HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement and Additional Provision 2 Environmental Statement

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CFA7 | Colne Valley

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CFA14 | Newton Purcell to Brackley

CFA15 | Greatworth to Lower Boddington

July 2015

SES and AP2 ES 3.5.5.2

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Volume 5: Technical Appendices

CFA7 to 15: Supplementary Ecological Baseline Data

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1 Introduction

1.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES). It details supplementary ecological baseline data collected since the main ES published in November 2013 (the main ES) for the following ecological aspects and species:

ancient woodland;

amphibians;

bats;

hazel dormouse;

otter; and

white clawed crayfish.

1.1.2 The ecological baseline data detailed within this document relates to community forum areas (CFA):

CFA7: Colne Valley;

CFA8: The Chalfonts and Amersham;

CFA9: Central Chilterns;

CFA10: Dunsmore, Wendover and Halton;

CFA11: Stoke Mandeville and Aylesbury;

CFA12: Waddesdon and Quainton;

CFA13: Calvert, Steeple Claydon, Twyford and Chetwode;

CFA14: Newton Purcell to Brackley; and

CFA15: Greatworth to Lower Boddington.

1.1.3 The document should be read in conjunction with Volume 2 (CFA reports), Volume 3 (route-wide effects assessment) and Volume 4 (off-route effects assessment) of the SES and AP2 ES. In addition as it focuses solely on new information obtained since the main ES it should be read in conjunction with the following corresponding Volume 5 Technical Appendices of the main ES:

CFAs 7 to 15 designated sites, habitat surveys and flora ecological baseline data: Colne Valley to Lower Boddington (Volume 5 appendix EC-001-002, ES 3.5.2.7-15.1);

CFAs 7 to 15 amphibians, reptiles and birds ecological baseline data: Colne Valley to Lower Boddington (Volume 5 appendix EC-002-002, ES 3.5.2.7-15.2);

CFAs 7 to 15 mammals ecological baseline data: Colne Valley to Lower Boddington (Volume 5 appendix EC-003-002, ES 3.5.2.7-15.3);

CFAs 7 to 15 invertebrates and fish ecological baseline data: Colne Valley to Lower Boddington: invertebrates and fish (Volume 5 appendix EC-004-002, ES 3.5.2.7-15.4);

CFAs 7 to 15 register of local level effects: Colne Valley to Lower Boddington (Volume 5 appendix EC-005-002, ES 3.5.2.7-15.5); and

CFAs 7 to 15 Ecology map books.

2 Ancient woodland

2.1 Introduction

2.1.1 This section of the appendix details supplementary ecological baseline data relating to habitat surveys, specifically ancient woodland assessments, that is relevant to the assessment of SES and AP2 ES design changes in CFA7 to CFA15 inclusive.

2.2 Methodology

2.2.1 Woodlands within or close to the construction boundary were considered for detailed survey if they would be directly affected by the construction of the scheme or potentially require measures to protect them from adverse effects during construction. Scoping surveys were carried out in woods that were considered to have less potential to be ancient and were carried out alongside other surveys for European protected species. As such a number of the woods surveyed are more distant from the construction boundary than woods proposed for detailed survey.

2.2.2 Scoping of woodland for survey was carried out as follows:

review of land within the construction boundary using aerial photographs, current Ordnance Survey (OS) maps and Phase 1 habitat survey data to identify woodland;

review of existing Phase 1 habitat and national vegetation classification (NVC) data to establish whether there was any previous survey or desk study information for the woodland that was used in the main ES as a basis for concluding that a particular woodland was not ancient;

check whether a woodland was already on the original Ancient Woodland Inventory (November 2012), and if not whether it was less than 2ha (and therefore below the size threshold for inclusion on the Ancient Woodland Inventory); and

review each of the sites to verify if they are likely to support ancient woodland taking into consideration:

- the site's proximity to a known ancient woodland;
- a name that is indicative of ancient woodland; or
- the site's association with topographic or landscape features more likely to support ancient woodland.

2.2.3 Sites with high potential to contain ancient woodland were short-listed for an NVC survey and those with low potential were subject to a scoping walk-over survey to be carried out alongside other survey work by non-specialist surveyors.

2.3 Field survey

2.3.1 For each survey, emphasis is placed on recording the following:

a list of vascular plant species, particularly species indicators of ancient woodland (ancient woodland indicator (AWI) species);

living evidence relating to the past management of a wood, for example, coppice structure, old coppice stools, veteran trees or pollards;

archaeological evidence relating to the past management of the site such as saw pits, charcoal hearths, drainage systems, old banks, mineral diggings, etc.;

historical boundary features delineating the wood, such as wood banks, stubbed trees or outgrown laid hedges; and

structural and habitat diversity, presence of dead wood, and the presence of streams and ponds following natural courses and depressions.

2.4 National vegetation classification surveys

2.4.1 NVC surveys were carried out in the woodland considered to have the greatest potential to be ancient woodland. The results have been used to establish whether a wood has affinities with semi-natural sub-commutes and to provide a basis for discussing its possible origins and past management. Table 1 provides details of woodlands assessed in 2014 based on the criteria described above.

Table 1: Summary of ancient woodland assessments undertaken in 2014 within CFA7 to CFA15 inclusive

CFA	Name of woodland (if applicable) and location	OS grid reference	Survey date	Approximate distance from the original scheme[1] (m) and orientation
7 Colne Valley	Wood south of West Hyde House and Weybeards Cottage	TQ 03680 89850	29 May 2014	Within an area of land required for the scheme
8 The Chalfonts and Amersham	The Larches, located between Amersham and Chalfont St Giles, Buckinghamshire	SU 96609 94686	25 June 2014	500m south-west
8 The Chalfonts and Amersham	The Gorse, located between Amersham and Chalfont St Giles, Buckinghamshire	SU 96496 94992	25 June2014	500m south-west
10 Dunsmore, Wendover and Halton	Woods on the corner of King's Lane and Bowood Lane, south of Wendover and north of Great Missenden	SP 89000 04260	30 May 2014	50m east
10 Dunsmore, Wendover and Halton	Hunt's Green Farm, located between The Lee and Wendover Dean, south of Wendover to the east of Kings Lane	SP 89170 03980	29 May 2014	Within an area of land required for the scheme

[1] In this table and following tables the term 'land required' is used as a shortened version of the full term 'land required for the construction of the original scheme'.

CFA	Name of woodland (if applicable) and location	OS grid reference	Survey date	Approximate distance from the original scheme[1] (m) and orientation
10 Dunsmore, Wendover and Halton	Road Barn Farm, located between London Road (A413) and Hogtrough Lane	SP87542 06297	30 May 2014	Within an area of land required for the scheme
10 Dunsmore, Wendover and Halton	Plantation adjacent to Rushmoor Wood, located north of Great Missenden and south of Wendover	SP 88726 03729	30 May 2014	250m west
10 Dunsmore, Wendover and Halton	Small wood on Bowood Lane, north of Great Missenden and south of Wendover	SP 88535 04249	30 May 2014	50m west
10 Dunsmore, Wendover and Halton	Grimm's Ditch located to the north of Great Missenden and to the west of Lee Common	SP 8915 0358	29 May 2014	Within an area of land required for the scheme
13 Calvert, Steeple Claydon, Twyford and Chetwode	Portway Farm located east of Twyford and north of Charndon	SP 67563 26013	09 June 2014	100m south-west
13 Calvert, Steeple Claydon, Twyford and Chetwode	Poor's Piece located northeast of Rose Hill Farm and south of the existing rail line.	SP 69843 25989	05 June 2014	50m south
14 Newton Purcell to Brackley	North of Warren Farm 001 located between Mixbury and Finmere	SP 62140 33571	26 June 2014	50m south
14 Newton Purcell to Brackley	North of Warren Farm 002 located between Mixbury and Finmere	SP 62140 33571	26 June 2014	50m south
14 Newton Purcell to Brackley	North of Warren Farm 003 located between Mixbury and Finmere	SP 62798 33518	26 June 2014	500m north-west

CFA	Name of woodland (if applicable) and location	OS grid reference	Survey date	Approximate distance from the original scheme[1] (m) and orientation
14 Newton Purcell to Brackley	Hollywell Plantation located to the north of Westbury, Buckinghamshire, along an un-named watercourse	SP 62138 36404	25 June 2014	500m north
14 Newton Purcell to Brackley	Mossycorner Spinney located to the south of Westbury, Buckinghamshire, between Mixwell and Fulwell	SP 61677 34373	19 June 2014	50m east
14 Newton Purcell to Brackley	Site 001 East of Glebe Farm located east of Brackley and north of the A422 in Northamptonshire	SP 60217 36904	26 June 2014	250m west
14 Newton Purcell to Brackley	Site 002 East of Glebe Farm located east of Brackley and north of the A422 in Northamptonshire, adjacent to arable fields	SP 60616 37046	26 June 2014	Within an area of land required for the scheme
14 Newton Purcell to Brackley	Block 1 North of the Great Ouse River located between Westbury and Brackley	SP 61442 35480	26 June 2014	Within an area of land required for the scheme
14 Newton Purcell to Brackley	Block 2 North of River Great Ouse located between Westbury and Brackley	SP 61348 35988	26 June 2014	50m east
14 Newton Purcell to Brackley	New Plantation located between Westbury and Brackley	SP 61113 35460	26 June 2014	Within an area of land required for the scheme
14 Newton Purcell to	Disused railway cutting located between	SP 61206 35314	26 June 2014	Within an area of land required

CFA	Name of woodland (if applicable) and location	OS grid reference	Survey date	Approximate distance from the original scheme[1] (m) and orientation
Brackley	Westbury and Brackley			for the scheme
14 Newton Purcell to Brackley	Pugpit Spinney and disused Railway located between Mixbury and Westbury	SP 60754 35175	01 July 2014	50m south-west

2.5 Deviations, constraints and limitations

2.5.1 In accordance with the 2011 ancient woodland review; the assessment was based on higher plant species, historical maps, archaeology and past management. Other potential indicators such as bryophytes were not considered.

2.5.2 Access was restricted in a number of cases, resulting in the partial survey of some woods and a reliance on surveying edge habitat.

2.5.3 The small size and limited access to a number of woodlands affected the number, shape and size of quadrats that were recorded in NVC surveys. For example, where the number of 50m x 50m canopy quadrats was inadequate, linear quadrats were used as a suitable alternative.

2.6 Baseline

CFA7

Wood south of West Hyde House and Weybeards Cottage

2.6.1 The woodland was subject to a scoping survey only (see Appendix EC-001-002 of the main ES). The site was partly inaccessible owing to fencing. One canopy quadrat of 50 x 50m and two tall herbaceous/scrub layer quadrats of 10 x 10m were completed. No ground flora quadrats were completed as this was dominated by common nettle (*Urtica dioica*) throughout. However, the woodland was similar in composition throughout and the sampling is considered likely to be representative.

2.6.2 The woodland is located to the south of Weybeards Cottages, which are between Maple Cross and Denham on the east side of the A412, Buckinghamshire (grid reference at the centre point of the wood is TQ 0368 8985). The woodland area is indistinct in shape as it merges into scrub.

2.6.3 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is approximately 250m south-east of the area surveyed: an unnamed woodland of 0.27ha at grid reference at centre TQ 03506 89634. There is also a larger area on the Ancient Woodland Inventory, 300m to the south; Northmoor Hill Wood (9.1ha) (grid reference at centre: TQ 03678 89296).

2.6.4 This is plantation woodland dominated by scattered ash *(Fraxinus excelsior)* and sycamore *(Acer pseudoplatanus)* with some black poplar *(Populus nigra 'italica'*). The

ground flora is entirely dominated by common nettle (*Urtica dioica*). As it is impoverished plantation woodland it cannot be easily classified. The dominance of nettle indicates eutrophic conditions. The canopy is patchy (providing 50% cover) and the shrub layer is absent. Ground flora is extremely limited owing to the dominance of nettle, however, a number of species expected in a W8e *Geranium robertianum* sub-community were recorded including cleavers (*Galium aparine*), herb Robert (*Geranium robertianum*) and the bryophyte *Kindbergia praelonga* (*Eurhynchium praelongum*). However, two constant species for a W8 community are absent including field maple (*Acer campestre*) and hazel (*Corylus avellana*).

2.6.5 One ancient woodland indicator species for the south of England (Rose, F (2006) *The WildFlower Key: How to Identify Wild Flowers, Trees and Shrubs in Britain and Ireland.* Frederick Ware[2]) was recorded during the survey: stinking iris (*Iris foetidissima*)

2.6.6 The surveyed area is clearly plantation woodland. No field-sign evidence relating to the past management of the site was recorded.

2.6.7 The woodland has a patchy cover in the canopy (50%) at on average 25m from the ground. There is no understorey but there is a tall herb layer (of nettle) 1m high with 100% cover.

2.6.8 The woodland is clearly plantation woodland. Only one ancient woodland indicator was present and the 1st Edition OS map shows scattered trees on part of the site but not woodland.

2.6.9 Given the evidence, it is unlikely that the woodland around Weybeards Cottages is ancient.

CFA8

The Larches

2.6.10 The Larches was subject to an NVC survey but findings were affected by the small size of the wood that limited the number of 50 x 50m canopy quadrats that could be recorded and lack of access to the semi-natural woodland in the eastern and western parts of the site.

2.6.11 The Larches is located between Amersham and Chalfont St Giles, Buckinghamshire, and is surrounded by open, arable fields (grid reference at the centre point of The Larches is SP 96730 94738). The Larches as a whole is approximately 450m east to west and 80m north to south at its widest point (approximately 3.5ha), of which the western part (1.6ha). The Larches is not shown on the 1st Edition OS mapping, but the nearby Brentford Wood is. However it is shown as wooded on the OS Drawings 1780-1840.

2.6.12 The western part of The Larches is classed as ancient woodland on the Natural England's Ancient Woodland Inventory. The Larches has an irregular shape, with some straight boundaries, forming the edges of agricultural fields. The quarry-like pits would have made the woodland unsuitable for agriculture and more likely to have been undisturbed. No other evidence relating to the past management of the site was recorded. The Larches includes four distinct woodland types:

[2] Rose, F (2006) *The WildFlower Key: How to Identify Wild Flowers, Trees and Shrubs in Britain and Ireland.* Frederick Ware.

the semi-natural woodland surveyed in the western half of The Larches, most resembles W8e *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland, *Geranium robertianum* sub-community;

the semi-natural woodland in the centre of The Larches is dominated by beech (*Fagus sylvatica*) and most resembles W14 *Fagus sylvatica-Rubus fruticosus* woodland;

coniferous plantation woodland made up entirely of Sitka spruce (*Picea sitchensis*) with no understorey or ground flora recorded. This section of The Larches is very uniform, and very little light reaches the woodland floor; and

young sycamore (*Acer pseudoplatanus*) plantation to the south of the western half of the woodland block that was not accessible for surveys.

2.6.13 Seven Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded: holly (*Ilex aquifolium*), bluebell (*Hyacinthoides non-scripta*), remote sedge (*Carex remota*), wood speedwell (*Veronica montana*), woodruff (*Galium odoratum*), wood millet (*Milium effusum*), and wood sorrel (*Oxalis acetosella*). None were recorded in the coniferous plantation at The Larches.

2.6.14 Surveys confirmed the findings of the 2014 inventory that the western part of the wood is ancient. On the basis of a preliminary assessment it is also considered that the semi-natural woodland to the east of the block and the sycamore (*Acer pseudoplatanus)* plantation have the potential to be ancient woodland, as they are on the OS Drawings 1780-1840, have a good cover of ground flora and are in close proximity to the known ancient woodland. On a precautionary basis it is also considered that the easternmost part of wood (that could not be accessed for survey) is also possibly ancient. The coniferous plantation within The Larches is unlikely to be ancient woodland; it does not appear on the 1st Edition OS mapping as wooded and currently appears to be a uniform plantation with very limited ground flora.

The Gorse

2.6.15 This site was subject to a scoping survey only. Steep terrain made some parts difficult to access. Given the small size of the woodland block, there is likely to be a large amount of edge-affected woodland.

2.6.16 The Gorse is located between Amersham and Chalfont St Giles, Buckinghamshire, and is surrounded by open, arable fields (grid reference at the centre point of The Gorse is SU 96496 94992). The Gorse is approximately 115m by 110m (approximately 1.4ha).

2.6.17 It is not on Natural England's Ancient Woodland Inventory and it is not shown on any of the available historical mapping. The Gorse is a small square area of plantation woodland (with straight lines of trees visible on aerial photography) and scrub with limited ground flora. It is surrounded by arable land, with much edge affected habitat. Old pits or quarries may be present in where the land dips away; it is not clear whether these are from man-made use or natural. No other evidence relating to the past management of the site was recorded. This wood comprises mixed plantation and more scrubby semi-natural areas. The plantation accessible from the edge includes Sitka spruce (*Picea sitchensis)*. No Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded in the plantation woodland at The Gorse. Three Ancient Woodland Indicator species, field maple (*Acer campestre*), hornbeam

(*Carpinus betulus*) and crab apple (*Malus sylvestris*) were recorded on the edges however.

2.6.18 The Gorse is unlikely to be ancient woodland, given the limited number and distribution of Ancient Woodland Indicator species, its absence from historical mapping.

CFA9

2.6.19 No NVC or woodland assessments were undertaken in CFA9 in 2014 as they were not required.

CFA10

Wood on the corner of King's Lane and Bowood Lane

2.6.20 The woodland is located on the corner of Bowood Land and King's Lane, south of Wendover and north of Great Missenden, Buckinghamshire (grid reference at the centre point of the wood is SP 89000 04260). The wood is rectangular in shape, with its longest edge running along Bowood Lane. It is approximately 170 x 90m (approximately 1.4ha). The woodland was subject to an NVC survey.

2.6.21 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 60m to the south along King's Lane: an un-named woodland of 2.12ha at grid reference at centre SP 89256 04116. There is also a block of woodland listed on the Ancient Woodland Inventory 160m to the north-west, which is 1.84ha (grid reference at centre: SP88720 04423).

2.6.22 The woodland resembles W8e *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland, *Geranium robertianum* sub-community. Eleven ancient woodland indicator species for the south of England (Rose, 2006) were recorded during the survey.

2.6.23 The woodland appeared from survey to be predominantly semi-natural in character. It was largely dominated by beech (*Fagus sylvatica*) of even age with little understorey or ground flora, but approximately 30% was dominated by oak (*Quercus* sp.). No field-sign evidence relating to the past management of the site was recorded but the wood contains a chalk pit and a pond is present close to King's Lane.

2.6.24 The woodland has eleven ancient woodland indicators, four of which were abundant, and is within 60m of known ancient woodland. Historical maps do not indicate that the wood was present at 1885 at the earliest. Therefore the recorded diversity of plant species is more likely to be associated with an old trackway rather than the main part of the wood. Therefore it is unlikely that the wood is ancient.

Hunt's Green Farm, east of Kings Lane

2.6.25 The woodland is located between The Lee and Wendover Dean, south of Wendover, Buckinghamshire, to the east of Kings Lane (grid reference at the centre point of the wood is SP 89170 03980). The wood is linear in shape and lies between arable fields on the west and Kings Lane on the east. It is approximately 270m north to south and 15m east to west at the widest point (approximately 0.3ha). The woodland was subject to an NVC survey.

2.6.26 There are two ancient woodlands within 500m of the surveyed woodland, according to Natural England's Ancient Woodland Inventory. These are Rushmoor Wood ancient

semi-natural woodland (10m east of the surveyed wood, on the other side of Kings Lane, at SP 89267 04134), and Jones' Hill Wood ancient semi-natural woodland (360m north-west of the surveyed wood, at grid reference at centre SP 88720 04418).

2.6.27 The wood land most resembles W12a *Fagus sylvatica-Mercurialis perennis* woodland, *mercurialis perennis* sub-community. Fourteen Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: hornbeam (*Carpinus betulus*), holly (*Ilex aquifolium*), field maple (*Acer campestre*), field rose (*Rosa arvensis*, sanicle (*Sanicula europaea*, wood sedge (*Carex sylvatica*, bush vetch (*Vicia sepium*), woodruff (*Galium odoratum*), black bryony (*Tamus communis*), wood speedwell (*Veronica montana*), wood melick (*Melica uniflora*), wood millet (*Milium effusum*) , wild cherry (*Prunus avium*) and bluebell (*Hyacinthoides non-scripta*).

2.6.28 The surveyed woodland is in close proximity to two known ancient semi-natural woodlands and has fourteen Ancient Woodland Indicator species. Only part of the wood is recorded on the most recent and accurate mapping. The omission of the wood from earlier drawings could be due to the wood's small areas and linear shape.

2.6.29 Other evidence provided by Ancient Woodland Indicator and the site's location in relation to other woodland indicates that the woodland surveyed has potential to be ancient woodland.

Road Barn Farm

2.6.30 The woodland is located south of Wendover, on the east side of the London Road (grid reference at centre is SP87542 06297). The woodland was subject to a scoping survey.

2.6.31 There is no ancient woodland according to Natural England's Ancient Woodland Inventory within 1km of the surveyed woodland. The OS drawings 1780-1840 do not show any woodland at this site.

2.6.32 The species recorded during the scoping survey are hornbeam (*Carpinus betulus*), holly (*Ilex aquifolium*), crab apple (*Malus sylvestris*), wild cherry (*Prunus avium*), dog's mercury (*Mercurialis perennis*), ivy (*Hedera helix*), elder (*Sambucus nigra*), common nettle (*Urtica dioica*), beech (*Fagus sylvatica*), wood dock (*Rumex sanguineus*), lords-and-ladies (*Arum maculatum*), larch (*Larix* sp.) and snow berry (*Symphoricarpos albus*).

2.6.33 Four Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: hornbeam (*Carpinus betulus*), holly (*Ilex aquifolium*), crab apple (*Malus sylvestris*) and wild cherry (*Prunus avium*).

2.6.34 The group of trees at this location are unlikely to be ancient woodland, as it appears to be very small shrubby group of trees rather than a woodland and has very limited ground flora.

Plantation adjacent to Rushmoor Wood

2.6.35 The woodland is located south of Bowood Lane which is north of Great Missenden and south of Wendover, Buckinghamshire (grid reference at centre is SP 88726 03729). It is a rectangular block of woodland that is approximately 1.5ha. It is surrounded by fields and a footpath runs along its northern boundary. The woodland was subject to a scoping survey.

2.6.36 There are two ancient woodlands according to Natural England's Ancient Woodland Inventory within 500m of the surveyed woodland: Rushmoor Wood 480m to the north-north-east (2.12ha at grid reference at centre: SP 89256 04116), and Jones' Hill Wood 500m to the north (1.84ha at grid reference at centre: SP 88729 04417).

2.6.37 The woodland appears to be a plantation of predominantly beech (*Fagus sylvatica*) canopy, with a holly (*Ilex aquifolium*) understorey. Oak (*Quercus* sp.) and hazel (*Corylus avellana*) are present in some areas. The ground flora is sparse with a lot of bare ground although there are patches where bluebell (*Hyacinthoides non-scripta*) or dog's mercury (*Mercurialis perennis*).

2.6.38 Three Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: holly (*Ilex aquifolium*), bluebell (*Hyacinthoides non-scripta*) and wood speedwell (*Veronica montana*). Holly, bluebell and wood speedwell are also present.

2.6.39 The beech woodland/plantation at this location has some potential to be on an unknown ancient woodland site, given the possibility of it being a remnant of a larger wood shown on historical maps. The wood was on the 1780-1840 and 1830-1840 drawings. The absence of tree cover on the first edition maps could reflect the felling and re-stocking of the wood around the time these maps were being prepared the plantation has limited ground flora with only three Ancient Woodland Indicator species, but this may be because of the deeply-shading canopy.

Small wood on Bowood Lane

2.6.40 The woodland is located on Bowood Lane, north of Great Missenden and south of Wendover, Buckinghamshire (grid reference at centre is SP 88535 04249). It is approximately 120m north-west to south-east, and 30m east to west at its widest point (approximately 0.2ha). It is on a steep slope down to Bowood Lane where there is a verge of semi-improved calcareous grassland. The woodland was subject to a scoping survey.

2.6.41 There is one ancient woodland according to Natural England's Ancient Woodland Inventory within 500m of the surveyed woodland: Jones' Hill Wood is 165m north-east (1.84ha at grid reference at centre SP 88729 04417). There is also another area of woodland on the Ancient Woodland Inventory which is 650m to the east: Rushmoor Wood (2.12ha at grid reference: SP 89256 04116).

2.6.42 The woodland is dominated by hazel (*Corylus avellana*) with two dead beech (*Fagus sylvatica*) on the boundary. Two ash (*Fraxinus excelsior*) are on the lane. Other woody species recorded included hawthorn (*Crataegus monogyna*) and wych elm (*Ulmus glabra*).

2.6.43 Four Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: crab apple (*Malus sylvestris*), wild cherry (*Prunus avium*), sweet woodruff (*Galium odoratum*) and wood melick (*Melica uniflora*).

2.6.44 The surveyed woodland is unlikely to be ancient woodland, as it is not on any historical maps and has limited ground flora. However, there are four Ancient Woodland Indicator species of which woodruff (*Galium odoratum*) and wood melick (*Melica uniflora*) are strong indicators. It is possible that the Ancient Woodland

Indicator species present are derived from the old boundary that adjoins arable fields to the north.

Grimm's Ditch

2.6.45 The woodland is located to the north of Great Missenden and to the west of Lee Common in Buckinghamshire (grid reference at centre is SP 8915 0358). It is a small strip of woodland which is approximately 200m long and 20m wide (0.4ha). It is surrounded by fields. The woodland was subject to a scoping survey.

2.6.46 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 400m to the north. The woodland is not named on the Ancient Woodland Inventory and is 2.2ha (grid reference at centre: SP 89261 04116). There is also a small woodland on the Ancient Woodland Inventory 70m south-south-east of Grimm's Ditch (0.24ha, grid reference at centre: SP 89401 02792).

2.6.47 The woodland appears to be broadleaved plantation consisting almost entirely of even-aged mature beech (*Fagus sylvatica*) and holly (*Ilex aquifolium*). Bluebell (*Hyacinthoides non-scripta*) is present on a bank where not shaded. Ivy (*Hedera helix*) is also present.

2.6.48 Nine ancient woodland indicator species for the south of England (Rose, 2006) were recorded during the scoping survey: bluebell (*Hyacinthoides non-scripta*), holly (*Ilex aquifolium*), field maple (*Acer campestre*), hornbeam (*Carpinus betulus*), wild cherry (*Prunus avium*), wych elm (*Ulmus glabra*), wood melick (*Melica uniflora*), three-veined sandwort (*Moehringia trinervia*) and field rose (*Rosa arvensis*).

2.6.49 Grimm's Ditch has potential to be ancient woodland, as it was on the 1780-1840 and 1830-1840 drawings and there were nine ancient woodland indicators recorded. The absence of tree cover on the first edition maps could reflect the felling and re-stocking of the wood around the time these maps were being prepared. Further detailed surveys and assessment are recommended.

2.6.50 Grimm's Ditch has since been classified as ancient woodland following the 2014 revision of the Natural England Ancient Woodland Inventory.

CFA11

2.6.51 No NVC or woodland assessments were undertaken in CFA11 in 2014.

CFA12

2.6.52 No NVC or woodland assessments were undertaken in CFA12 in 2014.

CFA13

Portway Farm

2.6.53 The woodland is located east of Twyford and north of Charndon in Buckinghamshire, bordered immediately to the north by a disused rail line (grid reference at centre is SP 67563 26013). It is approximately 68m north-west to south-east and 105m north-east to south-west at its widest point (approximately 0.7ha).

2.6.54 There is no ancient woodland according to Natural England's Ancient Woodland Inventory within 500m of this woodland (the closest is 2.2km south-east of Portway

Farm: an unnamed ancient semi-natural woodland at grid reference at centre: SP 69100 24300).

2.6.55 The surveyed area includes scrubby woodland with few mature trees including pedunculate oak (*Quercus robur*), ash (*Fraxinus excelsior*), rowan (*Sorbus aucuparia*) and Scots pine (*Pinus sylvestris*), with dog rose (*Rosa canina*) in the understorey. The ground flora is predominantly common nettle (*Urtica dioica*) with bramble (*Rubus fruticosus*) and forget-me-not (*Myosotis sp.*).

2.6.56 One Ancient Woodland Indicator species for the south of England (Rose, 2006) was recorded occasionally during the survey: hornbeam (*Carpinus betulus*).

2.6.57 Evidence of coppicing was recorded during the site visit possibly owing to historical management associated with the now disused rail line.

2.6.58 The trees around the edge are predominantly semi-mature, with mature trees to the centre, and the sub-canopy and ground flora appear to have low structural and floristic diversity.

2.6.59 The surveyed woodland is unlikely to be ancient woodland, based on the evidence of the botanical scoping survey, review of historical maps and limited archaeological features or evidence of historical management, as well as lack of proximity to any known ancient woodlands.

Poor's Piece

2.6.60 The woodland is located north-east of Rose Hill Farm and south of Steeple Claydon in Buckinghamshire, bordered immediately to the north by the Steeple Claydon disused rail line (grid reference at centre is SP 69843 25989). It is approximately 91m east to west and 120m north to south at its widest point (approximately 1.1ha).

2.6.61 There are no existing ancient woodlands within 500m of the surveyed woodland. The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 1.2km south of Poor's Piece: an unnamed ancient semi-natural woodland (grid reference at centre: SP 69887 24532).

2.6.62 The woodland is mature, broadleaf with predominantly mature oak (*Quercus* sp.), elm (*Ulmus* sp.), hawthorn (*Crataegus monogyna*), elder (*Sambucus nigra*), poplar (*Populus* sp.) and hazel (*Corylus avellana*) (see Appendix EC-001-002 of the main ES). An understorey of elm (*Ulmus* sp.) and dog rose (*Rosa canina*) is present with a ground flora of predominantly common nettle (*Urtica dioica*) with bramble (*Rubus fruticosus agg.*).

2.6.63 No Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey.

2.6.64 Evidence relating to the past management of the site was recorded, including a raised bank on the east and south of the woodland edge. There was no field-sign evidence of past coppicing or pollarding.

2.6.65 The trees are generally of uniform age and structure, and the sub-canopy and ground flora appear to have low structural or floristic diversity.

2.6.66 The surveyed woodland is unlikely to be ancient woodland, based on the evidence of the botanical scoping survey, and limited evidence of archaeological features or

evidence of historical management. The only evidence for ancient woodland is that it was wooded in 1878.

CFA14

North of Warren Farm 001

2.6.67 The woodland is located between Mixbury and Finmere in Buckinghamshire, adjacent to arable fields (grid reference at centre is SP 62140 33571). It is triangular in shape approximately 134m east to west and 78m north to south at its widest point (approximately 0.4ha). The woodland was subject to a scoping survey only.

2.6.68 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 300m north of Block A: Stonepit Spinney ancient semi-natural woodland (grid reference at centre: SP 62256 33957).

2.6.69 The woodland is a small block of semi-natural woodland with ash (*Fraxinus excelsior*), Canadian poplar (*Populus x canadensis*) (forming a planted windbreak on one edge of the woodland), damson (*Prunus insititia*), hawthorn (*Crataegus monogyna*), small-leaved elm (*Ulmus minor*) and alder (*Alnus glutinosa*) with a ground flora of ground ivy (*Glechoma hederacea*), common nettle (*Urtica dioica*), wood avens (*Geum urbanum*) and lords-and-ladies (*Arum maculatum*). One Ancient Woodland Indicator species for the south of England (Rose, 2006) was recorded during the survey: bluebell (*Hyacinthoides non-scripta*).

2.6.70 The surveyed woodland is unlikely to be ancient woodland, based on the evidence of the botanical scoping survey and lack of archaeological features or evidence of historical management.

North of Warren Farm 002

2.6.71 The woodland is located between Mixbury and Finmere in Buckinghamshire, adjacent to arable fields (grid reference at centre is SP 62140 33571). It is triangular in shape approximately 25m east to west and 49m north to south at its widest point (approximately 0.1ha). The woodland was subject to a scoping survey only.

2.6.72 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 446m west: Stonepit Spinney ancient semi-natural woodland (grid reference at centre: SP 62256 33957). OS drawings 1780-1840 do not show any woodland at this site. No other historical mapping was available for review.

2.6.73 The woodland is a very small block of trees and scrub with abundant hawthorn (*Crataegus monogyna*), young pedunculate oak (*Quercus robur*), ash (*Fraxinus excelsior*) and elder (*Sambucus nigra*), with blackthorn (*Prunus spinosa*) and small-leaved elm (*Ulmus minor*. The ground flora was dominated by common nettle (*Urtica dioica*), with some ground ivy (*Glechoma hederacea*) and cleavers (*Galium aparine*) also present. No Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey.

2.6.74 The surveyed woodland is unlikely to be ancient woodland, based on the evidence of the botanical scoping survey and lack of archaeological features or evidence of historical management.

North of Warren Farm 003

2.6.75 The woodland is located between Mixbury and Finmere in Buckinghamshire, adjacent to arable fields (grid reference at centre is SP 62798 33518). It is approximately 144m east to west and 42m north to south at its widest point (approximately 0.6ha). The woodland was subject to a scoping survey only.

2.6.76 There is no existing ancient woodland within 500m of the surveyed woodland. The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 613m west: Stonepit Spinney ancient semi-natural woodland (grid reference at centre: SP 62256 33957).

2.6.77 This surveyed woodland is a small block of semi-natural woodland with abundant ash (*Fraxinus excelsior*) and crack willow (*Salix fragilis*). In the understorey is elder (*Sambucus nigra*), bird cherry (*Prunus padus*), small-leaved elm (*Ulmus minor*) and blackthorn (*Prunus spinosa*). The ground flora is dominated by wood dock (*Rumex sanguineus*) with enchanter's nightshade (*Circaea lutetiana*), ground ivy (*Glechoma hederacea*), creeping buttercup (*Ranunculus repens*), wood avens (*Geum urbanum*), giant fescue (*Festuca giganteus*), cleavers (*Galium aparine*) and sedge sp. (*Carex sp.*).

2.6.78 Two Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: field maple (*Acer campestre*) and giant fescue (*Festuca giganteus*).

2.6.79 The surveyed woodland is unlikely to be ancient woodland, based on the evidence of the botanical scoping survey and lack of archaeological features or evidence of historical management.

Hollywell Plantation

2.6.80 Hollywell Plantation was subject to an NVC survey. The woodland is located to the north of Westbury, Buckinghamshire, along an un-named watercourse (grid reference at the centre point of the wood is SP 62138 36404). The wood is linear in shape, running east to west; its eastern edge is at Biddlesden Road and the western end adjoins arable fields. It is approximately 550m east to west and 160m north to south at its widest point (approximately 3.7ha).

2.6.81 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 490m south-east of Hollywell Plantation: Doctor's Spinney ancient semi-natural woodland (grid reference at centre: SP62750 35950).The woodland resembles W8d *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland, *Hedera helix* sub-community (see species lists and quadrat data in Appendix EC-001-002). Ash (*Fraxinus excelsior*) and field maple (*Acer campestre*) ranging from semi-mature to mature, dog's mercury (*Mercurialis perennis*) and bramble (*Rubus fruticosus*) are common throughout, with ivy (*Hedera helix*) throughout on the ground (which is common for this sub-community). Sycamore (*Acer pseudoplatanus*) is throughout, and is an indicator of wetter conditions Rodwell *et al.*, (1991) *National Vegetation Classification Field Guide to Woodland* JNCC[3]. Infrequent and generally sparse associated trees and shrubs within this habitat include silver birch (*Betula pendula*) and holly (*Ilex aquifolium*). The canopy is almost continuous (providing at least 75% cover) and the woodland underneath is generally very shaded, with a sparse woody

[3] Rodwell *et al.*, (1991) *National Vegetation Classification Field Guide to Woodland* JNCC.

understorey with a lower cover (40%) reaching on average 4m above ground, that includes patchy field maple (*Acer campestre*) and elder (*Sambucus nigra*). Ground-flora plants such as rough meadow-grass (*Poa trivialis*), ground ivy (*Glechoma hederacea*) and primrose (*Primula vulgaris*) are restricted to areas where ivy (*Hedera helix*) is not too thick on the ground. There is a tall herb layer of 1m (50% cover) and a layer composed of low herbs, grasses and mosses (on average 0.2m high and 90% cover).

2.6.82 Four Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: wood millet (*Milium effusum*) was rare, primrose (*Primula vulgaris*), field maple (*Acer campestre*) and holly (*Ilex aquifolium*).

2.6.83 There is little evidence from mapping or the assemblage of Ancient Woodland Indicator species that the site was wooded prior to being planted, as such, there is limited potential for Hollywell Plantation to be ancient woodland.

Mossycorner Spinney

2.6.84 The woodland is located to the south of Westbury, Buckinghamshire, between Mixwell and Fulwell (grid reference at the centre point of the wood is SP 61677 34373). From aerial photography, Mossycorner Spinney is roughly triangular in shape with a 2.4ha field in the middle. However, the southern tip, area around the field and sections to the west are scrub rather than true woodland. It is surrounded by arable fields and has a ditch on the northern boundary. It is approximately 500m long on each boundary. The total area of the woodland excluding the field is approximately 4.9ha.Mossycorner Spinney was subject to an NVC survey.

2.6.85 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is within Mossycorner Spinney[4], immediately south of the surveyed part of the woodland: Mossycorner Spinney ancient semi-natural woodland (grid reference at centre: SP 61677 34373). Another block of woodland on Natural England's Ancient Woodland Inventory is within 500m of Mossycorner Spinney: Stonepit Spinney ancient semi-natural woodland (grid reference at centre: SP 62280 33970) is 640m south-east of Mossycorner Spinney.

2.6.86 The western part of the wood is scrub and young plantation with pedunculate oak (*Quercus robur*), beech (*Fagus sylvatica*) and wild cherry (*Prunus avium*), but the eastern part where the quadrat was carried out resembles W8e *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland, *Geranium robertianum* sub-community (see species lists and quadrat data in Appendix EC-001-002). The canopy is dominated by mature ash (*Fraxinus excelsior*) with a dense understorey of elder (*Sambucus nigra*) with blackthorn (*Prunus spinosa*), hawthorn (*Crataegus monogyna*) and garden privet (*Ligustrum ovalifolium*).

2.6.87 Ground flora plants are abundant but not very diverse because of the presence of ruderal species, in particular, cow parsley (*Anthriscus sylvestris*). The woodland is narrow with farmland close to the boundary, and edge effects are evident. Other species present in the field layer include ivy (*Hedera helix*) and the moss *Thamnobryum alopecurum* with cleavers (*Galium aparine*). These species are typical of the *Geranium robertianum* sub-community. However, herb-Robert (*Geranium robertianum*) was only recorded outside the surveyed quadrat. The presence of both elder (*Sambucus nigra*)

[4] The revised ancient woodland inventory (June 2014) shows that the southern part of Mossycorner Spinney is classified as ancient woodland by Natural England.

and common nettle (*Urtica dioica*) is indicative of more eutrophic conditions. The moss *Kindbergia praelonga* (*Eurhynchium praelongum*) is frequent, which is typical in the W8 community. However, dog's mercury (*Mercurialis perennis*) is absent and this is normally a constant in W8. The canopy within the surveyed block has approximately 65% cover and the understorey is generally moderately shaded. The shape of the woodland dictates strong edge effects.

2.6.88 The W8e *Geranium robertianum* sub-community is found in the south-east of England (this wood is in Buckinghamshire), but is more common in the west and north (Rodwell *et al*., 1991). Hazel (*Corylus avellana*) usually dominates the understorey, and was present in the surveyed woodland although it was not dominant, and field maple (*Acer campestre*) usually plays a more prominent role in this sub-community. This sub-community typically has a high frequency of elder (*Sambucus nigra*) which is the case in Mossycorner Spinney and is indicative of nutrient enrichment and disturbance. Also typical is the abundance of ash (*Fraxinus excelsior*) and sycamore (*Acer pseudoplatanus*) saplings.

2.6.89 Three Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: wild cherry (*Prunus avium*) and black bryony (*Tamus communis*) and blackcurrant (*Ribes nigrum*).

2.6.90 Since the survey Mossycorner Spinney has been classified as ancient woodland following revision in 2014 of the Natural England Ancient Woodland Inventory.

Site 001 east of Glebe Farm

2.6.91 The woodland is located east of Brackley and north of the A422 in Northamptonshire, adjacent to arable fields (grid reference at centre is SP 60217 36904). It is approximately 330m east to west and 50m north to south at its widest point (approximately 0.8ha). This woodland was subject to a scoping survey.

2.6.92 The only ancient woodland according to Natural England's Ancient Woodland Inventory within 500m of the surveyed wood is 95m north: an unnamed ancient semi-natural woodland (grid reference at centre: SP 60483 37002) (within the surveyed woodland at Site 002 east of Glebe Farm).

2.6.93 The area includes a small strip of semi-natural broadleaf woodland and young broadleaved woodland plantation next to each other (the former is at the same location as the wooded area on the 1st Edition OS mapping). The semi-natural woodland included pedunculate oak (*Quercus robur*), with small-leaved elm (*Ulmus minor*), hawthorn (*Crataegus monogyna*), elder (*Sambucus nigra*), dog-rose (*Rosa canina*), field maple (*Acer campestre*) and ash (*Fraxinus excelsior*). The ground flora is dominated by cow parsley (*Anthriscus sylvestris*) and is otherwise quite bare. The plantation woodland is floristically diverse and includes field maple (*Acer campestre*), wild cherry (*Prunus avium*), ash (*Fraxinus excelsior*), rowan (*Sorbus aucuparia*), guelder rose (*Viburnum opulus*), dogwood (*Cornus sanguinea*) and pedunculate oak (*Quercus robur*) with hawthorn (*Crataegus monogyna*) and hazel (*Corylus avellana*).

2.6.94 One Ancient Woodland Indicator species for the south of England (Rose, 2006) was recorded in the semi-natural woodland during the survey: field maple (*Acer campestre*). Two other Ancient Woodland Indicator species in the plantation woodland included wild cherry (*Prunus avium*) (occasional) and guelder rose (*Viburnum opulus*).

2.6.95 The available information suggests that the surveyed woodland has some potential to be ancient woodland, based on its semi-natural character and presence of banks and ditches. However, only a small proportion was wooded on the OS 1st edition maps and none is shown on the earlier drawings. Few Ancient Woodland Indicator were present, all are capable of colonising unwooded sites or secondary woodland. Therefore, on balance the wood is unlikely to be ancient.

Site 002 east of Glebe Farm

2.6.96 The woodland is located east of Brackley and north of the A422 in Northamptonshire, adjacent to arable fields (grid reference at centre is SP 60616 37046). It is approximately 370m east to west and 135m north to south at its widest point (approximately 2.3ha). This woodland was subject to a scoping survey.

2.6.97 There is one ancient woodland according to Natural England's Ancient Woodland Inventory within 500m of the surveyed wood: an unnamed ancient semi-natural woodland is within the surveyed woodland at grid reference SP 60483 37002 (0.3ha).

2.6.98 The surveyed area is semi-natural broadleaf woodland dominated by ash (*Fraxinus excelsior*) and pedunculate oak (*Quercus robur*). Horse chestnut (*Aesculus hippocastanum*) and sycamore (*Acer pseudoplatanus*). Dog rose (*Rosa canina*), field maple (*Acer campestre*), hawthorn (*Crataegus monogyna*), holly (*Ilex aquifolium*) and elder (*Sambucus nigra*) are common in the understorey. The ground flora included enchanter's nightshade (*Circaea lutetiana*), wood dock (*Rumex sanguineus*), wood avens (*Geum urbanum*), herb-Robert (*Geranium robertianum*), common dog-violet (*Viola riviniana*), bluebell (*Hyacinthoides non-scripta*) and sedge sp. (*Carex sp.*).

2.6.99 Three Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: field maple (*Acer campestre*), holly (*Ilex aquifolium*) rare and bluebell (*Hyacinthoides non-scripta*).

2.6.100 Based on a preliminary scoping survey, there is potential for an additional area of the surveyed woodland to that included in the 2014 inventory to be ancient woodland. This conclusion is based on the wood's proximity to known ancient woodland and based on the evidence of the botanical scoping survey and evidence of historical management. Only the area already confirmed as ancient was on the OS 1st edition mapping, and it is likely that the remainder of the wood was not considered to be ancient during the revisions carried out for the 2014 inventory. Therefore, on balance, it is unlikely that the currently undesignated part of the wood is ancient woodland.

Block 1 north of the Great Ouse River

2.6.101 The woodland is located between Westbury and Brackley in Oxfordshire (grid reference at centre is SP 61442 35480). It is located within cattle-grazed improved grassland. The surveyed area covered approximately 140m east to west and 100m north to south at its widest point (approximately 0.5ha). This woodland was subject to a scoping survey.

2.6.102 There is no ancient woodland according to Natural England's Ancient Woodland Inventory within 500m of the surveyed woodland.

2.6.103 The woodland has sparse canopy cover (50%-70%). No woodland ground flora was evident and the area under the trees was heavily poached by cattle. The canopy

species include poplar species (*Populus sp.*), with a very sparse understorey including hawthorn (*Crataegus monogyna*), wild plum (*Prunus domestica*), crab apple (*Malus sylvestris*), dog-rose (*Rosa canina*), goat willow (*Salix caprea*), crack willow (*Salix fragilis*), wild cherry (*Prunus avium*) and field maple (*Acer campestre*). A richer ground flora is evident in the hedgerow running to the east and immediately adjacent to this area.

2.6.104 Three Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: crab apple (*Malus sylvestris*), wild cherry (*Prunus avium*) and field maple (*Acer campestre*).

2.6.105 The group of trees at this location are unlikely to be ancient woodland, as it appears to be a very small shrubby group of trees rather than a woodland and has very limited ground flora and limited cover of Ancient Woodland Indicator species.

Block 2 north of River Great Ouse

2.6.106 The woodland is located between Westbury and Brackley in Oxfordshire (grid reference at centre is SP 61348 35988). It is located within arable fields, with the south and western boundaries running along hedgerows. The surveyed area covered approximately 45m east to west and 45m north to south (approximately 0.2ha). This woodland was subject to a scoping survey.

2.6.107 There is no ancient woodland according to Natural England's Ancient Woodland Inventory within 1km of the surveyed woodland.

2.6.108 The woodland is a small block of semi-natural broadleaf woodland, with field maple (*Acer campestre*), sycamore (*Acer pseudoplatanus*) and ash (*Fraxinus excelsior*) in the canopy. The understorey is sparse with elder (*Sambucus nigra*), ash saplings (*Fraxinus excelsior*) and hawthorn (*Crataegus monogyna*). The ground flora is extensive and is dominated by ivy (*Hedera helix*) and cow parsley (*Anthriscus sylvestris*), with common nettle (*Urtica dioica*), cleavers (*Galium aparine*) and lords-and-ladies (*Arum maculatum*).

2.6.109 One ancient woodland indicator species for the south of England (Rose, 2006) was recorded during the survey: field maple (*Acer campestre*).

2.6.110 The woodland block has limited potential to be ancient woodland. It is semi-natural in character and appears on the 1st Edition OS Mapping but not on earlier drawings. There is a single Ancient Woodland Indicator species only and no field-sign evidence relating to the past management.

New plantation

2.6.111 The woodland is located between Westbury and Brackley in Oxfordshire (grid reference at centre is SP 61113 35460). It adjoins a dismantled railway to the south and the River Great Ouse to the north. It is approximately 1,100m east to west and 700m north to south at its widest point (approximately 20.1ha). The woodland was subject to a scoping survey.

2.6.112 The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 800m south of the plantation: Mossycorner Spinney ancient semi-natural woodland (grid reference at centre: SP 61677 34373). This woodland is a new addition to the Ancient Woodland Inventory (June 2014).

2.6.113 The woodland is a broadleaf plantation with a poplar species (*Populus sp.*) dominant throughout, and ash (*Fraxinus excelsior*) and crack willow (*Salix fragilis*) present in low numbers (see Appendix EC-001-002). The poplar trees are semi-mature, and ash and crack willow along the edges were semi-mature or mature. The understorey has high cover throughout and includes gorse (*Ulex europaeus*), goat willow (*Salix caprea*) and hawthorn (*Crataegus monogyna*).

2.6.114 No Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey.

2.6.115 It is unlikely that the surveyed woodland is ancient woodland, as it appears to be a recent plantation, and based on the evidence of the botanical scoping survey, review of historical maps and lack of archaeological features or evidence of historical management.

Disused railway cutting

2.6.116 The woodland is located between Westbury and Brackley in Oxfordshire (grid reference at centre is SP 61206 35314). It runs along the cutting of the dismantled railway. The surveyed area covers approximately 1,300m east to west and 20m north to south (approximately 4.1ha). This woodland was subject to a scoping survey.

2.6.117 There are no existing ancient woodland sites within 500m of the surveyed woodland. The nearest ancient woodland according to Natural England's Ancient Woodland Inventory is 800m south of the surveyed woodland at the dismantled railway: Mossycorner Spinney ancient semi-natural woodland (grid reference at centre: SP 61677 34373).

2.6.118 This woodland is a narrow band of broadleaf semi-natural woodland, running along the disused railway, with ash (*Fraxinus excelsior*), and in the understorey was hawthorn (*Crataegus monogyna*), elder (*Sambucus nigra*), blackthorn (*Prunus spinosa*) and hazel (*Corylus avellana*). Field maple (*Acer campestre*) and crab apple (*Malus sylvestris*). In some sections, the canopy is very limited and the woodland is replaced by scrub dominated by blackthorn (*Prunus spinosa*) and hawthorn (*Crataegus monogyna*). In the wooded sections the ground flora is often dominated by ivy (*Hedera helix*), wood avens (*Geum urbanum*), false-brome (*Brachypodium sylvaticum*), cleavers (*Galium aparine*) and cow parsley (*Anthriscus sylvestris*). Herb-Robert (*Geranium robertianum*) is also present, as is ground-ivy (*Glechoma hederacea*), wood speedwell (*Veronica montana*) and common dog-violet (*Viola riviniana*). Dog's mercury (*Mercurialis perennis*) is rare. There is one stand of Japanese knotweed (*Fallopia japonica*) at SP 61687 35202.

2.6.119 Three Ancient Woodland Indicator species for the south of England (Rose, 2006) were recorded during the survey: field maple (*Acer campestre*), wild apple (*Malus sylvestris*) and wood speedwell (*Veronica montana*).

2.6.120 The woodland on the railway cutting cannot be ancient woodland, as the cutting is a comparatively recent man-made structure for which construction would have required removal of any pre-existing woodland. It does not appear wooded on the historical maps, has low floristic diversity and a low number and cover of Ancient Woodland Indicator species.

Pugpit Spinney and disused railway

2.6.121 Pugpit Spinney is located between Mixbury and Westbury in Buckinghamshire, adjacent to an arable fields and a disused railway line (grid reference at centre is SP 60754 35175). It is approximately 160m east to west and 130m north to south at its widest point (approximately 1.1ha). This woodland was subject to a scoping survey.

2.6.122 There is no ancient woodland according to Natural England's Ancient Woodland Inventory within 500m of Pugpit Spinney (the nearest site is over 1km away at Mossycorner Spinney).

2.6.123 The disused railway with steep embankments included some scattered trees, predominantly pedunculate oak (*Quercus robur*) and ash (*Fraxinus excelsior*), and scrub and tall ruderals.

