant…” . Therefore all developments with a net increase of GHG will cause a significant cumulative impact***
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17	**POPULATION & HUMAN HEALTH**										The scheme alongside other proposed developments could potentially result in increased urbanisation of the rural setting. A small number of traffic, air quality or noise effects could result if the construction of more than one schemes coincides.
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