2.6.124 Pugpit Spinney is a young broadleaf plantation woodland with young ash (*Fraxinus excelsior*), beech (*Fagus sylvatica*), field maple (*Acer campestre*), hazel (*Corylus avellana*), pedunculate oak (*Quercus robur*) and silver birch (*Betula pendula*). The north-east side of the woodland is more mature and likely semi-natural with mature ash (*Fraxinus excelsior*) dominant in the canopy, and hawthorn (*Crataegus monogyna*) and elder (*Sambucus nigra*) in the understorey. The ground flora includes ground ivy (*Glechoma hederacea*), common dog violet (*Viola riviniana*), ivy (*Hedera helix*), cow parsley (*Anthriscus sylvestris*), wood avens (*Geum urbanum*), lord's-and-ladies (*Arum maculatum*) and dog's mercury (*Mercurialis perennis*).

2.6.125 One ancient woodland indicator species for the south of England (Rose, 2006) was recorded in Pugpit Spinney during the survey: field maple (*Acer campestre*).

2.6.126 Pugpit Spinney is unlikely to be ancient woodland, based on limited evidence provided by the botanical scoping survey review of historical maps and woodland name. The area on a railway embankment is not likely to be ancient due to the removal of existing habitat that would have been required during construction.

3 Amphibians

3.1 Introduction

3.1.1 This section of the appendix presents details of supplementary ecological baseline data relating to amphibians for the section of the scheme that will pass through CFA7 to 15 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5: Appendix EC-002-002).

3.2 Methodology

3.2.1 Details of the standard methodology utilised for amphibian surveys are provided in the Technical Note Ecological Field Survey Methods and Standards which is included within Volume 5: Appendix EC-002-003 of the main ES.

3.2.2 The scoping and desk study exercises undertaken in 2012 and 2013 can be found in Volume 5: Appendix EC-002-002 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

3.3 Deviations, constraints and limitations

3.3.1 For some of the water bodies surveyed it was not always possible to set bottle traps around the entire perimeter of the pond due to deep water, concrete/butyl pond lining and/or the presence of obstructions, such as areas of dense vegetation. In these instances, in accordance with the Field Survey Methods and Standards (FSMS), an estimate of the percentage of the pond margin omitted was noted on the recording form and traps were deployed at a frequency of one every two metres for those areas of the pond margin that were accessible. In the few cases where the majority of the pond margin was inaccessible, bottle trapping was replaced by a suitable alternative method, such as netting or refuge searching.

3.3.2 Adverse weather conditions during the survey season occasionally prevented the three preferred survey methods from being used. Cold overnight temperatures towards the beginning of the season in April 2014 led to bottle trapping being precluded for a small number of survey visits, whilst moderate to heavy rain led to unsuitable conditions for torching on a small number of occasions.

3.3.3 The condition of the water bodies, which in some instances changed during the survey season, occasionally prevented the three preferred survey methods from being used. These included high turbidity levels and high proportions of surface vegetation cover, both of which prevented the use of torching; lack of vegetation, which prevented egg searching; and low water levels, which prevented the use of bottle traps.

3.3.4 The topography and physical surroundings of a water body also prevented the three preferred survey methods from being used in a small number of cases. Examples included dense scrub surrounding the water body, or steep-sided banks, which prevented safe or adequate bottle trapping from being carried out.

3.3.5 Where temperature, water body condition or topography/physical surroundings meant the preferred method could not be used, it was replaced by a suitable alternative method to ensure a minimum of three survey methods were employed.

3.3.6 In order to undertake the requisite number of surveys during the mid-April to mid-May period, in a small number of cases in 2013 it was not possible to maintain the intervals between survey visits as stated in the FSMS. This was largely due to access to certain sites only becoming available during the middle of the survey season. Where this occurred, visits were spaced as best as possible and were never conducted on consecutive nights. It should be noted that this does not compromise Natural England guidelines[5], and is not predicted to have an impact on the quality of the survey data collected.

3.3.7 Where access to land only became available after the 2013 survey season had finished in mid-June, the ponds within these land parcels were subject to a Habitat Suitability Index (HSI)[6] assessment. This allowed the surrounding habitat and overall potential for the ponds to support breeding great crested newts (GCN) to be assessed and further survey requirements to be identified.

3.3.8 Table 2 lists the water bodies at which further survey was required, but where access to undertake the surveys in 2014 was not granted.

Table 2: Summary of locations where requirement for amphibian survey was identified but no access was available for survey

Ecology survey code	Location	OS grid reference	Initial survey prescription based on scoping exercise	CFA	Approximate distance from the original scheme (m) and orientation
020-AH1-026005	Buckinghamshire Golf Course, Denham	TQ 05206 87116	HSI and further surveys if suitable for GCN	7	Within an area of land required for the construction and operation of the original scheme
020-AH1-026012	Buckinghamshire Golf Course, Denham	TQ 05206 87383	HSI and further surveys if suitable for GCN	7	Within an area of land required for the construction and operation of the original scheme
020-AH1-026018	Buckinghamshire Golf Course, Denham	TQ 04547 86542	HSI and further surveys if suitable for GCN	7	250m west
020-AH1-026019	Buckinghamshire Golf Course, Denham	TQ 04822 86568	HSI and further surveys if suitable for GCN	7	60m west
020-AH1-026020	Buckinghamshire Golf Course, Denham	TQ 04757 86755	HSI and further surveys if suitable for GCN	7	200m west

[5] English Nature (2001), *Great Crested Newt Mitigation Guidelines*, English Nature, and Peterborough.
[6] ARG UK (2010), *ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index*, Amphibian and Reptile Groups of the United Kingdom.

Ecology survey code	Location	OS grid reference	Initial survey prescription based on scoping exercise	CFA	Approximate distance from the original scheme (m) and orientation
020-AH1-026021	Buckinghamshire Golf Course, Denham	TQ 04999 86829	HSI and further surveys if suitable for GCN	7	Adjacent to the original scheme
020-AH1-026022	Buckinghamshire Golf Course, Denham	TQ 05052 87286	HSI and further surveys if suitable for GCN	7	Adjacent to the original scheme
020-AH1-026023	Buckinghamshire Golf Course, Denham	TQ 04913 87307	HSI and further surveys if suitable for GCN	7	90m west
020-AH1-071001	Land east of Upper South Farm, Quainton	SP 73170 19238	HSI and further surveys if suitable for GCN	12	20m east
020-AH1-071001b	Land east of Upper South Farm, Quainton	SP 73150 19238	HSI and further surveys if suitable for GCN	12	Adjacent to the original scheme
020-AH1-071001c	Land east of Upper South Farm, Quainton	SP 73197 19225	HSI and further surveys if suitable for GCN	12	40m east
020-AH1-071001d	Land east of Upper South Farm, Quainton	SP 73162 19272	HSI and further surveys if suitable for GCN	12	Adjacent to the original scheme
020-AH1-071001e	Land east of Upper South Farm	SP 73222 19195	HSI and further surveys if suitable for GCN	12	10m south-east
020-AH1-071001f	Land east of Upper South Farm, Quainton	SP 73237 19234	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original scheme
020-AH1-071002	Land north of Upper South Farm, Quainton	SP 73055 19697	HSI and further surveys if suitable for GCN	12	70m east
020-AH1-071003	Land east of Doddershall House, Quainton	SP 72741 19620	HSI and further surveys if suitable for GCN	12	10m west
020-AH1-071004	Land east of Doddershall House, Quainton	SP 72760 19675	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original

Ecology survey code	Location	OS grid reference	Initial survey prescription based on scoping exercise	CFA	Approximate distance from the original scheme (m) and orientation
					scheme
020-AH1-071005	Land north of Upper South Farm, Quainton	SP 72899 19924	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original scheme
020-AH1-072003	Land north of Upper South Farm, Quainton	SP 72881 19694	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the Proposed Scheme
020-AH1-073003	Hill Farm, Quainton	SP 72335 20235	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original scheme
020-AH1-073004	Land north-east of Doddershall House, Quainton	SP 72138 20266	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original scheme
020-AH1-073005	Hill Farm, Quainton	SP 72439 20407	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original scheme
020-AH1-073006	Hill Farm, Quainton	SP 72415 20574	HSI and further surveys if suitable for GCN	12	60m north
020-AH1-073007	Hill Farm, Quainton	SP 72383 20396	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction

Ecology survey code	Location	OS grid reference	Initial survey prescription based on scoping exercise	CFA	Approximate distance from the original scheme (m) and orientation
					and operation of the original scheme
020-AH1-073008	Hill Farm, Quainton	SP 72195 20483	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original scheme
020-AH1-073009	Hill Farm, Quainton	SP 72820 20324	HSI and further surveys if suitable for GCN	12	120m north
020-AH1-073010	Hill Farm, Quainton	SP 72839 20327	HSI and further surveys if suitable for GCN	12	120m north
020-AH1-073011	Hill Farm, Quainton	SP 72943 20381	HSI and further surveys if suitable for GCN	12	220m north
020-AH1-073012	Land north-west of Doddershall House, Quainton	SP 71643 20488	HSI and further surveys if suitable for GCN	12	220m south
020-AH1-073013	Land north-west of Doddershall House, Quainton	SP 71610 20498	HSI and further surveys if suitable for GCN	12	210m south
020-AH1-073021	Doddershall House, Quainton	SP 72069 20138	HSI and further surveys if suitable for GCN	12	Adjacent to the original scheme
020-AH1-073022	Doddershall House, Quainton	SP 71984 20039	HSI and further surveys if suitable for GCN	12	Adjacent to the original scheme
020-AH1-073023	Hill Farm, Quainton	SP 72684 21387	HSI and further surveys if suitable for GCN	12	210m south-west
020-AH1-073024	Doddershall House, Quainton	SP 72026 19863	HSI and further surveys if suitable for GCN	12	110m south
020-AH1-074002	Land north-west of Doddershall House, Quainton	SP 71506 20920	HSI and further surveys if suitable for GCN	12	50m south
020-AH1-074006	Woodlands Farm Barn, Edgcott Road, Quainton	SP 71144 21362	HSI and further surveys if suitable for GCN	12	Adjacent to the original scheme
020-AH1-074007	Woodlands Farm Barn, Edgcott Road, Quainton	SP 71179 21394	HSI and further surveys if suitable for GCN	12	40m east
020-AH1-	Land west of	SP 71091 20406	HSI and further surveys if suitable	12	30m east

Ecology survey code	Location	OS grid reference	Initial survey prescription based on scoping exercise	CFA	Approximate distance from the original scheme (m) and orientation
074008	Doddershall House, Quainton		for GCN		
020-AH1-074020	Hill Farm, Quainton	SP 72455 21503	HSI and further surveys if suitable for GCN	12	Within an area of land required for the construction and operation of the original scheme
020-AH1-075014	Land west of Finemere Hill House, Quainton	SP 71454 22284	HSI and further surveys if suitable for GCN	12	110m north-east
020-AH1-075015	Land east of Finemere Hill House, Quainton	SP 71664 22441	HSI and further surveys if suitable for GCN	12	250m east
020-AH1-075017	Land north of Finemere Hill House, Quainton	SP 71538 22635	HSI and further surveys if suitable for GCN	12	210m north-east
020-AH1-076008	Land west of Romer Wood, Quainton	SP 70970 22873	HSI and further surveys if suitable for GCN	12	100m east
020-AH1-077006	Land at Claydon Estate, Steeple Claydon	SP 69729 23691	HSI and further surveys if suitable for GCN	13	70m north
020-AH1-077008	Land at Claydon Estate, Steeple Claydon	SP 70067 23941	HSI and further surveys if suitable for GCN	12	270m east
020-AH1-077009	Land at Claydon Estate, Steeple Claydon	SP 69927 24088	HSI and further surveys if suitable for GCN	13	200m east
020-AH1-078005	Pond Farm, Calvert Road, Calvert	SP 69432 24295	HSI and further surveys if suitable for GCN	13	Adjacent to the original scheme
020-AH1-078008	Pond Farm, Calvert Road, Calvert	SP 69036 24745	HSI and further surveys if suitable for GCN	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-078009	Pond Farm, Calvert Road, Calvert	SP 69033 24749	HSI and further surveys if suitable for GCN	13	Within an area of land required for the

Ecology survey code	Location	OS grid reference	Initial survey prescription based on scoping exercise	CFA	Approximate distance from the original scheme (m) and orientation
					construction and operation of the original scheme
020-AH1-078010	Pond Farm, Calvert Road, Calvert	SP 69295 24420	HSI and further surveys if suitable for GCN	13	Adjacent to the original scheme
020-AH1-078013	Pond Farm, Calvert Road, Calvert	SP 69449 24873	HSI and further surveys if suitable for GCN	13	130m east
020-AH1-078014	Pond Farm, Calvert Road, Calvert	SP 69782 24263	HSI and further surveys if suitable for GCN	13	130m north-east
020-AH1-078015	Land at Claydon Estate, Steeple Claydon	SP 69908 24029	HSI and further surveys if suitable for GCN	13	160m east
020-AH1-078016	Land at Claydon Estate, Steeple Claydon	SP 69998 23925	HSI and further surveys if suitable for GCN	13	200m east
020-AH1-079004	Land east and south of Rose Hill Farm, Steeple Claydon	SP 69878 25974	HSI and further surveys if suitable for GCN	13	Adjacent to the original scheme
020-AH1-079008	Land east and south of Rose Hill Farm, Steeple Claydon	SP 69545 25314	HSI and further surveys if suitable for GCN	13	170m east
020-AH1-079009	Land east and south of Rose Hill Farm, Steeple Claydon	SP 69560 25513	HSI and further surveys if suitable for GCN	13	150m east
020-AH1-079011	Blackmoorhill Farm, Middle Claydon	SP 70167 25841	HSI and further surveys if suitable for GCN	13	240m south
020-AH1-079024	Land east and south of Rose Hill Farm, Steeple Claydon	SP 69770 25819	HSI and further surveys if suitable for GCN	13	10m east
020-AH1-080011	Briarhill Farm, West Street, Steeple Claydon	SP 68172 26796	HSI and further surveys if suitable for GCN	13	150m west
020-AH1-080012	Briarhill Farm, West Street, Steeple Claydon	SP 68381 26779	HSI and further surveys if suitable for GCN	13	20m east

3.4 Baseline

Field survey

Habitat suitability index/walkover surveys

3.4.1 Following the completion of 2014 walkover surveys, incorporating a HSI survey (where appropriate), the water bodies identified in Table 3 were scoped out of the assessment.

Table 3: Summary of 2014 locations where requirement for further survey was scoped out following walkover survey

Ecology survey code	Location	OS grid reference	Brief rationale for scoping out	CFA	Approximate distance from the original scheme (m) and orientation
020-AH1-029008	East of Denham Way, A412, Denham Green	TQ 03646 90132	A small, very shallow man-made ornamental pond with no vegetation; not suitable for breeding GCN.	7	50m east
020-AH1-049001	Land to the east of Kings Lane, The Lee	SP 89640 04275	A small, very shallow pond that had dried up after the first survey visit; not suitable for breeding GCN.	10	340m north-east
020-AH1-049009	East of Kings Lane, The Lee	SP 89346 04276	The HSI assessment confirmed this to be a dry pond within a hedgerow; not suitable for breeding GCN.	10	230m north-east
020-AH1-059002	Standalls Farm, Bishopstone	SP 81476 10433	Dry ditch.	11	Within an area of land required for the construction and operation of the original scheme
020-AH1-059004	Hall End Farm, Stoke Mandeville	SP 82526 10947	Pond almost dry and completely shaded by trees. Surrounded by arable fields.	11	Within an area of land required for the construction and operation of the original scheme
020-AH1-073001	Hill Farm, Quainton	SP 72898 20415	The HSI assessment identified a dry, shallow ditch; not suitable for breeding GCN.	12	240m north
020-AH1-073002	Hill Farm, Quainton	SP 72612 20444	The HSI assessment identified a dry, shallow ditch; not suitable for breeding GCN.	12	120m east
020-AH1-074019	Hill Farm, Quainton	SP 72366 21265	The HSI assessment identified a dry, shallow pond within a hedgerow; not suitable for breeding GCN.	12	30m south-east

Ecology survey code	Location	OS grid reference	Brief rationale for scoping out	CFA	Approximate distance from the original scheme (m) and orientation
020-AH1-079002	Shepherd's Furze Farm, Steeple Claydon	SP 68604 25349	The HSI assessment confirmed this to be a dry pond; not suitable for breeding GCN.	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-079007	Shepherd's Furze Farm, Steeple Claydon	SP 68986 25493	The HSI assessment confirmed this to be a dry pond; not suitable for breeding GCN.	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-080001	Shepherd's Furze Farm, Steeple Claydon	SP 68226 25574	The HSI assessment confirmed there was no longer a water body present at this location.	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-080013	Portway Farm, Twyford	SP 67344 25279	The HSI assessment confirmed this to be a small, dry pond; not suitable for breeding GCN.	13	80m south-west
020-AH1-081002	Portway Farm, Twyford	SP6 7332 26296	The HSI assessment confirmed this to be a small, dry pond; not suitable for breeding GCN.	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-084002	Land at Chetwode Priory Estate	SP 64904 28350	The HSI assessment identified a very shallow ditch; not suitable for breeding GCN.	13	20m west
020-AH1-084002b	Land at Chetwode Priory Estate	SP 64720 28430	The HSI assessment identified a very shallow ditch; not suitable for breeding GCN.	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-084003	Land at Chetwode Priory Estate	SP 64594 28329	The HSI assessment identified a very shallow ditch; not suitable for breeding GCN.	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-084004	Land at Chetwode Priory Estate	SP 64588 28323	The HSI assessment identified a very shallow ditch; not suitable for breeding GCN.	13	Within an area of land required for the construction and operation of the original

Ecology survey code	Location	OS grid reference	Brief rationale for scoping out	CFA	Approximate distance from the original scheme (m) and orientation
					scheme
020-AH1-084005	Land at Chetwode Priory Estate	SP 64569 28301	The HSI assessment identified a very shallow ditch; not suitable for breeding GCN.	13	Within an area of land required for the construction and operation of the original scheme
020-AH1-088004	North of the Old Rectory, Newton Purcell	SP 62610 31220	Depression near cow drinker. No water body present.	14	90m south-east
020-AH1-092001	Mill Farm House, Mill Lane, Westbury	SP 61328 35922	Shallow grassed depression near edge of field. No water body present.	14	20m south
020-AH1-092002	Mill Farm House, Mill Lane, Westbury	SP 61902 35548	Level grassed area near edge of field. No water body present (possibly filled in).	14	80m south-east
020-AH1-095006	Orchard House, Main Street, Turweston	SP 60075 37831	Very small garden feature pond with solid base. Shallow water, vertical sided and deep accumulated leaf litter in bottom.	14	250m west
020-AH1-095007	Orchard House, Main Street, Turweston	SP 60083 37828	Very small garden feature pond with solid base. No macrophyte cover and large amount of accumulated leaf litter. Heavily shaded.	14	250m west
020-AH1-095008	Orchard House, Main Street, Turweston	SP 60090 37826	Very small garden feature pond with solid base, vertical sided edges, no macrophyte cover. Accumulated leaf litter in bottom of pond.	14	250m west
020-AH1-100001	Halse Copse Farm Cottages, Halse	SP 56783 41737	Depression on the edge of arable field, against hedge row, dominated by grass and algae.	15	Within an area of land required for the construction and operation of the original scheme
020-AH1-103003	Land south of Magpie Road, Sulgrave	SP 54821 44471	Dry pond.	15	80m south-west
020-AH1-110001	Manor Farm, Chipping Warden, and land at Aston le Walls	SP 50623 49337	Pond in middle of arable field. Fish present.	15	100m north-east
020-AH1-110003	Redhill Farm, Banbury Road, Chipping Warden,	SP 50490 49808	Narrow ditch (approximately 50cm wide). Heavily shaded	15	50m east

Ecology survey code	Location	OS grid reference	Brief rationale for scoping out	CFA	Approximate distance from the original scheme (m) and orientation
	Daventry		by bank vegetation.		
020-AH1-110004	Manor Farm, Chipping Warden, and land at Aston le Walls	SP 50699 49283	Very shallow flowing narrow ditch with heavy shading and low macrophyte cover.	15	140m east
020-AH1-110008	Redhill Farm, Banbury Road, Chipping Warden, Daventry	SP 50405 49984	Dry ditch.	15	100m north
020-AH1-114001	The Green, Lower Boddington	SP 47517 51883	Almost dry pond (depth c.5cm) and heavily shaded.	15	Within an area of land required for the construction and operation of the original scheme
020-AH1-114002	The Green, Lower Boddington	SP 47493 51894	Shallow area of seasonally inundated grassland.	15	Within an area of land required for the construction and operation of the original scheme
020-AH1-114004	Boddington Sewage Treatment Works	SP 47347 52443	Raised concrete tank in sewage treatment works.	15	40m north
020-AH1-114006	The Green, Lower Boddington	SP 4747 352378	Almost dry shallow pond, (depth < 8cm). Water turbid and anoxic.	15	Within an area of land required for the construction and operation of the original scheme
020-AH1-114011	The Green, Lower Boddington	SP 47927 52620	Shallow area of seasonally inundated grassland.	15	190m north-east
020-AH1-115001	The Green, Lower Boddington	SP 47141 52674	Dry pond.	15	20m north-east

Presence/absence and population size class estimate surveys

3.4.2 The results of amphibian presence/absence (P/A) and population size class (PSC) estimate surveys are detailed within Table 4.

Table 4: Summary of results from 2014 amphibian P/A and PSC estimate surveys

Ecology survey code	**Location**	**OS grid reference**	**Survey type**	**Number of visits completed**	**First survey visit**	**Last survey visit**	**Peak count during single visit with single method**					**CFA**	**Approximate distance from** the original scheme (m) and orientation
							Great crested newt	**Smooth newt**	**Palmate newt**	**Common frog**	**Common toad**		
020-AA1-029007	East of Denham Way, A412, Denham Green	TQ 03611 90314	P/A	4	30 April 2014	3 June 2014	None	6 (L)	None	None	None	7	50m east
020-AA1-032001	East of Roberts Lane, Horn Hill	TQ0181291996	P/A	4	06 May 2014	27 May 2014	None	3 (L)	None	None	None	8	200m south-west
020-AA1-043001	Land at Kennel Farm, Little Missenden	SU 92992 98692	P/A	4	14 April 2014	27 May 2014	None	2 (L)	None	None	None	9	160m south-west
020-AA1-043002	Land at Kennel Farm, Little Missenden	SU 93101 98673	P/A	4	14 April 2014	27 May 2014	None	1 (L) and 1 immature	None	None	None	9	125m south-west
020-AA1-048001	West of Potter Row, Great Missenden	SP 89902 02804	P/A	4	7 May 2014	27 May 2014	None	None	None	2 (L) and tadpoles	None	9	10m west
020-AA1-049002	Hunts Green Farm, Hunts Green, The Lee	SP 89647 03570	P/A	4	29 April 2014	2 June 2014	None	1 (L)	None	None	None	10	Adjacent to the original scheme
020-AA1-	Land forming	SP 89715 03571	P/A	4	29 April	2 June	None	None	None	None	None	10	65m east

Ecology survey code	Location	OS grid reference	Survey type	Number of visits completed	First survey visit	Last survey visit	Peak count during single visit with single method					CFA	Approximate distance from the original scheme (m) and orientation
							Great crested newt	Smooth newt	Palmate newt	Common frog	Common toad		
049003	part of Hunts Green Farm, Hunts Green, The Lee				2014	2014							
020-AA1-049007	East of Kings Lane, The Lee	SP 89166 04249	P/A	4	8 May 2014	10 June 2014	None	2 (L)	None	None	None	10	60m north-east
020-AA1-049008	East of Kings Lane, The Lee	SP 89237 04264	P/A	4	8 May 2014	10 June 2014	None	7 (L)	None	None	None	10	125m north-east
020-AA1-049010	Land forming part of Hunts Green Farm, Hunts Green, The Lee	SP 89232 03958	P/A	4	29 April 2014	2 June 2014	None	None	None	None	None	10	Within an area of land required for the construction and operation of the original scheme
020-AA1-056003	Land north of Nash Lee Lane, Wendover	SP 84852 09392	PSC	6	13 May 2014	12 June 2014	22 (M) and larvae and eggs	3 (L)	None	None	None	10	170m east
020-AA1-057004	Old Risborough Road, Stoke Mandeville	SP 83384 09522	PSC	6	29 April 2014	02 June 2014	7 (L) and eggs	9 (M)	None	None	None	11	50m west
020-AA1-	Old Risborough	SP 83380 09518	PSC	6	29 April	02 June	6 (L) and	5 (L) and	None	None	None	11	50m west

Ecology survey code	Location	OS grid reference	Survey type	Number of visits completed	First survey visit	Last survey visit	Peak count during single visit with single method					CFA	Approximate distance from the original scheme (m) and orientation
							Great crested newt	Smooth newt	Palmate newt	Common frog	Common toad		
057005	Road, Stoke Mandeville				2014	2014	eggs	eggs					
020-AA1-059003	Hall End Farm, Stoke Mandeville	SP 82568 10862	PSC	6	29 April 2014	02 June 2014	20 (M) and eggs	10 (G) and eggs	None	None	None	11	50m south-east
020-AA1-070003	Littleton Manor Farm, Waddesdon	SP 73913 17797	P/A	4	24 April 2014	20 May 2014	None	None	None	None	2 (L)	12	180m west
020-AA1-070004	Littleton Manor Farm, Waddesdon	SP 74272 17677	PSC	6	24 April 2014	4 June 2014	5 (L)	5 (L)	None	None	None	12	110m west
020-AA1-072001	Fieldside Farm, Doddershall	SP 73696 19624	P/A	4	15 April 2014	20 May 2014	None	None	None	None	None	12	160m north
020-AA1-079001	Calvert Jubilee LWS, Calvert	SP 68495 25177	P/A	4	7 May 2014	21 May 2014	None	None	None	None	None	13	Within an area of land required for the construction and operation of the original scheme
020-AA1-079022	Land west of Addison Road, Steeple Claydon	SP 69494 26230	P/A	4	24 April 2014	21 May 2014	None	5 (L)	None	None	None	13	Within an area of land required for the construction and operation of the original

Ecology survey code	Location	OS grid reference	Survey type	Number of visits completed	First survey visit	Last survey visit	Peak count during single visit with single method					CFA	Approximate distance from the original scheme (m) and orientation
							Great crested newt	Smooth newt	Palmate newt	Common frog	Common toad		
													scheme
020-AA1-079025	Shepherd's Furze Farm, Steeple Claydon	SP 69225 25102	P/A	4	7 May 2014	21 May 2014	None	None	None	None	None	13	Within an area of land required for the construction and operation of the original scheme
020-AA1-080002	Portway Farm, Twyford	SP 67542 25947	P/A	4	6 May 2014	20 May 2014	None	None	None	None	None	13	100m west
020-AA1-080009	Land west of Addison Road, Steeple Claydon	SP 69370 26351	PSC	6	24 April 2014	4 June 2014	2 (L) and eggs	13 (G) and eggs	None	None	None	13	100m west
020-AA1-081001	Portway Farm, Twyford	SP 67072 26623	P/A	4	6 May 2014	20 May 2014	None	1 (L)	None	None	None	13	Within an area of land required for the construction and operation of the original scheme
020-AA1-081004	Three Bridge Mill, Twyford	SP 67436 26808	P/A	4	15 April 2014	3 June 2014	None	None	None	None	None	13	50m east
020-AA1-081007	Land north of St. Mary's Church,	SP 66611 26730	PSC	6	12 May 2014	9 June 2014	5 (L) and eggs	1 (L)	None	Tadpoles	None	13	30m south-west

Ecology survey code	Location	OS grid reference	Survey type	Number of visits completed	First survey visit	Last survey visit	Peak count during single visit with single method					CFA	Approximate distance from the original scheme (m) and orientation
							Great crested newt	Smooth newt	Palmate newt	Common frog	Common toad		
	Twyford												
020-AA1-083002	Grange Farm, Godington	SP 65117 27886	P/A	4	15 April 2014	3 June 2014	None	None	None	None	None	13	Within an area of land required for the construction and operation of the original scheme
020-AA1-083003	Grange Farm, Godington	SP 65107 27851	P/A	4	15 April 2014	3 June 2014	None	None	None	None	None	13	20m south
020-AA1-091001	Mill Farm House, Mill Lane, Westbury	SP 61837 34503	PSC	6	29 April 2014	03 June 2014	27 (M) and eggs	5 (L) and eggs	None	None	None	14	Adjacent to the original scheme
020-AA1-114003	The Green, Lower Boddington	SP 47271 51710	P/A	4	08 May 2014	28 May 2014	None	None	None	None	None	15	140m west

Key:
Bracketed text within species column indicates the relevant PSC for the peak count obtained as follows:

Great crested newt - (H) = High; (M) = Medium; (L) = Low;

Smooth and palmate newt - peak count less than 10 = Low (L); peak count 10-100 = Good (G); peak count over 100 = Exceptional (E);

Common frog - spawn clumps counted less than 50 = Low (L); 50-500 = Good (G); greater than 500 = Exceptional (E); and

Common toad - peak count of less than 100 = Low (L); peak count 100-1000 = Good (G); peak count greater than 1000 = Exceptional (E).

A full six visits are required in order to obtain a robust PSC assessment. However, an indication of the corresponding size class category is shown here for all peak counts in order to show the minimum size class known to be present at those sites where the full six visits could not be completed during the time period available for survey.

Desk study

3.4.3 There is no relevant new desk study data that has been obtained since the issue of the main ES.

Discussion of combined results

CFA7

3.4.4 No GCN were found in CFA7 during the 2014 surveys or previous surveys.

CFA8

3.4.5 No GCN were found in CFA8 during the 2014 surveys. Two small populations of GCN were found in CFA8 (near Chalfont St Peter vent shaft) during previous surveys (as reported in the main ES).

CFA9

3.4.6 No GCN were found in CFA9 during the 2014 surveys. One small population (north of Mantle's Wood) was found during previous surveys (as reported in the main ES).

CFA10

3.4.7 One medium population of GCN (north of Nash Lee, Wendover) was identified in CFA10 during the 2014 surveys. One small population (Hartley Farm) and one medium population (Wellwick Farm, Wendover) were identified during previous surveys (as reported in the main ES).

CFA11

3.4.8 One new metapopulation of GCN (Old Risborough Road) and one new population of GCN (Hall End Farm; Stoke Mandeville) were identified in CFA11 during the 2014 surveys. Previous surveys identified medium populations at Aylesbury Golf Course and Putlowes Farm (as reported in the main ES).

CFA12

3.4.9 One small population of GCN (Littleton Manor Farm, Doddershall) was identified in CFA12 during the 2014 surveys. Four populations of unknown size were identified from desk study data (south-east of Station Road, Quainton; south of Knapps Hook Wood; Calvert Estate; and Akeman Street disused railway near Woodham) along with one medium population (Finemere Woods/southern section of Calvert Estate) identified during previous surveys (as reported in the main ES).

CFA13

3.4.10 Two new populations of GCN (north of St. Mary's Church, Twyford; and west of Addison Road, Steeple Claydon) were identified in CFA13 during the 2014 surveys. Two small (Calvert Jubilee LWS; Great Moor Sailing Club), and three medium populations (north of Calvert landfill site; north of Portway Road, Twyford; and near Rose Hill Farm, Steeple Claydon) were identified during previous surveys (as reported in the main ES).

CFA14

3.4.11 One medium population of GCN (Mill Farm House, Westbury) was identified in CFA14 during the 2014 surveys. Four medium populations (Finmere Quarry; between Newton Purcell and Finmere; Widmore Farm, Banbury Road; and south of the A421/Shelswell Park/south-west of Widmore Farm) and a small population (Warren Farm, Banbury Road) were identified during previous surveys and from desk study data (as reported in the main ES).

CFA15

3.4.12 No GCN were found in CFA15 during the 2014 surveys. Four medium populations (Banbury Lane, Thorpe Mandeville; Culworth Grounds Farm, Thorpe Mandeville; Chipping Warden Manor; and west of the road leading from Wormleighton to Upper Boddington) and a small population of GCN (near Glyn Davies Wood, Upper Boddington) were found during previous surveys (as reported in the main ES).

3.4.13 Table 5 summarises any new meta-populations that have been identified during the 2014 surveys. In addition it shows details of any meta-populations where the 2014 survey data has changed the conclusions reported in the corresponding appendix in the main ES (Volume 5: Appendix EC-002-002).

Table 5: Summary of great crested newt meta-populations assumed to occur within CFA7 to 15 inclusive

CFA	Meta-population reference	Location	Ecology survey code of ponds within assumed meta-population	Estimated PSC of meta-population	Approximate distance from the original scheme (m) and orientation
8	CFA8 - Amphibian Metapopulation1	A pond at Ashwells Farm, Little King's Hill	020-AA1-034002	Small	30m east
9	CFA9 - Amphibian Metapopulation1	A pond north of Mantle's Wood, Hyde Heath	020-AA2-044002	Small	Within an area of land required for the construction and operation of the original scheme
10	CFA10 - Amphibian Metapopulation1	A pond at Hartley Farm, Rocky Lane, Wendover	020-AA1-051001	Small	Within an area of land required for the construction and operation of the original scheme
10	CFA10 - Amphibian Metapopulation3	North of Nash Lee Lane, Wendover	020-AA1-056003	Medium	170m east
10	CFA10 - Amphibian Metapopulation4	Land at Wellwick Farm, Wendover	020-AA1-055002	Medium	80m south
11	CFA11 - Amphibian Metapopulation1	Cluster of ponds at Aylesbury Golf Course,	020-AA1-063001; 020-AA1-063003; 020-AA1-063006; 020-AA1-	Medium	Within an area of land required for the

CFA	Meta-population reference	Location	Ecology survey code of ponds within assumed meta-population	Estimated PSC of meta-population	Approximate distance from the original scheme (m) and orientation
		Aylesbury	063011; 020-AA1-063012; 020-AA1-064002		construction and operation of the original scheme
11	CFA11 - Amphibian Metapopulation2	Four ponds at Putlowes Farm, Aylesbury	020-AA1-065001, 020-AA1-065003, 020-AA1-066001, 020-AA1-066004	Medium	Within an area of land required for the construction and operation of the original scheme
11	CFA11 - Amphibian Metapopulation3	Two ponds at the Willows, Old Risborough Road, Stoke Mandeville	020-AH1-057004, 020-AH1-057005	Medium	50m west
11	CFA11 - Amphibian Metapopulation4	Hall End Farm, Stoke Mandeville	020-AH1-059003	Medium	50m south-east
12	CFA12 - Amphibian Metapopulation1	Ponds to the south-east of Station Road, Quainton	020-AH1-071011; 020-AH1-071012	Undetermined size	50m south- east
12	CFA12 - Amphibian Metapopulation2	Three ponds either side of the dismantled railway, south of Knapps Hook Wood, Woodham	020-AH1-073014; 020-AH1-073015; 020-AH1-073016	Undetermined size	40m west
12	CFA12 - Amphibian Metapopulation3	Cluster of ponds south and west of Finemere Woods and in the southern section of Calvert Estate, Quainton	020-AA1-074001; 020-AH1-074002, 020-AA1-074003; 020-AA1-074004; 020-AA1-075002; 020-AA1-075003; 020-AA1-075004; 020-AA1-075005; 020-AH1-075007; 020-AA1-075008; 020-AA1-075012; 020-AA1-075013; 020-AA1-076002	Medium	Within an area of land required for the construction and operation of the original scheme
12	CFA12 - Amphibian Metapopulation4	Three ponds south of Calvert landfill, Calvert Estate, Edgecote	020-AA1-076003; 020-AH1-076005; 020-AH1-077002	Undetermined size	70m west
12	CFA12 - Amphibian Metapopulation5	A pond west of Blackgrove Road, Waddesdon	020-AA1-069001	Small	Within an area of land required for the construction and operation of the original scheme

CFA	Meta-population reference	Location	Ecology survey code of ponds within assumed meta-population	Estimated PSC of meta-population	Approximate distance from the original scheme (m) and orientation
12	CFA12 - Amphibian Metapopulation6	A pond east of Upper South Farm, Quainton Road, Quainton	020-AA1-070001	Small	Within an area of land required for the construction and operation of the original scheme
12	CFA12 - Amphibian Metapopulation8	A pond at the southern end of the Akeman Street disused railway, Woodham	020-AH1-072008	Undetermined size	Within an area of land required for the construction and operation of the original scheme
12	CFA12 - Amphibian Metapopulation9	Littleton Manor Farm, Doddershall	020-AH1-070004	Small	110m west
13	CFA13 - Amphibian Metapopulation1	Three ponds on Calvert Estate land, north of Calvert landfill site, Edgecote	020-AA1-078017; 020-AA1-078018; 020-AA1-078019	Medium	130m west
13	CFA13 - Amphibian Metapopulation2	Two ponds at Calvert Jubilee LWS, Calvert	020-AA1-079001; 020-AA1-079003	Small	Within an area of land required for the construction and operation of the original scheme
13	CFA13 - Amphibian Metapopulation3	Two ponds at Grebe Lake (Great Moor Sailing Club), Steeple Claydon	020-AA1-080014; 020-AA1-080018	Small	40m south
13	CFA13 - Amphibian Metapopulation4	Cluster of four ponds north of Portway Road, Twyford	020-AA1-081007, 020-AA1-081013; 020-AA1-081017; 020-AA1-082005	Medium	Directly adjacent to the original scheme
13	CFA13 - Amphibian Metapopulation6	A pond near Rose Hill Farm, Steeple Claydon	020-AA2-079006	Medium	Within an area of land required for the construction and operation of the original scheme
14	CFA14 - Amphibian Metapopulation1	Cluster of water bodies at Finmere Quarry, Finmere	020-AH1-088003; 020-AH1-088016; 020-AH1-088017; 020-AH1-088018b, 020-AH1-	Medium	20m east

CFA	Meta-population reference	Location	Ecology survey code of ponds within assumed meta-population	Estimated PSC of meta-population	Approximate distance from the original scheme (m) and orientation
			088022; 020-AH1-088023; 020-AH1-089001; 020-AH1-089002; 020-AH1-089010; 020-AH1-089011, 020-AH1-089012, 020-AH1-089013, 020-AH1-089014		
14	CFA14 - Amphibian Metapopulation2	Two ponds in land south of Widmore Farm, Banbury Road, Finmere	020-AH1-088011, 020-AH1-088012,	Medium	Adjacent to the original scheme
14	CFA14 - Amphibian Metapopulation3	Two ponds south of the A421, Shelswell Park and directly south-west of Widmore Farm, Finmere	020-AH1-089003, 020-AH1-089005	Medium	Adjacent to the original scheme
14	CFA14 - Amphibian Metapopulation4	A pond between Newton Purcell and Finmere	020-AA1-088001	Medium	Within an area of land required for the construction and operation of the original scheme
14	CFA14 – Amphibian Metapopulation6	A pond at Warren Farm, Banbury Road, Mixbury	020-AA1-089009	Small	100m north
14	CFA14 – Amphibian Metapopulation7	One pond at Mill Farm House, Westbury	020-AH1-091001	Medium	Adjacent to the original scheme
15	CFA15 - Amphibian Metapopulation1	Cluster of ponds either side of Banbury Lane, Thorpe Mandeville	020-AA1-104006; 020-AA1-104007; 020-AA1-105011; 020-AA1-105012	Medium	10m south
15	CFA15 - Amphibian Metapopulation2	Two ponds at Culworth Grounds Farm, Thorpe Mandeville	020-AA1-105003; 020-AA1-105017	Medium	Within an area of land required for the construction and operation of the original scheme
15	CFA15 - Amphibian Metapopulation3	Three ponds at Chipping Warden Manor, Chipping	020-AA1-110005; 020-AH1-110006; 020-AA1-110007	Medium	110m south

CFA	Meta-population reference	Location	Ecology survey code of ponds within assumed meta-population	Estimated PSC of meta-population	Approximate distance from the original scheme (m) and orientation
		Warden			
15	CFA15 - Amphibian Metapopulation5	South-west of the road leading from Wormleighton to Upper Boddington	020-AA1-115005	Medium	Within an area of land required for the construction and operation of the original scheme
15	CFA15 - Amphibian Metapopulation6	Glyn Davies Wood, Upper Boddington	020-AA1-116008	Assumed medium	Within an area of land required for the construction and operation of the original scheme

4 Bats

4.1 Introduction

4.1.1 This section of the appendix presents details of supplementary ecological baseline data relating to bats relevant to the section of the scheme that will pass through CFA7 to 15 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5: Appendix EC-003-002).

4.1.2 It should be noted that all details relating to trapping and radio-tracking of bats undertaken at Bernwood Forest area in CFA12 and CFA13 during 2014 are presented within a separate appendix (Volume 5: Appendix EC-006-002).

4.2 Methodology

4.2.1 Details of the standard methodology utilised for bat surveys are provided in the Technical Note Ecological Field Survey Methods and Standards which is included within Volume 5: Appendix EC-002-003 of the main ES.

4.2.2 The scoping and desk study exercises undertaken in 2012 and 2013 and can be found in Volume 5: Appendix EC-003-002 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

4.2.3 The survey effort in 2014 was focused at sites that are proposed to start early in the construction phase of the scheme, and large areas of land that were not accessible in previous years, therefore the majority of surveys undertaken in 2014 were in CFA12, CFA13, CFA14 and CFA15. Survey effort in CFA7, CFA8, CFA9, CFA10, and CFA11, was primarily detailed reconnaissance to inform further survey work.

4.3 Deviations, constraints and limitations

Trees

4.3.1 A small number of trees were assessed as being unsafe to climb. To address this, ground assessments and, where required, emergence surveys were carried out to assess the roost potential of these trees.

4.3.2 There were no deviations within the tree survey methodologies.

Buildings and structures

4.3.3 The main constraints to external and internal building surveys comprised of restricted access to the site and/or declined access to building interiors and roof voids.

4.3.4 Where access was permitted, surveys of a small number of sites was constrained by health and safety concerns. These included sites with hazards, including structural safety and the presence or unknown status of asbestos, or where access was not physically possible. In these situations, internal assessments were not undertaken. To address this, emergence surveys were carried out to assess the potential of these buildings and structures to support roosting bats.

4.3.5 There were no deviations within the building survey methodologies.

Activity surveys

4.3.6 This section covers walked activity transect surveys. This survey type was undertaken at one site (Buckinghamshire Golf Course) in order to determine the areas with high bat activity and to identify important commuting routes across the route.

4.3.7 The main constraint to the activity surveys in 2014 was late access during the survey season. This resulted in an incomplete survey set.

4.3.8 Due to late access, only one of the recommended three activity surveys (as required by the Scope and Methodology Report (SMR) Addendum (Volume 5: Appendix CT-001-000/2 of the main ES) was undertaken in CFA7.

4.3.9 There were no deviations within the activity survey methodologies.

Radio-tracking

4.3.10 The main constraints within radio-tracking surveys were adverse weather conditions and gaining access to the railway infrastructure, and several sites within CFA12 and CFA13.

4.3.11 Poor radio signal and signal loss due to the nature of the surrounding landscape, the unpredictable behaviour of the tagged bat and limitations with the receiving and transmission distances of the equipment are common difficulties with radio-tracking. Together this resulted in the limited data collection for some of the tagged bats, such as not being able to confirm where the bat was roosting.

4.3.12 The main constraints within radio-tracking surveys were adverse weather conditions and gaining access to the railway infrastructure, and several sites within CFA12 and CFA13.

4.3.13 Poor radio signal and signal loss due to the nature of the surrounding landscape, the unpredictable behaviour of the tagged bat and limitations with the receiving and transmission distances of the equipment are common difficulties with radio-tracking. Together this resulted in the limited data collection for some of the tagged bats, such as not being able to confirm where the bat was roosting.

4.4 Baseline

Roosts (trees)

CFA7

4.4.1 A total of 137 trees in CFA7 were subject to an initial ground assessment. Of these 41 trees were subsequently subject to climbing surveys and six were subject to emergence surveys. Following these surveys:

- one confirmed roost was identified through tree climbing surveys;
- 24 trees were assessed as having high potential to support roosting bats;
- 77 trees were assessed as having moderate potential to support roosting bats; and
- the remaining 35 trees were assessed as having low or negligible potential to support roosting bats. These trees were subsequently scoped out of further

survey.

4.4.2 Details of confirmed tree roosts in this area of the route are provided in Table 6.

CFA8

4.4.3 A total of 20 trees were identified for survey in this area during 2014, all of which were subject to an initial ground assessment. Eight trees were subject to tree climbing surveys. Following these surveys:

no bat roosts were confirmed;

six trees were assessed as having high potential to support roosting bats;

six trees were assessed as having moderate potential to support roosting bats; and

eight trees were assessed as having low or negligible potential; these trees were subsequently scoped out of further survey.

CFA9

4.4.4 A total of 20 trees were identified for survey in this area during 2014, all of which were subject to an initial ground assessment. Two emergence surveys were undertaken on a tree with high potential to support roosting bats. No tree climbing surveys were carried out in 2014. Following these surveys:

no bat roosts were confirmed;

one tree was assessed as having high potential to support roosting bats;

11 trees were assessed as having moderate potential to support roosting bats; and

eight trees were assessed as having low or negligible potential; these trees were subsequently scoped out of further survey.

CFA10

4.4.5 A total of 24 trees were identified for survey in 2014, all of which were subject to an initial ground assessment, of which 19 trees were subsequently subject to climbing surveys. Following these surveys:

no bat roosts were confirmed;

three trees were assessed as having high potential to support roosting bats;

ten trees were assessed as having moderate potential to support roosting bats; and

11 trees were assessed as having low or negligible potential to support roosting bats; these trees were subsequently scoped out of further survey.

CFA11

4.4.6 A total of 49 trees in this area were subject to an initial ground assessment, of which 46 were subject to climbing surveys and 24 were subject to emergence surveys. Following these surveys:

- no bat roosts were confirmed;
- 17 trees were assessed as having high potential to support roosting bats;
- 14 trees were assessed as having moderate potential to support roosting bats; and
- 18 trees were assessed as having low or negligible potential; these trees were subsequently scoped out of further survey.

CFA12

4.4.7 Four trees were subject to an initial ground assessment in 2014, of which three were subject to tree climbing surveys and one to emergence surveys. Following these surveys:

- no bat roosts were confirmed;
- no trees were assessed as having high potential to support roosting bats;
- three trees were assessed as having moderate potential to support roosting bats; and
- the remaining tree was assessed as having low or negligible potential and was subsequently scoped out for further surveys.

CFA13

4.4.8 A total of 166 trees were subject to initial ground assessments. Following the initial assessment 149 trees were subject to tree-climbing surveys and 27 were subject to emergence surveys. Following these surveys:

- four confirmed roosts were identified; one during tree climbing surveys and three during emergence surveys[7];
- 31 trees were assessed as having high potential to support roosting bats;
- 54 trees were assessed as having moderate potential to support roosting bats; and
- 78 trees were assessed as having low or negligible potential to support roosting bats. These trees were consequently scoped out of further survey.

4.4.9 Details of confirmed tree roosts in this area of the route are provided in Table 6.

[7] Of the three confirmed roosts, two were recorded in different features on the same tree.

CFA14

4.4.10 A total of 202 trees in this area were subject to an initial ground assessment, of which 128 trees were subject to climbing surveys and 85 trees were subject to emergence surveys. Following these surveys:

- five tree roosts were confirmed; two during the tree climbing surveys and three during the emergence surveys;
- 42 trees were assessed as having high potential to support roosting bats;
- 61 trees were assessed as having moderate potential to support roosting bats; and
- 94 trees were assessed as having low or negligible potential; these trees were subsequently scoped out of further survey.

4.4.11 Social behaviour was observed at a further four trees but roosts were not confirmed.

4.4.12 Details of confirmed tree roosts in this area of the route are provided in Table 6.

CFA15

4.4.13 A total of 80 trees in this area were subject to an initial ground assessment of which 69 were subsequently subject to climbing surveys and one was subject to emergence surveys. Following these surveys:

- one confirmed roost was identified through climbing surveys;
- 16 trees were assessed as having high potential to support roosting bats;
- 24 trees were assessed as having moderate potential to support roosting bats; and
- 39 trees were assessed as having low or negligible potential; these trees were subsequently scoped out of further survey.

4.4.14 Details of confirmed tree roosts in this area of the route are provided in Table 6.

Table 6: Additional confirmed tree roosts recorded within CFA7 to 15 inclusive

Ecology survey code	Location	OS grid reference	Tree species	Species confirmed as utilising roost and (peak count)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme (m) and orientation
020-BT2-026001	Buckinghamshire Golf Club, Denham	TQ 05268 86554	*Oak*	Unknown	29 September 2014 - tree climbing	Day	Long split (approximately 50cm) with sheltered crevices. Three droppings found externally beneath split at top of tree	7	40m west
020-BT2-079065	Land on the east and west side of Addison Road, Steeple Claydon	SP 69719 26071	*Oak*	Noctule (1)	09 June 2014 - tree climbing	Day	Woodpecker hole.	13	Within an area of land required for the construction and operation of the original scheme
020-BT3-081001	Land at Three Bridge Mill, Twyford	SP 67217 26763	*Willow*	Common pipistrelle (3)	13 August 2014 - emergence survey	Day	Large main cavity in trunk (approximately 1m near base) with multiple secondary crevices	13	Within an area of land required for the construction and operation of the original scheme
020-BT3-081001	Land at Three Bridge Mill, Twyford	SP 67217 26763	*Willow*	Soprano pipistrelle (2)	17 June 2014 - emergence survey	Day	Large main cavity in trunk (approximately 1m near base) with multiple secondary crevices	13	Within an area of land required for the construction and operation of the original scheme

Ecology survey code	Location	OS grid reference	Tree species	Species confirmed as utilising roost and (peak count)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme (m) and orientation
020-BT3-082001	Disused railway, Twyford	SP 66337 26999	*Willow*	Common pipistrelle (1)	3 September 2014 - emergence survey	Day	Deep cavity leading up into stem over a stream	13	Within an area of land required for the construction and operation of the original scheme
020-BT3-090001	Land lying to the north of Warren Farm, Finmere	SP 62146 33504	Ash	Daubenton's bat (1) established through sound analysis	15 May 2014 - re-entry survey	Day	Ash tree with significant decay (adjacent to another tree in same condition) Tree tag 053.Roost located in trunk cavity. Tree in field boundary connecting woodland and railway	14	80m east
020-BT3-091002	Land at Tibbetts Farm, Church Lane, Mixbury, Brackley	SP6170034478	Ash	Daubenton's Bat (3) (established through sound analysis)	11 July 2014 - re-entry survey	Maternity; Day	Dead ash is within Mossycorner Spinney adjacent to a field drain connecting to Westbury Mill and waterbodies	14	50m north east
020-BT3-096002	Land on the East and West side of the road leading from Brackley to Helmdon, Radstone	SP 59161 38795	Alder	Soprano pipistrelle (1) (established through sound analysis)	28 May2014 - emergence survey	Day	Tree located in Fox Hill Spinney. Bat emerging from an upper woodpecker hole	14	40m west

Ecology survey code	Location	OS grid reference	Tree species	Species confirmed as utilising roost and (peak count)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme (m) and orientation
020-BT2-091011	Land at Tibbett's Farm, Church Lane, Mixbury, Brackley	SP6150934757	Ash	*Myotis* sp. (established by one dropping)	20 May 2014 - climbing inspection	Day	Extensive cavities up and downward from access point to trunk cavity. Single dropping recorded	14	Within an area of land required for the construction and operation of the original scheme
020-BT3-090002	Stonepit Spinney, Mixbury	SP6220433907	Oak	Noctule (established by one dropping and feeding remains	21 May 2014 - climbing inspection	Day	Roost located in trunk cavity. Tree located in isolated woodland fragment. Single decayed dropping recorded	14	200m east
020-BT3-113001	Two parcels of land lying to the south-west side of 1 The Green, Lower Boddington	SP4766351766	Ash	*Pipistrellus* sp. (established by one dropping)	24 July 2014 - climbing inspection	Transitional	Cavity 20cm hole with upward extension for further 10cm. Clean. Single bat dropping likely *Pipistrellus* sp. (decayed)	15	Within an area of land required for the construction and operation of the original scheme

Roosts (buildings and structures)

CFA7

4.4.15 A total of 14 buildings were identified for survey during 2014, all of which were subject to an initial assessment. Of these 12 were subject to an internal inspection and six were subject to emergence surveys. Following these surveys:

- seven roosts were confirmed in five buildings; four roosts were confirmed through internal inspections and three through emergence surveys;
- no buildings were assessed as having high potential to support roosting bats;
- five buildings were assessed as having moderate potential to support roosting bats; and
- the remaining buildings were assessed to have low or negligible potential to support roosting bats and were consequently scoped out of further survey.

4.4.16 Details of confirmed roosts in buildings/structures in this area of the route are provided in Table 7.

CFA8

4.4.17 Fifteen buildings were subject to an initial assessment. Following these surveys:

- no bat roosts were confirmed;
- none of these buildings were considered to have high potential to support roosting bats;
- seven were considered to have moderate potential to support roosting bats; and
- the remaining eight buildings were considered to have low or negligible potential to support roosting bats.

4.4.18 No internal inspections or emergence surveys were carried out in 2014.

CFA9

4.4.19 Two buildings were subject to an initial assessment, both of which were considered to have moderate potential to support roosting bats. No bat roosts were confirmed.

4.4.20 Further internal inspections and emergence surveys were not carried out in 2014.

CFA10

4.4.21 Two buildings were subject to emergence surveys having already been confirmed as roosts during internal inspections in 2012 and 2013 (Volume 5: baseline report - EC-003-002/2). Emergence surveys confirmed the presence of three bat roosts, comprising one soprano and two common pipistrelle roosts.

4.4.22 A third building was subject to an initial assessment during 2014 and was considered to have low potential to support roosting bats. This building was subsequently scoped out of further survey.

4.4.23 Details of confirmed roosts in buildings/structures in this area of the route are provided in Table 7.

CFA11

4.4.24 A total of 47 buildings were subject to an initial assessment, of which six were subject to internal inspections. Following these surveys:

- seven roosts were confirmed in five buildings;
- four buildings were considered to have high potential to support roosting bats
- seven buildings were considered to have moderate potential to support roosting bats; and
- the remaining 31 buildings were considered to have low or negligible potential to support roosting bats.

4.4.25 No emergence surveys were undertaken in 2014.

4.4.26 Details of confirmed roosts in buildings/structures in this area of the route are provided in Table 7.

CFA12

4.4.27 Five buildings were subject to an initial assessment. Of these all were subject to a detailed internal inspection in 2014 and four were subject to an emergence survey. Following these surveys:

- two confirmed roosts were identified during internal inspections;
- no buildings were assessed as having high potential to support roosting bats;
- two buildings were assessed as having moderate potential to support roosting bats; and
- the remaining building was considered to have low or negligible potential to support roosting bats and was therefore scoped out for further surveys.

4.4.28 Details of confirmed roosts in buildings/structures in this area of the route are provided in Table 7.

CFA13

4.4.29 A total of 45 buildings in this area were subject to initial assessment. Of these 26 were subject to internal survey and 17 were subject to emergence surveys. These included a bridge and a residential building that were identified as requiring emergence surveys in 2013. Following these surveys:

- 27 confirmed roosts were identified in 12 building; 14 roosts were confirmed during the internal assessments and 13 roosts during emergence survey;
- two of the remaining buildings were assessed as having high potential to support roosting bats;
- eight buildings were assessed as having moderate potential to support roosting bats; and

the remaining buildings were assessed as having either low or negligible potential to support roosting bats and were consequently scoped out of further survey.

4.4.30 Details of confirmed roosts in buildings/structures in this area of the route are provided in Table 7.

CFA14

4.4.31 In total 36 buildings were subject to an initial assessment, of which four buildings were subject to internal assessments. Following these surveys:

two bat roosts were confirmed;

none of these buildings were considered to have high potential to support roosting bats;

five were considered to have moderate potential to support roosting bats; and

the remaining 29 buildings were considered to have low or negligible potential to support roosting bats.

4.4.32 No emergence surveys were undertaken in 2014.

4.4.33 Details of confirmed roosts in buildings/structures in this area of the route are provided in Table 7.

CFA15

4.4.34 A total of 80 trees in this area were subject to an initial ground assessment of which 69 were subsequently subject to climbing surveys and one was subject to emergence surveys. Following these surveys:

one confirmed roost was identified through climbing surveys;

16 trees were assessed as having high potential to support roosting bats;

24 trees were assessed as having moderate potential to support roosting bats; and

39 trees were assessed as having low or negligible potential. These trees were subsequently scoped out of further survey.

4.4.35 Details of confirmed roosts in buildings/structures in this area of the route are provided in Table 7.

Table 7: Additional confirmed bat roosts in buildings/structures in CFA7 to 15 inclusive

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
020-BS3-029003	Land and buildings on the east side of Denham Way, West Hyde	TQ 03654 90171	Residential	Brown long-eared	29 April 2014 - internal inspection	Maternity	Large, well maintained building with traditional roof structure, timber framed with clay tiles, bitumen felt and internal wooden sarking boards. Four moderately large piles and some scattered droppings	7	100m east
020-BS3-029002	Land and buildings on the east side of Denham Way, West Hyde	TQ 03624 89879	Residential	Common pipistrelle	28 August 2014 - internal inspection	Maternity	Semi-detached cottage with a well-ventilated loft space with timber rafters and joists. Two droppings found in the east facing dormer. Droppings also found on the chimney breast at the north-facing gable	7	20m north
020-BS3-029001	Land and buildings on the east side of Denham Way, West Hyde	TQ 03623 89870	Residential	Common pipistrelle	28 August 2014 - internal inspection	Maternity	Semi-detached cottage with a well-ventilated loft space with timber rafters and joists. Large number of droppings concentrated at the north gable end and at centre of loft space	7	20m north

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
							under the ridge beam		
020-BS3-029004	Land and buildings on the east side of Denham Way, West Hyde	TQ 03669 90214	Residential	Common pipistrelle (2)	23 June 2014 – emergence survey	Day	Large brick building, well maintained and painted. Tiled, tall roof which has an extension that connects with the main building. Bat emerged from near north elevation of the gable apex	7	100m east
020-BS3-029003	Land and buildings on the east side of Denham Way, West Hyde	TQ 03631 90186	Residential	Common pipistrelle (1)	23 June 2014 - emergence survey	Day	Large brick building, well maintained and painted. Tiled roof, with windows and chimneys on the south-west side. Bat emerged from the lower area of the west facing elevation	7	100m east
020-BS3-029003	Land and buildings on the east side of Denham Way, West Hyde	TQ 03641 90159	Residential	Soprano pipistrelle (1)	24 June 2014 - emergence survey	Day	Large brick building, well maintained and painted. Tiled roof, with windows and chimneys on the south-west side. Bat was seen emerging from midway up west-facing roof	7	100m east
020-BS3-029005	Land and buildings on	TQ 03629 90221	Warehouse	Soprano pipistrelle (4)	24 June 2014 - emergence	Day	Simple brick building with tiled roof. Walls are	7	80m east

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
	the east side of Denham Way, West Hyde				survey		well maintained but roof has several loose tiles - bat emerged from raised tile at bottom of gable end on south western elevation of building		
020-BS3-053002	Cobwebs, Bacombe Lane, Wendover	SP 86664 07223	Residential	Common pipistrelle (1)	14 July 2014 - emergence survey	Day	One bat emerged from under the ridge tile above the second window from the left, on the southern elevation	10	30m south-east
020-BS3-053001	Grove Farm, Wendover	SP 86933 06865	Residential	Soprano pipistrelle (1)	22 July 2014 - emergence survey	Day	One bat emerged from southern elevation of building	10	30m south-west
020-BS3-053001	Grove Farm, Wendover	SP 86933 06865	Residential	Common pipistrelle (3)	15 September 2014 - emergence survey	Day	Roost located under ridge tile on southern elevation	10	30m south-west
020-BS2-059-005	Standalls Farm, Bishopstone	SP 81398 10369	Residential building	Brown long-eared (confirmed through DNA analysis (droppings approximately 1200)	12 September 2014 - internal inspection	Maternity	Mid 17th century house situated in farm complex. In the roof void 3 piles of 300 plus droppings were recorded under each brace, collar and king	11	50m west

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
							truss. Also 200 plus droppings recorded in north east of void (and scattered throughout elsewhere). Both fresh and decayed droppings recorded		
020-BS2-059-005	Standalls Farm, Bishopstone	SP 81398 10369	Residential building	Common pipistrelle (established by approximately 40 droppings scattered)	12 September 2014 - internal inspection	Day	Mid 17th century house situated in farm complex. Droppings recorded scattered, slightly more densely around roof hatch at south aspect	11	50m west
020-BS2-059-006	Standalls Farm, Bishopstone	SP 81384 10398	Hayloft and stable	Brown long-eared (established by 3 decayed droppings).	12 September 2014 - internal inspection	Day	Open -ended, 18th century hayloft with old weatherboard cladding. Three decayed droppings found on loft timber. Stairway/open access from hayloft to stable and sheltered area of lower storey (hewn timber joints)	11	70m west
020-BS2-062-001	Glebe House, Oxford Road, Hartwell, Aylesbury	SP 80110 12346	Barn (open shelter)	Common pipistrelle established by single dropping (1)	21 August 2014 - internal inspection	Day	Open shelter, approximately 100 years old, with recent renovations. A single pipistrelle dropping was found adjacent to a	11	Within an area of land required for the construction and operation of the

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
							small cavity within a wall		original scheme
020-BS2-062-001	Glebe House, Oxford Road, Hartwell, Aylesbury	SP 80110 12346	Barn (open shelter)	Brown long-eared (established by droppings (2)	21 August 2014 - internal inspection	Day	Open shelter, approximately 100 years old, with recent renovations. Two brown long-eared dropping were found adjacent to a small cavity within a wall	11	Within an area of land required for the construction and operation of the original scheme
020-BS2-062-002	Glebe House, Oxford Road, Hartwell, Aylesbury	SP 80112 12358	Outbuilding	Brown long-eared (established by dropping (1)	21 August 2014 - internal inspection	Feeding; night	Brick building with a pitched roof, previously a livestock shelter, open and airy. A single brown long-eared dropping on top of one of the tables in the building	11	Within an area of land required for the construction and operation of the original scheme
020-BS2-062-003	Glebe House, Oxford Road, Hartwell, Aylesbury	SP 80105 12373	Residential	Species undetermined (established by droppings (3) in three locations	21 August 2014 - building inspection	Day	Residential building with adjoining permanently open structure and adjoining exterior driveway wall with cavities. Bat droppings identified using endoscope inside cavities within the thick stone exterior wall	11	Within an area of land required for the construction and operation of the original scheme
020-BS2-074003	Land at	SP 71582 21005	Residential	Brown long-eared	20 August	Satellite	Scattered droppings	12	Adjacent to land

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
	Woodlands Farm, Quainton				2014 - internal inspection		throughout loft space. Estimated 2000 droppings in total, with the majority being from previous seasons. The owner of the property reported seeing one bat in the loft in July		required for the original scheme
020-BS2-071002	Land on the north side of Station Road, Quainton	SP 74006 19242	Other	Common pipistrelle	29 April 2014 - internal inspection	Night	Simple wooden shed (approximately 2.5m high) with access to internal void through gaps in doors. Droppings found on internal walls	12	Adjacent to land required for the original scheme
020-BS2-079002	Rosehill Farm, Steeple Claydon	SP 69636 25755	Residential	Brown long-eared	28 August 2014 - internal inspection	Day	Roof void is approximately 10 x 10m and has a roof light centrally. It has been significantly modified from the original structure. Droppings appear fairly old and are scattered in darker areas of the roof away from the roof light	13	20m south
020-BS3-079001	Shepherd's Furze Farm, Steeple	SP 68714 25658	Residential	Brown long-eared (3)	16 September 2014 - emergence	Transitional	Traditional building structure adjacent to agricultural fields, hedgerows and small	13	Within an area of land required for the construction and

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
	Claydon				survey		woodland copses. Bats seen emerging from chimney		operation of the original scheme
020-BS3-079001	Shepherd's Furze Farm, Steeple Claydon	SP 68714 25658	Residential	Common pipistrelle (2)	7 July 2014 - emergence Survey	Day	Traditional building structure adjacent to agricultural fields, hedgerows and small woodland copses. Bat emerged from eastern elevation of building, flying south	13	Within an area of land required for the construction and operation of the original scheme
020-BS2-080006	Portway Farm, Twyford	SP 67378 25938	Barn	Brown long-eared	8 July 2014 - internal inspection	Day; feeding perch	19th/20th century brick built barn; double skin brick walls with no cavities. Butterfly wings caught in cobwebs and on the floor on the western side of the building	13	90m south-east
020-BS3-080004	Portway Farm, Twyford	SP 67378 25939	Barn	Brown long-eared (3)	8 July 2014 - emergence survey	Day	Agricultural building with numerous access points between brickwork and roof apex.	13	80m south-east
020-BS3-080004	Portway Farm, Twyford	SP 67378 25939	Barn	Common pipistrelle (1)	8 July 2014 - emergence survey	Day	Agricultural building with numerous access points externally; bat recorded returning to	13	80m south-east

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
							barn through hole in brickwork near roof apex		
020-BS3-080004	Portway Farm, Twyford	SP 67378 25939	Barn	Soprano pipistrelle (2)	20 August 2014 - emergence survey	Day	Agricultural building with numerous access points between brickwork and roof apex	13	80m south-east
020-BS3-080001	Portway Farm, Twyford	SP 67406 25910	Residential	Brown long-eared (22)	20 August 2014 - emergence survey	Maternity	Large residential building approximately late 19th/early 20th century; numerous access points into internal voids	13	100m south-east
020-BS3-080001	Portway Farm, Twyford	SP 67406 25910	Residential	Common pipistrelle (30)	9 July 2014 - emergence survey	Maternity	Large residential building approximately late 19th/early 20th century construction; bats re-entered through gaps in mortar and small gaps beneath hanging tile on southern elevation	13	100m south-east
020-BS3-080001	Portway Farm, Twyford	SP 67406 25910	Residential	Soprano pipistrelle (2)	9 July 2014 - emergence survey	Day	Large residential building approximately late 19th/early 20th century construction; bats re-entered into gap under roof tile at	13	100m south-east

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
							bottom of gable end on west side		
020-BS3-080002	Portway Farm, Twyford	SP 67388 25920	Barn	Brown long-eared (4)	8 July 2014 - emergence survey	Maternity	Traditional, agricultural gable ended barn with over 2000 droppings present internally; bats emerging from under roof tiles near to gable end	13	100m south-east
020-BS3-080002	Portway Farm, Twyford	SP 67388 25920	Barn	Common pipistrelle (1)	8 July 2014 - emergence survey	Day	Traditional, agricultural gable ended barn with over 2000 droppings present internally; bats emerging from the western elevation of the building	13	100m south-east
020-BS3-080003	Portway Farm, Twyford	SP 67422 25920	Other	Brown long-eared (4)	8 July 2014 – E emergence survey	Day	Square shaped turreted outbuilding with hipped, clay tiled roof; emergence from south-west corner	13	140m south-east
020-BS3-080003	Portway Farm, Twyford	SP 67422 25920	Other	Common pipistrelle (4)	24 September 2014 - emergence survey	Day	Square shaped turreted outbuilding with hipped, clay tiled roof; emergence from south-west corner	13	140m south-east

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
020-BS3-080004	Portway Farm, Twyford	SP 67408 25960	Barn	Brown long-eared (1)	19 August 2014 - emergence survey	Day	Traditional red brick-built, L-shaped agricultural building; emergences from western gable and main door. Numerous return visits and bats flying in and out of the building	13	90m south-east
020-BS3-080004	Portway Farm, Twyford	SP 67408 25960	Barn	Common pipistrelle (5)	19 August 2014 - emergence survey	Day	Traditional red brick-built, L-shaped agricultural building; bats emerged from western gable and main door	13	90m south-east
020-BS3-080004	Portway Farm, Twyford	SP 67408 25960	Barn	Soprano pipistrelle (3)	19 August 2014 - emergence survey	Day	Traditional red brick-built, L-shaped agricultural building; bats emerged from western gable and main door	13	90m south-east
020-BS3-080004	Portway Farm, Twyford	SP 67408 25960	Barn	Pipistrelle sp. (4)	19 August 2014 - emergence survey	Day	Traditional red brick-built, L-shaped agricultural building; bats emerged from western gable and main door	13	90m south-east
020-BS3-080006	Portway Farm,	SP 67784 26106	Other	Brown long-eared	8 July 2014 - internal	Feeding	Traditional brick built barn with a flat roof.	13	Within an area of land required

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
	Twyford				inspection		North-west side is exposed and open fronted. Small tortoiseshell and yellow underwing moth wings present with numerous droppings found adhered to a wall		for the construction and operation of the Proposed Scheme
020-BS3-080006	Portway Farm, Twyford	SP 67784 26106	Other	Common pipistrelle (1)	8 July 2014 - internal inspection	Day	Traditional brick built barn with a flat roof. North-west side is exposed and open fronted. Bat recorded emerging	13	Within an area of land required for the construction and operation of the original scheme
020-BS3-080006	Portway Farm, Twyford	SP 67784 26106	Other	Pipistrelle sp. (1)	19 August 2014 - emergence survey	Day	Traditional brick built barn with a flat roof. North-west side is exposed and open fronted. Bat recorded emerging	13	Within an area of land required for the construction and operation of the original scheme
020-BS2-078002	13 Brackley Lane, Calvert	SP 68805 24685	Residential	Brown long-eared (1)	22 July 2014 - internal inspection	Day	Brick-built 1950's semi-detached cottage; scattered droppings throughout void and one bat in-situ, hanging from a rafter	13	10m south
020-BS2-078002	13 Brackley Lane, Calvert	SP 68805 24685	Residential	Common pipistrelle (3)	22 July 2014 - emergence	Day	Brick-built 1950's semi-detached cottage; bat	13	10m south

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
					survey		emerged from slipped roof tile near chimney on eastern elevation, then towards trees		
020-BS3-081001	Land at Three Bridge Mill, Twyford	SP 67412 26812	Other	Brown long-eared (2)	28 May 2014 - emergence survey	Day	Brick building with slate roof; all windows and doors missing. Bats emerged from top window and later re-entered through a doorway	13	20m east
020-BS3-081001	Land at Three Bridge Mill, Twyford	SP 67412 26812	Other	Common pipistrelle (1)	23 July 2014 - emergence survey	Day	Brick building with slate roof; all windows and doors missing. Bats recorded returning to roost at the gully between roof ridges	13	20m east
020-BS3-081002	Land at Three Bridge Mill, Twyford	SP 67409 26835	Residential	Brown long-eared (5)	17 June 2014 - emergence survey	Day	A large residential house; the original water mill building with additional lean to workshop. Bats recorded emerging from gable end tile and windows	13	20m east
020-BS3-081002	Land at Three Bridge Mill, Twyford	SP 67409 26835	Residential	Common pipistrelle (7)	17 June 2014 - emergence survey	Day	A large residential house; the original water mill building with	13	20m east

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
							additional lean to workshop. Bats recorded emerging gable end tile and windows		
020-BS3-081002	Land at Three Bridge Mill, Twyford	SP 67409 26835	Residential	Soprano pipistrelle (1)	17 June 2014 - emergence survey	Day	A large residential house; the original water mill building with additional lean to workshop	13	20m east
020-BS2-092-001	Mill Farm House, Mill Lane, Westbury	SP 62161 35804	Farmhouse	*Myotis* sp. (established by droppings, (scattered throughout loft)	24 July 2014 - internal inspection	Likely to be a day roost	Old stone-walled farmhouse. Estimated circa 200 years old. Bat droppings collected from the west wing of the house scattered throughout the roof void	14	130m east
020-BS2-091-002	Glebe Farm, Mixbury, Brackley	SP 61115 34003	Detached building with loft in pitched roof	Brown long-eared (confirmed by DNA analysis of droppings (15)	13 August 2014 - internal inspection	Likely to be a day roost	Single storey building with pitched roof and loft. A few droppings were recorded adhered to chimney breast and <10 on a wall socket	14	40m north-west
020-BS2-111-001	Manor Farm, Aston Le Walls	SP 49463 50748	Barn	Common pipistrelle (1) (established through sound analysis)	29 July 2014 - emergence survey	Day	Large barn with asbestos cement roof. Bat emerged from the centre of the largest	15	110m north-east

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
							cavity (in line with highest point of roof)		
020-BS2-104-001	Magpie Farm, Culworth,	SP 54723 45166	Residential house	Soprano pipistrelle (1) (established through sound analysis)	06 August 2014 - emergence survey	Day	Residential house (former 19th century roadside Inn within farm complex) with substantial stone walls. Multiple surveyors confirmed a bat emerged; likely location was a cavity wall and chimney between two buildings	15	50m east
020-BS2-104-001	Magpie Farm, Culworth,	SP 54723 45166	Residential house	Species undetermined	08 September 2014 - internal inspection	Day	Residential house (former roadside Inn within farm complex). A few droppings were recorded in the roof void; both fresh and decayed droppings observed	15	50m east
020-BS2-104-001	Magpie Farm, Culworth,	SP 54723 45166	Residential house (ex-roadside inn within farm complex)	Brown long-eared (confirmed by DNA analysis of droppings)	08 September 2014 - internal inspection	Maternity	Over 200 scattered, fresh and decayed droppings were recorded in a shallow roof void	15	50m east

Ecology survey code	Location	OS grid reference	Building/ structure type	Species confirmed utilising roost and (peak count where emergence survey completed)	Date of peak count and nature of survey	Roost type	Roost description	CFA	Approximate distance from the original scheme and orientation (m)
020-BS2-101-001	Fields and agricultural land Greatworth Fields Farm House, Greatworth	SP 54723 45166	Residential house	Species undetermined	24 July 2014 - internal inspection	Day	Brick building (1876). Ridge-tiled roof. Pointing in good condition. Gaps between the top of the wall and the roof. One unidentified bat recorded between house wall and terminal truss	15	80m south-west
020-BS2-101-001	Fields and agricultural land Greatworth Fields Farm House, Greatworth	SP 54723 45166	Residential house	Brown long-eared (established by one bat in-situ and droppings)	24 July 2014 - internal inspection	Day	Brick building (1876). Ridge-tiled roof. Pointing in good condition. Gaps between the top of the wall and the roof. One brown long-eared bat observed flying in main roof space	15	80m south-west

Bat activity surveys

CFA7

4.4.36 One bat activity transect was undertaken in CFA7 during 2014 (Table 8), which recorded the presence of the following species:

noctule bat (*Nyctalus noctula*);

common pipistrelle (*Pipistrellus pipistrellus*); and

soprano pipistrelle (*Pipistrellus pygmaeus*).

4.4.37 A summary of the transect results is provided in Table 9 of this report.

Table 8: Bat activity surveys conducted within CFA7

Ecology survey code	Transect location	Number of surveys conducted	Survey date	CFA	Transect start (grid reference)	Transect end (grid reference)
020-BA4-026001	Buckinghamshire Golf Club	1 (1 night)	29 September 2014	7	TQ 05217 86467	TQ 04952 86474

Table 9: Bat activity transect survey results 2014 - Buckinghamshire Golf Course

Ecology survey code	Transect location				Description of habitats covered by transect															
020-BA4-026001	Buckinghamshire Golf Club				A mixture of semi-natural broadleaved woodland is present with the River Colne flowing north to south. The woodland is variable in character; drier areas are dominated by mature beech and conifer woodland. Areas of species-poor rough grass were also present throughout the area															
Visit number and date	**Weather conditions**				**Total species passes during transect survey**															
	Temp (°C)	**Cloud (0-8)**	**Rain (0-5)**	**Wind (0-12)**	**Pp**	**Ppy**	**Pn**	**P sp.**	**Mb**	**Md**	**Mn**	**Mm**	**Mbr**	**Mm /Mb**	**M sp.**	**Pa**	**Bb**	**Nn**	**Nl**	**Es**	**Ny/ Es**
Dusk 29 September 2014	14	5	0	1	5	17	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-

Sonographs from these species can be difficult to separate where only partial calls are recorded.

Pp - common pipistrelle, P py - soprano pipstrelle, Pn - Nathusius' pipistrelle, P sp. - Pipistrelle bat species, Mb - Bechstein's bat, Md - Daubenton's bat, Mn - Natterer's bat, Mm - whiskered bat, Mbr - Brandt's bat, Mm/Mb -whiskered/ Brandt's bat, M sp - *Myotis* bat species, Pa -brown long-eared bat, Bb - barbastelle bat, Nn - noctule bat, Nl - Leisler's bat, Es - serotine bat, Ny/Ep - Nyctaluis/ Eptesicus bat.

Cloud cover on a scale of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.

Precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.

Wind speed score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale, 12 = Hurricane

4.4.38 Low activity was recorded for the three species present, with five passes per night (ppn) for common pipistrelle, 17ppn for soprano pipistrelle and 5ppn for noctule. It was noted that noctule activity gradually increased towards the end of the activity transect.

Roosts (radio-tracking)

CFA12

4.4.39 A total of 53 tagged bats were tracked to 60 individual roosting locations in CFA12 and CFA13 during radio-tracking surveys in 2014. Of these, 58 were in CFA12 and comprised four building roosts and 54 tree roosts (including those roosts found in bat boxes). The species tagged include the very rare Bechstein's bat *(Myotis bechsteinii)*, the rare species whiskered *(Myotis mystacinus)* and Brandt's bat *(Myotis brandtii)*, and the common and widespread species; brown long-eared bat *(Plecotus auritus)*, Daubenton's bat *(Myotis daubentonii)* and Natterer's bat *(Myotis nattereri).*

4.4.40 Details of confirmed roosts identified through radio-tracking surveys in this area of the route are provided in Table 10.

CFA13

4.4.41 A total of 53 tagged bats were tracked to 60 individual roosting locations in CFA12 and CFA13 during radio-tracking surveys in 2014. Of these two Bechstein's bats roosts were confirmed in CFA13.

4.4.42 The species of bats tagged in CFA12 and CFA13 included the very rare Bechstein's bat, the rare species whiskered and Brandt's bat, and common and widespread species, including brown long-eared bats, Daubenton's bat and Natterer's bat.

4.4.43 Details of confirmed roosts identified through radio-tracking surveys in this area of the route are provided in Table 10.

CFA14

4.4.44 Radio-tracking surveys were conducted in May, July and September 2014 across CFA14 and CFA15. Fourteen Natterer's bats were tagged and tracked to a total of ten roosts; four in CFA14 and six in CFA15.

4.4.45 Of the four roosts identified in CFA14, two were confirmed in trees to the east and west of the route and two roosts were identified in buildings in and around Radstone village. This includes a large maternity roost of Natterer's bat (peak count 222 individuals) at the Church of St. Lawrence in Radstone.

4.4.46 Details of confirmed roosts identified through radio-tracking surveys in this area of the route are provided in Table 10.

CFA15

4.4.47 Radio-tracking surveys were conducted in May, July and September 2014 across CFA14 and CFA15. Fourteen Natterer's bat were tagged and tracked to a total of ten roosts; four in CFA14 and six in CFA15.

4.4.48 Of the six roosts identified in CFA15, all were confirmed in trees.

4.4.49 Details of confirmed roosts identified through radio-tracking surveys in CFA15 are provided in Table 10.

Table 10: Additional confirmed bat roosts identified during radio-tracking surveys in CFA12 to 13 inclusive

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
020-BA4-075078	Finemere Hill	SP 71960 22642	Building	Whiskered (1) (confirmed through DNA analysis)	April	Not determined[1]	Finmere Hill House	12	500m north-east
020-BA4-074029	Finemere Wood	SP 71899 21902	Tree	Whiskered (2)	April	Transitional[1]	Southern elevation of oak tree (tree tag 003)	12	500m north-east
020-BA4-075067	Finemere Wood	SP 71413 22101	Tree	Brown long-eared (1)	April	Not determined[1]	Northern elevation of oak tree	12	Adjacent to land required for the original scheme
020-BA4-075059	Finemere Wood	SP 71362 21985	Tree (bat box)	Natterer's bat (4)	April	Not determined[1]	Roosting in bat box (higher of the two on tree) on oak tree	12	120m south-east
020-BA4-075060	Finemere Wood	SP 71303 21999	Tree	Bechstein's bat (15)	May	Maternity	Woodpecker hole on western elevation of oak tree - western edge Finemere Woods	12	Adjacent to land required for the original scheme
020-BA4-075076	Finemere Wood	SP 71727 22277	Tree	Bechstein's bat (17)	May	Maternity	Ash tree on in northern tip of woodland	12	350m south-east
020-BA4-075068	Finemere Wood	SP 71771 22143	Tree	Bechstein's bat (2)	May	Not determined[1]	Tree cavity in oak tree (large hibernation box also present on tree)	12	390m east

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
020-BA4-076017	Romer Wood	SP 71124 23292	Tree	Bechstein's bat (1)	May	Not determined[1]	Unknown (no access) estimated coordinates	12	160m east
020-BA4-074035	Finemere Wood	SP 71829 21994	Tree	Bechstein's bat (6)	May	Maternity	Oak tree (tag number 03073	12	550m east
020-BA4-074032	Finemere Wood	SP 72083 21959	Tree	Brown long-eared (4)	May	Not determined[1]	Oak tree in the east of the woodland	12	560m east
020-BA4-075075	Finemere Wood	SP 71709 22217	Tree	Brown long-eared (1)	May	Not determined[1]	Bat recorded roosting in the base of an oak tree in the northern tip of the woodland	12	320m east
020-BA4-074018	Woodend, Kingswood Road	SP 68808 18589	Building	Brandt's bat (2)	June	Not determined[1]	Bat recorded roosting in main residential building	12	1.9km west
020-BA4-075054	Grendon and Doddershall Woods	SP 69970 21068	Tree	Bechstein's bat (1)	June	Not determined[1]	Unknown (no access) - estimated coordinates	12	900m south
020-BA4-075053	Grendon and Doddershall Woods	SP 69991 21046	Tree	Bechstein's bat (1)	June	Not determined[1]	Unknown (no access) - estimated coordinates	12	900m south
020-BA4-076016	Sheephouse Wood	SP 70215 23019	Tree	Brown long-eared (1)	June	Not determined[1]	Unknown (no access) - estimated coordinates	12	Adjacent to land required for the Proposed Scheme

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
020-BA4-074022	Grendon and Doddershall Wood	SP 70177 20358	Tree	Brown long-eared (1)	June	Not determined[1]	Unknown (no access) - estimated coordinates	12	530m west
020-BA4-075061	Finemere Wood	SP 71414 22030	Tree	Brown long-eared (2)	June	Not determined[1]	Western edge of Finemere Wood (tree tag number 0102)	12	130m east
020-BA4-075066	Finemere Wood	SP 71822 22092	Tree	Brown long-eared (1)	June	Not determined[1]	North of woodland (tree tag number 014)	12	450m east
020-BA4-075071	Finemere Wood	SP 71742 22167	Tree (bat box)	Brown long-eared (1)	June	Not determined[1]	Bat box on tree near to footpath	12	350m east
020-BA4-074026	Finemere Wood	SP 71914 21775	Tree	Natterer's bat (9)	June	Maternity	Oak tree adjacent to path towards the south of the woodland (tree tag number 0101)	12	350m east
020-BA4-074028	Finemere Wood	SP 71861 21873	Tree	Natterer's bat (2)	June	Not determined[1]	Tree adjacent to path towards the south of the woodland	12	325m north-east
020-BA4-075077	Claydon Estate, north of Finemere Wood	SP 71723 22388	Tree	Bechstein's bat (3)	July	Maternity	Ash tree in a field to the north of Finemere Wood. This roost was previously confirmed as a maternity colony during radio-tracking surveys in 2013	12	330m east
020-BA4-075065	Finemere Wood	SP 71841 22082	Tree	Bechstein's bat (67)	July	Maternity	Oak tree (tree tag number 039)	12	480m south-east

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
020-BA4-074020	Grendon and Doddershall Woods	SP 69993 20256	Tree	Daubenton's bat (1)	July	Not determined[1]	Unknown (no access) - estimated coordinates	12	780m west
020-BA4-075064	Finemere Wood	SP 71818 22073	Tree (bat box)	Natterer's bat (3)	July	Not determined[1]	In lower bat box on oak tree	12	480m south-east
020-BA4-074036	Finemere Wood	SP 71821 22012	Tree	Natterer's bat (7)	July	Maternity	Oak tree with tree tags 002 and 0689	12	550m south-east
020-BA4-075070	Finemere Wood	SP 71418 22153	Tree	Natterer's bat (1)	July	Not determined[1]	Five-stemmed ash tree in the west of the woodland	12	Adjacent to land required for the Proposed Scheme
020-BA4-075074	Finemere Wood	SP 71655 22204	Tree	Natterer's bat (1)	July	Not determined[1]	Double-stemmed ash tree (tree tag 0040), close to northern tip of the woodland	12	330m east
020-BA4-074027	Finemere Wood	SP 71859 21865	Tree	Natterer's bat (1)	July	Not determined[1]	Oak tree (tree tag 034) in southern part of woodland	12	450m east
020-BA4-075057	Grendon and Doddershall Woods	SP 70115 21571	Tree	Bechstein's bat (1)	August	Not determined[1]	Bat recorded roosting in southern elevation of an oak tree on the northern edge of the woodland	12	200m south
020-BA4-075051	Grendon and Doddershall Woods	SP 69988 20562	Tree	Bechstein's bat (1)	August	Not determined[1]	Bat recorded roosting in cavity on eastern elevation of an oak tree (approximately. 8m high)	12	830m west

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
020-BA4-075052	Grendon and Doddershall Woods	SP 69988 20567	Tree	Bechstein's bat (22)	August	Maternity	Oak tree with a woodpecker hole approximately 6m on eastern protruding limb	12	830m west
020-BA4-074019	Knapps Hook Farm	SP 70746 20105	Building	Bechstein's bat (1)	August	Not determined[1]	Within complex of farm buildings to the east of southern Doddershall Woods	12	80m south
020-BA4-073001	Doddershall Estate	SP 72038 19980	Tree	Bechstein's bat (1)	September	Not determined[1]	Bat recorded roosting in plane tree in private garden	12	Within an area of land required for the construction and operation of the original scheme
020-BA4-073003	Doddershall Estate	SP 72037 19997	Tree	Bechstein's bat (1)	September	Not determined[1]	Bat recorded roosting in sycamore tree in private garden	12	Within an area of land required for the construction and operation of the original scheme
020-BA4-073005	Doddershall Estate	SP 71777 20304	Tree	Natterer's bat (1)	September	Not determined[1]	Bat recorded roosting in oak tree in private garden	12	80m south-west
020-BA4-073004	Doddershall Estate	SP 72037 19997	Tree	Natterer's bat (1)	September	Not determined[1]	Bat recorded roosting in lime tree in private garden	12	Within an area of land required for the construction and operation of the original scheme

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
020-BA4-074031	Finemere Wood	SP 71913 21947	Tree	Brown long-eared (2)	September	Not determined[1]	Bat likely to be roosting woodpecker hole on south west aspect of oak tree	12	600m east
020-BA4-074030	Finemere Wood	SP 71913 21932	Tree	Brown long-eared (2)	September	Not determined[1]	Oak tree; roost on northern limb	12	600m east
020-BA4-075073	Finemere Wood	SP 71432 22194	Tree	Brown long-eared (3)	September	Not determined[1]	Sycamore tree with multi-stem decay	12	Adjacent the original scheme
020-BA4-075072	Finemere Wood	SP 71445 22189	Tree	Brown long-eared (1)	September	Not determined[1]	Oak tree with roosting feature high up in canopy	12	Adjacent to the original scheme
020-BA4-075069	Finemere Wood	SP 71363 22145	Tree	Brown long-eared (1)	September	Not determined[1]	Oak tree in the north-west of the woodland	12	Adjacent to the original scheme
020-BA4-075063	Finemere Wood	SP 71411 22051	Tree	Brown long-eared (1)	September	Not determined[1]	Multi-stem oak tree in the north-west of the woodland	12	100m east
020-BA4-075058	Finemere Wood	SP 71342 21985	Tree (bat box)	Brown long-eared (3)	September	Not determined[1]	Bat box number 44 (or possibly the box above) on an oak tree adjacent to the western edge of the woodland	12	100m east
020-BA4-075062	Finemere Wood	SP 71422 22044	Tree	Brown long-eared (1)	September	Not determined[1]	Oak tree	12	100m east
020-BA4-	Sheephouse	SP 70072	Tree	Daubenton's	September	Not	Unknown (no access) - estimated	12	250m south-east

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
077009	Wood	23500		bat (1)		determined[1]	coordinates		
020-BA4-075055	Grendon and Doddershall Woods	SP 70049 21142	Tree	Natterer's bat (1)	September	Not determined[1]	Bat recorded roosting in oak tree, possibly in large split limb cavity 5m on south eastern aspect	12	730m west
020-BA4-075056	Grendon and Doddershall Woods	SP 69676 21230	Tree	Natterer's bat (1)	September	Not determined[1]	Oak tree on the edge of the woodland	12	680m south
020-BA4-073002	Doddershall Estate	SP 72103 19985	Tree	Natterer's bat (1)	September	Not determined[1]	Unknown - tree surrounded by inaccessible vegetation	12	Within an area of land required for the construction and operation of the original scheme
020-BA4-074037	Finemere Wood	SP 71878 22057	Tree (bat box)	Natterer's bat (1)	September	Not determined[1]	Bat recorded roosting in bat box number 51 on ash tree towards north-eastern edge of woodland	12	530m east
020-BA4-074025	Finemere Wood	SP 71905 21773	Tree	Natterer's bat (1)	September	Not determined[1]	Oak tree towards the east of the woodland	12	300m north
020-BA4-076015	Sheephouse Wood	SP 70215 22980	Tree	Bechstein's bat (1)	September	Not determined[1]	Bat in southern edge of woodland	12	Adjacent to land required for the original scheme
020-BA4-074021	Grendon and Doddershall Woods	SP 70291 20330	Tree	Bechstein's bat (3)	September	Not determined[1]	Oak tree in the southern part of the woodland	12	450m west

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
020-BA4-074024	Finemere Wood	SP 71881 21470	Tree	Brown long-eared (1)	October	Not determined[1]	Sycamore tree along the edge of the River Ray	12	Adjacent to land required for the original scheme
020-BA4-074023	Woodlands Farm	SP 71476 21317	Building	Brown long-eared (1)	October	Not determined[1]	Unknown (no access) - estimated coordinates	12	Adjacent to land required for the original scheme
020-BA4-074034	Finemere Wood	SP 72018 21970	Tree	Natterer's bat (1)	October	Not determined[1]	Bat recorded roosting in a fork union on the north eastern face of silver birch, around 5m high	12	580m east
020-BA4-074033	Finemere Wood	SP 72015 21966	Tree	Natterer's bat (1)	October	Not determined[1]	Oak tree on the northern boundary of the woodland	12	580m east
020-BA4-078021	Calvert Landfill	SP 69015 24105	Tree	Bechstein's bat (1)	July	Day	Willow tree adjacent to ponds to the west of Calvert Landfill	13	90m south-east
020-BA4-079001	Warner Terrace, Calvert	SP 68665 24625	Tree	Bechstein's bat (1)	July	Not determined[1]	Ash tree in private residential garden, adjacent to Calvert Jubilee Nature Reserve	13	80m west
020-BA4-098001	Church of St. Lawrence, Radstone	SP 58796 40524	Building	Natterer's bat (222)	May, July and September	Maternity	Large maternity colony. Initially identified in 2013	14	Adjacent to the original scheme
020-BA4-097002	Hall Farm	SP 58775 39690	Building	Natterer's bat (1)	September	Transitional	Complex of farm buildings to the south of Radstone Church	14	Adjacent to the original scheme
020-BA4-	Shortgrove	SP 60609	Tree	Natterer's	September	Transitional	Ash tree within woodland to the	14	2km north-east

Ecology survey code	Location	OS grid reference	Tree/building	Species confirmed utilising roost (peak count)	Survey Month	Roost type	Roost description	CFA	Distance from land required for the original scheme (m) and orientation
097003	Wood	41897		bat (1)			north-east of Radstone		
020-BA4-098002	South of Halse Copse	SP 57828 40636	Tree	Natterer's bat (1)	September	Transitional	Oak tree in a hedgerow to the south of Halse Copse	14	Adjacent to the original scheme
020-BA4-099001	Halse Copse	SP 57593 41468	Tree	Natterer's bat (1)	September	Transitional	Southern section of the woodland	15	Adjacent to the original scheme, north
020-BA4-099002	Halse Copse	SP 57580 41470	Tree	Natterer's bat (1)	September	Transitional	Southern section of the woodland	15	Adjacent to the original scheme, north
020-BA4-099006	Halse Copse	SP 57330 41729	Tree	Natterer's bat (1)	September	Transitional	North-western part of the woodland	15	Adjacent to the original scheme, east
020-BA4-099003	Halse Copse	SP 57704 41489	Tree	Natterer's bat (1)	September	Transitional	South-eastern boundary of the woodland	15	Adjacent to the original scheme, north
020-BA4-099004	Halse Copse	SP 57349 41605	Tree	Natterer's bat (1)	September	Transitional	Along the eastern border of the woodland	15	Adjacent to the original scheme, east
020-BA4-099005	Halse Copse	SP 57328 41668	Tree	Natterer's bat (1)	September	Transitional	Along the eastern border of the woodland	15	Adjacent to the original scheme, east

[1] Not determined - roost type was undefinable where emergence surveys were limited in number or could not be undertaken due to lack of access

Discussion

CFA7

4.4.50 Field surveys in 2014 confirmed the presence of at least seven bat species. A number of records were returned for rare species, such as Nathusius' pipistrelle (*Pipistrellus nathusii*); and an uncommon species, noctule.

4.4.51 Common species recorded during field surveys in 2014 included soprano pipistrelle, common pipistrelle and brown long-eared bat. These species were recorded in relatively high numbers during emergence surveys. Daubenton's bat, which is commonly associated with habitats found in this area, such as broadleaved woodland and standing water, was also recorded during emergence surveys.

4.4.52 One tree roost was identified at the Buckinghamshire Golf Club, located approximately 40m west of land required for the scheme. Three droppings were found in a 50cm long split towards the top of an oak tree.

4.4.53 Seven roosts of common pipistrelle, soprano pipistrelle and brown long-eared bat were identified in five buildings located in buildings on the east side of Denham Way, which are within 100m of land required for the original scheme. Of these seven roosts, two common pipistrelle and one brown long-eared roost were confirmed as maternity roosts.

4.4.54 In 2012 and 2013, field surveys confirmed the presence of 13 bat species in CFA7, no additional species were identified in the 2014 field surveys.

4.4.55 In 2012 and 2013, field surveys confirmed 12 roosts comprising eight tree roosts (including one unidentified Myotis maternity roost and one common pipistrelle hibernation roost) and four building roosts. With the addition of the 2014 field surveys, a total of 20 roosts have now been confirmed.

CFA8

4.4.56 No building or tree roosts were confirmed during the 2014 field surveys; however, features with the potential to support roosting bats were identified.

4.4.57 In 2012 and 2013, field surveys confirmed the presence of six bat species including, noctule, Daubenton's bat, Natterer's bat, soprano pipistrelle, common pipistrelle and brown long-eared bat. No additional species were identified in the 2014 field surveys.

4.4.58 The 2013 field surveys confirmed two brown long-eared building roosts.

CFA9

4.4.59 No building or tree roosts were confirmed during the 2014 field surveys; however, features with the potential to support roosting bats were identified.

4.4.60 In 2012 and 2013, field surveys confirmed the presence of six bat species including noctule, Daubenton's bat, Natterer's bat, soprano pipistrelle, common pipistrelle and serotine. No additional species were identified in the 2014 field surveys.

4.4.61 The 2013 surveys confirmed one common pipistrelle roost near Park Farm.

4.4.62 Full discussion into the bat assemblage, roosts, foraging habitat and commuting habitat can be found in Volume 5 of the main ES, CFA7-15, (EC-001-002), Section 2.

CFA10

4.4.63 In 2014 a total of three new bat roosts were confirmed. This mirrors the findings of the main ES where bat populations have been recorded in these areas.

CFA11

4.4.64 At least five species of bat were identified in this area during surveys in 2014 these included one uncommon species, noctule, and four common species, *Myotis* (including Daubenton's), soprano pipistrelle, common pipistrelle and brown long-eared bat.

4.4.65 Seven building roosts were confirmed in five buildings including, one brown long-eared maternity roost. No tree roosts were confirmed in 2014.

4.4.66 In 2012 and 2013, field surveys confirmed the presence of twelve species of bat, these included three rare species (barbastelle bat (*Barbastella barbastellus)*, whiskered/Brandt's bats and Nathusius' pipistrelle), and one scarce species, Leisler's bat (*Nyctalus leisleri*). No additional species were identified in the 2014 field surveys.

4.4.67 In 2012 and 2013, field surveys confirmed five building and five tree roosts, one of which was a brown long-eared maternity roost in a building. With the addition of the 2014 field surveys, a total of 17 roosts have now been confirmed.

CFA12

4.4.68 Field surveys in 2014 confirmed the presence of 12 bat species; these included the very rare Bechstein's bat and uncommon species serotine, noctule, Brandt's bat, whiskered bat and Leisler's bat. Common species included common pipistrelle, soprano pipistrelle, brown long-eared bat, Natterer's bat and Daubenton's bat.

4.4.69 A total of 55 tree roosts and four building roosts were confirmed during radio-tracking surveys in 2014, of which six Bechstein's bat roosts and two Natterer's bat roosts were confirmed as maternity roosts, all of which were located in trees. One of the Bechstein's maternity roosts had already been recorded in 2013.

4.4.70 Two additional building roosts were confirmed during internal building assessments in 2014, comprising a brown long-eared bat day roost and a common pipistrelle night roost.

4.4.71 In 2012 and 2013, field surveys including radio-tracking surveys identified a total of 94 roosts, comprising ten different species. This included 17 Bechstein's maternity roosts, one brown long-eared maternity roost, one common pipistrelle maternity roost, one barbastelle roost located in a small woodland to the south of Waddesdon. In addition roosts of uncommon species were confirmed, such as Brandt's bat, Natterer's bat, noctule and whiskered bat.

4.4.72 With the addition of 2014 field surveys, a total of 154 tree and building roosts have now been confirmed.

CFA13

4.4.73 Field surveys in 2014 confirmed the presence of ten bat species; these included the very rare Bechstein's bat and uncommon species serotine, noctule, and Leisler's bat. Common species included common pipistrelle, soprano pipistrelle, brown long-eared bat, Natterer's and Daubenton's bat.

4.4.74 A total of four tree roosts were confirmed during climbing and emergence surveys and two further tree roosts were confirmed through radio-tracking surveys.

4.4.75 Twenty-seven building roosts were confirmed during the 2014 field surveys, these included one common pipistrelle maternity roost and one brown long-eared maternity roost.

4.4.76 In the 2012 and 2013 field season, a total of 33 roosts were confirmed in trees and buildings in CFA13, including ten identified during radio-tracking surveys. The roosts comprise two hibernation roosts (common pipistrelle and brown long-eared), five tree maternity roosts (two common pipistrelle and three Daubenton's), and three building maternity roosts (two brown long-eared and one common pipistrelle).

4.4.77 With the addition of 2014 field surveys, a total of 64 tree and building roosts have now been confirmed.

CFA14

4.4.78 Field surveys in 2014 confirmed the presence of at least eight bat species, including the rare whiskered/Brandt's bat and barbastelle bat (activity only); uncommon species including noctule and unidentified *Myotis* species. Common species recorded included Daubenton's bat, Natterer's bat, brown long-eared bat, soprano pipistrelle and common pipistrelle.

4.4.79 Seven tree roosts were identified, including two Natterer's roosts confirmed by radio-tracking, two confirmed during climbing inspections (unidentified *Myotis* species and noctule), and three confirmed during emergence surveys (two Daubenton's and soprano pipistrelle).

4.4.80 Four building roosts were identified in field surveys in 2014. Two were confirmed by internal assessments and two by radio-tracking survey. Of these, one of the roosts confirmed by radio-tracking, was recorded in 2013 and is a large Natterer's bat maternity roost of over 200 bats in the Church of St. Lawrence in Radstone.

4.4.81 Social behaviour of soprano pipistrelle was observed at an alder tree in east Radstone but a roost was not confirmed.

4.4.82 In 2012 and 2013, field surveys confirmed the presence of eight bat species. With the addition of the rare barbastelle bat recorded during field surveys in 2014 the species assemblage is now a total of nine species.

4.4.83 In 2012 and 2013, six buildings were confirmed to contain nine roosts, including maternity roosts in the Church of St. Lawrence Natterer's bat, brown long-eared and common pipistrelle of St. Lawrence, four maternity roosts in four residential buildings (Natterer's, two brown long-eared and an unidentified pipistrelle species). In addition,

one common pipistrelle tree roost was also confirmed. With the addition of the 2014 field surveys, a total of 20 roosts have now been confirmed.

CFA15

4.4.84 Field surveys in 2014 confirmed the presence of at least four bat species. These are common pipistrelle, soprano pipistrelle, noctule, and *Myotis* species (including Natterer's bat).

4.4.85 Six building roosts were confirmed in the 2014 field surveys, including one maternity roost of brown long-eared bat.

4.4.86 Seven tree roosts were confirmed in the 2014 field surveys, of which six were confirmed as Natterer's during radio-tracking surveys. All six roosts were identified in Halse Copse; an area of woodland to the north-west of Radstone and adjacent to land required for the original scheme.

4.4.87 In 2013, two confirmed tree roosts were identified, one of which was a noctule maternity colony; and six buildings were confirmed to support nine roosts (three brown long-eared maternity colonies and one pipistrelle species maternity colony).

4.4.88 With the addition of the 2014 field surveys, a total of 24 roosts have now been confirmed.

5 Hazel dormouse

5.1 Introduction

5.1.1 This section of the appendix presents details of supplementary ecological baseline data relating to hazel dormouse relevant to the section of the scheme that will pass through CFA7 to 15 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5: Appendix EC-003-002).

5.2 Methodology

5.2.1 Details of the standard methodology utilised for hazel dormouse surveys are provided in the Technical Note Ecological Field Survey Methods and Standards which is included within Volume 5: Appendix EC-002-003 of the main ES.

5.2.2 The scoping and desk study exercises undertaken in 2012/2013 can be found in Volume 5: Appendix EC-003-002 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

5.2.3 In accordance with this methodology, woodlands and hedgerows were surveyed in all areas where access was permitted. An initial habitat scoping assessment was undertaken to determine the need for detailed surveys, which if required included nest tubes, nest boxes (both completed at all sites) and nut searches (four sites, where heavily fruiting hazel was present), to establish the presence or likely absence of hazel dormouse (hereafter referred to as dormouse).

5.2.4 Dormouse surveys were carried out in the key months of May, August and September 2014 (when dormouse are most likely to use nest tubes) to increase the probability of detecting dormouse.

Scoping

5.2.5 The following types of woodland and hedgerow were considered as potentially suitable for dormouse and were surveyed:

- woodlands over 2ha in area, supporting a good diversity of broadleaved tree species at canopy level;
- areas of newly planted woodland with either stands of deciduous trees and / or connectivity to areas of mature woodland;
- coniferous woodland with either stands of deciduous trees or connectivity to deciduous woodland;
- both small (approximately 2ha) and large (approximately 10ha) areas of woodland connected to and/or adjacent to larger areas of woodland outside the required survey area (survey area detailed in the Field Survey Methods and Standards document); and
- intact, species-rich hedgerows with good connectivity to areas of woodland, which were not overly managed, and formed part of the wider hedgerow

network (hedges had to be able to hold a minimum of 50 survey nest tubes to qualify).

5.2.6 Factors such as diversity of shrub species within the understorey, presence of key species such as hazel (*Corylus avellana*), honeysuckle (*Lonicera* spp.) and bramble (*Rubus fruticosus* agg.) and good structural linkage between the canopy and understorey, were considered when assessing the suitability of the woodland habitats.

5.2.7 Sites surveyed in 2013 where no presence of dormouse was identified were not surveyed in 2014.

5.2.8 Table 11 provides details of the number of tubes, duration of deployment and number of points obtained for each nest tube/box survey undertaken.

Table 11: Methodological details for dormouse nest tube/box surveys conducted in 2014 within CFA7 to 15 inclusive

Ecology survey code	Location	Centroid grid reference	Number of tubes deployed	Survey start	Sum of indices of probability[8]	CFA
020-HD1-051001 020-HD1-052001	Land on the North side of Chesham Lane, Wendover	SP 884 056	55	May 2014 – September 2014	20	10
020-HD1-094001	Glebe Farm, Turweston	SP 603 369	105	May 2014 – October 2014	44	14
020-HD1-097001	Land on the East and West side of the road leading from Brackley to Helmdon, Radstone	SP 589 403	105	May 2014 – October 2014	44	14
020-HD1-090001 020-HD1-090002	Land at Tibbetts Farm and Stonepit Spinney	SP 614 338	55	April 2014 – October 2014	23	14
020-HD1-091001	Land adjoining Fulwell Farm, Mixbury	SP 619 350	105	May 2014 – October 2014	44	14
020-HD1-112001	Manor Farm, Aston le Walls	SP 492 508	55	May 2014 – September 2014	20	15
020-HD1-100001	1 and 2 Halse Copse Farm Cottages and land at Halse Copse Farm	SP 570 420	105	May2014 – September 2014	40	15

[8] Sum of the index of probability scores obtained for the months tubes were deployed, adjusted based on the number of tubes deployed in comparison with the standard of 50 tubes.

Ecology survey code	Location	Centroid grid reference	Number of tubes deployed	Survey start	Sum of indices of probability[8]	CFA
020-HD1-113001	Unregistered land belonging to Cleveland Farm, Lower Boddington	SP 484 514	55	April 2014 – September 2014	21	15

5.3 Deviations, constraints and limitations

5.3.1 Not all suitable habitat within the land required for construction of the scheme was subject to dormouse habitat appraisal surveys and subsequent dormouse nest tube surveys. Access was not given to one site, and at two other sites, access was granted too late in the survey season to allow the minimum survey effort to be achieved (see Table 12).

5.3.2 In order to secure the 20 survey effort points required as part of the standard methodology (see paragraph 6.2.1) within the timeframe permitted, it was necessary to double the number of tubes used in areas of suitable habitat at some sites. This method was endorsed by a recognised authority on dormouse as per previous years.

5.3.3 Due to access constraints, sites where suitable habitat for dormouse was identified during 2013 surveys were not surveyed in 2014. This is provided in Table 12.

Table 12: Summary of locations where requirement for dormouse survey was identified but access constraints prevented further survey

Location	OS grid reference	Survey Prescription (updated for 2014)	CFA	Approximate distance from the scheme (m) and orientation
Land at Amersham and Little Missenden	SU 934 978	Habitat suitability assessment and nest tube/box survey. Access permitted too late in the survey season	8	250m south
Land at Culworth	SP 517 479	Habitat suitability assessment and nest tube/box survey. Access permitted too late in the survey season.	15	Within an area of land required for the construction and operation of the original scheme
Land at the south east of Lower Thorpe Farm	SP 538 450	Habitat suitability assessment and nest tube/box survey. No access permitted.	15	Within an area of land required for the construction and operation of the original scheme

5.4 Baseline

5.4.1 Sites surveyed in 2013 where no presence of dormouse was identified were not surveyed in 2014, Table 13 summarises the 2014 surveys.

Table 13: Summary of dormouse records obtained from 2014 field survey in CFA7 to 15 inclusive

Location	Centroid OS grid reference	Nature of record	CFA	Distance from the original scheme (m) and orientation
North of Mixbury	SP 6164 3510	Hibernation nest	14	80m south
Turweston	SP6046 3733	Summer nest	14	70m west
Turweston	SP 6050 3704	Summer nest	14	Within an area of land required for the construction and operation of the original scheme
Turweston	SP 6050 3704	Summer nest	14	Within an area of land required for the construction and operation of the original scheme
Radstone	SP 5908 4024	Summer nest	15	600m east

5.4.2 Sites where suitable habitat areas were considered too small to support a dormouse population (and consequently unable to support 50 dormouse nest tubes), and sites that were not well connected to an area of woodland or scrub of more than 10 ha, were scoped out. This included all sites in CFAs 7-9 and 11-13 inclusive. No sites within CFA10, 14 and 15 were scoped out.

5.4.3 All sites where P/A surveys were undertaken achieved a minimum search effort score of 20 points.

Field survey

CFA7, 8, 9, 11, 12 and 13

5.4.4 No surveys were undertaken for dormouse in CFAs 7, 8, 9, 11, 12 and 13 in 2014. Previous surveys of these areas found no evidence of dormouse.

CFA10

5.4.5 No evidence of hazel dormouse was found during the 2014 surveys. Four edible dormouse *Glis glis* were observed during the surveys.

CFA14

5.4.6 A single likely dormouse hibernation nest was found in a tree cavity in woodland north of Mixbury and a further four likely summer nests in woodland north-east and south of Brackley.

5.4.7 Within CFA14, five dormouse nests were found during surveys in CFA14. Surveys were not undertaken at these sites in 2012 and 2013 and no evidence of dormouse was recorded in previous years within the wider area.

CFA15

5.4.8 No evidence of dormouse was found during the 2014 surveys.

6 Otter

6.1 Introduction

6.1.1 This section of the appendix presents details of supplementary ecological baseline data relating to otter relevant to the section of the scheme that will pass through CFA7 to 15 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5: Appendix EC-003-002).

6.2 Methodology

6.2.1 Details of the standard methodology utilised for otter surveys are provided in the Technical Note Ecological Field Survey Methods and Standards which is included within Volume 5: Appendix EC-003-002 of the main ES. Broadly this comprises an initial habitat suitability survey, which is followed by a search of the watercourse/waterbody for otter signs if the habitat is deemed suitable.

6.2.2 In addition to the standard field signs (stated in Volume 5: Appendix CT-001-000/2 of the Main ES), 'lying up' sites were also recorded during surveys. These were defined as cavities in river banks which are less than 1m deep and thus cannot be recorded as holts[9] but may be used by otter for resting or sheltering. Lying up sites have only been recorded where sprainting was also recorded in close proximity to the site.

6.2.3 The scoping and desk study exercises undertaken in 2012/2013 can be found in Volume 5: Appendix EC-003-002 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

6.2.4 Table 14 lists the watercourses surveyed in 2014, all of which were new survey locations, where access was not possible in previous years. Where the findings of the initial habitat surveys were that no detailed surveys were required, the reasons are given in the table. These include, no watercourse or suitable terrestrial habitat being present in the survey area, the watercourse being a permanently dry drainage ditch choked with vegetation (and therefore no otter signs would have been detectable), or the 'watercourse' actually being a concrete channel inside an operational sewage works which contained raw sewage.

Table 14: Summary of water courses subject to otter survey during 2014

Ecology survey code	Water course or water body name	Feature type	OS grid reference (start and finish)	Level of access within required survey extent	Survey dates	CFA	Approximate distance from the original scheme (m) and orientation
020-OT1-029005 020-OT1-030002	River Colne	River	TQ03999093 to TQ03999078	Moderate	02 June 2014	7	500m north-east
020-OT1-029006 020-	River Colne	River	TQ03989077 to	Moderate	02 June 2014	7	120m north-east

[9] Criteria for classifying otter holts and potential otter holts are provided in the Field Survey Methods and Standards document.

Ecology survey code	Water course or water body name	Feature type	OS grid reference (start and finish)	Level of access within required survey extent	Survey dates	CFA	Approximate distance from the original scheme (m) and orientation
OT1-030004			TQ03699067				
020-OT1-029007 020-OT1-030003	Blue Circle Lake (on River Colne)	Lake	TQ03959108 to TQ03789095	Majority	02 June 2014	7	140m north-east
020-OT1-036001	River Misbourne	River	SU98129577 to SU98579514	Full	30 Sept 2014	8	Within an area of land required for the construction and operation of the original scheme
020-OT1-042001 020-OT1-043001	River Misbourne - land at Kennel Farm	River	SU93439844 to SU92839883	Full	15 April 2014	9	200m south-west
020-OT1-056001	River Thame (Stoke Brook) – Land North of Nash Lee Road	Stream	SP84670933 to SP84380914	Full	08 July 2014	10	Within an area of land required for the construction and operation of the original scheme
020-OT1-059001	Un-named stream, Hall End Farm	Stream	SP82551052 to SP82461061	Majority	07 May 2014	11	50m north-east
020-OT1-059004	Un-named river, Standalls Farm	River	SP81441124 to SP81591105	Majority	07 August 2014	11	Within an area of land required for the construction and operation of the original scheme
020-OT1-59005	Un-named ditch, Standalls Farm	Ditch	SP81001027 to SP81001028	Majority – scoped out following initial habitat suitability survey. Ditch was stagnant and dry in places and choked with vegetation	07 August 2014	11	Within an area of land required for the construction and operation of the original scheme
020-OT1-058005	Un-named stream, land adjoining Hall End Farm	Stream	SP82671043 to SP 82541052	Majority	20 May 2014	11	80m north-east

Ecology survey code	Water course or water body name	Feature type	OS grid reference (start and finish)	Level of access within required survey extent	Survey dates	CFA	Approximate distance from the original scheme (m) and orientation
020-OT1-059006	Un-named stream, land to the south-west of Lower Road	Stream	SP82141073 to SP81721093	Majority	21 July 2014	11	Within an area of land required for the construction and operation of the original scheme
020-OT1-059003	Un-named stream, land adjoining Hall End Farm	Stream	SP824621061 to SP82181073	Majority	07 July 2014	11	Within an area of land required for the construction and operation of the original scheme
020-OT1-080008	Padbury Brook - Elm Tree Farm	Stream	SP68942605 to SP68912581	Moderate	10 June 2014	13	Within an area of land required for the construction and operation of the original scheme
020-OT1-080009	Padbury Brook – land on the east and west of Addison Road	Stream	SP69532644 to SP69212653	Full	1 May 2014	13	Within an area of land required for the construction and operation of the original scheme
020-OT1-080010	Padbury Brook - land lying to the South of Steeple Claydon	Stream	SP69192652 to SP6894926061	Full	09 July 2014	13	Within an area of land required for the construction and operation of the original scheme
020-OT1-081017	Padbury Brook - land at Three Bridge Mill	River	SP675268 to SP671268	Full	16 April 2014	13	Within an area of land required for the construction and operation of the original scheme
020-OT1-081001 020-OT1-081002	Padbury Brook - Land at Three Bridge Mill	Stream	SP671268 to SP675268	Full	16 April 2014	13	Within an area of land required for the construction and operation of the original scheme
020-OT1-081013	Padbury Brook - land at Three Bridge Mill	Stream	SP675268 to SP673267	Full	16 April 2014	13	Within an area of land required for the construction and operation of the original

Ecology survey code	Water course or water body name	Feature type	OS grid reference (start and finish)	Level of access within required survey extent	Survey dates	CFA	Approximate distance from the original scheme (m) and orientation
							scheme
020-OT1-082008	Padbury Brook - land to the north of St Mary's Church	River	SP664269 to SP667269	Full	22 May 2014	13	40m north-east
020-OT1-082009	Padbury Brook (Pond) - land to the north of St Mary's Church	Pond	SP66622673	Full	22 May 2014	13	Within an area of land required for the construction and operation of the original scheme
020-OT1-091001	Un-named stream, Glebe Farm	Stream	SP61193438 to SP61363439	Majority - scoped out following initial habitat survey. Dry ditch choked with vegetation and surrounded by agricultural land.	21 July 2014	14	Adjacent to the original scheme, north
020-OT1-094001	Un-named stream, Station House	Stream	SP62853126 to SP62883124	Majority	21 July 2014	14	Within an area of land required for the construction and operation of the original scheme
020-OT1-095002	Un-named stream, land lying north-east of A43	Stream	SP59513819 to SP59473860	Little	22 July 2014	14	Within an area of land required for the construction and operation of the original scheme
n/a	Boddington Sewage Treatment Works	n/a	n/a	Full – scoped out – operational sewage treatment works	27 May 2014	15	Within an area of land required for the construction and operation of the original scheme
020-OT1-114005	Un-named stream, land to south-west of The Green	Stream	SP47482524 to SP47855276	Majority	08 May 2014	15	Adjacent to the original scheme (on west boundary)
020-OT1-	Un-named ditch, land to	Ditch	SP47655221 to	Majority	08 May 2014	15	Adjacent to the original scheme

Ecology survey code	Water course or water body name	Feature type	OS grid reference (start and finish)	Level of access within required survey extent	Survey dates	CFA	Approximate distance from the original scheme (m) and orientation
114006	south-west of The Green		SP47935193				(on north boundary)
020-OT1-114007	Un-named ditch, land to south-west of The Green	Ditch	SP47935193 to SP47235237	Majority	14 May 2014	15	Adjacent to the original scheme (on north boundary)
020-OT1-114008	Un-named ditch, land to south-west of The Green	Ditch	SP47245237 to SP46685194	Moderate	14 May 2014	15	Within an area of land required for the construction and operation of the original scheme
020-OT1-114009	Un-named ditch, land to south-west of The Green	Ditch	SP47055222 to SP47105242	Moderate	14 May 2014	15	Within an area of land required for the construction and operation of the original scheme
020-OT1-114010	Un-named stream, land to south-west of The Green	Stream	SP47105242 to SP46885 256	Moderate	14 May 2014	15	Within an area of land required for the construction and operation of the original scheme
020-OT1-100-001	Land on south side of a road leading from Wormleight on to Lower Boddington	n/a	n/a	n/a – scoped out – was surveyed from adjacent land parcel	27 May 2014	15	Adjacent to the original scheme (on north boundary)
020-OT1-113005	Reservoir feeder (Boddington reservoir) Cleveland Farm	Feeder	SP 4857 5175 to SP4835 5170	Majority	18 June 2014	15	100m south-west
020-OT1-113006	Un-named stream, Cleveland Farm	Stream	SP48675128 to SP48365106	Little	18 June 2015	15	Adjacent to original scheme, south
n/a	Manor Farm	n/a	n/a	n/a – scoped out – no water found in land parcel	07 August 2014	15	Within an area of land required for the construction and operation of the original

Ecology survey code	Water course or water body name	Feature type	OS grid reference (start and finish)	Level of access within required survey extent	Survey dates	CFA	Approximate distance from the original scheme (m) and orientation
							scheme
020-OT1-109001	Un-named stream, land on north-east side of Welsh Road	Stream	SP50704927 to SP50564970	Majority - scoped out following initial habitat survey. Mostly dry and choked with vegetation.	07 Aug 2014	15	125m east
020-OT1-100001	Un-named ditch, Greatworth Farm	Ditch	SP56364205 to SP56134187	Little - scoped out following initial habitat survey. Dry ditch in agricultural setting.	07 Aug 2014	15	Within an area of land required for the construction and operation of the original scheme

6.3 Deviations, constraints and limitations

6.3.1 The main constraint to the surveys in 2014 was the lack of access to watercourses (see Table 15).

Table 15 : Summary of locations where requirement for otter survey was identified but no access was available for survey

Ecology Survey Code	Location	OS grid reference (6 figure)	Survey prescription (updated for 2014)	CFA	Approximate distance from the original scheme (m) and orientation
020-OT1-029008 020-OT1-030005	River Colne, The Bungalow, Old Uxbridge Road	TQ035907	No access permitted.	7	70m north-east
020-OT1-042001	River Misbourne, Land lying to the South of the A413	SU936985	No access permitted.	8	Within an area of land required for the construction and operation of the original scheme
020-OT1-053001	Grand Union Canal, Sluice Cottage, Heron Path	SP871074	No access permitted.	10	250m east
020-OT10057-004	Un-named stream, land on the east and west side of Risborough Road	SP839089	No access permitted.	11	Within an area of land required for the construction and operation of the original scheme

Ecology Survey Code	Location	OS grid reference (6 figure)	Survey prescription (updated for 2014)	CFA	Approximate distance from the original scheme (m) and orientation
020-OT1-093001	River Great Ouse, two parcels of land adjoining Grovehill Farm	SP605361	No access permitted.	14	Within an area of land required for the construction and operation of the original scheme
020-OT1-105010	Un-named stream, Lower Farm	SP538455	No access permitted.	15	Within an area of land required for the construction and operation of the original scheme

6.3.2 Other constraints and limitations encountered at some locations comprised:

the lack of access permission to both banks of the watercourse;

health and safety constraints which prevented access due to the steepness of the banks; and

dense vegetation alongside the banks and within the watercourse which reduced visibility, and hence evidence of otter may have been under-recorded.

6.4 Baseline

6.4.1 Of the land parcels subject to survey, seven were found not to require a more detailed survey (see Table 16). All other areas surveyed were found to support suitable otter habitat, and detailed surveys were undertaken.

6.4.2 Of the watercourses subject to a detailed search for otter signs, evidence of otter was found in four areas, with the majority of signs being recorded along Padbury Brook in CFA13.

Table 16 : Summary of holts, potential holts and couches recorded during 2014 surveys of CFA7 to 15 inclusive

Ecology survey code	Water course or water body name	OS grid reference	Nature of record	CFA	Approximate distance from original scheme (m) and orientation
River Misbourne 020-OT2-036001	Briardale, Chalfont St Giles	SU 983954	Anal jelly	8	Within an area of land required for the construction and operation of the original scheme
River Misbourne 020-OT2-036002	Briardale, Chalfont St Giles	SU983953	Slide	8	Adjacent to the original scheme (south boundary)
Padbury Brook	Land to the north of St Mary's Church	SP665270	7 spraints	13	Within an area of land required for the construction

Ecology survey code	**Water course or water body name**	**OS grid reference**	**Nature of record**	**CFA**	**Approximate distance from** original scheme **(m) and orientation**
020-OT2-082001					and operation of the original scheme
Padbury Brook 020-OT2-082002	Land to the north of St Mary's Church	SP665270	2 spraints and otter prints	13	Within an area of land required for the construction and operation of the original scheme
Padbury Brook 020-OT2-082003	Land to the north of St Mary's Church	SP666270	Spraint	13	20m east
Padbury Brook 020-OT2-082004	Land to the north of St Mary's Church	SP667270	Feeding remains	13	70m north-east
Padbury Brook 020-OT2-081014	Land at Three Bridge Mill	SP673267	Feeding remains	13	Within an area of land required for the construction and operation of the original scheme
Padbury Brook 020-OT2-081015	Land at Three Bridge Mill	SP672268	Feeding remains	13	Within an area of land required for the construction and operation of the original scheme
Padbury Brook 020-OT2-081016	Land at Three Bridge Mill	SP675268	Feeding remains	13	140m north-east
Padbury Brook 020-OT2-081017	Land at Three Bridge Mill	SP674268	Feeding remains	13	90m east
Padbury Brook 020-OT2-081018	Land at Three Bridge Mill	SP674268	Spraint	13	Within an area of land required for the construction and operation of the original scheme
Padbury Brook 020-OT2-081019	Land at Three Bridge Mill	SP673267	6 spraints	13	Within an area of land required for the construction and operation of the original

Ecology survey code	Water course or water body name	OS grid reference	Nature of record	CFA	Approximate distance from original scheme (m) and orientation
					scheme
Padbury Brook 020-OT2-081020	Land at Three Bridge Mill	SP673267	10 spraints	13	Within an area of land required for the construction and operation of the original scheme
020-OT2-094001	Un-named stream, Station House	SP628312	Spraint	14	Within an area of land required for the construction and operation of the original scheme

CFA7

6.4.3 No otter signs were recorded in CFA7 during the 2014 surveys. These findings mirror those of previous surveys which also found no evidence of otters.

CFA8

6.4.4 In 2014 otter signs were recorded at two locations in CFA8 on the River Misbourne (anal jelly and a slide). This concurs with the 2013 findings which recorded a spraint along the River Misbourne (to the west of Shardeloes Lake).

CFA9

6.4.5 No otter signs were recorded in this CFA during the 2014 surveys. These findings mirror those of previous surveys which also found no evidence of otters.

CFA10

6.4.6 No otter signs were recorded in CFA10 during the 2014 surveys. Previous surveys in 2013 identified an otter spraint along the southern branch of the Stoke Brook on the boundary of CFA10 and CFA11.

CFA11

6.4.7 No otter signs were recorded during the 2014 surveys. Otter spraints were recorded at Bear Brook (two), and at The Orchard on Nash Lee Road (one), and two potential otter holts on land to the south east of Upper Hartwell by the 2012/2013 surveys.

CFA12

6.4.8 No surveys were undertaken for otter within this area in 2014, because of access constraints. Surveys in 2013 have identified one spraint and a possible holt along the River Ray.

CFA13

6.4.9 In 2014 otter signs were recorded at eleven locations along Padbury Brook (twenty seven spraints, feeding remains and otter prints). This concurs with the 2013 surveys in other parts of Padbury Brook which identified 21 spraints, feeding remains, otter prints, pathways, two potential lying-up sites and a potential holt.

CFA14

6.4.10 In 2014 otter signs were recorded at one location in Newton Purcell, near Mixbury (one spraint). This complements the findings of the 2013 surveys which identified otter signs in six locations along the River Great Ouse and two along its tributaries.

CFA15

6.4.11 In 2014 no otter signs were recorded during the surveys. Otters are known to be present in the area as surveys in 2013 identified signs (footprints, feeding remains and spraints) at the Boddington Canal feeder (which is in the vicinity of the 2014 survey locations), and in the wider area at Culworth Brook, the River Cherwell and High Furlong Brook (an active holt on Culworth Brook, and spraints on the River Cherwell and High Furlong Brook).

7 White clawed crayfish

7.1 Introduction

7.1.1 This section of the appendix presents details of supplementary ecological baseline data relating to white clawed crayfish relevant to the section of the scheme that will pass through CFA7 to 15 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5: Appendix EC-003-002).

7.2 Methodology

7.2.1 Details of the standard methodology utilised for white-clawed crayfish surveys are provided in the SMR Addendum (Volume 5: Appendix CT-001-000/2 of the Main ES). Broadly, this comprises an initial scoping survey to assess the habitats along the watercourse. Following this, where habitat was found to be suitable for crayfish, further surveys such as manual searching, netting, or trapping were undertaken.

7.3 Deviations, constraints and limitations

7.3.1 Constraints and limitations were encountered at some locations as follows:

access permission did not always include both banks of the watercourse; and

health and safety constraints also prevented access to the water due to the steepness of the banks.

7.3.2 No constraints or limitations were encountered at the locations identified in CFA8. One site in CFA12 was not accessible (see Table 17).

Table 17 : Locations where surveys would have been carried out had access been granted

CFA	Ecology Survey Code	Location	OS grid reference	Survey Prescription (updated for 2014)	Approximate distance from the scheme (m) and orientation
11	020-WC1-066001	Un-named stream, east side of A41, Fleet Marston	SP774161	No access permitted.	540m east
12	020-WC1-071001 020-WC1-071002	Ditch flowing to Doddershall Brook, West of Buckinghamshire Railway Centre	SP 734 191	No access permitted	Within an area of land required for the construction and operation of the original scheme

7.4 Baseline

Scoping survey

7.4.1 The majority of the watercourses that were subject to an initial scoping survey during 2014 were deemed unsuitable habitat for crayfish, and no further surveys were necessary (see Table 18). Reasons included the watercourse/water body being temporarily dry, heavily silted / shaded, having low oxygen levels (e.g. stagnant water), or an absence of refuges (or any combination).

Table 18: Rationale for scoping out requirement for further crayfish survey of watercourses/water bodies in CFA7 to 15 inclusive

Watercourse/ water body	**Location**	**OS grid reference**	**Rationale for scoping watercourse/water body out of requirement for further survey**	**CFA**	**Distance from the Proposed Scheme (m) and orientation**
Ditch within Aylesbury golf course 020-WC1-063001	Ditch located at Aylesbury golf course	SP798129	Unsuitable for crayfish as the water was of poor quality, heavy siltation, low oxygen content and no refuges. In parts it was also dry.	8	Within an area of land required for the construction and operation of the original scheme
Ditch flowing to Doddershall Brook 020-WC1-071003	Ditch located north of Buckingham Railway Centre	SP737191	Watercourse had dried out in the summer.	12	100m east
Water body 020-WC1-069002	Pond at Glebe Farm, North of Waddesdon	SP747175	Watercourse had dried out in the summer.	12	75m west
Water body 020-WC1-069003	Pond at Glebe Farm, North of Waddesdon	SP747176	Water was of poor quality and had low oxygen levels.	12	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-069004	Pond at Glebe Farm, North of Waddesdon	SP747178	Water was of poor quality and had low oxygen levels.	12	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-069005	Pond at Glebe Farm, North of Waddesdon	SP748179	Water was of poor quality and had low oxygen levels.	12	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-069006	Pond at Glebe Farm, North of Waddesdon	SP755177	Watercourse had dried out in the summer.	12	262m east

Watercourse/ water body	Location	OS grid reference	Rationale for scoping watercourse/water body out of requirement for further survey	CFA	Distance from the Proposed Scheme (m) and orientation
Tributary of the River Thame 020-WC1-070001	Tributary of the River Thame, North of Waddesdon	SP742183	Watercourse had dried out in the summer.	12	Within an area of land required for the construction and operation of the original scheme
Ditch flowing to Doddershall Brook 020-WC1-071004	Buckinghamshire Railway Centre	SP735189	Watercourse had low water levels.	12	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-078001	Pond within land at Calvert Estate	SP690242	Water was of poor quality and had low oxygen levels.	13	24m west
Water body 020-WC1-078002	Land at Calvert Estate	SP689241	Watercourse had dried out in the summer.	13	136m west
Water body 020-WC1-078004	Pond within land at Calvert Estate	SP689238	Watercourse had dried out in the summer.	13	260m west
Water body 020-WC1-077001	Pond within land at Calvert Estate	SP696230	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme
Tributary of the River Ray 020-WC1-076006	Tributary within land at Calvert Estate	SP701224	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme
Water body at Calvert Jubilee Nature Reserve 020-WC1-079003	Pond located at Calvert Jubilee Nature Reserve	SP683253	Watercourse had dried out in the summer.	13	30m west
Tributary of the River Ray 020-WC1-075001 020-WC1-076001	Tributary of the River Ray located at Greatmoor	SP701219	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme

Watercourse/ water body	Location	OS grid reference	Rationale for scoping watercourse/water body out of requirement for further survey	CFA	Distance from the Proposed Scheme (m) and orientation
Water body 020-WC1-075002	Pond located at Greatmoor	SP702218	Watercourse had dried out in the summer.	13	124m east
Water body 020-WC1-075003	Pond located at Greatmoor	SP703217	Watercourse had dried out in the summer.	13	293m east
Water body 020-WC1-075004	Pond located at Greatmoor	SP708221	Watercourse had dried out in the summer.	13	5m north-east
Water body 020-WC1-075005	Pond located at Greatmoor	SP711220	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-076001	Pond located at Greatmoor	SP703226	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-075006	Pond located at Greatmoor	SP711222	Watercourse had dried out in the summer.	13	5m south
Water body 020-WC1-075007	Pond located at Greatmoor	SP708223	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-075008	Pond located at Greatmoor	SP712224	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-076002	Pond located at Greatmoor	SP707226	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme

Watercourse/ water body	Location	OS grid reference	Rationale for scoping watercourse/water body out of requirement for further survey	CFA	Distance from the Proposed Scheme (m) and orientation
Water body 020-WC1-076003	Pond located at Greatmoor	SP704229	Watercourse had dried out in the summer.	13	Within an area of land required for the construction and operation of the original scheme
Water body 020-WC1-076004	Pond located at Greatmoor	SP703229	Watercourse had dried out in the summer.	13	3m north
Ditch adjacent to Shelswell Inn 020-WC1-087002	Ditch located north east of Newton Purcell	SP629312	Watercourse had very shallow water levels or dry, and where wet had heavy siltation.	14	21m west
Ditch near Halse Copse 020-WC1-099001	Ditch located north west of Radstone	SP578414	Watercourse had 100% shading, heavy siltation, and no refuges.	14	Within an area of land required for the construction and operation of the original scheme
Ditch on land either side of road leading from Brackley to Helmdon 020-WC1-097003	Ditch located near Radstone	SP586500	Watercourse had very shallow water levels or dry, heavily silted, low oxygen and no refuges.	14	345m east
Ditch on land either side of road leading from Brackley to Helmdon 020-WC1-097004	Ditch located near Radstone	SP599401	Watercourse was dry in places, shallow, heavily silted, low oxygen and no refuges.	14	10m east
Ditch on land either side of road leading from Brackley to Helmdon 020-WC1-097005	Ditch located near Radstone	SP590403	Watercourse was dry in places, shallow, heavily silted, low oxygen and no refuges.	14	Within an area of land required for the construction and operation of the original scheme
Ditch on land either side of road leading from Brackley to Helmdon 020-WC1-097001	Ditch located near Radstone	SP578408	Watercourse was dry in places, shallow, heavily silted, low oxygen and no refuges.	14	Within an area of land required for the construction and operation of the original scheme

Watercourse/ water body	Location	OS grid reference	Rationale for scoping watercourse/water body out of requirement for further survey	CFA	Distance from the Proposed Scheme (m) and orientation
Ditch on land either side of road leading from Brackley to Helmdon 020-WC1-097006	Ditch located near Radstone	SP588392	Watercourse was dry in places, shallow, heavily silted, low oxygen and no refuges.	14	150m south-east
Ditch adjacent to sewage pumping station 020-WC1-097007	Ditch located south east of Radstone	SP590403	Watercourse was shallow and silty and had an outflow from the adjacent sewage pumping station.	14	8m east

7.4.2 Of the sites which were subject to the initial scoping survey, one water body was deemed suitable for further survey in CFA12 (see Table 19).

Table 19 : Summary of detailed surveys undertaken in CFA7 to 15 inclusive

Ecology survey code	Location and watercourse	OS grid reference	Species recorded and number	Survey methods	CFA	Distance from the Proposed Scheme (m) and orientation
020-WC2-069001 020-WC3-069001	Water body at Glebe Farm, North of Waddesdon	SP748178	None	Manual search and trapping	12	Within an area of land required for the construction and operation of the original scheme
020-WC2-078001 020-WC3-078001	Water body within land at Calvert Estate	SP688239	None	Manual search, netting and trapping	13	250m west
020-WC2-078002 020-WC3-078002	Water body within land at Calvert Estate	SP690239	None	Manual search, netting and trapping	13	100m west
020-WC2-076001 020-WC3-076001	Water body within land at Calvert Estate	SP696228	None	Manual search, netting and trapping	13	30m west
020-WC2-079001	Drain from Calvert Jubilee Nature Reserve	SP685252	Signal crayfish (1) and remains of signal crayfish (1)	Manual search and netting	13	Within an area of land required for the construction and operation of the original scheme
020-WC2-079002	Water body at Calvert Jubilee Nature Reserve	SP684249	Signal Crayfish (4)	Manual search and netting	13	12m west

Ecology survey code	Location and watercourse	OS grid reference	Species recorded and number	Survey methods	CFA	Distance from the Proposed Scheme (m) and orientation
020-WC2-079003	Drain from Calvert Jubilee Nature Reserve	SP690254	Signal Crayfish (1)	Netting	13	Within an area of land required for the construction and operation of the original scheme
020-WC2-097002	Land either side of road leading from Brackley to Helmdon	SP590411	Signal Crayfish remains (1)	Manual search	14	Ditch section begins 1m from Proposed Scheme, crayfish signs found 666m south-east from Proposed Scheme

Discussion of combined results

7.4.3 No white-clawed crayfish signs were recorded in CFA7 to 15 inclusive during the 2014 surveys. This mirrors the findings of previous surveys, reported in the Main ES, which found no evidence of white-clawed crayfish in locations surveyed within CFA7 to 15 inclusive.

8 References

Rodwell *et al.*, (1991), *National Vegetation Classification Field Guide to Woodland*, JNCC.

Rose, F. (2006), *The WildFlower Key: How to Identify Wild Flowers, Trees and Shrubs in Britain and Ireland.* Frederick Warne.

Volume 5: Technical Appendices

CFA7 to 15: Summary of changes to ecology baseline data that do not generate new or different significant effects

Contents

List of tables

1 Introduction

1.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES).

1.1.2 Since September 2013[1] a range of supplementary ecological baseline data has been collected. Table 1 presents a summary of additional ecology baseline survey data collected since September 2013 that does not lead to new or different likely significant environmental effects from those reported within the ES published in November 2013 (i.e. the main ES), for the following community forum area (CFA):

CFA7: Colne Valley;

CFA8: The Chalfonts and Amersham;

CFA9: Central Chilterns;

CFA10: Dunsmore, Wendover and Halton;

CFA11: Stoke Mandeville and Aylesbury;

CFA12: Waddesdon and Quainton;

CFA13: Calvert, Steeple Claydon, Twyford and Chetwode;

CFA14: Newton Purcell to Brackley; and

CFA15: Greatworth to Lower Boddington.

1.1.3 The document should be read in conjunction with Volume 2 (community forum area reports), Volume 3 (route-wide effects assessment) and Volume 4 (off-route effects assessment) of the SES and AP2 ES. Details of all survey work and desk study information gathered since September 2013 which is relevant to this area is provided in Volume 5: SES AP2 ES Appendix EC-011-002 (baseline data appendix) and Volume 5 map series.

[1] The date after which it was no longer possible to include survey data for the main ES.

Table 1 : Summary of changes to ecology baseline data that do not generate new or different significant effects

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
CFA7	Pond with potential to support great crested newt to the west of Troy Lake.	N/A	N/A	Presence/absence survey for great crested newts at a pond to the west of Troy Lake.	Surveys confirmed the absence of great crested newt at this location.	No Change	No Change	No Change
CFA7	Bat assemblage likely to be associated with open water, river habitat and woodland south of Moorhall Road (roosting, foraging and commuting)	Volume 2, CFA7, paragraph 7.3.28 (Table 10)	A high abundance and a diverse assemblage of bats has been recorded immediately north of this area. Similar habitat of equal quality is present here and there are strong habitat connections between both areas of habitat. The network of lakes interspersed by woodland here is optimal for foraging bats and	Bat tree climbing survey on a tree near Buckinghamshire Golf Club.	Surveys confirmed the presence of a roost for an unknown species (3 droppings found beneath a split at the top of the tree).	The roost will be retained during construction. The valuation of the bat assemblage likely to be associated with open water, river habitat and woodland south of Moorhall Road (regional) is also unchanged.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			provides connectivity to potential roost sites. As part of the precautionary assessment it is assumed that a large number of bats of a range of species are present.					
CFA7	Bat assemblage associated with the woodland, river habitat and standing water in and adjacent to the Mid Colne Valley SSSI (roosting, foraging and commuting).	Volume 2, CFA7, paragraph 7.3.28 (Table 10)	Static monitoring surveys recorded eleven species of bat, with high levels of activity for common pipistrelle, soprano pipistrelle in the south-western corner of the SSSI. Leisler's were recorded in moderate numbers. Serotine, brown long-eared bats, Natterer's bat, whiskered bat	Internal inspection of buildings on the east side of Denham Way.	Surveys confirmed the presence of a maternity roost for brown long-eared bats. Four moderately large piles and some scattered droppings were recorded during the survey.	The roost will be retained during construction. The valuation of the bat assemblage associated with the woodland, river habitat and standing water in and adjacent to the Mid Colne Valley SSSI (regional) is also unchanged.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			and unidentified whiskered/Brandt's bats were recorded in low numbers. Although both common species, the high levels of activity of common and soprano pipistrelle bats was notable. Three roosts were identified in the land required for the construction of the Proposed Scheme.					
CFA7	Bat assemblage associated with the woodland, river habitat and standing water in and adjacent to the Mid Colne Valley SSSI (roosting, foraging and commuting).	Volume 2, CFA7, paragraph 7.3.28 (Table 10)	Static monitoring surveys recorded eleven species of bat, with high levels of activity for common pipistrelle, soprano pipistrelle in the south-western corner of the SSSI. Leisler's were	Internal inspection of buildings on the east side of Denham Way.	Surveys confirmed the presence of a two maternity roosts for common pipistrelle. Droppings were found on the chimney breast at the north-facing gable end of one	The roosts will be retained during construction. The valuation of the bat assemblage associated with the woodland, river habitat and standing water in and adjacent to the Mid Colne Valley SSSI (regional) is also	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			recorded in moderate numbers. Serotine, brown long-eared bats, Natterer's bat, whiskered bat and unidentified whiskered/Brandt's bats were recorded in low numbers. Although both common species, the high levels of activity of common and soprano pipistrelle bats was notable. Three roosts were identified in the land required for the construction of the Proposed Scheme.		building. Large number of droppings concentrated at the north gable end and at centre of loft space under the ridge beam in the second building.	unchanged.		
CFA7	Bat assemblage associated with the woodland, river habitat and standing water	Volume 2, CFA7, paragraph 7.3.28 (Table 10)	Static monitoring surveys recorded eleven species of bat, with high levels of activity	Emergence surveys of buildings on the east side of Denham Way.	Surveys confirmed the presence of two day roosts for common	The roosts will be retained during construction. The valuation of the bat assemblage associated	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	in and adjacent to the Mid Colne Valley SSSI (roosting, foraging and commuting).		for common pipistrelle, soprano pipistrelle in the south-western corner of the SSSI. Leisler's were recorded in moderate numbers. Serotine, brown long-eared bats, Natterer's bat, whiskered bat and unidentified whiskered/Brandt's bats were recorded in low numbers. Although both common species, the high levels of activity of common and soprano pipistrelle bats was notable. Three roosts were identified in the land required for the construction of the Proposed		pipistrelle. A single bat emerged from one building and two individuals emerged from the second building.	with the woodland, river habitat and standing water in and adjacent to the Mid Colne Valley SSSI (regional) is also unchanged.		

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			Scheme.					
CFA7	Bat assemblage associated with the woodland, river habitat and standing water in and adjacent to the Mid Colne Valley SSSI (roosting, foraging and commuting).	Volume 2, CFA7, paragraph 7.3.28 (Table 10)	Static monitoring surveys recorded eleven species of bat, with high levels of activity for common pipistrelle, soprano pipistrelle in the south-western corner of the SSSI. Leisler's were recorded in moderate numbers. Serotine, brown long-eared bats, Natterer's bat, whiskered bat and unidentified whiskered/Brandt's bats were recorded in low numbers. Although both common species, the high levels of activity of common and soprano pipistrelle	Emergence surveys of buildings on the east side of Denham Way.	Surveys confirmed the presence of two day roosts for soprano pipistrelle. A single bat emerged from one building and four individuals emerged from the second building.	The roosts will be retained during construction. The valuation of the bat assemblage associated with the woodland, river habitat and standing water in and adjacent to the Mid Colne Valley SSSI (regional) is also unchanged.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			bats was notable. Three roosts were identified in the land required for the construction of the Proposed Scheme.					
CFA8	Otter population utilising the River Misbourne	Volume 2, CFA8, paragraph 7.3.20 (Table 8)	Field survey results identified an otter spraint on the River Misbourne to the west of Shardeloes Lake, on the boundary with the Central Chilterns area (CFA 9). Habitat around Shardeloes Lake is highly suitable for holts though none were found. There are no desk study records of otter within 5km of the Proposed Scheme. Otters may use the River Misbourne and Shardeloes	Otter field signs survey along the River Misbourne.	Otter field signs confirmed at two locations along the River Misbourne near Chalfont St Giles. Confirmation of otter using this watercourse for foraging and/or as a movement route.	No Change	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			Lake for foraging and as a movement route					
CFA9	Potential great crested newt population near Kennel Farm, Little Missenden	Volume 2, CFA9, paragraph 7.3.16 (Table 10)	One pond is present within 200m of the western edge of the land required for the construction of the Proposed Scheme and was not surveyed due to access restrictions. As part of the precautionary assessment, it is assumed that it could support a medium population of breeding great crested newt and thus could be of county importance.	Presence/absence survey for GREAT CRESTED NEWT at two ponds near Kennel Farm, Little Missenden.	Presence/absence surveys confirmed that great crested newts were not present in the two ponds at this location.	No Change	No Change	No Change
CFA9	Potential great crested newt	Volume 2, CFA9,	Two ponds are present in close	Presence/absence survey for GREAT	Presence/absence surveys	No Change	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	population near Potter Row, Springfield Farm	paragraph 7.3.16 (Table 10)	proximity to each other and neither was surveyed due to access restrictions. As part of the precautionary assessment, it is assumed that it could support a medium population of breeding great crested newt and thus it could be of county importance.	CRESTED NEWT at one of the two ponds near Potter Row, Springfield Farm	confirmed that great crested newts were not present in one of the two ponds at this location.			
CFA10	N/A	N/A	N/A	Presence/absence survey for GREAT CRESTED NEWT at two ponds near Hunts Green Farm, Hunts Green.	Presence/absence surveys confirmed that great crested newts were absent in both ponds.	No Change	No Change	No Change
CFA10	Potential great crested newt population between Hunts	Volume 2, CFA10, paragraph 7.3.20 (Table	There are six ponds at this location. Woodland and	Presence/absence survey for GREAT CRESTED NEWT at three ponds between	Presence/absence surveys confirmed that great crested	No Change	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	Green and Strawberry Hill Farm.	8)	grassland suitable for this species during its terrestrial phase are well connected by intact hedgerows. The ponds were not surveyed due to restricted access. As part of the precautionary assessment it is assumed all of the ponds that were not surveyed support a sustainable breeding population that could form a meta-population and may qualify as being of county importance. Great crested newts are a species of principal	Hunts Green and Strawberry Hill Farm.	newts were absent in three ponds at this location. Four additional ponds were not surveyed at this location so presence/absence cannot be confirmed.			

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			importance.					
CFA10	Potential great crested newt population north-west of Wendover	Volume 2, CFA10, paragraph 7.3.20 (Table 8)	A single pond south of Nash Lee Road is in the land required and two ponds, one east of the A413 and one north of Nash Lee Lane, are within 250m of the land required for the construction of the Proposed Scheme. The ponds were not surveyed due to restricted access. As part of the precautionary assessment however, it is assumed each has a sustainable breeding population and together qualify as being of county importance	Population size class survey for great crested newt at a single pond to the north of Nash Lee Lane.	Surveys recorded a medium-sized population (peak adult count 22) of great crested newt in the surveyed pond. This confirms the assumption in the original ES that great crested newt were potentially present at this location.	No Change	No Change	No Change
CFA10	Soprano	Volume 2,	Field surveys	Emergence surveys on	Surveys recorded	The roost will be	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	pipistrelle bat population associated with habitats around Grove Farm.	CFA10, paragraph 7.3.20 (Table 8)	recorded one soprano pipistrelle emerging from a building at Grove Farm. Adjacent hedgerows connect the roost to the woodland at Bacombe Hills, which is suitable foraging habitat.	a building at Grove Farm previously confirmed as a bat roost during surveys completed in 2012/13.	both common pipistrelle (3) and soprano pipistrelle emerging (1) from the building.	retained during construction. The identification of a common pipistrelle Roost at this location does not change the value of this receptor (local/parish).		
CFA10	Soprano pipistrelle bat population associated with habitats around Grove Farm.	Volume 2, CFA10, paragraph 7.3.20 (Table 8)	Field surveys recorded one soprano pipistrelle emerging from a building at Grove Farm. Adjacent hedgerows connect the roost to the woodland at Bacombe Hills, which is suitable foraging habitat.	Emergence surveys on a building near Bacombe Lane previously confirmed as a bat roost during surveys completed in 2012/13.	Surveys recorded a single common pipistrelle emerging from the building.	The roost will be retained during construction. The identification of a common pipistrelle Roost at this location does not change the value of this receptor (local/parish).	No Change	No Change
CFA11	A medium sized population of great crested newt was identified in a	N/A	N/A	Population size class (PSC) assessment survey of previously unsurveyed ponds at Hall End Farm	A medium sized GREAT CRESTED NEWT population was recorded during the	No change	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	single pond at Hall End Farm, Stoke Mandeville				surveys (peak count of 20 individuals)			
CFA11	Brown long-eared bat population west of Stoke Mandeville,	Volume 2, CFA11, paragraph 7.3.23 (Table 9)	A roost with over 1,000 brown long-eared bat droppings was recorded in a building west of Stoke Mandeville (approximately 100m from the Proposed Scheme). The evidence indicates that it is a maternity roost. The brown long-eared bat is common and widespread in the UK, but a maternity roost meets the threshold for being of county importance.	Internal inspection of previously unsurveyed buildings near Standalls Farm.	Two brown long-eared roosts were identified in separate buildings near Standalls Farm, Bishopstone. Piles of 300+ droppings were recorded under each brace, collar and king truss in the farmhouse which was classified as a maternity roost. Three decayed droppings were recorded in a separate building which was classified as a day roost.	Roosts are outside the SES AP2 revised Scheme. No Change.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
CFA11	Bat assemblage associated with the Stoke Brook to the south of Stoke Mandeville	Volume 2, CFA11, paragraph 7.3.23 (Table 9)	Common and soprano pipistrelle, Myotis species, noctule and serotine were recorded in low to moderate numbers. A single common pipistrelle was recorded in a tree roost within the land required for the construction of the Proposed Scheme. A residential building 150m north of land required for the construction of the Proposed Scheme had a small number of common pipistrelle bats roosting (less than five). Both roosts are likely to be	Internal inspection of previously unsurveyed buildings near Standalls Farm.	Mid 17th century house situated in farm complex. Droppings recorded scattered, slightly more densely around roof hatch at south aspect. Classified as a day roost.	Roost is outside the SES AP2 revised Scheme. No Change.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			summer/transient roosts					
CFA12	A small population of great crested newt was identified in a single pond near Littleton Manor Farm	N/A	N/A	Population size class (PSC) assessment survey of previously unsurveyed ponds at Littleton Manor Farm.	A small GREAT CRESTED NEWT population was recorded during the surveys (peak count of 5 Larvae)	No Change.	No Change	No Change
CFA12	Great crested newt population near Fieldside Farm, Doddershall	Volume 2, CFA12, paragraph 7.3.30 (Table 9)	Field survey results indicate a low population size class is present with a peak count of a single great crested newt.	Presence/absence survey of previously unsurveyed pond at Fieldside Farm, Doddershall	No GREAT CRESTED NEWT were recorded in the additional pond at this location.	No Change	No Change	No Change
CFA12	Assemblage of bats associated with woodland habitat using the Aylesbury Link railway line and nearby woodland habitat from the Edgcott Road to	Volume 2, CFA12, paragraph 7.3.30 (Table 9)	The vegetation along the Aylesbury Link railway and nearbywoodland, as well as adjoining hedges, scrub and water bodies provide foraging, roosting and	Internal inspection of a residential building at Woodlands Farm.	A brown long-eared satellite roost was recorded during survey. Scattered droppings throughout loft space. Estimated 2000 droppings in total, with the	Roost is outside the SES AP2 revised Scheme. No Change	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	Calvert Jubilee LWS		commuting habitat for an assemblage of woodland bat species.		majority being from previous seasons.			
CFA12	Assemblage of bats present in the central part of this area - north of Station Road to Edgcott Road.	Volume 2, CFA12, paragraph 7.3.30 (Table 9)	Data from transect surveys, which included coverage of woodland and permanent pasture, is typical for the habitats present in this area. In addition to common and soprano pipistrelle, activity for a range of less common species was recorded	Internal inspection of a building to the north of Station Road.	A night roost for common pipistrelle was recorded during an internal inspection. Droppings were found on internal walls.	Roost is outside the SES AP2 revised Scheme. No Change	No Change	No Change
CFA13	Great crested newt metapopulation associated with un-accessed land near Rose Hill Farm, south of Steeple	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	Surveys recorded a medium sized population (13 adults) in a pond approximately 20m from land required for the construction of the	Great crested newt presence/absence and population size class surveys at two additional ponds south of Steeple Claydon.	Absence was confirmed in one pond immediately to the west of Addison Road. A small population of great crested	The pond that contains the great crested newt population will be retained during construction. No Change.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	Claydon.		Proposed Scheme. There are five additional un-accessed ponds, three within, one directly adjacent and one within 10m of land required for the construction of the Proposed Scheme, linked by terrestrial habitat that is suitable for great crested newt. On a precautionary basis, it is assumed that medium metapopulations of great crested newts are present in these five ponds.		newts was recorded in the second pond which is to the west of Addison Road in the centre of an arable field.			
CFA13	The great crested newt metapopulation associated with	Volume 2, CFA13, paragraph 7.3.34 (Table	Field surveys recorded a medium population size	Population size class (PSC) assessment survey of previously unsurveyed ponds at	A small great crested newt population was recorded in an	The pond that contains the great crested newt population will be retained during	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	land north of Portway Road in Twyford	11)	class, spread across three breeding ponds comprising one pond with a medium population and two with small populations. The peak nightly count (for all three ponds combined) is 36 individuals, which together form a metapopulation. Populations of this size meet criteria for county significance.	Land north of St. Mary's Church, Twyford.	additional pond to the north of Twyford.	construction and the valuation of the metapopulation (county/metropolitan) remains unchanged. No Change.		
CFA13	The potential great crested newt metapopulation associated with un-surveyed portions of the GCML north-east of	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	There are ditches and ponds suitable for great crested newts at the GCML at this location. As part of a precautionary assessment, it is assumed that	Presence absence surveys for great crested newt at two ponds near Grange Farm, Godington.	The surveys confirmed that great crested newts were absent from both of the two surveyed ponds which form part of the aquatic	Although absence was confirmed in two of the ponds, it was not possible to survey other ponds associated with the potential great crested newt metapopulation at this location due to lack of	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	Godington.		great crested newt metapopulations potentially meet criteria for county significance.		habitat associated with the potential great crested newt metapopulation associated with un-surveyed portions of the GCML north-east of Godington.	access. No change to the valuation of the metapopulation (county/metropolitan) or impact assessment.		
CFA13	Populations of serotine and noctule and Leisler's bats associated with Calvert Jubilee Nature Reserve LWS and the existing railway corridor between Finemere fishing lake and Sheephouse Wood in CFA12	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	Activity surveys recorded low to moderate activity from unidentified species of the Myotis genus and high levels of noctule bat activity in the scrub and woodland at the north-eastern edge of Calvert Jubilee Nature Reserve LWS. There are very few records for Leisler's bat in	Bat tree climbing surveys near Land on the east and west side of Addison Road, Steeple Claydon.	Surveys confirmed the presence of a day roost for a single noctule bat (recorded in a woodpecker hole).	The roost will be lost as a result of construction, although with an abundance of alternative roosting opportunities within the surrounding habitat, the loss of this roosts is unlikely to significantly affect the bat assemblage.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			Buckinghamshire and the presence of Noctule, Leisler's bat and Serotine as part of the wider assemblage of bats present in this area is of note.					
CFA13	Assemblage of bats associated with woodland habitat using the Aylesbury Link railway line and nearby woodland habitat from the Edgcott Road (in CFA12) to Calvert Jubilee Nature Reserve LWS.	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	The vegetation along the Aylesbury Link railway and nearby woodland, as well as adjoining hedges, scrub and water bodies provide foraging, roosting and commuting habitat for an assemblage of woodland bat species. In CFA12, Brandt's, brown long-eared, Natterer's and whiskered bats	Internal inspection of a building near Rosehill Farm, Steeple Claydon.	Surveys confirmed the presence of a day roost for brown long-eared bats (droppings recorded within the roof void of the building.	The roost will be retained during construction. The identification of an additional brown long-eared bat roost at this location does not change the value of this receptor (Regional).	No Change	No Change.

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			were all shown to use parts of the Aylesbury Link railway line for commuting between roosts, foraging areas and other flightlines. They are also likely to use the Aylesbury Link railway line as a flightline in this area.					
CFA13	Assemblage of bats associated with woodland habitat using the Aylesbury Link railway line and nearby woodland habitat from the Edgcott Road (in CFA12) to Calvert Jubilee Nature Reserve LWS.	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	The vegetation along the Aylesbury Link railway and nearby woodland, as well as adjoining hedges, scrub and water bodies provide foraging, roosting and commuting habitat for an assemblage of woodland bat	Emergence surveys of a building at Shepherd's Furze Farm, Steeple Claydon.	Surveys confirmed the presence of a transitional roost for brown long-eared bats. Three individuals were recorded emerging from the building.	The roost will be lost as a result of construction, although with an abundance of alternative roosting opportunities within the surrounding habitat, the loss of this roost is unlikely to significantly affect the bat assemblage. The presence of the additional roost will not result in a change	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			species. In CFA12, Brandt's, brown long-eared, Natterer's and whiskered bats were all shown to use parts of the Aylesbury Link railway line for commuting between roosts, foraging areas and other flightlines. They are also likely to use the Aylesbury Link railway line as a flightline in this area.			to the valuation of the bat assemblage (Regional).		
CFA13	Populations of common pipistrelle and soprano pipistrelle bats associated with the Aylesbury Link Railway line from Station	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	Common and soprano pipistrelle have been shown to use much of the Aylesbury Link railway line between Station Road, Quainton in CFA12 and Calvert	Emergence surveys of a building at Shepherd's Furze Farm, Steeple Claydon.	Surveys confirmed the presence of a day roost for common pipistrelle. Two individuals were recorded emerging from the building.	The roost will be lost as a result of construction, although with an abundance of alternative roosting opportunities within the surrounding habitat, the loss of this roost is unlikely to	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	Road, Quainton in CFA12 to Calvert Jubilee Nature Reserve LWS		Jubilee Nature Reserve LWS, and it is likely that the railway line forms a continuous flightline of this species. A maternity colony of common pipistrelle is present along the Aylesbury Link railway line to the north of Decoypond Wood. High levels of activity were recorded for both species and the presence of a maternity colony is important in maintaining populations over wide areas.			significantly affect the bat assemblage. The presence of the additional roost will not result in a change to the valuation of the bat assemblage (County/metropolitan).		
CFA13	Common pipistrelle, soprano	Volume 2, CFA13, paragraph	Transitional roosts supporting common and	Emergence surveys of buildings at Portway Farm, Twyford.	Surveys recorded the presence of the following bat	The roosts will be retained during construction. No	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	pipistrelle and brown long-eared bat populations associated with land at Twyford	7.3.34 (Table 11)	soprano pipistrelle supporting individual bats were recorded in a residential property to the north of Twyford. A brown long-eared night roost was also recorded at the same site (estimated to be 1 individual). These species are common and widespread in Buckinghamshire.		roosts (figures are provided for the roost with the highest peak count for each roost type): Three day roosts for brown long-eared bats (3). Two maternity roosts for brown long-eared bats (22). One maternity roost for common pipistrelle (30). Four day roosts for common pipistrelle (5). Three day roosts for soprano	Change.		

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
					pipistrelle (3). One day roost for Pipistrellus sp. (4)			
CFA13	Populations of common pipistrelle and soprano pipistrelle bats associated with the Aylesbury Link Railway line from Station Road, Quainton in CFA12 to Calvert Jubilee Nature Reserve LWS	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	Common and soprano pipistrelle have been shown to use much of the Aylesbury Link railway line between Station Road, Quainton in CFA12 and Calvert Jubilee Nature Reserve LWS, and it is likely that the railway line forms a continuous flightline of this species. A maternity colony of common pipistrelle is present along the Aylesbury Link railway line to the north of	Emergence surveys of buildings Brackley Lane, Calvert.	Surveys confirmed the presence of a day roost for common pipistrelle. Three individuals were recorded emerging from the building	The roost will be retained during construction. No Change.	No Change.	No Change.

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			Decoypond Wood. High levels of activity were recorded for both species and the presence of a maternity colony is important in maintaining populations over wide areas.					
CFA13	Assemblage of bats associated with woodland habitat using the Aylesbury Link railway line and nearby woodland habitat from the Edgcott Road (in CFA12) to Calvert Jubilee Nature Reserve LWS.	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	The vegetation along the Aylesbury Link railway and nearby woodland, as well as adjoining hedges, scrub and water bodies provide foraging, roosting and commuting habitat for an assemblage of woodland bat species. In CFA12, Brandt's, brown long-eared,	Internal inspection of buildings Brackley Lane, Calvert.	Surveys confirmed the presence of a day roost for brown long-eared bats. One individual was recorded hanging from a rafter in the roof void of the building.	The roost will be retained during construction. No Change.	No Change.	No Change.

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			Natterer's and whiskered bats were all shown to use parts of the Aylesbury Link railway line for commuting between roosts, foraging areas and other flightlines. They are also likely to use the Aylesbury Link railway line as a flightline in this area.					
CFA13	Common pipistrelle, soprano pipistrelle and brown long-eared bat populations associated with land at Twyford	Volume 2, CFA13, paragraph 7.3.34 (Table 11)	Transitional roosts supporting common and soprano pipistrelle supporting individual bats were recorded in a residential property to the north of Twyford. A brown long-eared night roost	Emergence surveys of buildings near Three Bridge Mill, Twyford	Surveys recorded the presence of the following bat roosts (figures are provided for the roost with the highest peak count for each roost type):	The roosts will be retained during construction. No Change.	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			was also recorded at the same site (estimated to be 1 individual). These species are common and widespread in Buckinghamshire.		Two day roosts for brown long-eared bats (5). Two day roosts for common pipistrelle (7). One day roost for soprano pipistrelle (1).			
CFA14	Great crested newt population near Mill Farm House, Mill Lane, Westbury	N/A	N/A	Population size class (PSC) assessment survey of previously unsurveyed ponds near Mill Farm House, Mill Lane, Westbury	A medium sized GREAT CRESTED NEWT population was recorded during the surveys (peak count of 27 adults).	The SES AP2 Revised Scheme results in additional woodland planting to the east of the pond. This will provide additional terrestrial habitat for the GREAT CRESTED NEWT population.	No Change	No Change
CFA14	Bat assemblage using the Old LNER Railway for commuting and foraging between	Volume 2, CFA14, paragraph 7.3.26 (Table 11)	The area provides foraging habitat for moderate to high numbers of common pipistrelles and	Emergence/re-entry surveys on a tree at Land lying to the north of Warren Farm, Finmere	Day roost for Daubenton's bat recorded near Land lying to the north of Warren Farm, Finmere.	The roost will be retained during construction, although the SES AP2 Scheme may result in the fragmentation of	No Change	Habitat connectivity across the route will be provided by the existing proposed

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	Finmere Quarry and Mixbury		soprano pipistrelles. The presence of uncommon species, mostly Myotis in low-moderate numbers indicate the habitat is important for foraging and commuting.		Identification established through sound analysis.	habitat severing links between this and other roosts recorded during 2014 surveys. This was not assessed in the original ES, although, the effects are not likely to be significant.		planting on the embankments of the Bridleway 213/4 accommodation overbridge and A421 London Road overbridge to encourage flying species to cross the route safely at height. An oversize culvert will also be provided at Mossycorner Spinney to encourage bats to cross the Proposed Scheme. No additional measures are considered to be required
CFA14	Bat assemblage using the Old	Volume 2, CFA14,	The area provides foraging habitat	Emergence/re-entry surveys on a tree near	Day roost for Daubenton's bat	The roost will be retained during	No Change	Habitat connectivity

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	LNER Railway for commuting and foraging between Finmere Quarry and Mixbury	paragraph 7.3.26 (Table 11)	for moderate to high numbers of common pipistrelles and soprano pipistrelles. The presence of uncommon species, mostly Myotis in low-moderate numbers indicate the habitat is important for foraging and commuting.	Land at Tibbetts Farm, Church Lane, Mixbury, Brackley	recorded near Land at Tibbetts Farm, Church Lane, Mixbury, Brackley. Identification established through sound analysis.	construction, although the SES AP2 Scheme may result in the fragmentation of habitat severing links between this and other roosts recorded during 2014 surveys. This was not assessed in the original ES, although, the effects are not likely to be significant.		across the route will be provided by the existing proposed planting on the embankments of the Bridleway 213/4 accommodation overbridge and A421 London Road overbridge to encourage flying species to cross the route safely at height. An oversize culvert will also be provided at Mossycorner Spinney to encourage bats to cross the Proposed Scheme. No additional measures are

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
								considered to be required
CFA14	Bat assemblage using the Old LNER Railway for commuting and foraging between Finmere Quarry and Mixbury	Volume 2, CFA14, paragraph 7.3.26 (Table 11)	The area provides foraging habitat for moderate to high numbers of common pipistrelles and soprano pipistrelles. The presence of uncommon species, mostly Myotis in low-moderate numbers indicate the habitat is important for foraging and commuting.	Emergence/re-entry surveys on a tree near Land on the East and West side of the road leading from Brackley to Helmdon, Radstone	Day roost for Soprano pipistrelle recorded near Land on the East and West side of the road leading from Brackley to Helmdon, Radstone. Identification established through sound analysis.	The roost will be retained during construction, although the SES AP2 Scheme may result in the fragmentation of habitat severing links between this and other roosts recorded during 2014 surveys. This was not assessed in the original ES, although, the effects are not likely to be significant.	No Change	Habitat connectivity across the route will be provided by the existing proposed planting on the embankments of the Bridleway 213/4 accommodation overbridge and A421 London Road overbridge to encourage flying species to cross the route safely at height. An oversize culvert will also be provided at Mossycorner Spinney to encourage bats to cross the

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
								Proposed Scheme. No additional measures are considered to be required
CFA14	Bat assemblage using the Old LNER Railway for commuting and foraging between Finmere Quarry and Mixbury	Volume 2, CFA14, paragraph 7.3.26 (Table 11)	The area provides foraging habitat for moderate to high numbers of common pipistrelles and soprano pipistrelles. The presence of uncommon species, mostly Myotis in low-moderate numbers indicate the habitat is important for foraging and commuting.	Tree climbing surveys for bats near Land at Tibbett's Farm, Church Lane, Mixbury, Brackley.	Day roost for Myotis sp. Recorded in a tree (established by one dropping)	The roost will be lost as a result of construction, although with an abundance of alternative roosting opportunities within the surrounding habitat, the loss of this roost is unlikely to significantly affect the bat assemblage.	No Change	
CFA14	Bat assemblage using the Old LNER Railway for commuting	Volume 2, CFA14, paragraph 7.3.26 (Table	The area provides foraging habitat for moderate to high numbers of	Tree climbing surveys for bats near Stonepit Spinney.	Day roost for Noctule bats established through	The roost will be retained during construction, although the SES AP2 Scheme	No Change	Habitat connectivity across the route will be provided

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	and foraging between Finmere Quarry and Mixbury	11)	common pipistrelles and soprano pipistrelles. The presence of uncommon species, mostly Myotis in low-moderate numbers indicate the habitat is important for foraging and commuting.		droppings and feeding remains.	may result in the fragmentation of habitat severing links between this and other roosts recorded during 2014 surveys. This was not assessed in the original ES, although, the effects are not likely to be significant.		by the existing proposed planting on the embankments of the Bridleway 213/4 accommodation overbridge and A421 London Road overbridge to encourage flying species to cross the route safely at height. An oversize culvert will also be provided at Mossycorner Spinney to encourage bats to cross the Proposed Scheme. No additional measures are considered to be required

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CFA14	Bat assemblages associated with the Banbury to Verney Junction disused railway and the parallel River Great Ouse	Volume 2, CFA14, paragraph 7.3.26 (Table 11)	Both linear features provide optimal foraging habitat for many bat species and link with the Old LNER Railway. Together they provide the most significant east–west connectivity in the landscape and have the potential to support large numbers of bats of a range of species and provide connectivity to a potential roost site and foraging opportunities.	Internal inspection of a building near Mill Farm House, Mill Lane, Westbury.	Likely day roost for *Myotis* sp. recorded in a farmhouse (established by assessment of droppings).	The roost will be retained during construction. The valuation of the bat assemblage using the Banbury to Verney Junction disused railway (county/metropolitan) is also unchanged.	No Change	No Change
CFA14	Bat assemblage using the Old LNER Railway for commuting and foraging between	Volume 2, CFA14, paragraph 7.3.26 (Table 11)	The area provides foraging habitat for moderate to high numbers of common pipistrelles and	Internal inspection of a building at Glebe Farm, Mixbury, Brackley.	Likely day roost for Brown long-eared bats recorded in a building at Glebe Farm, Mixbury,	The roost will be retained during construction. The valuation of the bat assemblage using the Old LNER Railway for	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
	Finmere Quarry and Mixbury		soprano pipistrelles. The presence of uncommon species, mostly Myotis in low-moderate numbers indicate the habitat is important for foraging and commuting.		Brackley (established through DNA analysis).	commuting and foraging between Finmere Quarry and Mixbury (county/metropolitan) is also unchanged.		
CFA14	Otter population using the River Great Ouse and tributaries	Volume 2, CFA14, paragraph 7.3.26 (Table 11)	Evidence of otter was recorded at six locations along the River Great Ouse during field surveys and at two locations along its tributaries. Terrestrial habitat that provides opportunities for breeding holts are present in woodland near Finmere, Mixbury and Westbury but	Otter surveys near Station House, Newton Purcell.	Otter signs were recorded near Station House, Newton Purcell. This complements the findings of the 2013 surveys which identified otter signs in six locations along the River Great Ouse and two along its tributaries	No Change	No Change	No Change

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
			no breeding holts were recorded. If there are any such holts in land that was not accessible for survey, the site may be of county importance. Otter are a species of principal importance.					

Volume 5: Technical Appendices

CFA7 to 15: Register of local level ecological effects

Contents

List of tables

1 Introduction

1.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES).

1.1.2 Since the main ES published in November 2013 (the main ES) a range of supplementary ecological baseline data has been collected. Table 1 : provides a summary of additional local/parish level adverse effects on ecological receptors that in light of the new data and/or design changes are considered likely to arise from the construction and operation of the Proposed Scheme for the following community forum area (CFA):

CFA7: Colne Valley;

CFA8: The Chalfonts and Amersham;

CFA9: Central Chilterns;

CFA10: Dunsmore, Wendover and Halton;

CFA11: Stoke Mandeville and Aylesbury;

CFA12: Waddesdon and Quainton;

CFA13: Calvert, Steeple Claydon, Twyford and Chetwode;

CFA14: Newton Purcell to Brackley; and

CFA15: Greatworth to Lower Boddington.

1.1.3 The document should be read in conjunction with Volume 2 (community forum area reports), Volume 3 (route-wide effects assessment) and Volume 4 (off-route effects assessment) of the SES and AP2 ES. In addition as this document focuses solely on new information obtained since publication of the main ES it should be read in conjunction with the corresponding Volume 5 Technical Appendix of the main ES.

Table 1 : Summary of additional local/parish level adverse effects arising from the construction/operation of the Proposed Scheme within CFA7 to CFA15 inclusive

CFA	Arising from SES changes or AP2 amendments?	Habitat, species or species/group	Receptor/location	Effect arising from construction or from operation?	Description of effect prior to 'other mitigation'	Effect addressed by mitigation and/or compensation proposed? (Yes/No)
CFA9	SES	Badger	There is one main and one annex badger sett in the vicinity of Mantle's Wood. As reported in the main ES, the badger population in the area is of local/parish value	Construction	Loss of badger sett due to construction of the Chiltern tunnel.	Yes
CFA12	AP2 ES	Ditch habitat, improved grassland and scrub.	A section of ditch forming an unnamed tributary of the Tetchwick Brook with associated scrub and trees.	Construction	The AP2 Revised Scheme will result in an additional loss of 300m² of improved grassland, ditch habitat and associated scrub.	No
CFA12	AP2 ES	Arable Land	Arable habitat is within the land required for the SES AP2 Revised Scheme throughout Waddesdon and Quainton.	Construction	The SES AP2 Revised Scheme will result in the loss of additional arable land.	No
CFA12	AP2 ES	Scrub	Scrub within the SES AP2 Revised Scheme throughout Waddesdon and Quainton.	Construction	The SES AP2 Revised Scheme will result in the loss of additional scrub habitat.	No
CFA12	AP2 ES	Grassland	Species poor semi-improved grassland and wet grassland within SES AP2 Revised Scheme throughout Waddesdon and Quainton.	Construction	The SES AP2 Revised Scheme will result in the loss of additional species poor semi-improved grassland and wet grassland.	No
CFA12	AP2 ES	Pond	Ponds throughout Waddesdon and Quainton.	Construction	The SES AP2 Revised Scheme will result in the partial loss of 1 additional pond.	No
CFA12	AP2 ES	Badgers	Potential badger population associated suitable habitat on land required for AP2-012-004.	Construction	The SES AP2 Revised Scheme will result in the potential loss and disturbance of setts and territory fragmentation.	Yes
CFA12	AP2 ES	Woodland	Semi-natural broadleaved woodland within SES AP2 Revised Scheme throughout Waddesdon and Quainton.	Construction	The SES AP2 Revised Scheme will result in the loss of additional semi-natural broadleaved woodland.	No
CFA12	AP2 ES	Traditional Orchard	Traditional Orchard west of the HS2 route at Adam's accommodation underbridge.	Construction	The construction the balancing pond associated with AP2-012-005 will result in the loss of approximately 0.1ha of a traditional orchard.	No
CFA14	AP2 ES	Grassland	Scrub and semi-improved neutral grassland on damp soils recorded in the Helmdon Disused Railway SSSI.	Construction	The SES AP2 Revised Scheme will result in small additional loss of this scrub and semi-improved neutral grassland habitat. Neither habitat forms a part of the reason for designation of the SSSI.	No
CFA10	AP2 ES	Hedgerows	Hedgerows are present on the northern and eastern boundaries within the area required for AP2-010-004. They border the edge of	Construction	The SES AP2 Revised Scheme will result in the additional loss of hedgerows present within the land required for AP2-010-004.	No

CFA	Arising from SES changes or AP2 amendments?	Habitat, species or species/group	Receptor/location	Effect arising from construction or from operation?	Description of effect prior to 'other mitigation'	Effect addressed by mitigation and/or compensation proposed? (Yes/No)
			Rowborough Copse.			
CFA13	SES	Bats	Common pipistrelle, soprano pipistrelle and brown long-eared bat populations associated with land at Twyford.	Construction	The SES AP2 Revised Scheme will result in the loss of three bat roosts recorded during emergence surveys undertaken in 2014. Three common pipistrelle and two soprano pipistrelle bats were observed emerging from a tree near land at Three Bridge Mill, Twyford. Both roosts were categorised as being day roosts. A single common pipistrelle bat was also recorded emerging from a tree near the disused railway at Twyford which was also categorised as a day roost. The loss of these three roosts as a result of construction will result in an adverse effect on the common pipistrelle and soprano pipistrelle bat populations associated with land at Twyford, which will be relevant at the local/parish level.	Yes
CFA13	SES	Bats	Common pipistrelle, soprano pipistrelle and brown long-eared bat populations associated with land at Twyford.	Construction	The SES AP2 Revised Scheme will result in the loss of three bat roosts recorded during surveys undertaken in 2014. A day roost for common pipistrelle (one individual recorded emerging), a day roost for *Pipistrellus* sp. (one individual recorded emerging) and a feeding perch for brown long-eared bats (feeding remains/droppings recorded during an internal inspection) were all recorded in a building at Portway Farm, Twyford. The loss of these three roosts as a result of construction will result in an adverse effect on the common pipistrelle, soprano pipistrelle and brown long-eared bat populations associated with land at Twyford, which will be of relevance at the local/parish level.	Yes

Volume 5: Technical Appendices

CFA 12 and 13: Bat Trapping/Radio-Tracking Study 2014- Bernwood Forest

Contents

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1 Summary

1.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES). It details supplementary ecological baseline data relating to trapping and radio tracking of bats in Community Forum Areas (CFA) Waddesdon and Quainton; and Calvert, Steeple Claydon, Twyford and Chetwode which have been conducted since production of the main ES in September 2013 (the 'main ES').

1.1.2 The document should be read in conjunction with Volume 2, CFA 12 and CFA 13, Section 7 of the Phase One Environmental Statement (the 'main ES') and Volume 2, CFA 12 and CFA 13, Section 7 of the SES. In addition as it focuses solely on new information obtained since the main ES it should be read in conjunction with the following corresponding Volume 5 Technical Appendices of the main ES:

Volume 5 appendix EC-003-002, ES 3.5.2.7-15.3;

Volume 5 appendix EC-006-002, ES 3.5.2.12-13.1;

CFA 12 ecology map book: Waddesdon and Quainton (Ref: ES 3.5.1.5.12); and

CFA 13 ecology map book: Calvert, Steeple Claydon, Twyford and Chetwode (Ref: ES 3.5.1.5.13).

1.1.3 A detailed bat survey comprising activity transects, paired sampling of linear habitat features, automated static detectors, trapping and radio-tracking was carried out from April to October 2014. The surveys supplement the baseline surveys already collected at this location in 2012/2013 (HS2 Ltd. (2013) Volume 5, appendix EC-006-002 of the main ES). The survey area covered woodland and other habitat of the Bernwood Forest between Quainton and Calvert in close proximity to the land required for the construction and operation of the High Speed 2 (HS2) Scheme. This area is known to support an important assemblage of bat species, including Bechstein's bat that is near threatened at the European level.

1.1.4 As in 2013, radio-tracking and trapping in 2014 targeted woodland bat species which were; Bechstein's, brown long-eared, whiskered, Daubenton's, Brandt's and Natterer's bat. Surveys were carried out to obtain additional data on how the target species use the landscape affected by the scheme described in the main ES (hereafter ' the original scheme' when referring specifically to that set out in the main ES), and to inform the detailed design of mitigation measures proposed to maintain the favourable conservation status of the populations concerned.

1.1.5 A total of 257 bats of nine species were caught between 27 April and 15 October 2014. Of these 50 bats were radio-tagged, and were subsequently radio-tracked to determine roosting locations, foraging areas and flightlines. Data was obtained from 19 Bechstein's, two Brandt's, two Daubenton's, eight Natterer's, one whiskered and 18 brown long-eared bats; this includes 18 bats radio-tagged by the North Bucks Bat Group. This resulted in the confirmation of 61 roosting locations from 50 individuals radio-tracked during the study period; three additional bats were tagged but the tags failed or the bats were not relocated.

1.1.6 Radio-tracking and activity surveys indicated several sites important for foraging and commuting including Sheephouse Wood Site of Special Scientific Interest, between Grendon Junction and the Akeman Disused Railway, north and south of Benfield's overbridge, along the Mega Ditch and the vegetation associated with existing Aylesbury Link railway line. Several crossing points were identified including the River Ray, Grendon Junction, south of Sheephouse Wood SSSI, north of Decoypond Wood and School Hill which were all used by Bechstein's bats.

1.1.7 Automated surveys recorded a total of 92,691 passes recorded over 435 survey nights, with calls from six genera including at least nine species of bats. Common pipistrelle and soprano pipistrelles were the most commonly recorded species with a total of 57741 passes and 4179 passes respectively. There were 2083 passes for *Myotis* bats throughout the survey area, and brown long-eared bats were occasionally recorded with 383 passes.

1.1.8 At least five species of four genera were identified from a total of 188 recorded calls and/or observed during flight over two transects. These were *Myotis* species, common pipistrelle, soprano pipistrelle, noctule, and *Nyctalus* spp.

1.1.9 Paired sampling recorded a statistically significant difference between bats commuting along linear habitats and those that did not at Costello underbridge and School Hill overbridge. The lack of a statistically significant difference at other paired sampling survey locations is attributed to the proportion of pipistrelle bats that were included to provide a sufficiently large sample for statistical analysis. These species do not show strong preferential use of linear habitat demonstrated by *Myotis* species is likely to have masked any significant differences that may have been possible to detect if *Myotis* data had been analysed separately.

1.1.10 The infra-red filming surveys recorded bats, including brown long-eared, pipistrelle species and *Myotis* species flying at heights of between 2m and 8m at Costello underbridge and a hedge linking Finemere to the Aylesbury Link Railway.

1.1.11 The thermal imaging surveys recorded bats flying at canopy heights (between 5 and 10m) along wooded sections of the existing Aylesbury Link Railway Line and at lower levels at crossing points, most clearly at Grendon Junction and Benfield's overbridge where vegetation was fragmented.

1.1.12 At Edgcott Road overbridge bats were recorded at varying heights during thermal imaging surveys whilst foraging directly south of the bridge and commuting north along the existing Aylesbury Link Railway.

1.1.13 Radio-tracking surveys carried out in September 2014 identified a new Bechstein's roosts south of Calvert village. The bat was recorded crossing the railway and flying northwards to Calvert Jubilee Nature Reserve along vegetation adjacent to the existing Aylesbury Link Railway. This record and one from 2013 at nearby Decoypond Wood are both for a single male bat.

2 Introduction

2.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES). It details supplementary ecological baseline data relating to trapping and radio tracking of bats in Community Forum Areas (CFA) Waddesdon and Quainton; and Calvert, Steeple Claydon, Twyford and Chetwode which have been conducted since production of the main ES in September 2013 (the 'main ES').

2.1.2 The document should be read in conjunction with Volume 2, CFA 12 and CFA 13, Section 7 of the Phase One Environmental Statement (the 'main ES') and Volume 2, CFA 12 and CFA 13, Section 7 of the SES. In addition as it focuses solely on new information obtained since the main ES it should be read in conjunction with the following corresponding Volume 5 Technical Appendices of the main ES:

Volume 5 appendix EC-003-002, ES 3.5.2.7-15.3;

Volume 5 appendix EC-006-002, ES 3.5.2.12-13.1;

CFA 12 ecology map book: Waddesdon and Quainton (Ref: ES 3.5.1.5.12); and

CFA 13 ecology map book: Calvert, Steeple Claydon, Twyford and Chetwode (Ref: ES 3.5.1.5.13).

2.1.3 A radio-tracking study was undertaken in Bernwood Forest during 2012 and 2013 for inclusion in the main ES and to inform the detailed design of mitigation measures required to maintain the favourable conservation status of the populations of each species concerned. During 2014 a further radio-tracking study was carried out in the Bernwood Forest with the aim of supplementing the baseline information collected by HS2 Ltd in 2012 and 2013. In particular the 2014 study was designed to provide more detailed information on flight behaviour at locations where bats cross the scheme, and information on bat behaviour for pre-maternity (April and May) and post maternity survey season (September and October). Further information on the objectives of the 2014 surveys is provided in Section 2.2 below.

2.1.4 As in previous years, 2014 surveys collected data on roosting, commuting and foraging behaviour of bat species, with a particular focus on the Annex II Bechstein's bat *Myotis bechsteinii* and other woodland bat species including, brown long-eared *Plecotus auritus,* whiskered *Myotis mystacinus*, Daubenton's *Myotis daubentonii*, Brandt's *Myotis brandtii* and Natterer's bat *Myotis nattereri.* This report presents the findings of bat surveys carried out during the 2014 field season at Bernwood Forest in Buckinghamshire. They are a continuation of survey work carried out in 2012 and 2013 (Volume 5, appendix EC-006-002 of the main ES).

2.1.5 Surveys were carried out under licence from Natural England; the licence holder was Dr Stephanie Murphy. As in previous years, surveys were carried out with collaboration with the North Bucks Bat Group (NBBG) and the Bernwood Forest Bechstein's Project (BFBP). Survey methods were similar to those used in the 2012/13 surveys, with the addition of infra-red filming was also used in order to provide information on flight heights across and along the alignment of the scheme and

thermal imaging surveys were used to confirm how woodland bat species, including Bechstein's bat, use the Aylesbury Link Railway.

2.1.6 The 2014 surveys included areas covered in 2012/13, but also included land to the south of Edgcott Road, once access was possible in August.

2.1.7 Survey results provided in Section 4 of this report present the findings of automated recorder, activity transect, paired sampling, infra-red filming, trapping and radio tracking and thermal imaging surveys carried out in 2014, as well as the results of home range analysis.

2.1.8 Discussion of results in Section 5 provides a comparison with results of surveys in previous years, and discusses the findings from infra-red filming and thermal imaging surveys.

2.2 Legislation

2.2.1 Council Directive 92/43/EEC of the Conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive was adopted in 1992. The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance.

2.2.2 The Conservation of Habitats and Species Regulations 2010 (as amended) (referred to as the 'Habitats Regulations') transpose the Habitats Directive into national legislation. Regulation 41 provides protection for certain species (European Protected Species) and contains a range of prohibitions include deliberate capture or killing, deliberate disturbance and the deterioration or destruction of a breeding site or resting place of such an animal.

2.2.3 All species of bat are fully protected under the Habitat Regulation as European Protected Species through their inclusion on Schedule 2. In addition, certain species, including Bechstein's bat, are Annex II species listed under the Directive, for which specific protection through the establishment of Special Areas of Conservation (SAC) applies.

2.3 Project aims and approach

2.3.1 The 2014 surveys were designed to supplement the baseline data on woodland bat species using habitats along the scheme and surrounding areas, in proximity to the Bernwood Forest areas. A Natural England (NE) licence 2014-242-SCI-SCI was obtained to undertake the catching, ringing and radio-tracking survey work.

2.3.2 The specific aims of the 2014 survey work within the Bernwood Forest were:

- to confirm the findings of the 2012/13 surveys with a focus on flightlines, roost locations and foraging areas;
- to confirm how woodland bat species use the Aylesbury Link Railway at known crossing points of the scheme;
- to provide baseline data for areas not surveyed during the 2012 and 2103

field season, from south of the Edgcott Road to Buckinghamshire Railway Centre, Quainton; to provide additional data for early and late in the survey season, particularly April and October; and

to obtain data on bat flight behaviour through use of thermal imaging and infra-red filming.

2.3.3 It was proposed to radio-tag adult female (both parous and non-parous) and juvenile bats (providing they were of an appropriate weight and in good condition) to a maximum of 40, in accordance with the Natural England licence conditions. The numbers of bats allowed for contingencies such as failed tags.

3 Methodology

3.1 Survey area

3.1.1 The survey area for trapping, automated surveys, infra-red filming, thermal imaging and paired sampling was along the Aylesbury Link Railway from north of the Buckinghamshire Railway Centre (SP 73279 19304) to north of Calvert village (SP68732 24897) and is approximately 7km in length.

3.1.2 The survey area for radio-tracking encompasses the wider landscape surrounding the scheme. To the northeast it included Finemere Wood SSSI, Sheephouse Wood SSSI, five woods designated as a Local Wildlife Sites (LWS) - Romer Wood, Greatsea Wood, Balmore Wood, Runts Wood and Decoypond Wood. To the southwest it includes Grendon and Doddershall Woods SSSI, Ham Home-cum-Hamgreen Woods SSSI, Calvert Landfill and the Akeman Disused Railway, now a construction access track for the Greatmoor Energy from Waste Facility (EFW). The north of the survey area includes Calvert Jubilee Nature Reserve Local Wildlife Site (LWS), the adjacent Grebe Lake LWS and Calvert Railway Station LWS. Radio-tracking was also carried out along the River Ray west to Marsh Gibbon and east towards Hogshaw.

3.1.3 All surveys were undertaken from land parcels where access had been granted, or from suitable roads and Public Rights of Way (PRoW).

3.1.4 In August 2014 it became possible to undertake surveys at land south of the Edgcott Road, within the Copse to the north west of Doddershall estate. The area of new access covers land east and west of the Aylesbury Link Railway from the Buckinghamshire Railway Centre (SP 73279 19304) north to the Edgcott Road (SP 71972 20795), including Grendon and Doddershall Woods SSSI and Grendon and Doddershall Meadows LWS. Due to the improved access the two trapping locations south of the Edgcott Road on the Aylesbury Link Railway were superseded by the twelve trapping locations on the newly accessible land. Similarly, two of the automated survey locations were superseded. It was considered likely that the intensive survey effort in the more optimal habitat would yield better results than the sub-optimal habitat on the Aylesbury Link Railway south of the Edgcott Road.

3.2 Automated surveys

3.2.1 Automated surveys were carried out in two Tranches, due to additional land becoming accessible in August 2014. The locations were identified as likely areas of high bat activity based on the 2012 and 2013 survey data, analysis of aerial photographs and Ordnance Survey (OS) maps.

3.2.2 The SM2+ Bat static recorder units were programmed to record bat echolocation in WAC0 format from 15 minutes prior to dusk until dawn. Tranche 1 units were set out for five consecutive nights each month from April to October 2014, and Tranche 2 units were set out for ten consecutive nights each month from August to October 2014. The specific recording dates for each unit are detailed in Annex 2.

3.2.3 Tranche 1 static recorder units were located adjacent to the Aylesbury Link Railway and the original scheme, as follows (see Figure EC-22-005):

Location 1. Buckinghamshire Railway Centre (SP73282 19298);

Location 2. Doddershall PRoW (Footpath QUA/24A between Lee Road, Quainton and Kingswood Lane) (SP72467 20250);

Location 3. South of the Edgcott Road overbridge (SP72371 20384);

Location 4. At the Edgcott Road overbridge (SP71855 20973);

Location 5. Grendon Junction (SP71076 21874);

Location 6. Benfield's overbridge (SP70703 22329);

Location 7. Costello underbridge (SP70231 22874);

Location 8. North of Sheephouse Wood (SP69704 23469);

Location 9. Decoypond Wood (SP69291 24068); and

Location 10. School Hill overbridge (SP68827 24734).

3.2.4 Tranche 2 static recorder units were located on land to the south of Edgcott Road, as follows (see Figure EC-22-006):

Location 1. Copse to the south of Doddershall house. (SP 72060 19840) South West of Railway line;

Location 2. Hedgerow adjacent to existing Aylesbury Link Railway (SP 72422 20268);

Location 3.East of Akeman Street Disused Railway (SP 71040 19905);

Location 4. Copse to the north west of Doddershall house(SP 71656 20491), adjacent to a pond;

Location 5. Doddershall Wood (SP 69851 20446); and

Location 6. Grendon Wood (SP 69970 21424).

3.2.5 Locations 2 and 3 of Tranche 1 were replaced from August 2014 onwards with Locations 2 and 4 of Tranche 2, as the newly accessible land to the south of the Edgcott Road was more suitable to record bat activity in relation to the scheme.

3.2.6 The recorded WACo files were converted to WAV files and analysed in full spectrum using auto-identification based on selected call parameters using Kaleidoscope Pro Version 2.0.5 in line with the protocol outlined in Annex 1.

3.2.7 All files were subject to a secondary manual analysis to ensure identification was accurate by a suitably qualified analyst (including a number of bat survey licence holders). Classifications for common species and noise were checked with further attention given to less typical calls or species. Outputs were collated and further checks were undertaken in an internal peer review to ensure accuracy and consistency with identification.

3.2.8 Experienced analysts undertook call identification using a robust protocol (outlined in Annex 1) using this software and identifying species with high resolution.

3.2.9 Activity levels thresholds qualify the level of bat activity recorded at each location were used to summarise differences in the level of activity at different Locations as follows:

very high – average > 750 passes per night (ppn);

high – average > 300 ppn;

moderate – average > 200 ppn;

low – average > 100 ppn; and

very low - average < 100 ppn.

3.2.10 These thresholds are intended to compare relative levels of activity at locations within the Bernwood Forest and are based on data obtained in surveys of the Bernwood Forest in previous years. In order to avoid under representation of *Myotis* bats the percentage of calls of these species is provided in discussion of the results.

3.2.11 Identification was also carried out to species level, with the exception of the *Myotis* bats, as they are often inseparable through sound analysis alone[1] and therefore were analysed to genus level only. Description of bat species assemblages therefore represents the minimum number of species present rather than a definite list of the species present.

3.3 Bat activity transect

3.3.1 Two bat activity transect surveys were undertaken along the existing Aylesbury Link Railway and associated Public Rights of Way (PRoW) between Buckinghamshire Railway Centre and Calvert Village (see Figure EC-25-004). Both transects were repeated on six occasions, once a month between April and October 2014, see Tables 8 and 9 for specific survey dates. All surveys were carried out from sunset for approximately two hours. Surveyors used an EM3+ or SM2+ bat recorder in conjunction with Bat Box Duet detectors connected to Roland R05 Edirol digital recorder. All recordings were made in WAV and analysed using Kaleidoscope Pro Version 2.0.5. Time expansion analysis was undertaken on WAV recordings to confirm the species. Calls not identified through auto-recognition and manual analysis in the Kaleidoscope Pro version 2.0.5 Viewer and were subject to further manual analysis using the protocol outlined in Annex 1.

3.4 Paired sampling

3.4.1 Paired sampling surveys, undertaken in the 2014 field season aimed to provide data on where and when bats crossed and how they used the existing Aylesbury Link Railway from observations. The first point (surveyor) was situated on one of the known crossing points (identified from the 2013 surveys) where a linear habitat feature (such as a tree line or hedgerow) is perpendicular to the railway and the second point (surveyor) was situated adjacent to the existing railway in open habitat (such as an arable field) within 100m from the first surveyor.

[1] Fitzsimons, P.J.R., 2005; Parsons, S., & Jones, G., 2000; Walters, C.L, *et al.*, 2012.

3.4.2 Five locations were identified within the scheme between School Hill overbridge and Edgcott Road as shown in Figure EC-22-007, and described below:

Location 1. Edgcott Road;

Location 2. Grendon Junction;

Location 3. Finemere Hedgerow and Benfield's overbridge;

Location 4. Costello underbridge, south of Sheephouse Wood; and

Location 5. School Hill overbridge.

3.4.3 Each paired sampling location was surveyed one night a month between April and October 2014. Paired sampling surveys commenced 15 minutes before sunset and continued until after civil twilight[2]. Relative levels of activity were compared between locations and species in order to investigate whether bat activity followed linear habitat features to cross the existing line, as indicated by the radio-tracking study in 2012/13 as opposed to crossing in open habitats.

3.4.4 Surveyors used an EM3+ or SM2+ bat recorder in conjunction with Bat Box Duet detectors connected to Roland R05 Edirol digital recorder to record all bat activity. All recordings were made in WAV, full spectrum analysis was undertaken to confirm the species using Kaleidoscope Pro Version 2.0.5. Calls, which could not be identified using auto-recognition or confidently confirmed, were subject further to manual analysis the protocol outlined in Annex 1 section 7.1.1 of this report. All bat flight paths, directions of flight, where seen, and time of bat pass were also recorded in order identify bat behaviour around the existing Aylesbury Link Railway.

3.4.5 A Mann-Whitney's U statistical test was undertaken on the data to determine if there was a significant difference between total numbers of bats commuting along linear features and those that were not observed to use linear features.

3.5 Infra-red filming survey

3.5.1 Filming was carried out to record the behaviour of bats, such as flight height and frequency of passes, at four locations where bats are known from previous surveys to cross the existing Aylesbury Link Railway, shown in Figure EC-22-008. Filming was carried out in June, August and September 2014, from sunset for 90 minutes, using a Canon XA-10 digital video recorder and an external infrared LED spot lamp (850 nm Wavelength) with a 150 m range and 40 degree angle. Surveys were timed to record the behaviour during the peak period of emergence activity at the key crossing points for 90 minutes and this data was used to supplement the data collected from thermal imaging surveys. An Elkon Batlogger was to correlate species and visual observation of bat movements, which was done at the time of the survey. Acoustic equipment used in other survey methods was the same as used in previous years' survey, maintaining consistency of results.

[2] During civil twilight, the sky is still illuminated, and with clear weather it is brightest in the direction of the Sun. The Moon and the brightest stars and planets may be visible. It is usually bright enough for outdoor activities without additional lighting.

3.6 Thermal imaging survey

3.6.1 Thermal imaging cameras are designed to detect heat (infrared radiation) emitted from objects within a defined field of view. The metabolic heat produced by bats produces a distinct thermal image against a cooler background. Thermal imaging surveys were used to obtain better estimates of the number and direction of bat movements in dark conditions than would be possible from the human eye alone.

3.6.2 Thermal imaging surveys were carried out to determine the behaviour of bats using the existing Aylesbury Link Railway at eight locations based at five key crossing points, specifically, those located close to known flight lines of Bechstein's bats and/or areas with high bat activity. These crossing points were identified from previous surveys (Figures EC-24-010 to EC-24-016) and were selected in order to provide data on the flight behaviour of bats using the existing Aylesbury link Railway, which is supplemented by data from the Infra-Red filming surveys.

3.6.3 Each location was surveyed for one night per month during the months of June, July, August and September 2014 where access and survey conditions permitted. Surveys commenced after sunset, and continued until at least midnight which is the time that passenger services will finish in the operational phase of the scheme.

3.6.4 At each location the height of the vegetation (see Table 1) adjacent to the Aylesbury Link railway line adjoining flightlines was measured to provide an estimate of the maximum height at which bats flew when crossing, foraging or following the Aylesbury Link railway line.

3.6.5 Thermal imaging does not provide an inclusive method for the identification of bat species. In order to address this constraint, timings and locations of automated detector locations have been correlated to the locations of thermal imaging. The proportion of different bat species or genera present at each thermal imaging location was calculated to provide an estimate of proportions of *Myotis* species present during thermal imaging surveys (see Annex 6 Table 20).

3.6.6 The eight thermal imaging locations were identified within the scheme between School Hill overbridge and Edgcott Road as shown in Figures EC-24-010 to EC-24-016, and described in Table 1.

Table 1 : Thermal imaging survey dates and locations

Location	Survey month	Date	Canopy heights at locations (m)
1. Edgcott Road overbridge south	July	30/07/2014	6 (2.5m cutting, 3.5m scrub)
	August	27/08/2014	
	September	11/09/2014	
2. Edgcott Road overbridge north	July	29/07/2014	6 (2.5m cutting plus 3.5m scrub)
	August	26/08/2014	

Location	Survey month	Date	Canopy heights at locations (m)
	September	12/09/2014	
3. Grendon Junction	June	07/06/2014	6 (vegetation)
	July	03/08/2014	
	September	13/09/2014	
4. Benfield's overbridge south	June	06/06/2014	8 (3m cutting plus 5m vegetation)
	July	28/07/2014	
	August	24/08/2014	
	September	15/09/2014	
5. Benfield's overbridge north	September	14/09/2014	8 (3m cutting plus 5m vegetation)
6. Costello underbridge	June	03/06/2014	5 (1m cutting plus 4m vegetation)
	July	31/07/2014	
7. Sheephouse Wood lineside recording south	July	01/08/2014	10 (3m cutting plus 7m vegetation)
	August	28/08/2014	
8. Sheephouse Wood lineside recording north	September	10/09/2014	10 (3m cutting plus 7m vegetation)

3.6.7 A level 1 Certified Thermographer carried out all thermal imaging surveys. Bats were recorded using a FLIR T650sc thermal imaging camera (IR Lens f = 13mm, 45° including case T197915; (FLIR Systems, Wilsonville, Oregon, United States) connected to and controlled by a Novatech laptop computer. The thermal imaging (.fcf) files were recorded using FLIR ResearchIR software.

3.7 Thermal imaging analysis

3.7.1 Files were analysed using FLIR ResearchIR software (FLIR Systems, Wilsonville, Oregon, United States). Each file was viewed to record flight behaviour, including direction and height of flight in relation to nearby vegetation. For these purposes a 'flight event' is defined as a single identified and mapped flight of a bat. Observations of flight behaviour has been categorised in order to explain how the bats are using the

existing Aylesbury Link Railway and associated linear features and key crossing points. 'Flight behaviour' has been categorised as the following for this report:

following the line: where a bat flight event is recorded following the existing Aylesbury Link Railway or the associated hedgerow/scrub. A clear continuous directional flight line following one or more of the linear features at the location is observed;

crossing the line: where a bat flight event is recorded as crossing the existing Aylesbury Link Railway or associated hedgerow/scrub and is following a key crossing location; and

foraging: is recorded when a bat flight event is not following a clear flight path and is characterised by backwards and forward movement and , circling within a limited area.

3.7.2 Where a bat was crossing, or foraging or flying along the existing Aylesbury Link Railway, this was categorised into a zone and subsequently mapped. 'Flight zones' were defined at each location as the following (see Figures EC-24-010 to EC-24-016):

zone 1: between ground level to mid- canopy;

zone 2: between mid to top of canopy;

zone 3: above the canopy; and

multiple zones: where the bat follows a behaviour category listed above but in doing so crosses two or more of the flight zones.

3.7.3 A single flight event can comprise several behaviours and occur in a number of zones. Therefore the records for behaviour in different zones can be equal to or greater than the total number of flight events at each location.

3.7.4 Bat flight events were identified using software zoom and thermal span controls and by frame by frame observation of flight pattern and behavioural characteristics and were subsequently isolated from flight events of other species such as insects or birds. Where a bat was recorded, the flight path was mapped onto a still background thermal image and referred to as a single flight event. Single flight events were collated to illustrate the commonly used flight paths of bats and the numbers falling into the above categories were tabulated for each thermal imaging location.

3.7.5 The following specific parameters recorded for each flight event:

start time (start of flight event – the point in time when the bat was first recorded);

end time (end of flight event - point in time when the bat left the field of view or was no longer detected visually by the analyst);

number of individual bats per flight event[3];

direction and form of flight, for instance if the bat was crossing the line, following the line or foraging (see Figures EC-24-010 and EC-24-016);

flight zone category (see Paragraph 7.3.7): if a bat passed through more than one flight zone, all zones passed through were noted; and

other flight event details (notes on behavioural information such as: following flight, chasing flight, foraging behaviour).

3.7.6 Where a flight event could not be positively identified as that of a bat, a note was made of the time but the event was not further analysed. A 10% sample of the data, including unidentified flight events, was cross-checked by another analyst.

3.8 Trapping surveys

3.8.1 Trapping surveys were carried out at eight locations within and adjacent to the existing Aylesbury Link Railway between April and July 2014, as shown in Figure EC-22-009.When additional land in proximity to the scheme south of the Edgcott Road became accessible in August 2014, a trapping survey was carried out at 12 new locations to the south of the Edgcott road as shown in Figure EC-22-010. Therefore in September and October 2014, surveys were conducted at combination of new locations in August 2014 and the original April to July 2014 locations as detailed in Figure EC-22-011.

3.8.2 Trapping locations were selected using the 2012/ 13 baseline data from the ES, aerial photographs and OS maps were also used to identify habitats of value to bats within and adjacent to the scheme.

3.8.3 At Locations 1 to 8, inclusive, three harp traps and one mist net were set approximately 100 - 150 m apart. Six harps traps were set out approximately 100 – 150 m apart were placed on land south of the Edgcott Road. Each trap was fitted with an acoustic lure that produced simulations of a variety of bat social calls, to increase the likelihood of trapping bats.

3.8.4 Thirty seven nights trapping within and adjacent to the scheme was carried out. Each of the trapping locations was surveyed for one night during each survey session, with multiple locations being surveyed each night. The trapping commenced at sunset and lasted for a minimum of six hours on each survey night.

3.8.5 The bats caught in the harp traps were removed, by or under the direction of the licence holder, from the traps and transferred to a clean cloth bag. At the end of each trapping session the biometric information was obtained from all bats caught. Biometric data collection included, sex of the bat, weight obtained using a light line spring scale (Pesola), forearm measurement using digital callipers (Sealey S0707), reproductive status and any other general health observations.

[3] In most cases each flight event is for an individual bat. Two bats observed in close following flight along the same flight route are noted as two individual bats during the same flight event. Two bats observed in the same time window, but following different flight trajectories are noted as separate flight events.

3.8.6 Bats were selected for tagging where the weight of the radio-tag was always less than 5% of the animal's weight. Female bats, in particular breeding age females, were selected for radio-tagging as they enabled the identification of flightlines associated with a maternity colonies. Any heavily pregnant were immediately released without being tagged for animal welfare reasons.

3.8.7 Radio-transmitters were attached with Skin-Bond® (Pfizer Inc.) to the area between the shoulder blades from which fur had been clipped. Recapture data indicates that the tags usually fall off the animals after 5 - 12 days. The animals that were fitted with radio-transmitters were released on the same night of capture in close proximity to the capture site.

3.8.8 All other bats were released immediately in close proximity to the site of capture during the hours of darkness. Droppings were collected from small Myotis bats for DNA analysis to verify species.

3.9 Radio-tracking survey

3.9.1 To determine the position of radio-tagged bats during the day (daytime roost locations) and night (commuting and foraging locations) the animals were tracked on foot and by car by a minimum of four surveyors using a Biotrack 'Sika' receiver and a Yagi 3-element antenna on a height-adjustable and portable mast. A Yagi 5-element was also used to provide information on daytime roosting locations. Taking sequential paired bearings from various locations in the survey area determined the position of each radio-tagged bat and resulted in data on the bats flightlines and foraging habitats. When a radio-tagged bat remained in a specific location for an extended period of time, a technique known as close-approach[4] was used to obtain more accurate bearings. Notes including time, compass bearing, GPS reading and weather were recorded on data sheets in the field. The radio-tracking teams followed the bats from sunset until sunrise.

3.9.2 Each animal was radio-tracked for between one and nine days (depending on how long contact with each radio-tagged animal was maintained) to obtain estimates of home range. Bats were radio-tracked concurrently whereby the radio-tracking teams would switch between radio-tag frequencies in order to obtain estimates of locations for different animals. Data from each night of radio-tracking was added to a cumulative database and for each individual this was used to estimate the bat's home range area.

3.9.3 When a new roost location was identified emergence surveys were carried out at newly recorded roosts (where access was available) to establish a minimum colony size. The emergence surveys allowed flightlines between roosts and foraging areas to be recorded. Where roosting locations were identified on land where access was prohibited, this was addressed by using the techniques described in Sections 3.9.

[4] Close approach technique involves the surveyors approaching the signal being emitted and get very close to the radio-transmitter. It is useful when an animal is not moving or foraging in discrete areas.

3.10 Home range analysis

3.10.1 Pairs of compass bearings, and the locations they were taken from, were used to estimate the bat's position in the landscape (termed fix) by triangulation with the software package LOAS (version 2.12, Ecological Software Solutions, 1998 – 2003). The fixes obtained from LOAS were imported into Biotas (version 2.0 Ecological Software Solutions, 1998 – 2003) Ranges 7 (version 1.8, Anatrack Ltd, 2006) and ArcGIS 9 (version 9.2, ESRI, 2006) which were used to produce visual representations of the estimated ranging areas.

3.10.2 The home range of an individual animal is typically constructed from a set of fixes collected over a period of time that identify the multiple locations of an individual. A variety of analytical tools exist to estimate home ranges, these can be divided into two major classes: (i) minimum linkage approaches that describe ranges as polygons with minimised distances between edge locations; and (ii) probabilistic approaches that estimate the density of locations throughout a range[5]. Current analytical studies on animal home range tend to use both methodologies[6].

3.10.3 Two range estimators were used to calculate total range estimates for each individual animal including 100% Minimum Convex Polygon (100%MCP) and 95% Kernel Density Estimator (95%KDE). The Minimum Convex Polygon (MCP) simply connects the outermost points on the scatter of mapped locations such that the sum of linkage distances between edge points is minimised. KDE[7] is a nonparametric estimator that describes home ranges by means of hierarchical probabilities for the intensity of habitat utilisation, termed isopleths. Series of isopleths can be plotted around the smallest area where the cumulative probability reaches a particular value. For example, the 95% isopleth encompasses the area where the probability of finding an animal is 95%.

3.10.4 Studies on various species' home ranges show that, for a number of environment-related reasons, certain portions within the home range are visited more frequently than others[8]. The centre of activity can be defined as the area within the home range in which the most fixes occurred during the radio-tracking period and can give an indication of which part of the range the bat used more intensively. Areas of more intensive use have been termed as the 'core area of the home range' of the animal and may be related to the greater availability of food resources and refuges[9].

3.10.5 Core areas can be a useful concept when describing patterns of behaviour or identifying particularly resources[10]. The 50% isopleth (median value) was adopted as an indicator of core area use. The use of 50% KDE for bats radio-tracked in this study, would also make it comparable with other radio-tracking studies on woodland bats, for example, Bechstein's[11] and brown long-eared[12]. The 50% isopleth was, therefore, adopted as an indicator of core bat foraging areas.

[5] Harris *et al.*, 1990; White and Garrott, 1990; Kenward, 2001.
[6] Nicholls and Racey, 2006; Murphy *et al.*, 2012.
[7] (Silverman, 1986; Worton, 1987; Worton, 1989).
[8] Adams and Davis, 1967; Dixon and Chapman, 1980.
[9] Samuel *et al.*, 1985; Thompson *et al.*, 2007.
[10] Harris *et al.*, 1990; Powell, 2000.
[11] Dietz and Pir, 2009; Kerth and Melber, 2009.

3.10.6 The fixes, MCP, 95% KDE and 50% KDE were plotted onto an OS map to produce visual representations of the home range of each bat radio-tracked.

3.11 Constraints

Static monitoring

3.11.1 Static monitoring data is not available in circumstances where microphones or static detectors failed to record and in areas where access was limited in April 2014. A large data volume of data was obtained from a number of other static detector units as well as from other survey methods. As such minor gaps in static monitoring data are considered unlikely to significantly impact overall findings of the study.

3.11.2 Night-time temperatures were low (below 5°C) during the end of April / beginning of May and October 2014; this is expected given the time of the year. Therefore, this is considered to be representative of the changeable conditions and is not considered to represent a significant constraint to the survey findings. In addition data for these periods is available from surveys carried out in 2012 and 2013.

3.11.3 The automated data recorded during the surveys is unlikely to be a true representation of the relative population densities for different species of bat due to the inherent bias in detectors. Quieter bats such as brown long-eared and *Myotis* bats are harder to detect and are therefore likely to have been under-recorded. This is a standard limitation associated with automated recording and its impact on the survey have been minimised by the use of several survey techniques to provide a more accurate assessment of bat activity in the study area. As such the inherent survey constraints of current standard survey methodologies have been minimised.

Paired sampling

3.11.4 Paired sampling could not be carried out at all known key crossing point due to restrictions for access to some areas of private land. This was addressed by conducting intensive surveys of land south of the Edgcott Road once access was approved, and by transferring survey locations to more optimal habitat in this area. Where possible surveys which were cancelled due to access restrictions were re-scheduled at a later date.

3.11.5 Dense vegetation restricted the view of bat activity at some of paired sampling locations later in the summer. As such surveys were designed to use two detectors in order to provide an indication of the direction of flight. Therefore the limitations on the findings of paired sampling from restricted access and visibility is considered to be negligible.

3.11.6 Paired sampling was subject to the same constraints as automated recording, such as poor weather and limitations inherent to using bat detectors, such as the under-representation of quieter bats species such as brown long-eared and *Myotis*. The high level of survey effort and multiple survey techniques carried out in project area over three seasons make it unlikely that these constraints have had significant impact overall findings of the study.

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[12] Murphy *et al* 2012.

Infra-red filming

3.11.7 Infra-red filming surveys were conducted for a period of 90 minutes after sunset, and as such, did not record data throughout the night. However the data provided a robust comparison of bat activity at all locations during the peak emergence period at dusk. Therefore it is unlikely that this constraint had a significant effect on the overall findings of this survey method. This impact was further negated as this survey methodology was used to supplement that data gathered from thermal imaging surveys that were carried out from sunset to midnight when passenger services cease.

3.11.8 Handheld detectors were used to record species during the filming surveys but it was not possible to detect and record calls of all the bats that were visible on infra-red filming, due to the distance between the bats and the detector microphone. As such the genus or species of a small portion of the bats could not be determined. However, the required data on flight height and frequency of passes was recorded; this constraint had limited impact on the objectives of this survey method.

Thermal imaging

3.11.9 The objective of the thermal imaging surveys was to record information on the behaviour of bats using the existing Aylesbury Link Railway Line and the alignment of the scheme. The duration of thermal imaging surveys were particularly limited at Locations 1 and 2, on the existing Aylesbury Link Railway Line, as surveys were dependent on provision of line blockages by Network Rail (NWR). Although surveys were scheduled and carried out under supervision of Controller of Site Safety (CoSS), they were interrupted for varying periods by passing trains or the nearby stationary trains that meant the surveyors had to leave the area. This is likely to have had an overall impact on the numbers of bats recorded at these location compared with others. During the analysis efforts were made to correct for this by analysing total number of bats recorded per hour at each location rather than direct comparison of total numbers of flight events (see Annex 4).

3.11.10 Survey nights at Edgcott Road overbridge (south), Sheephouse Wood lineside (north and south), Costello underbridge and Benfield's overbridge were cancelled due to changes in the schedule of NWR activities. One survey night at Sheephouse Wood lineside (north) and at Grendon Junction were cancelled during August 2014 and could not be re-scheduled due to the long period required to book a CoSS. The cancellation of surveys is considered likely to impact the results and the ability to draw conclusions between sites and months for these results due to the low number of survey visits undertaken at each location.

3.11.11 Thermal imaging equipment was sensitive to sub-optimal weather conditions. To avoid cancelling or cutting short the surveys the equipment was secured and covered to protect from moderate winds and short light rain showers. As such limitations to surveys were not significant.

Trapping and radio tracking

3.11.12 A trapping survey was terminated early on one occasion in October 2014 due to unsuitable weather (heavy rain) This survey was re-scheduled and trapping was again terminated early on one occasion as result of low temperatures (below 8°C). Overall

the weather conditions in 2014 were good, poor weather had no significant impact on the findings of this study.

3.11.13 There were excellent weather conditions for bats early in the 2014 survey period which resulted in maternity colonies forming earlier in the season. Consequently surveys were stopped earlier than planned in June 2014 as a high number of heavily pregnant females were being trapped. Those that were caught were released immediately on the basis of animal welfare. This resulted in a reduced volume of data for June in 2014 compared with 2012/13 data.

3.11.14 The location and duration of trapping and radio-tracking surveys was limited in April 2014 due to access restrictions. However, the data that was obtained in April 2014 does provide an insight on bat behaviour early in the activity season and means the surveys from 2012 to 2014 cover the entire activity period. No constraints apply at other periods of the year as good numbers of bats were caught in 2013 and 2014.

3.11.15 Access to habitats to the east of the Aylesbury Link railway line was limited. This reduced the accuracy of the bearings taken for some roost locations and fixes of flightlines when radio-tracking bats back to roost locations in some areas. The radio signal of radio-tracked bat was occasionally lost for one or more of the survey teams; this was usually caused by the nature of the surrounding topography, the unpredictable behaviour bats, and range limitations with the equipment. These constraints were addressed in the following ways:

- where bats were roosting in land where access was prohibited, multiple bearings were taken from a variety of different locations;
- where radio-tracking data on bats was deficient, subsequent surveys focused on those bats for which data was limited;
- where radio signals were lost, bearings would be taken by a single survey team or with another team until such time as a better position in the landscape was possible or signal was regained; and
- if the bat was foraging in an area of land where the signal strength was weak, then the radio-tracking surveyors would move to higher areas of land to get an omnidirectional bearing on the bat being tracked and re-adjust their positions to achieve a clearer signal.

3.11.16 Some bats were radio tracked to roost locations on land where access was not permitted or distant from the scheme and access had not been requested. In these cases it was not possible to carry out emergence counts of the numbers of bats using roosts and as such the size of these roosts could not be determined.

3.11.17 MCPs are very sensitive to outlier fixes and require large data sets for accurate estimations of home range size[13]. Furthermore, they give no information about how the animal is using its home range[14]. The limitations to using MCP to identify the home range were addressed by also using KDE, a probabilistic approach to home

[13] Powell, 2000.
[14] Harris et al., 1990.

ranges analysis, whereby the density of fixes was estimated throughout the area used by the animal.

3.11.18 In summary, the impacts of most survey constraints were considered negligible or minimised through survey design and employment of additional techniques. However, it was not possible to fully address access constraints that affected roost emergence and thermal imaging surveys on land that could not be surveyed. These limitations apply to a small number of locations and survey events and are likely to have a minor impact on the recording of bat numbers, species and flight behaviour. It has been possible to draw conclusions from the data obtained from all survey types carried out and, where necessary, the implication of the constraints described above is discussed in the results and discussion.

4 Results

4.1 Automated surveys

4.1.1 A total of 92,691 passes were recorded over 435 survey nights over both tranches of automated detector surveys. Calls belonging to at least six genera incorporating at least nine species of bats. Table 2 below summarises the total number of passes per night (ppn) at each recording location, and the average ppn during, pre and post the maternity season. Table 3 and Table 4 summarise the proportion of *Myotis* calls in Tranche 1 and Tranche 2, respectively. Survey locations are shown on EC-22-005 and EC-22-006.

Table 2 : Summary of the automated survey results for Tranche 1 and Tranche 2, 2014

Location	Total number of passes per location	Total average number of ppn per location	Pre-maternity season (April-May) average number of ppn for location	Maternity season (June- August) average number of ppn for location	Post maternity season (September - October) average number of ppn for location
Tranche 1 (April to October 2014, 5 nights of recording)					
1. Buckinghamshire Railway Centre	3072	123	256	28	36
2. Doddershall PRoW (Footpath QUA/24A)	1368	68	65	72	Replaced with locations in Tranche 2
3. South of the Edgcott Road Overbridge	2108	105	40	171	
4. Edgcott Road	3633	145	220	120	133
5. Grendon Junction	19309	772	500	310	1074
6. Benfield's overbridge	12485	499	575	748	552
7. Costello underbridge	12610	420	351	125	756
8. North of Sheephouse Wood	3647	146	41	199	225
9. Decoypond Wood	12981	519	98	1233	16
10. School Hill overbridge	1741	70	81	125	8

Tranche 2 (August to October 2014, 10 nights of recording)

1. Copse to the south of Doddershall house	430	43	No Pre-maternity season data. Tranche 2 surveys started in late August- October 2014.	Recording failure	43
2. Hedgerow adjacent to Railway line	3937	131		91	303
3. East of Akeman Street Disused Railway	6206	310		445	175
4. Copse to the north west of Doddershall house	5307	177		100	431
5. South of Doddershall Wood	1843	61		120	65
6. North of Grendon Wood	2014	101		Recording failure	201

Table 3 : Proportion of Myotis bat calls from Static Detector surveys in Tranche 1

Month (all 2014)	1. Buckinghamshire Railway Centre	2. Doddershall PRoW (Footpath QUA/24A)	3. South of the Edgcott road	4. Edgcott Road	5. Grendon Junction	6. Benfield's overbridge	7. Costello underbridge	8. North of Sheephouse Wood	9. Decoypond Wood	10. School Hill overbridge
April	0	3	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
May	1	8	7	1	2	1	3	21	1	2
June	16	16	4	29	5	2	0	4	6	44
July	N/A	14	14	4	1	2	6	N/A	0	2
September	21	0	0	5	3	3	0	2	21	20
October	0	0	N/A	14	0	0	4	0	0	3

Table 4 : Proportion of Myotis bat calls from Static Detector surveys in Tranche 2

Month (all 2014)	1. Copse to the south of Doddershall house	2 Hedgerow adjacent to existing Aylesbury Link railway line	3. East of Akeman Street Disused Railway	4. Pond located at the Copse to the north west of Doddershall estate	5. South of Doddershall Wood	6. North of Grendon Wood
August	0	25	0	3	3	0
September	26	0	0	14	2	3
October	6	2	1	1	1	4

Tranche 1

4.1.2 Activity for all bat species during the pre-maternity season (April and May 2014) was Very High at Location 7, and High at Locations 5, 6 and 10 (see section 3.2.4 for location names). Maternity season (June and July 2014) activity levels were Very High at Location 9 with an average of 1234 ppn (with total passes of 2533 and 9793 respectively for June and July 2014 recorded over ten survey nights). Post maternity season (late August to October 2014) activity levels were Very High at Location 5 with an average of 1073 ppn recorded over this period (with total passes of 487 and 1660 respectively for September and October 2014 over ten survey nights). High levels of activity were also recorded at Location 6 with an average of 551 ppn recorded over this period (with 1859 and 3656 ppn in September and October 2014 respectively over ten survey nights). The pre-, post- and maternity season passes at each location are shown in Figures EC-22-015, EC-22-016 and EC-22-017, using the thresholds outlined in Section 3.2 to show variation of all species bat activity.

4.1.3 The peak month of activity for all bat species across all locations in Tranche 1 was during the maternity season in July 2014, when a total of 20,694 passes and an average of 517 ppn was recorded. Activity was also high during October 2014 in the post-maternity season, with an average of 321 ppn and a total of 12,845 passes. The lowest activity was recorded in April and June 2014, with averages of 54 and 128 ppn respectively.

4.1.4 Very High levels activity (average of 772 ppn) were recorded at Location 5 and High activity levels were also recorded at Location 6, 7 and 9, with averages of 519, 499 and 420 ppn recorded respectively.

4.1.5 At least nine species were recorded over the entire survey period, the location and amount of activity of different species are summarised in Table 5 and 6 and described below:

high levels of *Myotis* bat activity were recorded at Location 10 in June, with an average of 77 ppn. This area was also a trapping location and all *Myotis* species were caught, with the exception of Brandt's and Alcathoe *Myotis alcathoe*, as such the records are likely to be made up of a diverse assemblage including but not limited to Bechstein's. There were lower levels of *Myotis* activity in April at all ten locations when compared with other months;

the highest proportions of *Myotis* species were recorded in June at Location 10, where 44% of calls were identified as *Myotis sp.*, Location 4 (29% *Myotis*), Location 1 (16% *Myotis*) and Location 2 (15% *Myotis*). High percentages of *Myotis* calls were also recorded in September at Locations 1 (21 %), 9 (also 21%) and 10 (20%) and in May at Location 8 (21%);

the proportions of *Myotis* species recorded at all other Locations during May, June, July and September 2014 ranged between 0% and 6%;

proportions of *Myotis* species recorded during surveys in April 2014 ranged from 0% to 3%;

during October 2014 14% of bats recorded at Location 4 were *Myotis* species, and 4% and 3% respectively at Locations 7 and 10, and no Myotis bats were

recorded at other locations ;

one pass of barbastelle bat *Barbastella barbastellus* was recorded in September 2014 at Location 4, 6 and 7; one and two passes respectively were recorded in September and October 2014 at Location 5;

there were few recordings of Leisler's bat at all ten survey locations. The highest level of activity was recorded at Location 6 with an average of three ppn in September 2014;

there was infrequent noctule bat activity at all ten survey locations, the highest recorded was an average of 52 ppn at Location 7 in April 2014;

serotine bat activity was recorded at Locations 2, 3, 4, 5, 7 and 9, with the highest average count of four ppn at Location 8 in September 2014;

*t*he peak counts of brown long-eared bat were at Location 7 with an average of 33 ppn recorded in May 2014 and an average of 15 ppn in October 2014;

the highest recorded activity of all species recorded was for common pipistrelle *Pipistrellus pipistrellus*. An average of 1931 ppn at Location 9 in July 2014. Comparatively high levels of common pipistrelles were also recorded at Locations 5, 6 and 7 throughout the survey season with averages of 1646, 719 and 749 ppn respectively;

the highest activity of Nathusius' pipistrelle *Pipistrellus nathusii* bat were recorded at Locations 5 and 9, both with an average 13 ppn in June 2014 with comparatively more limited activity recorded Locations 3, 4, 6, 7 and 8; and

soprano pipistrelle *Pipistrellus pygmaeus* was the second-most commonly recorded species. The highest level of activity was average of 157 ppn in September 2014 at Location 7.

Tranche 2

4.1.6 The activity levels of all bat species during the maternity season were High at Location 3 where an average of 445 ppn was recorded. Post maternity season activity levels were High at Location 2 and 4 where the recorded averages were 303 and 431 ppn respectively. The pre-, post- and maternity season passes for each detector are shown in Figures EC-22-015 and EC-22-016, EC-22-017, using the thresholds outlined in Section 3.2 to show variation of bat activity.

4.1.7 The highest levels of activity in Tranche 2 were during the post-maternity period in August 2014 when a total of 7564 ppn (an average of 270 ppn) was recorded. Actively levels were Low and Very Low in September and October 2014, with averages of 136 and 91 ppn, respectively.

4.1.8 The highest activity levels for all species were recorded at Location 3 and Location 2 where average of 310 ppn and 131 ppn were recorded.

4.1.9 High proportions of *Myotis* species were recorded at Locations 2 where 25% of all calls were *Myotis* bats in August 2014 and Location 1 and Location 4 in September 2014 where 26% and 14% of bat calls respectively were *Myotis* species. At all other

locations during August, September and October 2014 Myotis bats made up between 0% and 6% of the bat calls.

4.1.10 At least nine species were recorded during the entire period of automated surveys. The location and amount of activity of different species are summarised in Table 7, and described below:

- the highest passes of Myotis bats were recorded at Location 4 in August 2014 with an average of 33 ppn, and Location 2 in September 2014 with an average of 27 ppn;
- two passes of barbastelle bat were recorded in September 2014;
- the greatest number of Leisler's bat passes of were recorded at Location 5 with an average of five ppn;
- the highest activity of noctule bats was recorded in September 2014 at Location 2 and Location 6, with an average of 13 ppn and 20 ppn respectively;
- the greatest amount of serotine bat activity was recorded at Location 5 in August 2014 with a total of 29 ppn and there were no records in October 2014;
- brown long-eared activity level was comparatively low at all six locations, the average of four ppn was recorded at Location 4 in September 2014;
- common pipistrelle was the species with the highest recorded activity, at Location 3, with an average of 626 average ppn in August 2014;
- limited amounts or no Nathusius' bat activity was recorded across the six locations, with a peak average of 13 ppn at Location 5 in June 2014; and
- limited amounts of soprano pipistrelle activity was recorded at all six locations, with a peak average of four ppn at Location 4 in October 2014.

Table 5 : Automated survey results 2014, Tranche 1 Locations 1 to 5

Month (all 2014)	**Species**[15]	**Location**									
		1. Buckinghamshire Railway Centre		2. Doddershall PRoW (Footpath QUA/24A)		3. South of the Edgcott road		4. Edgcott Road		5. Grendon Junction	
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night
April	B. barb	0	0	0	0	0	0	No Access		No Access	
	E. ser	0	0	1	0	0	0				
	P.pyg	3	1	12	2	8	2				
	P.pip	58	12	505	101	265	53				
	P.nat	0	0	0	0	0	0				
	P.aur	0	0	13	3	0	0				
	Myotis sp	0	0	19	4	12	2				
	N.noc	1	0	28	6	0	0				
	N.leis	0	0	1	0	1	0				
	Total	62	13	579	116	286	57				
May	B. barb	0	0	0	0	0	0	0	0	0	0

[15] P.pip - common pipistrelle, P pyg - soprano pipistrelle, P.nat - Nathusius' pipistrelle, P sp. - Pipistrelle bat species, *Myotis* sp. *Myotis* bat species Includes the following species; Bechstein's bat, Daubenton's bat, Natterer's bat, whiskered bat, Brandt's bat, P.aur -brown long-eared bat, B. barb - barbastelle bat, N.noc - noctule bat, N.leis - Leisler's bat, E.ser - serotine bat.

Month (all 2014)	Species[15]	Location									
		1. Buckinghamshire Railway Centre		2. Doddershall PRoW (Footpath QUA/24A)		3. South of the Edgcott road		4. Edgcott Road		5. Grendon Junction	
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night
	E. ser	0	0	0	0	0	0	0	0	0	0
	P.pyg	202	40	0	0	2	0	41	8	130	26
	P.pip	2259	452	63	13	95	19	1027	205	2280	456
	P.nat	0	0	0	0	0	0	0	0	4	1
	P.aur	8	2	0	0	6	1	15	3	7	1
	Myotis sp	17	3	6	1	8	2	12	2	61	12
	N.noc	20	4	2	0	2	0	7	1	16	3
	N.leis	1	0	0	0	0	0	0	0	3	1
	Total	250[i]7	501	71	14	113	23	1102	220	2501	500
June	B.barb	0	0	0	0	0	0	0	0	0	0
	E. ser	0	0	0	0	0	0	0	0	0	0
	P.pyg	2	0	2	0	22	4	1	0	38	8
	P.pip	115	23	115	23	694	139	71	14	2770	554

Month (all 2014)	Species[15]	Location									
		1. Buckinghamshire Railway Centre		2. Doddershall PRoW (Footpath QUA/24A)		3. South of the Edgcott road		4. Edgcott Road		5. Grendon Junction	
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night
	P.nat	0	0	0	0	6	1	0	0	66	13
	P.aur	0	0	0	0	0	0	0	0	3	1
	Myotis sp	23	5	23	5	28	6	30	6	153	31
	N.noc	0	0	0	0	9	2	1	0	0	0
	N.leis	1	0	1	0	0	0	0	0	3	1
	Total	141	28	141	28	759	152	103	21	3033	607
July	B.barb	Microphone malfunction-noise recorded		0	0	0	0	0	0	0	0
	E. ser			0	0	5	1	2	0	0	0
	P.pyg			13	3	204	41	8	2	0	0
	P.pip			475	95	583	117	1037	207	65	13
	P.nat			0	0	0	0	0	0	0	0
	P.aur			1	0	0	0	2	0	0	0
	Myotis sp			79	16	131	26	44	9	1	0

Month (all 2014)	Species[15]	Location									
		1. Buckinghamshire Railway Centre		2. Doddershall PRoW (Footpath QUA/24A)		3. South of the Edgcott road		4. Edgcott Road		5. Grendon Junction	
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night
	N.noc			4	1	27	5	1	0	1	0
	N.leis			5	1	0	0	3	1	0	0
	Total			577	115	950	190	1097	219	67	13
September	B.barb	0	0	Replaced with locations in Tranche 2		Replaced with locations in Tranche 2		1	0	1	0
	E. ser	0	0					0	0	2	0
	P.pyg	15	3					9	2	108	22
	P.pip	205	41					580	116	2208	442
	P.nat	0	0					3	1	0	0
	P.aur	0	0					0	0	18	4
	Myotis sp	64	13					35	7	71	14
	N.noc	17	3					11	2	21	4
	N.leis	0	0					6	1	6	1
	Total	301	60					645	129	2435	487

Month (all 2014)	Species[15]	Location									
		1. Buckinghamshire Railway Centre		2. Doddershall PRoW (Footpath QUA/24A)		3. South of the Edgcott road		4. Edgcott Road		5. Grendon Junction	
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night
October	B.barb	0	0	Replaced with locations in Tranche 2		Replaced with locations in Tranche 2		0	0	2	0
	E. ser	0	0					0	0	0	0
	P.pyg	0	0					133	27	26	5
	P.pip	1	0					450	90	8229	1646
	P.nat	0	0					0	0	3	1
	P.aur	58	12					3	1	16	3
	Myotis sp	0	0					97	19	18	4
	N.noc	2	0					2	0	0	0
	N.leis	0	0					1	0	8	2
	Total	61	12					686	137	8302	1160

Table 6 : Automated survey results 2014, Tranche 1 Locations 6 to 10

Month (all 2014)	**Species**[15]	**Location**										Total number of passes per month	Total number of passes per month averaged across the season
		6. Benfield's overbridge		**7. Costello underbridge**		**8. North of Sheephouse Wood**		**9. Decoypond Wood**		**10. School Hill overbridge**			
		No. Passes	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**		
April	B.barb	No Access		0	0	0	0	No Access		No Access		1357	54
	E. ser			2	0	0	0						
	P.pyg			8	2	1	0						
	P.pip			327	65	103	21						
	P.nat			0	0	0	0						
	P.aur			0	0	0	0						
	Myotis sp			5	1	1	0						
	N.noc			261	52	5	1						
	N.leis			2	0	1	0						
	Total			605	121	111	22						
May	B.barb	0	0	0	0	0	0	0	0	0	0	12865	257

Month (all 2014)	Species[15]	Location										Total number of passes per month	Total number of passes per month averaged across the season
		6. Benfield's overbridge		7. Costello underbridge		8. North of Sheephouse Wood		9. Decoypond Wood		10. School Hill overbridge			
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night		
	E. ser	0	0	0	0	0	0	0	0	0	0		
	P.pyg	26	5	68	14	11	3	79	1	89	18		
	P.pip	2777	555	2523	505	207	101	396	20	296	59		
	P.nat	5	1	5	1	0	0	0	0	0	0		
	P.aur	7	1	167	33	0	7	0	1	2	0		
	Myotis sp	41	8	84	17	64	3	7	1	7	1		
	N.noc	18	4	57	11	17	2	6	0	6	1		
	N.leis	0	0	2	0	0	0	4	0	4	1		
	Total	2874	575	2906	581	299	60	492	98	404	81		
June	B.barb	0	0	0	0	0	0	0	0	0	0	6410	128
	E. ser	0	0	0	0	0	0	0	0	0	0		
	P.pyg	0	0	1	0	85	17	38	8	71	14		

Month (all 2014)	Species[15]	Location										Total number of passes per month	Total number of passes per month averaged across the season
		6. Benfield's overbridge		7. Costello underbridge		8. North of Sheephouse Wood		9. Decoypond Wood		10. School Hill overbridge			
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night		
	P.pip	310	62	113	23	866	173	2270	454	416	83		
	P.nat	0	0	0	0	0	0	66	13	0	0		
	P.aur	0	0	0	0	0	0	3	1	0	0		
	Myotis sp	8	2	0	0	35	7	153	31	385	77		
	N.noc	39	8	0	0	6	1	0	0	10	2		
	N.leis	0	0	0	0	0	0	3	1	2	0		
	Total	357	71	114	23	992	198	2533	507	884	177		
July	B.barb	0	0	0	0	Microphone malfunction- noise recorded		0	0	0	0	20694	517
	E. ser	6	1	6	1			0	0	0	0		
	P.pyg	75	15	29	6			88	18	115	23		
	P.pip	3565	713	1016	203			9654	1931	237	47		
	P.nat	1	0	3	1			1	0	0	0		

Month (all 2014)	Species[15]	Location										Total number of passes per month	Total number of passes per month averaged across the season
		6. Benfield's overbridge		7. Costello underbridge		8. North of Sheephouse Wood		9. Decoypond Wood		10. School Hill overbridge			
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night		
	P.aur	8	2	1	0			1	0	2	0		
	Myotis sp	79	16	66	13			15	3	7	1		
	N.noc	2	0	4	1			29	6	5	1		
	N.leis	3	1	5	1			5	1	4	1		
	Total	3739	748	1130	226			9793	1959	370	74		
September	B.barb	2	0	1	0	0	0	0	0	0	0	11729	293
	E. ser	0	0	0	0	4	1	0	0	0	0		
	P.pyg	108	22	785	157	753	151	2	0	2	0		
	P.pip	1640	328	3747	749	936	187	94	19	32	6		
	P.nat	0	0	2	0	3	1	2	0	0	0		
	P.aur	20	4	4	1	4	1	1	0	0	0		
	Myotis sp	61	12	12	2	41	8	27	5	9	2		

Month (all 2014)	Species[15]	Location										Total number of passes per month	Total number of passes per month averaged across the season
		6. Benfield's overbridge		7. Costello underbridge		8. North of Sheephouse Wood		9. Decoypond Wood		10. School Hill overbridge			
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night		
	N.noc	13	3	19	4	4	1	0	0	1	0		
	N.leis	15	3	0	0	3	1	1	0	0	0		
	Total	1859	372	4570	914	1748	350	127	25	44	9		
October	B.barb	0	0	0	0	0	0	0	0	0	0	12845	321
	E. ser	2	0	0	0	2	0	0	0	0	0		
	P.pyg	42	8	314	63	49	10	33	7	1	0		
	P.pip	3593	719	2764	553	441	88	0	0	32	6		
	P.nat	0	0	1	0	0	0	0	0	0	0		
	P.aur	8	2	73	15	1	0	0	0	5	1		
	Myotis sp	7	1	128	26	1	0	0	0	1	0		
	N.noc	3	1	5	1	3	1	3	1	0	0		
	N.leis	1	0	0	0	0	0	0	0	0	0		

Month (all 2014)	Species[15]	Location										Total number of passes per month	Total number of passes per month averaged across the season
		6. Benfield's overbridge		7. Costello underbridge		8. North of Sheephouse Wood		9. Decoypond Wood		10. School Hill overbridge			
		No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night	No. Passes	Av. passes/night		
	Total	3656	731	3285	657	497	99	36	7	39	8		

Table 7 : Automated survey results 2014, Tranche 2 Locations 1 to 6

Month (All 2014)	**Species**Error! Bookmark not defined.	**Location**												**Total number of passes per month**	**Total number of passes per month averaged across the season**
		1. Copse to the south of Doddershall house		**2 Hedgerow adjacent to existing Aylesbury Link railway line**		**3. East of Akeman Street Disused Railway**		**4. Pond located at the Copse to the north west of Doddershall estate**		**5. South of Doddershall Wood**		**6. North of Grendon Wood**			
		No. Passes	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**		
August	B. barb	Noise		0	0	0	0	0	0	0	0	Noise		7564	270
	E. ser			0	0	5	1	1	0	29	4				
	P.pyg			11	2	44	6	66	9	85	12				
	P.pip			630	90	4379	626	885	126	953	136				
	P.nat			5	1	0	0	0	0	0	0				
	P.aur			0	0	0	0	0	0	2	0				
	Myotis sp			229	33	6	1	33	5	36	5				
	N.noc			18	3	10	1	16	2	44	6				
	N.leis			19	3	8	1	1	0	49	7				
	Total			912	91.2	4452	445	1002	100	1198	119				

Month (All 2014)	**Species**Error! Bookmark not defined.	**Location**												**Total number of passes per month**	**Total number of passes per month averaged across the season**
		1. Copse to the south of Doddershall house		**2 Hedgerow adjacent to existing Aylesbury Link railway line**		**3. East of Akeman Street Disused Railway**		**4. Pond located at the Copse to the north west of Doddershall estate**		**5. South of Doddershall Wood**		**6. North of Grendon Wood**			
		No. Passes	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**		
September	B. barb	0	0	0	0	Noise		2	0	0	0	0	0	6777	136
	E. ser	0	0	1	0			5	1	0	0	1	0		
	P.pyg	2	0	55	6			85	9	17	2	108	11		
	P.pip	62	6	2647	265			1602	160	91	9	1317	132		
	P.nat	0	0	0	0			3	0	0	0	2	0		
	P.aur	0	0	5	1			18	2	0	0	23	2		
	Myotis sp	23	2	10	1			273	27	2	0	52	5		
	N.noc	3	0	131	13			8	1	3	0	195	20		
	N.leis	1	0	2	0			2	0	1	0	27	3		
	Total	89	9	2851	285			1998	199	114	11	1725	172		
October	B.barb	0	0	0	0	0	0	0	0	0	0	0	0	5396	90

Month (All 2014)	**Species**Error! Bookmark not defined.	**Location**												**Total number of passes per month**	**Total number of passes per month averaged across the season**
		1. Copse to the south of Doddershall house		**2 Hedgerow adjacent to existing Aylesbury Link railway line**		**3. East of Akeman Street Disused Railway**		**4. Pond located at the Copse to the north west of Doddershall estate**		**5. South of Doddershall Wood**		**6. North of Grendon Wood**			
		No. Passes	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**	**No. Passes**	**Av. passes/night**		
	E. ser	0	0	0	0	0	0	0	0	0	0	0	0		
	P.pyg	66	7	2	0	87	9	95	10	26	3	45	5		
	P.pip	211	21	165	17	1589	159	2129	213	491	49	205	21		
	P.nat	0	0	0	0	2	0	2	0	0	0	0	1		
	P.aur	5	1	1	0	5	1	5	1	1	0	3	0		
	Myotis sp	19	2	3	0	23	2	25	3	5	1	12	1		
	N.noc	33	3	3	0	41	4	44	4	5	1	19	2		
	N.leis	7	1	0	0	7	1	7	1	3	0	5	1		
	Total	341	34	174	17	1754	175	2307	230	531	53	289	28		

4.2 Bat activity transect

4.2.1 At least five species were recorded during the bat activity transects, comprising *Myotis*, *Pipistrellus*, *Nyctalus* species (see Tables 8 and 9). The sound analysis only confirmed the species to Genus level and not species level for activity transects. Higher levels of activity and higher species diversity were recorded at Transect 1 than at Transect 2. This pattern was consistent throughout the season with the exception of October 2014, where higher levels of activity were recorded along Transect 2.

Transect 1

4.2.2 At least five species were recorded during the activity transects. *Myotis* species were recorded at several locations along the transect route including Decoypond Wood and a hedgerow to the west of Finemere Wood. Noctule bats were recorded close to Finemere hedgerow and to the north of Sheephouse Wood. Multiple records of common and soprano pipistrelles were recorded at several locations including crossing the Aylesbury Link Railway near Benfield's overbridge, foraging at Grendon Junction south of the Mega Ditch and near Finemere hedgerow. The results of Transect 1 are summarised in Table 8.

Transect 2

4.2.3 At least two species were recorded along this transect, including *Myotis* species and common pipistrelles. *Myotis* species were recorded crossing the Aylesbury Link Railway between a PRoW bisecting the railway and the bridge adjacent to Doddershall and using the railway corridor south of the Edgcott Road junction. Common pipistrelles were recorded crossing the railway north of the Buckinghamshire Railway Centre, and using the existing railway to the north of a PRoW which crosses the railway adjacent to Doddershall House. The results of Transect 2 are summarised in Table 9.

Table 8 : Bat activity transect 1 survey results – Finemere Hedgerow - Calvert

Total species passes recorded during transect survey												
Visit number and date	**Common pipistrelle**	**Soprano pipistrelle**	**Nathusius' pipistrelle**	***Myotis* species**	**Brown long-eared bat**	**Barbastelle bat**	**Noctule**	**Leisler's bat**	**Nyctalus species**	**Serotine**	**Unknown species**	**All species total**
Visit 1: April 2014 Dusk	16	5	0	1	0	0	3	0	1	0	6	32
Visit 2: May 2014 Dusk	12	8	0	3	1	0	5	0	14	0	10	53
Visit 3: June 2014 Dusk	4	0	0	2	1	0	0	0	0	0	15	22
Visit 4: Jul/Aug 2014 Dusk	5	2	0	4	0	0	0	0	0	0	18	29
Visit 5: September 2014 Dusk	5	6	0	1	0	0	1	0	0	0	2	15
Visit 6: October 2014 Dusk	0	4	0	0	0	0	0	0	0	0	0	4
Total per species	42	25	0	11	2	0	9	0	15	0	51	155

Table 9 : Bat activity transect 2 survey results – Buckinghamshire Railway Centre to Edgcott Road

Total species passes recorded during transect survey											
Visit number and date	**Common pipistrelle**	**Soprano pipistrelle**	**Nathusius' pipistrelle**	**Pipistrelle species**	***Myotis* species**	**Brown long-eared bat**	**Barbastelle bat**	**Noctule**	**Leisler's bat**	**Serotine**	**All species total**
Visit 1: April 2014	2	0	0	0	4	0	0	0	0	0	6
Visit 2: May 2014	2	0	0	0	1	0	0	0	0	0	3
Visit 3: June 2014	3	0	0	0	3	0	0	0	0	0	6
Visit 4 July 2014	1	0	0	0	2	0	0	0	0	0	3
Visit 5: September 2014	3	0	0	0	0	0	0	0	0	0	3
Visit 6: October 2014	10	0	0	0	10	0	0	0	0	0	20
Total per species	21	0	0	0	20	0	0	0	0	0	41

4.3 Paired sampling

4.3.1 The results of paired sampling are summarised by survey month and by bat species in Tables 10 and 11.

4.3.2 The highest numbers of bats using linear features was recorded at the Locations 4 and 5, with a total count of 47 and 39 bats respectively, while the least association of with linear habitats was recorded at Location 2 and Location 3, with a count of 12 and 10 respectively.

4.3.3 At least three genera were recorded during paired sampling surveys, including *Myotis*, *Pipistrellus*, *Nyctalus* species, as well as undetermined species.

4.3.4 *Myotis* species were exclusively recorded commuting along linear features with peak numbers using the scrub and hedgerow along the Aylesbury Link Railway at Location 5. *Myotis* species were also recorded foraging along linear features at Location 3 and Location 4 which are adjacent to the scheme.

4.3.5 *Nyctalus* species were recorded foraging in open habitat over arable land and Aylesbury Link Railway adjacent to a hedgerow leading from Finemere Wood to Sheephouse Wood.

4.3.6 Common pipistrelles were more commonly recorded commuting along linear features at Location 1, 2, 4 and 5 with occasional records over open habitat.

4.3.7 Soprano pipistrelles were also recorded using linear features at Location 4 and 5, with a peak count of 15 individual bats at the Location 4.

Table 10 : Results of paired sampling for all bat species observed in surveys May-October 2014

Survey Month (all 2014)	Location 1. Edgcott Road		Location 2. Grendon Junction-Finemere Hedgerow		Location 3. Benfield's overbridge		Location 4. Costello underbridge south of Sheephouse Wood		Location 5. School Hill overbridge	
	Not associated with linear features	**Commuting using linear features**	**Not associated with linear features**	**Commuting using linear features**	**Not associated with linear features**	**Commuting using linear features**	**Not associated with linear features**	**Commuting using linear features**	**Not associated with linear features**	**Commuting using linear features**
May	No bats observed	1 x unknown species	5 x unknown species	1 x unknown species	1 x unknown species	5 x common pipistrelles	No bats observed	No bats observed	1 x common pipistrelle	15 (3 x soprano pipistrelle, 3 x common pipistrelle, 9 x *Myotis* species
June	1 x unknown species	No observations made	1 x unknown species	10 (1 x *Nyctalus*, 1 x *Myotis*, 8 x common pipistrelle)	Surveys Cancelled	Surveys Cancelled	No bats observed	4 (1 x *Myotis* species, 1 x soprano pipistrelle, 2 x common pipistrelle)	No observations made	8 (1 x soprano pipistrelle, 4 x common pipistrelle, 3 x *Myotis* species)
July- August	1 x *Nyctalus*	13 (6 x common pipistrelle, 7 x unknown species)	No bats observed	4 x common pipistrelle	1 x unknown species	1 x unknown species	5 x *Nyctalus*	31 (11 x *Nyctalus*, 4 x *Myotis* species, 5 x soprano pipistrelle, 9 x common pipistrelle, 2 x unknown species)	No bats observed	5 x unknown species
September	No bats observed	6 x common pipistrelle	2 (1 x brown long-eared, 1 x common pipistrelle)	No observations made	Surveys Cancelled	Surveys Cancelled	No bats observed	6 (5 x soprano pipistrelle, 1 x common pipistrelle)	1 x common pipistrelle	10 (1 x *Nyctalus*, 3 x soprano pipistrelle, 6 x common pipistrelle)
October	No bats observed	5 x common pipistrelle	4 (1 x brown long-eared, 2 x pipistrelle species, 1 unknown species)	No observations made	8 (1 x soprano pipistrelle, 4 x common pipistrelle, 3 x unknown)	5 x unknown species	No bats observed	6 (4 x soprano pipistrelle, 2 x unknown species)	No bats observed	1 x *unknown species*

Table 11. Results of paired sampling surveys for each bat species from observed flight

Species	Location 1. Edgcott Road		Location 2. Grendon Junction-Finemere Hedgerow		Location 3. Benfield's overbridge		Location 4. Costello underbridge south of Sheephouse Wood		Location 5. School Hill overbridge		Total Not associated with linear features	Total Commuting using linear features
	Not associated with linear features	Commuting using linear features	Not associated with linear features	Commuting using linear features	Not associated with linear features	Commuting using linear features	Not associated with linear features	Commuting using linear features	Not associated with linear features	Commuting using linear features		
Common pipistrelle	0	17	1	12	4	5	0	12	2	13	7	59
Soprano pipistrelle	0	0	0	0	1	0	0	15	0	7	1	22
Pipistrelle species	0	0	2	0	0	0	0	0	0	0	2	0
Myotis species	0	0	0	1	0	0	0	5	0	17	0	23
Nyctalus species	1	0	0	1	0	0	5	11	0	1	6	13
Brown long-eared	0	0	2	0	0	0	0	0	0	0	2	0
Unknown species	1	8	7	1	5	6	0	4	0	1	13	20
All bats species	2	25	12	15	10	11	5	47	2	39	31	137

4.4 Infra-red filming survey

4.4.1 Three filming surveys were carried out at four known crossing points as detailed in Figure EC-22-008 in June, August and September 2014. The date and location and results of the surveys are detailed in Annex 4.

4.5 Thermal imaging survey

4.5.1 Thermal imaging surveys were carried out at eight locations along the Aylesbury Link railway line. A summary of the data recorded during surveys on 19 nights between 3 June 2014 and 15 September 2014 are provided below. Further information of the flight events detailing flight behaviour and zones and the proportion of flight events that crossed or followed the railway are summarised in Annex 5 Table 18 and Table 19. Automated survey results for these locations at these survey times are detailed in Annex 6 Table 20 and provide the approximate likely proportions of the species present during the thermal imaging surveys.

4.5.2 The results below summarise the findings of flight events and behaviours observed during the thermal imaging surveys. A single flight event can comprise several behaviours and occur in a number of zones. Therefore the records for behaviour in different zones can be equal to or greater than the number of flight events at each location.

4.5.3 Access and weather restrictions affected the consistency of survey nights and length of surveys per night at Edgcott Road overbridge (north and south), Sheephouse Wood lineside (north and south) and Benfield's overbridge throughout the season.

Edgcott Road overbridge recording south

4.5.4 Two hundred and twenty three flight events were recorded during surveys at Edgcott Road south on 30 July 2014. The flight behaviours recorded were as follows: 103 (44%) as foraging, 92 (40%) crossing the railway and 38 (16%) following the line. The majority of activity was in zone 3 (6m) where 139 flight events were recorded, while 13 and 64 were recorded in zones 1 and 2 respectively. *Myotis* species were 4% of all bats recorded during static monitoring surveys at Edgcott Road that were correlated with thermal imaging at this location.

4.5.5 One hundred and ninety four flight events were recorded on 27 August 2014. The flight behaviours recorded were as follows: 61 (30%) crossed the Aylesbury Link railway line, 126 (61%) followed it and 19 (9%). Aylesbury Link railway line Most flight events (192) were in zone 3 (6m) and 59 flight events were in zone 2. Six bats only were recorded in zone 1. *Myotis* species were 5% of all bats recorded during static monitoring surveys at Edgcott Road that were correlated with thermal imaging at this location.

4.5.6 Four hundred and forty four flight events were recorded on 11 September 2014 (recording south). The flight behaviours recorded were as follows: 93 (18%) were recorded crossing the line, 165 (32%) were following the railway and 263 (50%) were foraging. The majority of flight events were recorded in zone 3 level (6m) (389) and zone 2 (181). The remaining 18 flight events were recorded in zone 1. *Myotis* species were 5% of all bats recorded during static monitoring surveys at Edgcott Road that were correlated with thermal imaging at this location.

Edgcott Road overbridge recording north

4.5.7 Three hundred and fifty four flight events were recorded during the survey at Edgcott Road overbridge (recording north) on 29 July 2014. The flight behaviours recorded were as follows: 115 (31%) were recorded as following the railway, 98 (27%) were recorded as crossing the line and 154 (42%) were recorded foraging. The majority of flight was recorded in zone 3 (6m), with 394 flights event recorded using this zone and only 81 and 21 flight events recorded in zones 2 and 1. The proportion of *Myotis* species recorded at this location in July 2014 was 4% of all bats recorded.

4.5.8 Eight hundred and five flight events were recorded on 26 August 2014. The flight behaviours recorded were as follows: 134 (15%) were recorded crossing the line, 693 (80%) were recorded following the railway and 43 (5%) were recorded foraging. During this survey, bats tended fly close to the tops of the vegetation alongside the Aylesbury Link railway line. The majority (798) of flight events took place in at 6m in zone 3. No bats were observed in zone 1 during this survey and only seven were observed flying in zone 2. The proportion of *Myotis* species recorded at this location in August 2014 was 5% of all bats recorded.

4.5.9 Six hundred and five flight events were recorded from the survey at the Edgcott Road overbridge north on 12 September 2014. The flight behaviours recorded were as follows: 144 (23%) events were recorded crossing the Aylesbury Link railway line, 214 (33%) were following the Aylesbury Link railway line, and 284 (44%) were foraging. Aylesbury Link railway line Aylesbury Link railway line. The majority of these flight events were recorded within zone 3 (479) and zone 2 (220). Twenty seven flight events were recorded within zone 1. The proportion of *Myotis* species recorded at this location in September 2014 was 5% of all bats recorded.

Grendon Junction

4.5.10 One hundred and fifty four flight events were recorded from the survey at the Grendon Junction on 7 June 2014. The flight behaviours recorded were as follows: 10 (6%) were crossing the line, 12 (8%) were following the railway and 132 (86%) were foraging. A clear crossing point at Grendon Junction (over Bridleway QUA/36) corresponds to the hedgerow from Finemere Wood. Bats cross here in zone 3 at tree top level (6m), following the hedge line. The majority of flight events passed through zone 3 at approximately 6m (142) and the remaining 12 flight events passed through zone 2. There were no flight events in zone 1 but bats were observed by the surveyor flying directly over the level crossing at Grendon Junction in zone 1/zone 2 early in the survey (behind camera field of view). The proportion of *Myotis* species recorded at this location in June 2014 was 5% of all bats recorded.

4.5.11 Six hundred and fifty nine flight events were recorded during the survey on 3 August 2014. The flight behaviours recorded were as follows: 260 (37%) were crossing the railway, 199 (28%) were following the railway and 248 (35%) were recorded as foraging. Three hundred and ten flight events were recorded in zone 3 (6m), 191 were in zone 2 and 49 in zone 1. The proportion of *Myotis* species recorded at this location in August 2014 was 1% of all bats recorded.

4.5.12 Four hundred and twenty four flight events were recorded on 13 September 2014. The flight behaviours recorded were as follows: 59 (13%) were recorded crossing the railway, 161 (35%) flight events were recorded following the railway and 237 (52%)

were recorded foraging. A notable crossing point corresponding to the hedgerow that leads from the north-western end of Finemere Wood to the existing Aylesbury Link railway. Bats flew along this feature and cross over the railway corridor at canopy height. Most (278) flight events were in zone 3 (6m), 211 were in zone 2 and 39 in zone 1. The proportion of *Myotis* species recorded at this location in September 2014 was 3% of all bats recorded.

Benfield's overbridge south

4.5.13 One hundred and two flight events were recorded from the survey at Benfield's overbridge south on 6 June 2014. The flight behaviours recorded were as follows: 19 (18%) were recorded crossing the line, 9 (8%) were following the railway and 79 (74%) were recorded foraging. Sixty seven flight events were in zone 1 and these comprised mainly of bats flying close to (and underneath) Benfield's overbridge, 54 flight events passed through zone 2 and 17 flight events passed through zone 3 (8m). Bats were also observed flying over Benfield's overbridge and along Bridleway GUN/28 either side of the camera field of view, therefore it was not possible to quantify the number of passes. The proportion of *Myotis* species recorded at this location in June 2014 was 2 % of all bats recorded.

4.5.14 Fifty six flight events were recorded during the survey on 24 August 2014. The flight behaviours recorded were as follows: 32 (58%) were recorded crossing the railway and 23 (42%) followed it. Flight events in zone 1 were commonly recorded close to and underneath Benfield's overbridge. Bats were recorded regularly reducing their flight elevation when crossing the existing railway close to the bridge, therefore spanning both zones 1 and 2 during a single recorded flight event. The proportion of *Myotis* species recorded at this location in August 2014 was 3 % of all bats recorded.

4.5.15 Two hundred and ninety one flight events were recorded from the survey at Benfield's overbridge south on 15 September 2014. The flight behaviours recorded were as follows: 80 (27%) were recorded crossing the line, 18 (6%) were following the railway and 196 (67%) were foraging. The majority of the flight events passed through zone 3 (8m) where 371 flight events were recorded. The remaining flight events were recorded in zone 1(168) and zone 2 (160). The proportion of *Myotis* species recorded at this location in September 2014 was 5 % of bats recorded.

Benfield's overbridge north

4.5.16 Three hundred and seventy five flight events were recorded during the analysis of the data from the survey at Benfield's overbridge north on 28 July 2014. The flight behaviours recorded were as follows: 265 (71%) were recorded foraging, 98 (26%) were recorded crossing the line and 11 (3%) recorded following the line. The majority of flights were recorded in zone 3 at approximately 8m (224), however a high proportion were also recorded in zones 1 and 2 respectively. The proportion of *Myotis* species recorded at this location in July 2014 was 1 % of bats recorded.

4.5.17 Three hundred and sixty one flight events were recorded during the survey at Benfield's overbridge north on 14 September 2014. The flight behaviours recorded were as follows: 20 (5%) were crossing the railway, 79 (21%) were following the railway and 284 (74%) were foraging. The majority (307) of flight events passed through zone 1, 170 flight events passed through zone 2, 62 flight events passed

through zone 3 (8m). The proportion of *Myotis* species recorded at this location in September 2014 was 5 % of bats recorded.

Costello underbridge, recorded from the field south of Sheephouse Wood

4.5.18 One hundred and sixty four flight events were recorded on 3 June 2014. The flight behaviours recorded were as follows: 76 (42%) were following the railway, 46 (26%) were crossing the railway and 58 (32%) were foraging. The camera was located in the field south of Sheephouse Wood and facing towards the Costello underbridge that provides access beneath the existing Aylesbury Link railway line. This view allowed recording of movement above and below the underbridge. There were 42 flight events over the railway through zone 1 during this survey, mostly following the railway and were more frequent within the first hour of the survey. Four flight events were recorded in which bats were observed flying within the underbridge. Seventy four flight events passed over the railway through zone 2 and zone 3 during the survey. No *Myotis* species were recorded at this location in June 2014.

4.5.19 A total of 726 flight events were recorded during the survey at Costello underbridge, the field south of Sheephouse Wood on 31 July 2014. The flight behaviours recorded were as follows: 333 (48%) were recorded foraging, 189 (28%) crossing the railway and 167 (24%) following the line. Of these 453 flight events were recorded using zone 3 (8m) and 211 recorded in zone 2, with 90 flight events recorded using zone 1. The proportion of *Myotis* species recorded at this location in July 2014 was 6 % of bats recorded.

Sheephouse Wood lineside south

4.5.20 Seven hundred and fifty two flight events were recorded at Sheephouse Wood lineside south during surveys on 1 August 2014. The flight behaviours recorded were as follows: 157 (19%) crossed the railway, 173 (21%) followed the railway and 488 (60%) were foraging. The flight events most frequently passed through zone 2 (215) and zone 3 at approximately 10m (190) with 56 flight events passing through zone 1 during this survey. No sound data was collected for this survey due to an equipment malfunction.

4.5.21 Two hundred and twenty five flight events were recorded during the survey on 28 August 2014. The flight behaviours recorded were as follows: 37 (15%) were recorded crossing the line, 201 (84%) were recorded following the railway and 2 (1%) were foraging. Flight events most frequently passed through zone 3, 10m, (162) and zone 2 (91) and one flight event passed through zone 1 during this survey. In this area railway is bordered on both sides by Sheephouse Wood and bats were observed following the railway both above and below this canopy. The proportion of *Myotis* species recorded at this location in August 2014 was 2 % of bats recorded.

Sheephouse Wood lineside north

4.5.22 A total of 301 flight events were recorded during the survey 10 September 2014. The flight behaviours recorded were as follows: 73 (22%) were recorded crossing the line, 90 (28%) were recorded following the railway and 163 (50%) were foraging. Flight events most frequently passed through in zone 3 (261) and zone 2 (81). The remaining 17 flight events passed through and zone 1. The proportion of *Myotis* species recorded at this location in September 2014 was 2 % of bats recorded.

4.6 Trapping surveys

4.6.1 On 37 nights between 29 April and 6 October 2014 a total of 257 bats were caught. The species, location and biometric data for all bats caught is detailed in Table 21 Annex 7.

4.6.2 The following species were caught: Bechstein's, Brandt's, brown long-eared, common pipistrelle, Daubenton's, Natterer's, noctule, soprano pipistrelle and whiskered bat.

4.7 Radio-tracking survey

4.7.1 Thirty five bats of six species were fitted with radio-transmitters, including 12 female and four male Bechstein's bats. In addition, NBBG tagged an additional 18 female bats, including three Bechstein's. The 53 radio-tagged bats were subsequently radio-tracked to determine roosting locations, foraging locations and flightlines.

4.7.2 Two bats, one whiskered bat (bat number 12, whiskered bat number 2), and one Daubenton's bat (bat number 31, Daubenton's bat 2) were not re-located after release. It is likely that the radio-tag had failed or the bats had dispersed from the survey area. The roost for a further Daubenton's bat (bat number 51, Daubenton's bat 4) could not be located however, the bat was located on each survey evening arriving from the southwest into Grendon and Doddershall woods. Therefore, it is assumed that the bat was roosting out of the survey area, away from the scheme.

4.7.3 Excluding the three bats detailed above, a total of 61 roosting locations were identified from 50 individuals radio-tracked during 2014 as summarised in Table 12.

Table 12 : The number of roosts located and number of nights radio-tracked for each bat

Bat	Species	Date Caught	No of roosts used in tracking period.	No of nights radio-tracked
1	Whiskered bat	29/04/2014	2	3
2	Brown long-eared bat	29/04/2014	1	3
3	Natterer's bat	30/04/2014	1	3
4	Bechstein's bat	14/05/2014	2	3
5	Bechstein's bat	15/05/2014	3	4
6	Bechstein's bat	15/05/2014	3	5
7	Bechstein's bat	16/05/2014	2	3
8	Bechstein's bat	16/05/2014	2	5
9	Brown long-eared bat	16/05/2014	1	2

Bat	Species	Date Caught	No of roosts used in tracking period.	No of nights radio-tracked
10	Brown long-eared bat	16/05/2014	1	1
11	Brown long-eared bat	18/05/2014	1	3
12	Whiskered bat	18/05/2014	Unknown; the bat could not be tracked	0
13	Brandt's bat	02/06/2014	1	3
14	Bechstein's bat	03/06/2014	1	2
15	Bechstein's bat	03/06/2014	1	5
16	Brown long-eared bat	03/06/2014	2	3
17	Brandt's bat	04/06/2014	1	4
18	Brown long-eared bat	07/06/2014	1	3
19	Brown long-eared bat	07/06/2014	1	3
20	Brown long-eared bat	07/06/2014	1	3
21	Brown long-eared bat	07/06/2014	1	3
22	Natterer's bat	07/06/2014	1	3
23	Natterer's bat	07/06/2014	1	3
24	Bechstein's bat	29/07/2014	1	2
25	Bechstein's bat	29/07/2014	3	9
26	Daubenton's bat	29/07/2014	1	8
27	Natterer's bat	29/07/2014	5	8
28	Bechstein's bat	29/07/2014	2	6

Bat	Species	Date Caught	No of roosts used in tracking period.	No of nights radio-tracked
29	Bechstein's bat	31/07/2014	1	3
30	Bechstein's bat	03/08/2014	1	4
31	Daubenton's bat	03/08/2014	Unknown; the bat could not be tracked	0
32	Bechstein's bat	03/08/2014	1	3
33	Bechstein's bat	26/08/2014	3	5
34	Brown long-eared bat	26/08/2014	1	4
35	Bechstein's bat	26/08/2014	1	7
36	Bechstein's bat	09/09/2014	2	6
37	Natterer's bat	09/09/2014	2	4
38	Brown long-eared bat	08/09/2014	2	3
39	Brown long-eared bat	08/09/2014	1	0
40	Brown long-eared bat	08/09/2014	1	1
41	Brown long-eared bat	08/09/2014	1	3
42	Brown long-eared bat	08/09/2014	1	0
43	Brown long-eared bat	08/09/2014	1	5
44	Brown long-eared bat	08/09/2014	4	9
45	Daubenton's bat	10/09/2014	1	1
46	Natterer's bat	13/09/2014	3	7
47	Natterer's bat	13/09/2014	2	4

Bat	Species	Date Caught	No of roosts used in tracking period.	No of nights radio-tracked
48	Bechstein's bat	14/09/2014	1	2
49	Bechstein's bat	14/09/2014	2	4
50	Bechstein's bat	14/09/2014	2	4
51	Daubenton's bat	15/09/2014	Unknown; the bat could not be tracked n/a	0
52	Brown long-eared bat	03/10/2014	2	4
53	Natterer's bat	03/10/2014	2	4

4.7.4 Flightlines alongside the Aylesbury Link Railway and crossing the scheme between roost sites and foraging sites were identified in 2014 for a number of radio-tracked individuals. The species roost locations and flightlines are shown on the following figures:

Bechstein's bat roost locations figure EC-23-003;

Bechstein's flightlines figure EC-25-005;

Brandt's bat roost locations figure EC-23-004;

Brandt's flightlines figure EC-25-006;

Brown long-eared bat roost locations EC-23-005;

Brown long-eared flightlines EC-25-007;

Daubenton's bat roost locations EC-23-006;

Daubenton's flightlines EC-25-008;

Natterer's bat roost locations EC-23-007;

Natterer's flightlines 2EC-25-009;

Whiskered bat roost locations EC-23-008; and

Whiskered flightlines EC-25-010.

Bechstein's

4.7.5 Bechstein's bat 1 (radio-tagged bat number 4), a pregnant female, was caught on 14 May 2014 at Location 3. Bat 4 was recorded roosting in a woodpecker hole in an oak tree on the western edge of Finemere Wood and, on another night roosting in an ash tree on the northern tip of Finemere Wood. It was recorded travelling north from the southern edge of the wood and then through Romer Wood, then south along a

hedgerow toward a copse on Three Points Lane between Romer Wood and Finemere Wood. The bat did not cross the scheme.

4.7.6 Bechstein's bat 2 (radio-tagged bat number 5) a pregnant female was caught on 15 May 2014 at Location 4. Bat 5 was recorded roosting in the same roosts as bat 4. Bat number 5 was also recorded roosting within a cavity in a different oak tree within Finemere Wood. It was recorded travelling north from the southern edge Finemere Wood and then through Romer Wood, then south along a hedgerow toward a woodland copse between Romer Wood and Finemere Wood. From the south of Romer Wood bat 5 was also recorded travelling along a hedgerow to the west and into Sheephouse Wood. The bat did not cross the scheme.

4.7.7 Bechstein's bat 3 (radio-tagged bat number 6) a pregnant female was caught on 15 May 2014 at Location 4.Bat 6 was also recorded in the same two roosts as bat numbers 4 and 5, and a location in Romer Wood (lack of access meant that accurate location of the roost's location was not possible). Bat 6 was recorded travelling north from Finemere through Romer Wood, then south along a hedgerow toward a woodland copse between Romer Wood and Finemere Wood. From the south of Romer Wood bat 6 was recorded travelling along a hedgerow and into Sheephouse Wood. Bat 6 was recorded travelling northwest from Finemere Wood, into Greatsea and Romer Wood and to the east of Knoxhill Farm into Home Wood. The bat did not cross the l scheme.

4.7.8 Bechstein's bat 4 (radio-tagged bat number 7) a pregnant female was caught on 16 May 2014 in Finemere Wood by the NBBG. Bat 7 was recorded roosting in the same ash tree and oak tree in Finemere Wood as bat numbers 4, 5 and 6. Bat 7 had no discernible flight lines as it foraged close to its roost within Finemere Wood. The bat did not cross the scheme.

4.7.9 Bechstein's bat 5 (radio-tagged bat number 8) a pregnant female was caught on 16 May 2014 in Finemere Wood by the NBBG. Bat 8 was recorded roosting in the same ash roost in Finemere Wood as bat numbers 4, 5, 6, and 7 and in the same cavity as bat number 5 in an oak tree in Finemere Wood. Bat 8 had no discernible flight line as it mostly foraged within or close to Finemere Wood. The bat did not cross the l scheme.

4.7.10 Bechstein's bat 6 (radio-tagged bat number 14) a pregnant female was caught on 3 June 2014 at Location 6. Bat 14 was recorded roosting within an estimated (due to lack of access), location in Grendon and Doddershall woods. Bat 14 travelled north from Grendon Wood bat along a watercourse to the east of Prune Farm Cottage and then north to Sheephouse Wood. The bat crossed the scheme at Sheephouse Wood.

4.7.11 Bechstein's bat 7 (radio-tagged bat number 15) a non-breeding female was caught on 3 June 2014 at Location 6. Bat 15 was recorded roosting within an estimated, (due to lack of access), location in Grendon and Doddershall woods. Bat 15 travelled north from Grendon Wood along a watercourse to the east of Prune Farm Cottage and then north to Sheephouse Wood. The bat crossed the scheme at Sheephouse Wood.

4.7.12 Bechstein's bat 8 (radio-tagged bat number 24) was a juvenile male caught on 29 July 2014 at Location 4. Bat 24 was recorded roosting within an ash tree adjacent to Finemere Wood, on the Claydon Estate. This roost was recorded as a maternity roost during 2013 field surveys. Bat 24 commuted from its roost north to Romer, Greatsea and Balmore Woods. The bat did not cross the scheme.

4.7.13 Bechstein's Bat 9 (radio-tagged bat number 25) was an immature male caught on 29 July 2014 at Location 4. Bat 25 was recorded roosting within the same ash tree as bat number 24, and also in an oak tree within Finemere Wood and a willow tree adjacent to ponds at the Calvert landfill Site. It flew from the roost at the landfill northwest to Calvert Jubilee Nature Reserve, east to Shrubs Wood and southeast to Decoypond Wood and returned south west to the ponds at the Calvert landfill site. The bat crossed the scheme on multiple occasions between Calvert landfill site and Decoypond Wood.

4.7.14 Bechstein's bat 10 (radio-tagged bat number 28) was a post-lactating female caught on 29 July 2014 at Location 4. Bat 28 was recorded roosting within the same ash and oak trees as bat number 25, within Finemere Wood. Bat 28 was recorded travelling north from Finemere Wood toward Finemere House, west toward the southern edge of Romer Wood, and northwest to Sheephouse Wood. The bat did not cross the scheme.

4.7.15 Bechstein's bat 11 (radio-tagged bat number 29) was a female caught on 31 July 2014 in Finemere Wood by the NBBG. Bat 29 was recorded roosting with the same Oak tree as bat numbers 25 and 28 within Finemere Wood. Bat 29 was recorded travelling north from Finemere Wood toward Finemere House then west toward Romer Wood. The bat did not cross the l scheme.

4.7.16 Bechstein's bat 12 (radio-tagged bat number 30) was an adult male caught on 3 August 2014 at Location 8. Bat 30 was recorded roosting in an ash tree in a private garden in Calvert. Bat 30 travelled southeast to Decoypond Wood and Sheephouse Wood, northwest to Calvert Jubilee Nature Reserve and southwest to the ponds at Calvert Landfill Site. The bat crossed the scheme on multiple occasions between Calvert Jubilee Nature Reserve and Decoypond Wood and also used Bridleway GUN/25 between Calvert Landfill and Calvert Jubilee which is within the scheme.

4.7.17 Bechstein's bat 13 (radio-tagged bat number 32) was a juvenile male caught on 4 August 2014 at Location 3. Bat 32 was recorded roosting within the same oak tree as bat numbers 25, 28 and 29. Bat 32 was recorded travelling north from Finemere Wood, past Finemere House to Balmore Wood. The bat did not cross the scheme.

4.7.18 Bechstein's bat 14 (radio-tagged bat number 33) was a juvenile female caught on 26 August 2014 at Location 11 in the newly accessible land south of the Edgcott Road. Bat 33 was recorded roosting within three oak trees within Grendon and Doddershall woods. Bat 33 was recorded travelling west from Grendon Wood, along a watercourse toward the woodland to the west of Grendon Wood. Bat 33 was also recorded travelling south from Grendon Wood into Doddershall Wood. The bat did not cross the scheme.

4.7.19 Bechstein's bat 15 (radio-tagged bat number 35) was an adult non-breeding female caught on 26 August 2014 at Location 10 in the newly accessible land south of the Edgcott Road. Bat 35 was recorded roosting within one of the same oak trees as bat number 33, in a woodpecker hole approximately 6m from ground level, within Grendon and Doddershall woods. Bat 35 was recorded travelling from Grendon Wood along the River Ray towards Grendon Underwood, continuing southwest along the river before travelling north towards Tudor Farm. The bat continued along the watercourse to Gubbinshole Ditch and travelled north to meet Marsh Gibbons Road where it travelled west. The bat did not cross the scheme.

4.7.20 Bechstein's bat 16 (radio-tagged bat number 36) was a juvenile female caught on 9 September 2014 at Location 5 in the newly accessible land south of the Edgcott Road. Bat 36 was recorded roosting within a plane tree and oak tree in the gardens of Doddershall House. The Bernwood Bechstein's Project representative confirmed the roost locations as no access was granted. Bat 36 was recorded travelling west from the garden at Doddershall house, along hedgerows to Doddershall Wood and to a watercourse to the east of Grendon and Doddershall woods. The bat did not cross the scheme.

4.7.21 Bechstein's bat 17 (radio-tagged bat number 48) was a post-lactating female caught on 14 September 2014 at Location 10 in the newly accessible land south of the Edgcott Road. Bat 48 was recorded roosting in an estimated location (due to lack of access), within Sheephouse Wood. After emerging the signal of the bat was lost until it was again recorded roosting in Sheephouse Wood therefore, no flightlines were recorded. The bat stayed foraging within Sheephouse Wood for the remaining tracking period. The bat crossed the scheme but the location where it crossed was not determined.

4.7.22 Bechstein's bat 18 (radio-tagged bat number 49) was a post-lactating female caught on 14 September 2014 at Location 10 in the newly accessible land south of the Edgcott Road. Bat 49 was recorded roosting within two oak trees in Grendon and Doddershall woods. Bat 49 was recorded travelling between Grendon Wood and the Aylesbury Link Railway, along Muxwell Brook adjacent to Hewin's Wood. The bat crossed the scheme at a hedgerow which links Finemere Wood to the Aylesbury Link railway line at Ditchburn's overbridge (Grendon Junction).

4.7.23 Bechstein's bat 19 (radio-tagged bat number 50) was a post-lactating female caught on 14 September 2014 at Location 10 in the newly accessible land south of the Edgcott Road. Bat 50 was recorded roosting within the same two roosts as bat number 49; two oak trees within Grendon and Doddershall woods. Bat 50 was recorded travelling northeast from Grendon Wood and along the Muxwell Brook adjacent to Hewin's Wood. The bat did not cross the scheme.

Brandt's

4.7.24 Brandt's bat 1 (radio-tagged bat number 13) was a pregnant female caught on 2 June 2014 at Location 5. Bat 13 was recorded roosting within Woodend house on Kingswood Road. Bat 13 had no discernible flight lines as the bat disappeared from contact with the receiver on numerous occasions and was only recorded intermittently within and adjacent to the scheme and crossed the scheme.

4.7.25 Brandt's bat 2 (radio-tagged bat number 17) was a pregnant female caught on 3 June 2014 at Location 6. Bat 17 was also recorded roosting within Woodend on Kingswood Road. Bat 17 was recorded flying southwest along the northern edge of Finemere Wood, then west along a hedgerow, crossing the scheme at Grendon Junction flying to Hewin's Wood.

Brown long-eared

4.7.26 Brown long-eared bat 1 (radio-tagged bat number 2), a pregnant female, caught on 29 April 2014 at Location 4. Bat 2 was recorded roosting in an oak tree within Finemere

Wood and had no discernible flight lines as it was recorded foraging within and adjacent to Finemere Wood. The bat did not cross the scheme.

4.7.27 Brown long-eared bat 2 (radio-tagged bat number 9) was a female caught on 16 May 2014 by the NBBG in Finemere Wood. Bat 9 was recorded roosting within an oak tree in the east of Finemere Wood and had no discernible flight lines as it was recorded foraging within Finemere Wood. The bat did not cross the scheme.

4.7.28 Brown long-eared bat 3 (radio-tagged bat number 10) was a female caught on 16 May 2014 by the NBBG in Finemere Wood. Bat 10 was recorded roosting within an oak tree at the northern tip of Finemere Wood and had no discernible flight lines as it was recorded foraging within Finemere Wood. The bat did not cross the scheme.

4.7.29 Brown long-eared bat 4 (radio-tagged bat number 11) was a pregnant female caught on 18 May 2014 at Location 8. Bat 11 was recorded roosting in a barn at Portway Farm. After emerging Bat 11 was recorded flying south along Perry Hill from the cross roads to the west of Steeple Claydon, to Calvert Jubilee Nature Reserve and southwest to along Akeman Disused Railway, returning to Portway Farm. The bat crossed the scheme north of Calvert Jubilee Nature Reserve.

4.7.30 Brown long-eared bat 5 (radio-tagged bat number 16), was a pregnant female, caught on 3 June 2014 at Location six. Bat 16 was recorded roosting within two estimated locations (due to lack of access) in Sheephouse Wood. Bat 16 crossed the scheme to forage around the large waterbodies at Calvert Landfill Site.

4.7.31 Brown long-eared bat 6 (radio-tagged bat number 18), was a female radio-tagged by the NBBG on 7 June 2014. Bat 18 was recorded within a tree in the western end of Finemere Wood and was recorded foraging exclusively within Finemere Wood. The bat did not cross the scheme.

4.7.32 Brown long-eared bat 7 (radio-tagged bat number 19), was a female radio-tagged by the NBBG on 7 June 2014. Bat 19 was recorded roosting within the same tree as bat number 18. After emergence, bat 19 was recorded travelling to Romer Wood and, from here along a hedgerow to Sheephouse Wood. The bat did not cross the scheme.

4.7.33 Brown long-eared bat 8 (radio-tagged bat number 20), was a female radio-tagged by the NBBG on 7 June 2014. Bat 20 was recorded roosting within a tree along the track towards the north of Finemere Wood and was recorded foraging exclusively within Finemere Wood. The bat did not cross the scheme.

4.7.34 Brown long-eared bat 9 (radio-tagged bat number 21), was a female radio-tagged by the NBBG on 7 June 2014. Bat 21 was recorded roosting within a bat box on a tree within Finemere Wood and was recorded foraging exclusively within Finemere Wood. The bat did not cross the scheme.

4.7.35 Brown long-eared bat 10 (radio-tagged bat number 34), was a post-lactating female, caught on 26 August 2014 at Location 12. Bat 34 was recorded roosting within an estimated location (due to lack of access) at Knapps Hook Farm. After emergence, bat 34 was recorded flying west along a hedgerow to Doddershall Wood then north to Grendon Wood. The bat did not cross the scheme.

4.7.36 Brown long-eared bat 11 (radio-tagged bat number 38) was a female radio-tagged by the NBBG on 8 September 2014. Bat 38 was recorded roosting within two oak trees in

Finemere Wood. Bat 38 and was recorded foraging exclusively within Finemere Wood. The bat did not cross the scheme.

4.7.37 Brown long-eared bat 12 (radio-tagged bat number 39) was a female radio-tagged by the NBBG on 8 September 2014, and was recorded in the same oak tree as bat number 38 on the northern limb in Finemere Wood. Bat 39 disappeared from range and consequently no flightlines were recorded.

4.7.38 Brown long-eared bat 13 (radio-tagged bat number 40) was a female radio-tagged by the NBBG on 8 September 2014, and was recorded roosting within the same oak tree as bat number 38, in the feature that was not visible. Bat 40 foraged exclusively within Finemere Wood and did not cross the scheme.

4.7.39 Brown long-eared bat 14 (radio-tagged bat number 41) was a female radio-tagged by the NBBG on 8 September 2014. Bat 41 was recorded roosting within a field maple in Finemere Wood. Bat 41 foraged exclusively within Finemere Wood and did not cross the scheme.

4.7.40 Brown long-eared bat 15 (radio-tagged bat number 42) was a female radio-tagged by the NBBG on 8 September 2014. Bat 42 was recorded roosting within the same field maple as bat number 41. The tag failed after one day and consequently no flightlines were recorded and the bat was not recorded crossing the scheme during the period in which it was radio-tracked.

4.7.41 Brown long-eared bat 16 (radio-tagged bat number 43) was a female radio-tagged by the NBBG on 8 September 2014. Bat 43 was recorded roosting within the same Field Maple as bat numbers 41 and 42 as well as an oak tree within Finemere Wood. Bat 43 foraged exclusively within Finemere Wood and did not cross the scheme.

4.7.42 Brown long-eared bat 17 (radio-tagged bat number 44) was a female radio-tagged by the NBBG on 8 September 2014, and was recorded roosting within four separate roosts in Finemere Wood, in three oak trees and one bat box. After emerging Bat 44 was recorded flying along a hedgerow from the northwest corner of Finemere Wood perpendicular to the Aylesbury Link Railway, crossing the Aylesbury Link railway line at Grendon Junction, then flying southeast along the Energy from Waste access track (the former Akeman Street Railway) and south towards Oak Tree Farm. Bat 44 was also recorded travelling north from Finemere Wood, along a hedgerow to Romer Wood.

4.7.43 Brown long-eared bat 18 (radio-tagged bat number 52) was a post-lactating female caught on 3 October 2014 at Location 4, and was recorded roosting within a field maple along the River Ray and at estimated location at Woodlands Farm. After emerging bat 52 was recorded flying within Finemere Wood and along the River Ray on the southern edge of Finemere Wood, to Woodlands Farm. From here bat 52 was recorded travelling north along the Aylesbury Link railway line to Finemere Fishing Lake, adjacent to the scheme. It crossed the scheme at Ditchburn's overbridge and used the Aylesbury Link Railway from the River Ray to return to Ditchburn's overbridge.

Daubenton's

4.7.44 Daubenton's bat 1 (radio-tagged bat number 26), was an adult non-breeding female, caught on 29 July 2014 at Location 4. Bat 26 was recorded roosting at an estimated

location (due to lack of access at the time of survey) within Grendon and Doddershall woods. Bat 26 was recorded flying into both Decoypond Wood and Sheephouse Wood from the Aylesbury Link railway line and south along the mega-ditch (Muxwell Brook) to the south of the large waterbodies within Calvert Landfill Site, towards Grendon Wood. The bat crossed the scheme and used the Aylesbury Link railway line as a flightline.

4.7.45 Daubenton's bat 2 (radio-tagged bat number 31), was a juvenile female, caught on 3 August 2014 at Location 3. After the bat was caught it disappeared from range and consequently no flightlines were recorded.

4.7.46 Daubenton's bat 3 (radio-tagged bat number 45), was an immature female, caught on 10 September 2014 at Location 10 in Grendon and Doddershall woods. Bat 45 was recorded roosting at an estimated location (due to no access) within Sheephouse Wood. After emerging bat 45 flew south to the large waterbodies in Calvert Landfill Site and along the River Ray to the west of Grendon Wood to the south of Edgcott. The bat crossed the scheme and used the Aylesbury Link railway line as a flightline.

4.7.47 Daubenton's bat 4 (radio-tagged bat number 51), was a post-lactating female, caught on 15 September 2014 at Location 7. The signal of the bat could not be located during the day; consequently the roost location was not recorded. The flightline was recorded with bat 51 flying back and forth between Sheephouse Wood and the large waterbodies within Calvert Landfill site, travelling across the scheme.

Natterer's

4.7.48 Natterer's bat 1 (radio-tagged bat number 3), was a pregnant female, caught on 30 April 2014 at Location 4, and was recorded roosting in a bat box on an oak tree within Finemere Wood. After emergence bat 3 was recorded flying across the field between Finemere Wood and Oak Tree Farm. The bat crossed the scheme.

4.7.49 Natterer's bat 2 (radio-tagged bat number 22) was a female radio-tagged by the NBBG on the 7 June 2014, and was recorded roosting within an oak tree within Finemere Wood. After emerging bat 22 was recorded flying toward Romer Wood and did not cross the scheme.

4.7.50 Natterer's bat 3 (radio-tagged bat number 23) was a female radio-tagged by the NBBG on 7 June 2014. Bat 23 was recorded roosting within a tree in Finemere Wood. After emergence bat 23 was recorded commuting along the River Ray to the southeast of Finemere Wood but did not cross the scheme.

4.7.51 Natterer's bat 4 (radio-tagged bat number 27), was a post-lactating female, caught on 29th July 2014 at Location 4. Bat 27 was recorded at five different roosting locations within Finemere Wood in two oak trees, a bat box and two ash trees. After emerging bat 27 was recorded flying north along hedgerows to Balmore Wood. The bat was not recorded crossing the scheme.

4.7.52 Natterer's bat 5 (radio-tagged bat number 37), was a juvenile female, caught on 9 September 2014 at Location 2 in the Copse to the north west of Doddershall estate. Bat 37 was recorded roosting within a lime tree and oak tree in the gardens of Doddershall House. The Bernwood Bechstein's Project representative confirmed the roost locations as no access was granted. After emerging bat 37 was recorded foraging along the watercourse to the northeast of Doddershall House, and north along the

Aylesbury Link Railway. The bat was recorded foraging to the east of the scheme and, as such, crossed the scheme.

4.7.53 Natterer's bat 6 (radio-tagged bat number 46), was an immature female, caught on 13 September 2014 at Location 11, and was recorded roosting within three tree roosts in Grendon and Doddershall woods. One roost was within a large split limb in an oak tree at 5m above ground level, the other in an oak tree on the edge of Grendon and Doddershall woods and a further tree roost was identified within the northeast of Grendon Wood (the tree was inaccessible because of dense vegetation). After emerging bat 46 was recorded flying along the River Ray within Grendon Wood and west along a hedgerow to the northwest of Tudor Farm, towards Gubbins Hole Farm. The bat did not cross the scheme.

4.7.54 Natterer's bat 7 (radio-tagged bat number 47), was caught on 13 September, at Location 4, and was recorded roosting within a bat box on an oak tree within Finemere Wood. After emerging bat 47 was recorded flying along the River Ray to the southeast of Finemere Wood and along the river to the northeast of Finemere Wood. The bat did not cross the scheme.

4.7.55 Natterer's bat 8 (radio-tagged bat number 53), was caught on 3 October 2014, at Location 4 and was recorded roosting within a silver birch tree at a height above ground level of 5m, and within an oak tree on the northern boundary of Finemere Wood. After emerging bat 53 was recorded flying east from the eastern tip of Finemere Wood towards the west of Dry Leys Farm. The bat did not cross the scheme.

Whiskered

4.7.56 Whiskered bat 1 (radio-tagged bat number 1) was caught on 29 April 2014, at Location 4 and was recorded roosting in Finemere Hill House and an oak tree within Finemere Wood. After emerging bat 1 was recorded flying east along the River Ray to the Aylesbury Link Railway then northwest along the Aylesbury Link railway, and returning to Finemere Wood via the river. The bat used the Aylesbury Link Railway as part of its flightline to access foraging habitat.

4.7.57 Whiskered bat 2 (radio-tagged bat number 2) was caught on 18 May 2014 at Location 8. After the bat was caught it disappeared from range and consequently no flightlines were recorded.

4.8 Home range analysis

4.8.1 Descriptions of foraging areas are provided below in individual species accounts. These are based on the MCP and KDE analysis as described in the methodology. Table 22 (table 1) summarises the MCP, and KDE data for each bat radio-tracked bat in 2014.

Bechstein's

4.8.2 Figure EC-24-004 details the 100% MCP, 95%KDE and 50%KDE for all 19 Bechstein's bats radio-tracked (where adequate foraging data were obtained). Core foraging areas (denoted by 50%KDE) dominated by woodland habitat were identified in Finemere Wood; Sheephouse Wood; Grendon Wood; Doddershall Wood; the woodland complex to the north-east of the scheme that comprises Greatsea, Romer, and Balmore woods; a small copse on Three Points Lane between Greatsea Wood and

Finemere Wood; a small wood immediately east of the Aylesbury Link Railway and north of Decoypond Wood; and habitat immediately west of the Aylesbury Link Railway between Calvert village and the Calvert Landfill site.

4.8.3 Total range areas (denoted by 100%MCP) and peripheral foraging areas (denoted by 95%KDE) comprised predominately of woodland, but habitat features such as water bodies, watercourses, scrub, hedgerows and linear vegetation alongside the Aylesbury Link Railway were also used.

4.8.4 The maternity colony of Bechstein's bats that roosts predominately in Finemere Wood used Finemere Wood, Greatsea Wood, Romer Wood, Sheephouse Wood, Balmore Wood, Runts Wood, and nearby scrub and hedgerows as part of their foraging area within their home range. Of the ten radio-tracked bats from this colony two crossed the scheme. One juvenile female bat (Bat 28) crossed the scheme at Grendon Junction to forage briefly at the ponds at Oak Tree Farm to the west of the scheme. The majority of this bat's foraging time, however, focused around the hedgerows and woodland copses surrounding Finemere Wood to the east of the scheme. Bat 25, a male, used core foraging areas at Finemere Wood, but also made multiple crosses over the scheme and regularly visited Sheephouse Wood, Decoypond Wood and Calvert Landfill where it foraged near willow scrub and waterbodies.

4.8.5 The maternity colony of Bechstein's bats that roosts predominantly in Grendon and Doddershall woods (southwest of the scheme) used these woods and the surrounding habitats (scrub, hedgerows and riparian habitats) for their home range and foraging areas. Of the six radio-tracked bats from this colony, four female bats (14, 15, 49 and 50) crossed the scheme to foraging areas north-east of the Aylesbury Link railway. Bats 14 and 15 crossed the scheme close to Sheephouse Wood southwest of waterbodies in Calvert Landfill. Bat 49 foraged extensively at linear habitat along Bridleway GUN/25 adjacent to Hewin's Wood. It also used this vegetation as a flightline to cross the scheme to reach foraging areas north of the Aylesbury Link Railway at Romer and Greatsea Wood. Bat 50 mainly foraged in Grendon Wood but also used this flightline to reach to foraging areas north of the railway.

4.8.6 In July 2014 a male Bechstein's bat (Bat 30) was caught at Calvert Jubilee Nature Reserve. It was subsequently recorded roosting in an ash tree in a private garden in Calvert village. Bat 30 made multiple crosses between the Calvert Land Fill and Decoypond Wood and used core foraging areas to the north of the Aylesbury Link Railway (in a small wood northwest of Decoypond Wood) and to the south of the railway (in woodland and scrub adjacent to the Aylesbury Link Railway between Calvert village and the Calvert Landfill Site). Bat 30 also flew southeast to Sheephouse Wood and northwest to Calvert Jubilee Nature Reserve, using foraging areas adjacent to the scheme.

4.8.7 Core foraging area used by Bat 36 comprised the private gardens and immediate surroundings of Doddershall House to the south of the scheme, west of the village of Quainton.

4.8.8 Core foraging habitat used by Bat 48 comprised an area of Sheephouse Wood directly adjacent to the scheme.

Brandt's

4.8.9 Two Brandt's bats (Bat 13 and Bat 17) were radio-tracked during the study. Figure EC-24-005 details the 100% MCP, 95%KDE and 50%KDE respectively for Bat 17 and the 100%MCP for Bat 13. Core foraging areas (denoted by 50%KDE) used by Bat 17 were dominated by woodland habitat at Sheephouse Wood, Romer Wood, Hewin's Wood and the adjacent Bridleway GUN/25, , and a small copse within fields between Greatsea Wood and Finemere Wood. This bat roosted in a house on Kingswood Road near the A41 and therefore crossed the scheme to visit its core foraging areas. There was contact intermittent with the receiver on Bat 13 and the paucity of data gained for this bat did not allow its core foraging area to be identified.

4.8.10 Foraging habitats (denoted by the 50%, 95%KDE and 100%MCP) used within the wider landscape as part of home range of both bats included woodland, arable fields and scrub adjacent along the Aylesbury Link Railway.

Brown long-eared

4.8.11 Figure EC-24-006 details the 100% MCP, 95%KDE and 50%KDE respectively for the 16 brown long-eared bats radio-tracked during the study (sufficient foraging data were not obtained from Bats 39 and 42, due to the failure of radio-tags).

4.8.12 The core foraging of Bat 16 (denoted by 50%KDE) was Sheephouse Wood, but it also used the waterbodies within Calvert Landfill Site as part of its home range (as indicated by the 100%MCP). It therefore crossed the scheme to move between these foraging areas.

4.8.13 Core foraging areas used by Bats 11 and 44 were dominated by scrub directly adjacent to or within the scheme, respectively near waterbodies within the Calvert Jubilee Nature Reserve and at Grendon Junction. The core foraging areas of both bats included the Aylesbury Link Railway and, as such, they made multiple crosses over the scheme. Peripheral foraging areas (as denoted by the 95%KDE) used by Bat 11 comprised multiple areas of scrub and hedgerow habitat along the scheme northwest of Calvert village as far as Padbury Brook. Peripheral habitat used by Bat 44 comprised areas of scrub and hedgerow adjacent to the scheme.

4.8.14 Core foraging area used by Bat 52 was dominated by scrub and hedgerow habitat bordering the River Ray south of Finemere Wood. Peripheral habitat used by this bat comprised areas of scrub and hedgerow on and adjacent to the scheme between Woodlands Farm and Oak Tree Farm.

Daubenton's

4.8.15 Figure EC-24-007 details the 100% MCP, 95%KDE and 50%KDE respectively for the three Daubenton's bats radio-tracked during the study (Bat 31 caught and radio-tagged on the River Ray in July 2014 was never re-located). Core foraging areas (denoted by 50%KDE) used by Bat 26 and 51 comprised the water bodies within Calvert Landfill Site and hedgerow/ditch and scrub habitat to the south of the water bodies. Peripheral foraging areas (denoted by 95%KDE) used by Bat 26 comprised Decoypond Wood, Sheephouse Wood, Grendon Wood and Doddershall Wood indicating that this bat made multiple crosses over the scheme to reach foraging areas on either side of the Proposed. Peripheral habitat used by Bat 51 comprised areas of

Sheephouse Wood indicating that Bat 51 crossed over the proposed route to these foraging areas.

4.8.16 Core foraging area (denoted by 50%KDE) used by Bat 45 comprised a small area on the River Ray to the west of Grendon Wood. Peripheral habitat used by used by this bat included part of Sheephouse Wood, indicating that it crossed the scheme.

Natterer's

4.8.17 Figure EC-24-008 details the 100% MCP, 95%KDE and 50%KDE respectively for the eight Natterer's bats radio-tracked during the study. Core foraging areas (denoted by 50%KDE) dominated by woodland habitat were identified in Finemere Wood, Greatsea and Romer woods and Grendon Wood.

4.8.18 Core foraging areas used by Bat 3 comprised mature hedgerow habitat and arable fields between the western tip of Finemere Wood and habitats to the west of the scheme at Oak Tree Farm, Grendon Junction, indicating that this bat crossed the scheme multiple times to access these foraging areas. Peripheral foraging areas (denoted by 95%KDE) used by Bat 3 included a large area of Finemere Wood.

4.8.19 Core foraging the remaining radio tagged Natterer's bats were as follows:

bats 23 and 46 respectively used the River Ray east of Finemere Wood and Gubbinshole Ditch southeast of Marsh Gibbon and did not used the land required to construct the scheme;

bat 37 used hedgerows and arable fields to the north of Doddershall House and incorporated part of the scheme; and

bat 47 also used mature hedgerows and arable fields between the north-western tip of Finemere Wood, the between the northern part of this wood, the existing Aylesbury Link railway line and Finemere Fishing Lake.

Whiskered

4.8.20 Figure EC-24-009 details the 100% MCP, 95%KDE and 50%KDE respectively for the single whiskered bat, Bat 1, radio-tracked during the study (Bat 12 caught and radio-tagged at Calvert Jubilee Nature Reserve was never re-located). The core foraging area (denoted by 50%KDE) for Bat 1 were around Adams Underbridge and included arable fields adjacent to the scheme and the River Ray. Peripheral habitat (denoted by 95%KDE) used by this bat comprised woodland, scrub, arable fields, buildings and riparian habitats to the north and south of the scheme.

5 Discussion

5.1 Automated surveys

5.1.1 A total of 92,691 calls from at least nine species from six genera were recorded during automated surveys in 2014, including *Myotis* species, barbastelle, noctule, Leisler's , serotine , brown long-eared , common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle.

5.1.2 Peak activity during pre-maternity season for all species was centred on Locations 2 and 7 in Tranche 1, Doddershall PRoW (Footpath QUA/24A) and Costello underbridge during 2014. There were also High levels of activity at Locations 1, 5, 6 and 7 of Tranche 1 (Buckinghamshire Railway Centre, Grendon Junction, Benfield's overbridge and Costello underbridge) in May 2014, when an average number of passes in excess of 500 ppn was recorded at all locations. This indicates that these are important areas for pre-maternity commuting and foraging.

1.1.1 Levels of recorded activity for all species were Very High at Locations 5, 6 and 7 in Tranche 1 (Grendon Junction, Benfield's overbridge and Costello underbridge) in June and July 2014 and Location 4 in Tranche 2 (Copse to the north west of Doddershall estate) in August 2014. These areas are therefore likely to be important post-maternity season commuting and foraging areas.

5.1.3 Overall, the highest proportion of calls for *Myotis* bats was recorded at Locations 1(21%), 4 (29%), 9(21%) and 10 (44%) in Tranche 1 (Benfield's overbridge, Costello underbridge, Decoypond Wood and School Hill overbridge) and Location 4 in Tranche 2 (Copse to the north west of Doddershall estate).

5.1.4 High levels of activity of brown long-eared bats were also recorded at Location 1 and 7 in Tranche 1 (Buckinghamshire Railway Centre and Costello underbridge). These locations are key areas for these species over all survey months.

5.1.5 Data from 2014 is broadly consistent with the 2012/13 survey findings, indicating similar levels of activity to that described in the main ES. However variation in activity was recorded at some of the key crossing points of the Aylesbury Link Railway. A comparison of the results of the 2013 and 2014 static monitoring surveys is as follows:

- a drop in activity levels was recorded at Location 6 Tranche 1 (Benfield's overbridge), with an average of 623 ppn in 2013 compared with 499 ppn in 2014;
- an increase in passes between 2013 and 2014 was recorded at Location 5, Tranche 1 (Grendon Junction) with an average of 230 ppn in 2013 and 772 ppn in 2014; and
- an increase in activity levels between 2012 and 2014 was recorded at Location 9 in Tranche 1 (Decoypond Wood) where an average of 519 ppn in 2014, while in 2012 an average of 15 ppn was recorded.

5.1.6 Despite the reduction in activity levels at Benfield's overbridge and Grendon Junction, they both remain key crossing points of the existing Aylesbury Link railway line.

5.2 Bat activity transect

5.2.1 At least five species of four genera (*Myotis* species, common pipistrelle, soprano pipistrelle, noctule, and *Nyctalus* species) were identified in both transects from a total of 188 recorded calls and/or observation. Seven species were recorded in activity transects carried out in 2012 and 2013 which included Leisler's and serotine bat in addition to those listed above. The additional species were identified during the 2014 automated surveys.

5.2.2 Slightly higher levels of activity and species diversity were recorded throughout the season along Transect 1 than in Transect 2. This pattern was consistent throughout the season except October, where more activity and a more diverse bat assemblage was recorded along Transect 2.The highest levels of activity, across both transects, were recorded in April and May 2014 with a total of 38 and 56 passes respectively.

5.2.3 Relatively high levels of bat activity were recorded at Benfield's overbridge, adjacent to the Aylesbury Link Railway between Calvert Jubilee and Sheephouse Wood, the hedgerow leading from Finemere Wood to the Aylesbury Link Railway and directly south of Edgcott Road.

5.2.4 Multiple records of *Myotis* species were recorded at the following locations:

crossing the railway near Benfield's overbridge;

foraging around Grendon Junction;

south of the Mega Ditch; and

near the hedgerow linking Finemere Wood to the Aylesbury Link railway line at Grendon Junction.

5.3 Paired sampling

5.3.1 At least three genera of at least five species were recorded in flight during paired sampling surveys these were; *Myotis* species, common and soprano pipistrelles, *Nyctalus* species and undetermined species.

5.3.2 A total of 168 bat passes were recorded during surveys, of these 137 passes (82%) were observed foraging along linear features and habitats, compared with 31 passes (18%) that were not associated with linear features. The proportion of passes identified as woodland bat species associated with linear habitat was 93%.

5.3.3 The highest levels of activity for the 2014 survey as a whole were recorded at Locations 4 and 5 (Costello underbridge and School Hill overbridge), with a total of 52 and 41 passes respectively. A number of bats (including *Myotis* and brown long-eared bats) were recorded flying under as well over these features.

5.3.4 A significant difference was recorded between bats commuting along linear habitats and those not associated with linear features at Location 4 and Location 5. No significant difference was found with how *Nyctalus* species or pipistrelle species used linear features and open habitats at Location 2 and 3 (Benfield's overbridge and Grendon Junction) (Annex 3, Table 16). No significant difference was recorded at Locations 1, 2 and 3. The results for these surveys are provided in Table 7Table 10 and Table 11, and the statistical results are detailed in Annex 3.

5.3.5 A Mann-Whitney's U statistical test was undertaken on the data to determine if there was a significant difference between total numbers of bats commuting along linear features and other flight behaviours. This showed statistically significant preferential use of linear habitat at two of five sampling locations for *Myotis* bats. The lack of significance (at 95% confidence levels) at the remaining locations can be attributed to the inclusion of pipistrelle bats in the sample (necessary to provide a sample of sufficient size for statistical analysis). This was the case at Benfield's overbridge and Grendon Junction, where flight behaviour of *Pipistrellus* and *Nyctalus* species was not associated with linear habitat. Pipistrelle and *Nyctalus* bats do not show strong preferential use of linear habitat demonstrated by *Myotis* species. Therefore the analysis of data that combined records, necessary to have a large enough sample size, for both species groups is likely to have masked any significant differences that may have been possible to detect if *Myotis* data had been analysed separately.

5.3.6 The 2014 data confirms the findings from 2013 surveys and additionally confirms that the Costello Underbridge and School Hill overbridge are key crossing points, with a number of species flying across the existing Aylesbury Link Railway at these locations. In particular, a high proportion (44%) of bats recorded at School Hill overbridge were *Myotis* species.

5.4 Infra-red filming survey

5.4.1 The majority of bat passes were associated with vegetation along the southern edge of Sheephouse Wood. The most frequently used crossing point identified by infra-red filming was the Costello underbridge (immediately south of Sheephouse Wood). Most bats were recorded flying above the existing underbridge structure, as dense vegetation immediately to the west stopped the majority bats flying through it. Bats were flying at heights of between 2 and 5 metres above the ground. Brown long-eared, common pipistrelle and *Myotis* bats were all recorded which corresponded with the bats observed on film.

5.4.2 No activity was recorded along the hedgerow linking the northern part of Finemere Wood to the Aylesbury Link railway line in June, but three *Myotis* bats were recorded in August and September 2014, flying at canopy height (between 5 and 8m) in an easterly direction towards Finemere Wood. Numerous common and soprano pipistrelle bats were recording foraging around the hedgerow and grassland to the south of the hedgerow in August and September 2014.

5.4.3 Common and soprano pipistrelle bats were observed foraging and commuting at the School Hill overbridge. Common pipistrelles foraged in the vicinity of low pressure sodium lamps on land to the south of the bridge. Normally such behaviour is associated with high pressure sodium lamps[16] and mercury lamps[17] that emit ultra-violet light that attracts invertebrates.

5.4.4 Low numbers of common and soprano pipistrelle bats were recorded at the Edgcott Road overbridge in June 2014. Pipistrelle bats were observed flying along the Aylesbury Link Railway and the adjacent vegetation at heights of between 2 and 5m.

[16] Jones, G., 2000.
[17] Jones, G. & Rydell, J., 1994.

5.5 Thermal imaging survey

5.5.1 The most frequently used crossing points of those subject to thermal imaging surveys were the Edgcott Road overbridge north, Sheephouse Wood lineside south and Grendon Junction. Recorded activity was highest in July 2014 at all locations.

5.5.2 Most of the recorded flight events were of foraging bats most commonly in zone 3(6-10m). This behaviour was particularly prevalent during June and July 2014 when bats were also recorded flying across multiple zones. In August and September 2014 more bats were recorded following linear features, with more bats recorded in zone 3.

5.5.3 A proportion of bats were recorded flying through zones 1 and 2 (and 'multiple zones') during August and September. This behaviour was most common along the existing Aylesbury Link Railway or associated scrub at Edgcott Road overbridge north, Benfield's overbridge (north and south) and at Grendon Junction.

5.5.4 The majority of the bats at Edgcott Road north were recorded flying in zones 2 and 3 but at Edgcott Road overbridge south a higher number of flight events were recorded using multiple zones for foraging. Data also suggests the latter location is of particular importance for *Myotis* species during the maternity season, where 29% of calls recorded in June 2014 were *Myotis* species. This is consistent with the findings from the radio-tracking, automated and transect surveys, but data from the single survey night in June 2014 cannot allow for any definitive conclusions to be drawn. The variation in activity is likely to be due to the optimal foraging and roosting habitat to the north of the Edgcott Road, with less optimal habitat (with lower scrub and embankments) further to the south of Edgcott Road overbridge.

5.5.5 Similar flight behaviour and numbers of flight events were recorded at Grendon Junction and Benfield's overbridge which have both been shown to be key crossing points of Bechstein's bat and other woodland species in radio tacking surveys in 2012-14. Automated surveys at both these locations suggest that between 2 and 5% of recorded bat assemblage are likely to be *Myotis* species and between 87 and 97% of the bat assemblage likely to be common pipistrelles (refer to Annex 6).

5.5.6 At Benfield's overbridge and Grendon Junction, bats flew over tall vegetation along either side of the Aylesbury Link railway line but descended and occasionally flew along the intervening area occupied by the railway line. At both of these locations bats used linear vegetation leading to these crossing points. Where the vegetation or structures associated with a key crossing point, such as a tree or bridge were high, the bats flight was correspondingly high. Specifically to the north of Grendon Junction, bats were recorded flying at canopy height along a tall hedgerow approximately 4 meters, and remained at this height in order to cross existing Aylesbury Link Railway when commuting from Finemere Wood to Hewin's wood. This data indicates that bats will retain a high flight path if the features present allow for this.

5.5.7 Similar numbers of flight events were recorded at Sheephouse Wood lineside north and south, with bats most frequently characterised as foraging to north and following the railway to the south. These data confirm previous survey findings that this area is an important location for commuting bats, particularly south along the line and crossing toward Calvert Landfill. Automated surveys at this location indicate that between 2 and 5% of the bats are likely to be *Myotis* species and between 54 and 87% likely to be common pipistrelle species (refer to Annex 6). The majority of the flight

events recorded at these locations found bats were using zone 3 i.e. at canopy height, or were flying through multiple zones. Therefore if suitable structures were present at this location they are likely retain the flight height of bats to facilitate crossing and commuting over the tree canopy and reduce the incidence of train strike.

5.5.8 Seven hundred and twenty six flight events were recorded during surveys at Costello underbridge, the field south of Sheephouse Wood. Automated surveys in this area indicate that between 1 and 6% of passing bats are likely to be *Myotis* species and between 82 and 99% are likely to be common pipistrelles. Similar numbers of bats were observed in all flight zones and behaviour categories. Most flight events followed the Aylesbury Link railway line and were present in all flight zones. Only four flight events were recorded in which bats were observed flying within the underbridge and eight were observed crossing the railway above it.

5.6 Trapping surveys

5.6.1 A total of 257 bats of nine species were caught during trapping surveys carried out between April and October 2014, with 43 night's survey effort. The species caught included Bechstein's (27 bats), brown long-eared (148 bats), Brandt's (5 bats), common pipistrelle (27 bats), Daubenton's (21 bats) Natterer's (43 bats), noctule (3 bats) soprano pipistrelle (38 bats) and whiskered (24 bats).

5.6.2 One of the objectives of the survey in 2014 was to provide additional information on the flightlines within and adjacent to the scheme that were identified in the main ES. Therefore, between April and July 2014 the surveys were predominately on the existing Aylesbury Link Railway, adjoining habitat links (where access was possible), and in Finemere Wood. Trapping was not carried out in other woods containing large numbers of roosts to avoid bias from catching individuals that did not use habitat within or directly adjacent to the scheme. Hence moderate numbers of bats only were caught because most trapping locations were not in the immediate vicinity of known roosts.

5.6.3 Between April and July 2014 no bats were caught at Location 1 on the Aylesbury Link Railway and only one bat was caught at Location 2. This low bat capture rate concurs with the low bat activity recorded during the bat activity transects and by the automated surveys and is likely associated with the poor quality habitat present along the existing railway and the more optimal habitat on the adjacent land. When newly accessible land to the south of Edgcott Road was surveyed, a total of 74 bats were caught over seven night's survey effort. However, this area included high quality habitat including Grendon and Doddershall woods approximately 2km to the west of the scheme where roosts of Bechstein's, Daubenton's, Natterer's and whiskered bat were recorded in 2013.

5.6.4 The highest number of bats caught at locations along the Aylesbury Link railway line was at Location 4 the Finemere hedgerow and Finemere Wood (71 bats) and Location 6 Sheephouse Wood (44 bats). The proximity to woodland, which is known roosting and foraging habitat, is likely to have influenced the numbers of bats caught.

5.6.5 A total of 27 Bechstein's were caught which comprised 19 females and eight males. In 2014 Bechstein's bats were caught at the same locations as in the 2012 and 2013 surveys and also at the newly accessible land south of the Edgcott Road at the following locations.

Location 5, the private garden of Doddershall House, where a single bat was trapped by the Bernwood Forest Bechstein's Project;

Locations 10 and 11, respectively Grendon Wood and Doddershall Wood, where a colony was present and where 15 Bechstein's bats were caught; and

Location 8, where a male Bechstein's bat was caught.

5.6.6 Fewer small *Myotis* bats were caught in 2014 compared to the previous years. Three female Brandt's bat (two of which were radio-tagged) were caught over 43 nights trapping effort, compared to eight females in 2013 over 38 nights trapping and one bat in 2012 over 20 nights trapping. Twenty four whiskered bats were caught in 2014 of which of 11 were females and 13 were males compared to 57 in 2013 of which 44 were females and 13 were males. Only two of the females could be radio-tagged in 2014 as the other females were either too light or heavily pregnant.

5.6.7 Three colonies of brown long-eared bats were identified in 2014. Data from the four tagged bats were supplemented by additional data collected from bats tagged by NBBG in Finemere Wood (which HS2 Ltd Surveyors were allowed to track). The following flightlines and roosting and foraging activity was recorded:

the colony at Finemere Wood was identified from bats caught at Location 4, Tranche 1 and also identified from previous surveys in 2012/13. They crossed the scheme at the existing Aylesbury Link railway line at Costello underbridge, Grendon Junction and Adam's accommodation underbridge, and flew north along the existing Aylesbury Link railway line at the latter location (refer to EC-23-005 EC-24-006, EC-25-007;

the colony at Grendon and Doddershall woods, identified from bats caught at Location 2 Tranche 2 did not have recorded flight lines or a home range which crossed the existing Aylesbury Link railway line (refer to EC-23-005 EC-24-006, EC-25-007); and

Portway Farm was identified from bats caught at Tranche 1 Location 8 crossed the existing Aylesbury Link railway at Main Street and Perry Hill, Calvert (refer to EC-23-005 EC-24-006, EC-25-007).

5.7 Radio-tracking survey

5.7.1 The locations where the highest number of bats were recorded verified key bat crossing locations as identified in the main ES and confirmed the findings of the 2012 and 2013 survey data, with the exception of Location 5, Benfield's overbridge using Bridleway GUN/28. The information on roosts, flightlines and foraging habitat obtained from radio tracking for each species is discussed below.

Bechstein's

5.7.2 In May 2014 five females were radio-tracked (including two Bechstein's radio-tagged by the NBBG). All were from the colony in Finemere Wood. They foraged within Finemere Wood and used flightlines to the north and north-west of the scheme that were previously identified in the 2013 surveys.

5.7.3 In June 2014 two female Bechstein's bat were caught at the south of Sheephouse Wood. These bats roosted in Grendon Wood and used the watercourses and scrub vegetation to commute north to Moor Farm and subsequently east towards Sheephouse Wood. The bats crossed the Aylesbury Link Railway at Sheephouse Wood.

5.7.4 In July and early August 2014 three female and one male Bechstein's bat (including one female caught and radio-tagged by NBBG) from the colony in Finemere Wood were caught and radio-tagged. The following flightlines and roosting and foraging activity was recorded:

two females foraged in Finemere Wood and Runt's, Greatsea and Balmore woods further to the north-west of the scheme;

the third female foraged along hedgerows to the northeast of the scheme, including the hedge linking the northern part of Finemere Wood to the Aylesbury Link Railway and the mature hedgerow on the Grendon Junction-that connects to Sheephouse Wood;

the male bat travelled more than 3km to foraging habitat surrounding the waterbodies at Calvert Landfill;

the male bat crossed the scheme each night on multiple occasions moving between the waterbodies at Calvert Landfill and Decoypond Wood, crossing the scheme. This crossing point was not recorded in previous years; and,

the male bat used a willow tree at the Calvert Landfill to the west of the scheme as a roost for one day-this roosting location was not recorded in previous years.

5.7.5 The maximum count obtained for the colony in Finemere Wood in August 2014 was 68 individuals. This would have included juveniles and, as such, is not directly comparable to the colony count obtained in 2013 (as it was a pre-maternity count of 38 bats). It was not possible to carry out a pre-maternity count earlier in the season in 2014 as the bats were either roosting in a location that was not visible at ground level or in a location where access was not possible.

5.7.6 An adult male Bechstein's was bat caught at Calvert Jubilee Nature Reserve in early August 2014. It roosted in a tree in a private garden in Calvert to the west of the scheme-this roost was not recorded in previous years. The following commuting and foraging activity was recorded which was not recorded in 2012 and 2013:

it used the Benfield's overbridge to commute between the roost site and foraging habitat at Calvert Landfill, crossing the scheme to forage in Decoypond Wood-the flightline between Calvert Landfill and Decoypond Wood was not recorded in previous years;

this bridleway was also identified as a flightline linking the Calvert Landfill and Calvert Jubilee Nature Reserve. Bechstein's bat were not recorded in previous years, but this flightline was used Daubenton's bats in 2012 and 2013; and

it made occasional flights to Sheephouse Wood from Decoypond Wood.

5.7.7 The new Bechstein's roost and flightlines are considered to be outliers deviating from the standard population flightlines, as roost and flightline data were gathered from male Bechstein's bats and therefore it is considered unlikely this reflects flightlines used by the maternity population.

5.7.8 The male Bechstein's bats radio-tracked in 2014 travelled further than the females to access foraging sites. This difference in the behaviour of male and female bats was also evident in the 2013 surveys. It is assumed that male Bechstein's bats may have to travel further from the roosts than the females as, potentially; the females will require foraging habitat in proximity to the roost when rearing young.

5.7.9 In August and September 2014 the newly accessible land to the south of the Edgcott Road enabled an intensive survey to be carried out over seven nights. In August two non-breeding female Bechstein's bats were caught and radio-tagged. One of these bats foraged predominately in Grendon Wood and made occasional flights west along the River Ray, away from the scheme. The second bat travelled at least 5km west towards Marsh Gibbon using the River Ray and vegetated ditches around Gubbins Hole Farm. The radio-tag was still active in September (some 20 days after radio-tagging), and the bat continued to fly west to forage along watercourses. This flightline was not recorded in surveys carried out in 2012/13 but importantly the flightline is not crossed by the scheme.

5.7.10 A non-breeding female was caught and radio-tagged on land south of the Edgcott Road, roosted in the private garden of the Copse to the north west of Doddershall estate. It foraged in the gardens and flow west to Doddershall wood, using tree lines and woodland copses for foraging on occasion, but was also recorded flying quickly and directly to the wood.

5.7.11 Three further Bechstein's bats that were radio-tagged south of the Edgcott Road in September were all caught in the north of Grendon and Doddershall woods. One was subsequently re-located roosting and foraging in Sheephouse Wood. It was not recorded crossing the scheme during the tracking period but must have done so to move between the two areas of woodland. Another bat roosted in the Grendon and Doddershall woods for the entire period but travelled north-west to forage in Hewin's Wood and crossed the scheme (where a hedge links northern part of Finemere Wood to the Aylesbury Link Railway) to access foraging habitat in Greatsea and Romer woods. The third bat did not cross the scheme and foraged predominately in Grendon and Doddershall woods. The maximum colony count obtained in this month was 19 bats which is lower than the colony count obtained by the Bernwood Forest Bechstein's Project in 2011 (78 bats). This may be because the colony had disbanded as it was late in the season or, potentially, this could be a small sub-colony.

5.7.12 As concluded in 2013, habitat connectivity between woods to the south-west and the north-east of the scheme will be important to ensure that the favourable conservation status of the population of Bechstein's bats in the Bernwood area is maintained. The link between the Grendon and Doddershall colonies and habitats northeast of the scheme is likely to be critical, as at least 50% of the bats radio-tracked from this colony crossed the scheme to access foraging habitats to the east - at Sheephouse, Greatsea and Romer woods. The Bechstein's bats radio-tracked from the colony in Finemere Wood all travelled north and northwest and only two crossed the scheme, one at Grendon Junction to access hedgerows and riparian habitat to the south-west

at Oak Tree Farm and the other crossed at Decoypond Wood to access the woodland and ponds at the Calvert Landfill. None of the radio-tracked bats from this colony travelled south or southwest to access woodlands to the opposite side of the scheme.

5.7.13 The use of watercourses and hedgerows by the Bechstein's population in this landscape is likely to be integral to how this population exists in a fragmented landscape. Data from radio-tracking studies in the southern England[18], where populations exist in a more wooded landscape have not shown this behaviour whereas, by comparison, a study on Bechstein's in Grafton Woods in Worcestershire[19] found that the colony, which existed in a largely fragmented landscape, utilised watercourses and hedgerows for foraging and commuting.

Brown long-eared

5.7.14 Eighteen brown long-eared bats were radio-tagged (five by HS2 Ltd. and 13 by NBBG). Those radio-tagged by NBBG were all part of the Finemere Wood colony. Two bats from this colony were radio-tagged by HS2 Ltd, in order to obtain data from early and late in the bat activity season (April and October) when NBBG were not radio-tagging bats. Many bats of this colony remained in Finemere Wood and did not cross the scheme. However, one bat used the hedgerow linking the northern part of Finemere Wood to the Aylesbury Link Railway at Ditchburn's Overbridge to cross the scheme, to access foraging habitat. No new flightlines or foraging habitat was identified for brown long-eared bats of the Finemere Wood colony in 2014. Radio-tags failed on four bats and there is insufficient data from 2014 surveys to conclusively identify home ranges.

5.7.15 The pregnant female brown long-eared bat caught at Calvert Jubilee Nature Reserve in May 2014 roosted in a building at Portway Farm. It commuted north to the Padbury Brook and foraged near the watercourse prior to commuting south along the Great Central Mainline north of Calvert Jubilee Nature Reserve to access foraging habitat at Calvert Jubilee Nature Reserve. The use of this flightline and this area foraging habitat by Daubenton's bat roosting at Chetwode was demonstrated by the radio-tacking surveys in 2013, but its use by brown long-eared bats has not been recorded previously.

5.7.16 In 2014 brown long-eared bats from the colony in Sheephouse Wood crossed the scheme to access foraging habitat to the west, including hedgerows and scrub in Calvert Landfill and at Moor Farm. The same behaviour was recorded 2012, therefore, no new flightlines or foraging areas have been identified for this colony.

5.7.17 A new roost and flightline was identified for a breeding female brown long-eared bat to the south of Edgcott Road in 2014. This bat was caught in the south of Doddershall Wood and roosted in a building at Knapps Hook Farm. It used the hedgerows west of the scheme to commute to Doddershall Wood for foraging. The flightlines and foraging areas identified are to the west of the scheme and, as such, will not be bisected by the scheme.

[18] Fitzsimons et al. 2002; Schofield and Morris 1999.
[19] Palmer, E. *et al.*, 2013.

Brandt's

5.7.18 The two female Brandt's bats (confirmed by DNA analysis) radio-tracked in 2014 were caught in June along the Muxwell Brook to the west Hewin's Wood. Both roosted to the southwest of the scheme in a residential property south of the A41 (in close proximity to Mercer's Wood). This is a new roost location for this species. Both bats travelled more than 4km from their roost and crossed the scheme to access foraging habitats at Greatsea and Romer woods and Sheephouse Wood. This flightline was identified in 2012 and 2013 where a radio-tracked bat from Brandt's colony in Sheephouse Wood travelled south-west to forage.

Daubenton's

5.7.19 Roosts of breeding and non-breeding females Daubenton's bats were recorded at Sheephouse Wood and Grendon and Doddershall woods. This confirms the findings of the 2012 and 2013 data and no new roosting localities in proximity to the scheme were found for this species.

5.7.20 The 2014 radio-tracking data shows that the Daubenton's bats roosting in Grendon and Doddershall woods use the Muxwell Brook and nearby watercourses to access foraging resources at Calvert Landfill. In 2014 Daubenton's bats continued to use the Aylesbury Link Railway to commute to Sheephouse Wood, Decoypond Wood and Calvert Jubilee Nature Reserve, which concurred with the flightlines identified in 2012 and 2013.

5.7.21 A new flightline for Daubenton's bat was identified along the River Ray to the west of the scheme. A single bat foraged along the watercourse from beyond Grendon Underwood, moving north at Moor Farm, and crossed the scheme at Sheephouse Wood.

Natterer's

5.7.22 Six female Natterer's' bats from the colony in Finemere Wood were radio-tagged in 2014, two by NBBG and six by HS2 Ltd. surveyors. These bats were all caught in at Location 3 and Location 4 and roosted in Finemere Wood. Three bats foraged predominately in Finemere Wood, but also used the hedgerows and fields to the west. They crossed the scheme at Ditchburn's overbridge. Two bats used the River Ray to commute to foraging habitats along hedgerows and fields east of Finemere Wood and did not cross the scheme. The final bat commuted north-east to access foraging habitat in Romer and Greatsea Woods and did not cross the scheme.

5.7.23 Two further Natterer's bats were caught to the west of the scheme were also radio-tracked in 2014. A juvenile female Natterer's bat caught and radio-tagged close to Doddershall House in September 2014 crossed the scheme south of the Edgcott Road. It foraged predominately in the pasture fields to the north of Doddershall House and, on occasion, foraged to the east of the scheme. No specific crossing points of the scheme were identified. This foraging area was not recorded previous surveys.

5.7.24 A second non-breeding female Natterer's bat was radio-tracked in September 2014. It roosted in the north-west of Grendon and Doddershall woods was recorded foraging along the Mega-Ditch, at Calvert Landfill, along the River Ray to the west of the scheme and in fields and ditches near Marsh Gibbon. This foraging area was not recorded during previous surveys, however it is not bisected by the scheme.

Whiskered

5.7.25 The majority of whiskered bats caught in 2014 were too light to radio-tag. Therefore, only one whiskered bat roost was recorded in 2014 at Finemere Hill House and Finemere Wood. A whiskered bat (confirmed by DNA analysis) was radio-tagged in April 2014. It used the River Ray corridor for commuting and foraging and crossed the scheme at Adams Underbridge to access foraging habitat around Woodlands Farm. This is the same flightline that was identified for this species in the 2012 and 2013 surveys.

Summary

5.7.26 The findings of the 2014 surveys largely confirmed those of survey carried out in 2012 and 2013. No additional species were recorded and the location of flightlines were similar to previous years. However, localised changes in the level of bat activity and the frequency of use of flightlines recorded in the 2014 and previous surveys, as well as new information on flight behaviour along and across the scheme were recorded. The main findings of the 2014 surveys are summarised below and compared with results from surveys in 2013.

5.7.27 As in previous years high levels of activity by a range of woodland bat species was recorded in wooded habitat close to the Aylesbury Link railway line to the north of Edgcott but was largely absent from farmland further south, except for limited activity by Bechstein's and Natterer's bat.

5.7.28 Data from 2014 confirmed key crossing points that were identified in 2012/13 including the River Ray, Grendon Junction, Benfield's Overbridge and Costello's underbridge. School Hill overbridge and Edgcott road were identified from surveys in 2014 as important crossing locations where high proportions of *Myotis* species, (44% and 30% respectively) were recorded at these locations during June. Higher proportions of *Myotis* species were recorded at Buckinghamshire railway centre, Decoypond Wood and School hill overbridge in September (where between 20 and 21% of all bat calls were *Myotis* species), confirming that *Myotis* species disperse through the landscape during the autumn.

5.7.29 The 2014 transect and automated surveys identified high levels of *Myotis* species activity directly south of the Edgcott Road overbridge. This is thought to be associated with a flightline for Bechstein's bat along a hedgerow between Grendon and Doddershall woods and the existing Aylesbury Link Railway. The 100% MCP for Bechstein's demonstrates that foraging activity does not extend south from Edgcott Road along the Aylesbury Link railway line; rather it is in more optimal woodland habitat to the north and the Doddershall Estate to the west.

5.7.30 Natterer's bats that roost close to Doddershall House foraged in habitat to the north and commute along a nearby section of the existing Aylesbury Link Railway Line. The construction of the scheme is therefore likely to result in limited reduction in foraging habitat within the home range of the roost. However, as described in the main ES crossing points (the Footpath QUA/26 Accommodation Underbridge and the Bridleway QUA/28A Accommodation Overbridge) and associated habitat corridors, parallel planting and vegetation clearance will address the potentially adverse effects on this roost.

5.7.31 A range of survey types carried out in 2014 indicated that bats changed behaviour along Bridleway GUN/28 and in the vicinity of Benfield's overbridge. Broadly, levels of activity recorded by all survey types in this area were less than in previous years. Automated surveys recorded minor changes in levels of bat activity compared with 2012/13 surveys at some locations. Less bat activity was recorded along Bridleway GUN/28, at Hewin's Wood and at Benfield's overbridge. Higher levels of activity were recorded north and south Benfield's overbridge (at Decoypond Wood and at Grendon Junction). Transect surveys carried out in 2014 generally recorded similar areas of high activity to those recorded in 2013, but higher levels of activity were recorded along Bridleway SCL/18 (adjacent to the existing Aylesbury Link Railway) between Calvert Jubilee and Sheephouse Wood in 2014. Fewer bats (including Bechstein's) were caught during trapping surveys at Benfield's overbridge and Hewin's Wood in 2014. Radio tracking surveys recorded greater use of flightpaths for Bechstein's bat along the Edgcott Road, rather than previously well-used flightlines along the Bridleway GUN/28.

5.7.32 During thermal imaging surveys bats were regularly recorded flying at canopy height (between 5 and 10 m) in the vicinity of key crossing locations including at Edgcott Road recording north, Grendon Junction, Benfield's overbridge recording north and south and Sheephouse Wood lineside north. However, they were also recorded flying underneath Benfield's overbridge and reducing their flight elevation when crossing the existing railway close to the bridge, as well as foraging along the Aylesbury Link railway line in this area. This crossing point is used by *Myotis* species (which were 3% of recorded activity), including Bechstein's.

5.7.33 Statistical analysis of paired sampling surveys carried out in 2014 at the Costello underbridge and School Hill overbridge demonstrated that bats movements are significantly associated with linear vegetation along the Aylesbury Link railway and Muxwell Brook. This corroborates findings from 2013 paired sampling surveys and confirms the measures provided in the main ES that links roosts and foraging areas, for Daubenton's bats in particular.

5.7.34 Data from 2014 paired sampling surveys at School Hill overbridge confirmed this location is a key crossing point for *Myotis* species including Bechstein's commuting from Decoypond Wood to Calvert Jubilee where in June 44% of bats recorded were *Myotis* bats. Overall, the proportion of passes identified as woodland bat species (including *Myotis)* associated with linear habitat was 93%.

5.7.35 The Costello underbridge was identified as the most frequently used crossing point in infra-red filming surveys paired with a detector, mostly by pipistrelle species. Most bats were recorded flying above the existing structure; this was corroborated by paired sampling. Thermal imaging surveys at this location recorded the majority of flight events, likely to be 82-99% pipistrelle species, followed the Aylesbury Link railway line.

5.7.36 Radio-tracking surveys carried out in September identified a new Bechstein's roost south of Calvert village. The bat was recorded crossing the railway and flying northwards to Calvert Jubilee Nature Reserve along vegetation adjacent to the existing Aylesbury Link Railway. This record and one from 2013 at nearby Decoypond Wood are both for single male bats. Such records are of limited significance in terms

of the conservation status of the population, and male bats tend to have wider home ranges and disperse further in the autumn.

5.7.37 A brown long-eared maternity roost was recorded at Portway Farm to the north of Calvert during radio tracking surveys. Bats crossed the original scheme and then flew south to reach foraging habitat at Calvert Jubilee nature reserve. As such bats are potentially at risk of being struck by trains.

6 Annexes

Annex 1

Sound analysis protocol using Kaleidoscope

6.1.1 The recorded WACo files were converted to WAV files and analysed using auto-identification based on selected call parameters using Kaleidoscope Pro Version 2.0.5

6.1.2 Recorded files were split into 15 second segments, these segments were later used to calculate bat call counts. The files were analysed using UK Bats Recogniser[20] within Kaleidoscope Pro software which automatically locates and identifies both noise and bat calls. Calls are classified into species or species groups based on pre-set parameters within the UK Bat Recogniser function.

6.1.3 The software provides an output listing all file segments with metadata including time, call length and the automated call identification.

6.1.4 All files were subject to a secondary manual analysis to ensure identification was accurate by experienced analysts (team of four with a combined experience of 26 years; and included a number of bat survey licence holders). Clearly recorded calls of common or distinctive species had a high success rate of correct identification using the auto-identification system. Calls which were atypical, of rarer species or recorded in clutter required further manual analysis. Calls from rarer species were individually subject to internal peer review among the analysts for the purposes of accuracy and consistency.

6.1.5 Internal peer review was undertaken by experienced analysts in conjunction with the use of an identification spreadsheet based upon the call parameters in Vaughan, N., Jones, G. & Harris, S. (1997) Identification of British Bat Species by Multivariate Analysis of Echolocation Call Parameters. The International Journal of Animal Sound and its Recording 7: 189-207 and Russ, J. (1999) The Bats of Britain and Ireland. The spreadsheet allowed the measured call parameters from a sonogram to be entered and compared with the 'average' species values for bat call parameters in these two publications. Providing a grade for how well the measured parameter fits with published data and allows a simple score out of 10 to be calculated for the call, quantifying how well a call fitted within the range for a particular species. In addition to this, further information is derived from Russ, J. (2012) and Middleton, N., *et al.* (2014) to support judgement calls.

6.1.6 Subsequent to peer review results were collated for further analysis of a number calls during a session at a particular location. Where more than one species of bat is present within a 15 second segment, then all species are tagged in the results spreadsheet - so for example, a common pipistrelle, soprano pipistrelle and Myotis bat all calling simultaneously would result in three individual bat registrations for calculating bat call counts.

[20] Wildlife Acoustics, 2012

Annex 2

Table 13 : Automated detector recording dates for Tranche 1 in 2014

Location	Recording dates per month					
	April/May	**May**	**June**	**July/August**	**September**	**October**
1. Buckinghamshire Railway Centre	29 April – 3 May	14 – 19	8 - 12	2 – 8 August	15 – 19	03 – 09
2. Doddershall PRoW (Footpath QUA/24A)	29 April – 3 May	14 – 19	4 -8 Detector failed	2 - 8 August	Not set out due to these locations being replaced by Tranche 2	
3. South of the Edgcott road	29 April – 3 May	19 - 23	4 -8	2 - 8 August		
4. River Ray Culvert	4 – 8 May	14 – 19	4 -8	2 - 8 August	15 – 19	03 – 09
5. Grendon Junction	Not set out due to no access	14 – 19	4 -8	2 - 8 August	15 – 19	03 – 09
6. Benfield's overbridge		14 – 19	8 - 12	29 July – 1 August	15 – 19	03 – 09
7. Costello underbridge	29 April – 3 May	14 – 19	8 - 12	29 July – 1 August	10 – 15	09 - 14
8. North of Sheephouse Wood	29 April – 3 May	19 - 23	8 - 12	29 July – 1 August	10 – 15	09 - 14
9. Decoypond Wood	Not set out due to no access	19 - 23	8 - 12	29 July – 1 August	10 – 15	09 - 14
10. School Hill overbridge		19 - 23	4 -8	29 July – 1 August	10 – 15	09 - 14

Table 14 : Automated detector dates for Tranche 2 in 2014

Location	**Recording dates per month**		
	August/September	**September**	**October**
1. **Copse to the south of Doddershall house** (SP 72060 19840)	26/08/14-02/09/14	09/09/14-19/09/14	04/10/14-14/10/14
2. Hedgerow adjacent to existing Aylesbury Link railway line (SP 72422 20268)	26/08/14-02/09/14	09/09/14-19/09/14	04/10/14-14/10/14
3.East of Akeman Street Disused Railway (SP 71040 19905)	26/08/14-02/09/14	09/09/14-19/09/14	04/10/14-14/10/14
4. Pond located at the Copse to the north west of Doddershall estate (SP 71656 20491)	26/08/14-02/09/14	09/09/14-19/09/14	04/10/14-14/10/14
5. South of Doddershall Wood (SP 69851 20446)	26/08/14-02/09/14	09/09/14-19/09/14	04/10/14-14/10/14
6. North of Grendon Wood (SP 69970 21424)	26/08/14-02/09/14	09/09/14-19/09/14	04/10/14-14/10/14

Table 15 :Transect survey dates April to October 2014, inclusive

Transect 1	**Transect 2**
30 April	30 April
14 May	16 May
6 June	6 June
4 August	31 July
15 September	12 September
8 October	8 October

Annex 3

Table 16 : Paired sampling data Mann-Whitney U test

Paired Sampling Locations	Ranked Means of open habitat commuting	Ranked Means of linear habitat commuting	U	Z	p	r
Location 1 Edgcott Road	3.9	7.1	20.5	-1.57	0.0582	-0.35106
Location 2 Grendon Junction-Finemere Hedgerow	3.7	2.5	7	3.45	0.5	0.77
Location 3 Benfield's overbridge	4	3	2	4	0.8145	0.89
Location 4 Costello underbridge south of Sheephouse Wood	3.8	7.2	21	-1.67	0.0475	-0.37342
Location 5 School Hill overbridge	3.2	7.8	24	-2.3	0.0107	-0.514

Annex 4

Table 17 : Infra-red filming data

Date	Easting	Northing	Time	Species	Height (m)	Notes
06/06/2014	459053	240505	21:55	P.pip	2.5	Flew under bridge
06/06/2014	459053	240505	22:10	P.pip	2	Flew under bridge
06/06/2014	459053	240505	22:12	P.pip	2.5	Flew under bridge
06/06/2014	459053	240505	22:16	P.pip	3-3.5	Flying around lamps on station platform
06/06/2014	459053	240505	22:17	P.pip	2-2.5	Not seen on camera
06/06/2014	459053	240505	22:18	P.pyp	4	Overbridge
06/06/2014	459053	240505	22:19	P.pip	2-2.5	Not seen on camera
06/06/2014	459053	240505	22:21	P.pip	2-2.5	Under bridge
06/06/2014	459053	240505	22:56	P.pip	2.5	Under bridge
06/06/2014	459053	240505	23:07	P.pip	2	Under bridge
07/062014	471105	221982	N/A	N/A	N/A	No bats heard or seen for 90 minutes of filming between 21:20 and 23:00
08/06/2014	470207	222894	21:45	P.pip	3	Commuting across open field towards Aylesbury Link railway - not seen on

Date	Easting	Northing	Time	Species	Height (m)	Notes
						camera
08/06/2014	470207	222894	21:54	P.pip	Heard not seen	
08/06/2014	470207	222894	21:55	P.pip	5	Southern edge of Sheephouse Wood - not seen on camera
08/06/2014	470207	222894	21:56	P.pip	4	Around Costello underbridge - foraging adjacent to vegetation along railway line
08/06/2014	470207	222894	21:57	P.pip	Heard not seen	
08/06/2014	470207	222894	22:00	P.pip	2-2.5	Around Costello underbridge - foraging adjacent to vegetation along railway line
08/06/2014	470207	222894	22:03	P.pip	5	Around Costello underbridge - foraging adjacent to vegetation along railway line
08/06/2014	470207	222894	22:05	P.pip	4	Around Costello underbridge - foraging adjacent to vegetation along railway line
08/06/2014	470207	222894	22:08	P.pip	5	
08/06/2014	470207	222894	22:09	P.pip	7	Southern edge of

Date	Easting	Northing	Time	Species	Height (m)	Notes
						Sheephouse Wood
08/06/2014	470207	222894	22:12	P.pip	3	Southern edge of Sheephouse Wood
08/06/2014	470207	222894	22:13	N.noc	Heard not seen	
08/06/2014	470207	222894	21:57	Pip sp	3	Near 2m marker at edge of railway line
08/06/2014	470207	222894	21:55	P.pip	Heard not seen	
08/06/2014	470207	222894	21:58	P.pip	7	on video
08/06/2014	470207	222894	22:05	P.pip	5	on video
08/06/2014	470207	222894	22:27	*Myotis*	Heard not seen	
08/06/2014	470207	222894	22:30	P.pip	Heard not seen Heard not seen	Regular foraging
08/06/2014	470207	222894	22:38	N.noc	Heard not seen	
08/06/2014	470207	222894	22:52	P.pip	5	on video
08/06/2014	470207	222894	22:52	*Myotis*	5	Southern edge of Sheephouse Wood
08/06/2014	470207	222894	22:34	Bat	4	on video - no sound recording

Date	Easting	Northing	Time	Species	Height (m)	Notes
08/06/2014	470207	222894	22:34	Bat	4	on video - no sound recording
08/06/2014	470207	222894	22:47	P.pip	6	on video
09/06/2014	471876	220956	22:09	P.pip	4	Flying north along Aylesbury Link - commuting north
09/06/2014	471876	220956	22:30	P.pip	2.5 - 4	Foraging back and forth alongside vegetation adjacent to embankment
01/08/2014	470207	222894	22:10	P.aur	2.5	Southern edge of Sheephouse Wood
01/08/2014	470207	222894	22:12	P.aur	2.5	Southern edge of Sheephouse Wood
01/08/2014	470207	222894	22:31	P.pip	Heard not seen	Regular foraging
01/08/2014	470207	222894	22:34	P.pip	Heard not seen	Regular foraging
01/08/2014	470207	222894	22:52	P.pip	5	on video
01/08/2014	470207	222894	22:52	*Myotis*	2.5 - 4	Southern edge of Sheephouse Wood - feeding adjacent to woodland edge
01/08/2014	470207	222894	22:34	Bat	4	on video - no sound recording

Date	Easting	Northing	Time	Species	Height (m)	Notes
01/08/2014	470207	222894	22:34	Bat	4	on video - no sound recording
03/08/2014	471105	221982	20:31	P.pip	3	Flying in open field - not on video
03/08/2014	471105	221982	20:34	P.pip	3	Flying in open field - not on video
03/08/2014	471105	221982	21:09	P.pip	2	Flying in open field - not on video
03/08/2014	471105	221982	21:11	P.pip	5	Flying in open field - not on video
03/08/2014	471105	221982	21:19	P.pip	3	Flying in open field - not on video
03/08/2014	471105	221982	21:30	*Myotis*	5.5 - 8	*Myotis* foraging and commuting at various heights alongside trees and hedgerows
03/08/2014	471105	221982	21:42	*Myotis*	5.5 - 8	*Myotis* foraging and commuting at various heights alongside trees and hedgerows
03/08/2014	471105	221982	21:45	*Myotis*	4	*Myotis* flying across open field
03/08/2014	471105	221982	22:09	P.pyg	5	Foraging back and forth

Date	Easting	Northing	Time	Species	Height (m)	Notes
						along hedgerow
05/08/2014	459053	240505	20:55	P.pip	2	Flew under bridge
05/08/2014	459053	240505	21:10	P.pip	2.5	Flew under bridge
05/08/2014	459053	240505	21:15	P.pip	2.5	Flew under bridge
05/08/2014	459053	240505	21:19	P.pip	3-3.5	Flying around lamps on station platform
05/08/2014	459053	240505	21:31	P.pip	2-2.5	flying around surveyors foraging on scrub and feeding near lights on station platform
05/08/2014	459053	240505	21:32	P.pyg	4	Overbridge from road side
05/08/2014	459053	240505	21:49	P.pip	Heard not seen	Not seen on camera
12/09/2014	471105	221982	20:11	*Myotis*	5.5 - 8	*Myotis* foraging at various heights alongside trees and hedgerows
12/09/2014	471105	221982	20:18	*Myotis*	6	*Myotis* flying across open field - not on video
12/09/2014	471105	221982	20:45	*Myotis*	4	*Myotis* flying across open field - not on video
12/09/2014	471105	221982	21:09	P.pyp	2-4.5	Flying around fields and

Date	Easting	Northing	Time	Species	Height (m)	Notes
						hedgerows foraging
14/09/2014	459053	240505	20:19	P.pip	2.5	Flew under bridge
14/09/2014	459053	240505	20:54	P.pip	2.5	Flew under bridge
16/09/2014	470207	222894	20:09	P.pip	3	Foraged around Costello underbridge
16/09/2014	470207	222894	20:11	P.pip	3.5	Foraged around Costello underbridge
16/09/2014	470207	222894	20:13	*Myotis*	4	Commuted over the railway line at the south of Sheephouse Wood
16/09/2014	470207	222894	20:30	*Myotis*	4	Commuted over the railway line at the south of Sheephouse Wood
16/09/2014	470207	222894	20:34	P.pip	3	Around Costello underbridge - foraging adjacent to vegetation along railway line
16/09/2014	470207	222894	20:44	P.pip	3	Around Costello underbridge - foraging adjacent to vegetation along railway line
16/09/2014	470207	222894	20:48	P.aur	2	Southern edge of Sheephouse - feeding adjacent to woodland

Date	Easting	Northing	Time	Species	Height (m)	Notes
						edge
16/09/2014	470207	222894	21:11	P.pip	4	Commuted over the railway line at the south of Sheephouse Wood
16/09/2014	470207	222894	21:16	P.pip	4	Around Costello underbridge - foraging adjacent to vegetation along railway line
16/09/2014	470207	222894	21:19	P.pip	3	Around Costello underbridge - foraging adjacent to vegetation along railway line
16/09/2014	470207	222894	21:42	P.pip	3	Around Costello underbridge - foraging adjacent to vegetation along railway line
Date	Easting	Northing	Time	Species	Height (m)	Notes
06/06/2014	459053	240505	21:55	P.pip	2.5	Flew under bridge
06/06/2014	459053	240505	22:10	P.pip	2	Flew under bridge
06/06/2014	459053	240505	22:12	P.pip	2.5	Flew under bridge
06/06/2014	459053	240505	22:16	P.pip	3-3.5	Flying around lamps on station platform

Date	Easting	Northing	Time	Species	Height (m)	Notes
06/06/2014	459053	240505	22:17	P.pip	2-2.5	Not seen on camera
06/06/2014	459053	240505	22:18	P.pyg	4	Overbridge
06/06/2014	459053	240505	22:19	P.pip	2-2.5	Not seen on camera
06/06/2014	459053	240505	22:21	P.pip	2-2.5	Under bridge
06/06/2014	459053	240505	22:56	P.pip	2.5	Under bridge
06/06/2014	459053	240505	23:07	P.pip	2	Under bridge

Annex 5

Table 18 : Thermal imaging data summary location 1 to 4

Month	Flight height	1. Edgcott Road overbridge south			2. Edgcott Road overbridge north			3. Grendon Junction			4. Bridleway GUN/28 Benfield's overbridge south		
		Crossing the line	Following the line	Foraging	Crossing the line	Following the line	Foraging	Crossing the line	Following the line	Foraging	Crossing the line	Following the line	Foraging
June	**Zone 3 only**	No Access			No Access			7	4	123	1	0	8
	Zone 2 only							2	4	2	7	0	11
	Zone 1 only							0	0	0	1	7	33
	Multiple zones							1	4	7	10	2	27
	Total behaviours recorded							10	12	132	19	9	79
	Total no. of flight events recorded							154			102		
July	**Zone 3 only**	No Access			59	35	116	No Access			38	2	178
	Zone 2 only				5	11	5				42	5	51
	Zone 1 only				0	2	1				0	1	2
	Multiple zones				34	67	32				18	3	34
	Total behaviours recorded				98	115	154				98	11	265
	Total no. of flight events recorded				354						375		
August	**Zone 3 only**	45	22	12	133	635	41	49	61	106	2	2	0
	Zone 2 only	0	10	8	0	0	0	19	74	51	1	1	0
	Zone 1 only	0	8	0	0	0	0	4	2	4	5	4	0
	Multiple zones	12	24	82	1	58	2	149	83	57	25	16	0
	Total behaviours recorded	57	64	102	134	693	43	221	220	218	33	23	0
	Total no. of flight events recorded	223			805			659			56		

September	**Zone 3 only**	81	81	153	113	68	162	51	34	105	59	1	22
	Zone 2 only	4	24	35	13	101	37	0	102	48	1	0	8
	Zone 1 only	0	1	1	0	3	0	0	1	2	3	2	31
	Multiple zones	8	59	74	18	42	85	8	24	82	17	15	135
	Total behaviours recorded	93	165	263	144	214	284	59	161	237	80	18	196
	Total no. of flight events recorded	444			605			424			291		

Table 19 : Thermal imaging data summary location 5 to 8

Month	Flight height	5. Benfield's overbridge north			6. Costello underbridge			7. Sheephouse Wood lineside recording south			8. Sheephouse Wood lineside recording north		
		Crossing the line	Following the line	Foraging	Crossing the line	Following the line	Foraging	Crossing the line	Following the line	Foraging	Crossing the line	Following the line	Foraging
June	**Zone 3 only**	No Access			11	21	18	No Access			No Access		
	Zone 2 only				19	27	17						
	Zone 1 only				8	24	15						
	Multiple zones				8	4	8						
	Total behaviours recorded				46	76	58						
	Total no. of flight events recorded				164								
July	**Zone 3 only**	No Access			36	35	113	No Access			No Access		
	Zone 2 only				39	17	98						
	Zone 1 only				59	51	78						
	Multiple zones				72	75	54						
	Total behaviours recorded				206	178	343						
	Total no. of flight events recorded				726								
August	**Zone 3 only**	No Access			No Access			28	102	2	62	57	97

Annex 6

Table 20 : Percentage of bat species passes at thermal imaging locations

Month	Species	Automated detector location and thermal imaging Location									
		Edgcott Road overbridge		Grendon Junction		Benfield's overbridge		Costello underbridge		Sheephouse Wood	
		No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes
June	B.barb	0	0	0	0	0	0	0	0	0	0
	E. ser	0	0	0	0	0	0	0	0	0	0
	P.pyg	1	1	38	1	0	0	1	1	85	9
	P.pip	71	69	2770	91	310	87	113	99	866	87
	P.nat	0	0	66	2	0	0	0	0	0	0
	P.aur	0	0	3	0	0	0	0	0	0	0
	Myotis sp	30	29	153	5	8	2	0	0	35	4
	N.noc	1	1	0	0	39	11	0	0	6	1
	N.leis	0	0	3	0	0	0	0	0	0	0
	Total	103		3033		357		114		992	
July	B.barb	0	0	0	0	0	0	0	0	**Microphone malfunction-noise recorded**	
	E. ser	2	0	0	0	6	0	6	1		
	P.pyg	8	1	0	0	75	2	29	3		
	P.pip	1037	95	65	97	3565	95	1016	90		
	P.nat	0	0	0	0	1	0	3	0		
	P.aur	2	0	0	0	8	0	1	0		
	Myotis sp	44	4	1	1	79	2	66	6		
	N.noc	1	0	1	1	2	0	4	0		
	N.leis	3	0	0	0	3	0	5	0		
	Total	1097		67		3739		1130			
September	B.barb	1	0	1	0	2	0	1	0	0	0

Month	Species	Automated detector location and thermal imaging Location									
		Edgcott Road overbridge		Grendon Junction		Benfield's overbridge		Costello underbridge		Sheephouse Wood	
		No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes	No. Passes	Percentage (%) of total passes
	E. ser	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**4**	**0**
	P.pyg	**9**	**1**	**108**	**4**	**108**	**6**	**785**	**17**	**753**	**43**
	P.pip	**580**	**90**	**2208**	**91**	**1640**	**88**	**3747**	**82**	**936**	**54**
	P.nat	**3**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**3**	**0**
	P.aur	**0**	**0**	**18**	**1**	**20**	**1**	**4**	**0**	**4**	**0**
	Myotis sp	**35**	**5**	**71**	**3**	**61**	**3**	**12**	**0**	**41**	**2**
	N.noc	**11**	**2**	**21**	**1**	**13**	**1**	**19**	**0**	**4**	**0**
	N.leis	**6**	**1**	**6**	**0**	**15**	**1**	**0**	**0**	**3**	**0**
	Total	**645**		**2435**		**1859**		**4570**		**1748**	

Annex 7

Table 21 : Biometric data 2014

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
1	1	29.04.14	1	4	*M. mys*	F	Adult	Pregnant	6.00	35.90	Ring: L00148, Radio-tag: 173.9430
2	2	29.04.14	1	4	*P. aur*	F	Adult	Pregnant	8.00	36.92	Ring: Z2474, Radio-tag: 173.3050
	3	29.04.14	1	4	*P. aur*	M	Adult	N/A	8.30	37.08	
3	4	20.04.14	1	4	*M. nat*	F	Adult	Pregnant	9.00	39.50	Ring: Z2587, Radio-tag
	5	30.04.14	1	8	*M. nat*	F	Immature	Non-parous	9.00	37.71	bristles on tail membrane / ear length
	6	12.05.14	1	5	*M. bra*	F	Immature	Non-parous	5.00	33.56	too light to radio tag
	7	12.05.14	1	5	*P. pyg*	M	Immature	N/A	4.00	30.92	
	8	12.05.14	1	5	*M. mys*	F	Adult	Non-parous	5.00	34.12	too light to radio tag
	9	13.05.14	1	4	*P. pyg*	F	Adult	Pregnant	5.00	32.97	
	10	13.05.14	1	4	*P. pip*	F	Adult	Pregnant	4.50	31.87	
	11	13.05.14	1	4	*P. pip*	M	Adult	N/A	4.50	31.30	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	12	13.05.14	1	4	*P. aur*	M	Adult	N/A	7.00	38.24	
4	13	14.05.14	1	3	*M. bec*	F	Adult	Pregnant	9.00	40.92	Ringed: H6000, Radio tagged 173.7700
	14	14.05.14	1	3	*P. aur*	M	Adult	N/A	7.00	39.70	
5	15	15.05.14	1	4	*M. bec*	F	Adult	Pregnant	9.50	41.66	Ringed H5998; Radio tagged 173.8840
6	16	15.05.14	1	4	*M. bec*	F	Adult	Pregnant	8.50	40.92	Ringed H5999; Radio tagged 173.3173
	17	15.05.14	1	4	*P. aur*	M	Adult	N/A	7.00	37.12	
	18	16.05.14	1	2	*P. pip*	M	Immature	N/I	4.00	31.02	
	19	17.05.14	1	6	*P. aur*	M	Immature	N/A	N/A	N/A	Released immediately as caught at end of trapping session, stressed and entangled. Did not record biometrics
	20	18.05.14	1	8	*P. pyg*	F	Adult	Pregnant	5.00	30.50	
11	21	18.05.14	1	8	*P. aur*	F	Adult	Pregnant	9.00	27.54	Radio-tagged 173.4030 - Did not ring as stressed after radio-tagging.
	22	18.05.14	1	8	*M. mys*	M	Adult	N/A	5.00	31.55	
	23	18.05.14	1	8	*M. mys*	M	Adult	N/A	5.00	34.9	
12	24	18.05.14	1	8	*M. mys*	F	Adult	N/A	6.00	33.33	Radio tagged 173.9910

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	25	18.05.14	1	8	*P. pyg*	F	Adult	N/A	N/A	N/A	no measurements taken, released /welfare reasons
13	26	02.06.14	1	5	*M. bra*	F	Adult	Pregnant	7.00	34.97	Ringed H5950: Radio tagged 173.9550
	27	02.06.14	1	5	*M. mys*	F	Immature	Non-parous	5.00	36.12	
	28	03.06.14	1	6	*P. pyg*	M	Immature	N/I	5.50	30.27	
	29	03.06.14	1	6	*M. nat*	M	Adult	N/A	7.50	40.69	H1087 - removed ring, wing damaged, too tight
14	30	03.06.14	1	6	*M. bec*	F	Adult	Pregnant	10.00	42.76	Ringed H5948; Radio tagged 173.8130
15	31	03.06.14	1	6	*M. bec*	F	Adult	Non-parous	8.50	41.02	Ringed H5949; Radio tagged 173.7829
16	32	03.06.14	1	6	*P. aur*	F	Adult	Pregnant	8.50	39.08	Ring: H3685; Radio-tagged 173.3840
	33	03.06.14	1	6	*M. mys*	M	Adult	N/A	5.50	33.85	
17	34	03.06.14	1	6	*M. bra*	F	Adult	Pregnant	6.00	35.88	Ringed H5947; Radio tagged 173.9140
	35	03.06.14	1	6	*M. mys*	F	Adult	Pregnant	6.50	33.49	v pregnant, released Immediately
	36	05.06.14	1	4	*P. pip*	F	Adult	Pregnant	N/A	N/A	Released Immediately: very extended abdomen & pronounced nipples

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	37	05.06.14	1	4	*M. dau*	M	Adult	N/A	N/A	N/A	No biometrics taken - terminated trapping
	38	05.06.14	1	4	*M. mys*	M	Adult	N/A	N/A	N/A	No biometrics taken - terminated trapping
	39	05.06.14	1	4	*P. aur*	F	Adult	Lactating	N/A	N/A	Released Immediately as recently given birth - trapping terminated.
	40	05.06.14	1	4	*M. mys*	F	Adult	Pregnant	N/A	N/A	Released Immediately: very extended abdomen & pronounced nipples
	41	05.06.14	1	4	*M. mys*	F	Adult	Pregnant	N/A	N/A	Released Immediately: very extended abdomen & pronounced nipples
24	42	29.07.14	1	4	*M. bec*	M	Juvenile	N/A	8.25	42.17	Ringed H5997; Radio-tagged 173.9728
25	43	29.07.14	1	4	*M. bec*	M	Immature	N/A	8.50	42.38	Ringed H5996 ; Radio-tagged 173.9728
	44	29.07.14	1	4	*P. aur*	M	Juvenile	N/A	7.50	37.42	Ring: A8247
	45	29.07.14	1	4	*P. pyg*	F	Juvenile	Non-parous	6.00	32.73	
	46	29.07.14	1	4	*M. dau*	M	Adult	N/A	9.00	39.66	
26	47	29.07.14	1	4	*M. dau*	F	Adult	Non-parous	8.50	39.77	Ringed H5995; Radio-tagged 173.7330

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	48	29.07.14	1	4	*P. aur*	F	Juvenile	Non-parous	6.25	31.78	
	49	29.07.14	1	4	*P. aur*	F	Juvenile	Non-parous	8.00	38.25	
	50	29.07.14	1	4	*P. aur*	F	Juvenile	Non-parous	8.00	40.13	
27	51	29.07.14	1	4	*M. nat*	F	Adult	Post Lactating	9.00	39.28	Ring Z2406: Radio-tagged 173.2410
28	52	29.07.14	1	4	*M. bec*	F	Adult	Post Lactating	8.50	42.33	Ringed H5994; Radio-tagged 173.9575
	53	29.07.14	1	4	*M. mys*	M	Adult	N/A	5.50	33.51	droppings samples taken for DNA
	54	29.07.14	1	4	*M. nat*	F	Adult	Post Lactating	8.00	40.95	Ring C1134
	55	29.07.14	1	4	*M. mys*	F	Juvenile	Non-parous	4.50	33.87	
	56	29.07.14	1	4	*M. mys*	F	Adult	Non-parous	5.00	35.03	
	57	29.07.14	1	4	*P. pip*	M	Adult	N/A	4.00	30.48	
	58	29.07.14	1	4	*P. pip*	M	Juveni	N/A	3.00	30.05	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
							le				
	59	29.07.14	1	4	*P. pip*	M	Juvenile	N/A	4.50	30.75	
	60	29.07.14	1	4	*P. pip*	M	Juvenile	N/A	4.50	30.92	
	61	29.07.14	1	4	*P. pyg*	M	Juvenile	N/A	4.50	30.56	
	62	30.07.14	1	3	*N. noc*	F	Juvenile	N/A	25.50	50.78	
	63	30.07.14	1	3	*P. aur*	F	Adult	Post Lactating	7.75	39.06	Ring A5172
	64	30.07.14	1	3	*M. mys*	F	Juvenile	N/A	5.75	36.02	
	65	30.07.14	1	3	*M. mys*	M	Juvenile	N/A	5.50	34.60	
	66	30.07.14	1	3	*P. aur*	F	Juvenile	N/A	7.50	38.48	Ring A5184
	67	30.07.14	1	3	*P. aur*	M	Immature	N/A	5.00	38.94	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	68	01.08.14	1	6	*P. pyg*	M	Adult	N/A	5.00	31.10	
	69	01.08.14	1	6	*N. noc*	F	Immature	Non-parous	31.50	54.54	
	70	01.08.14	1	6	*P. aur*	M	Adult	N/A	8.00	37.82	
	71	01.08.14	1	6	*M. dau*	M	Juvenile	N/A	10.00	37.97	4 parasites
	72	01.08.14	1	6	*M. bec*	M	Juvenile	N/A	8.00	38.70	Did not radio-tag because possibly from Finemere colony and 3 bats already radio-tagged in tree roost
	73	01.08.14	1	6	*M. nat*	M	Adult	N/A	8.00	38.75	
	74	01.08.14	1	6	*M. dau*	M	Adult	N/A	7.70	37.86	
	75	01.08.14	1	6	*M. dau*	M	Adult	N/A	9.50	32.73	
	76	01.08.14	1	6	*M. dau*	M	Adult	N/A	8.00	33.70	
	77	01.08.14	1	6	*M. dau*	M	Adult	N/A	8.00	39.36	
	78	01.08.14	1	6	*M. nat*	M	Adult	N/A	9.00	39.00	1 parasite
	79	02.08.14	1	8	*M. nat*	F	Adult	Non-parous	7.50	38.19	Ring H1029

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
30	80	02.08.14	1	8	*M. bec*	M	Adult	N/A	10.00	40.67	Ringed H5937; Radio-tagged 173.8259. First Bechstein's caught @ CJ. Considered unlikely to be in Finemere roost
	81	03.08.14	1	3	*M. mys*	M	Adult	N/A	6.50	34.09	
	82	03.08.14	1	3	*M. mys*	M	Juvenile	N/A	5.00	33.12	
	83	03.08.14	1	3	*P. pip*	M	Adult	N/A	5.00	31.09	
	84	03.08.14	1	3	*P. pyg*	F	Juvenile	Non-parous	4.00	31.67	
	85	03.08.14	1	3	*P. pyg*	M	Adult	N/A	4.50	30.95	
	86	03.08.14	1	3	*P. pyg*	M	Adult	N/A	5.00	31.83	
	87	03.08.14	1	3	*M. dau*	M	Juvenile	N/A	8.00	36.98	
	88	03.08.14	1	3	*P. aur*	F	Juvenile	Non-parous	8.00	38.96	Ring H3651
	89	03.08.14	1	3	*M. dau*	F	Juvenile	Non-parous	8.00	39.64	Ringed H5946
30	90	03.08.14	1	3	*M. bec*	M	Juvenile	Non-parous	8.50	38.12	Ringed H5936; Radio-tagged 173.8239

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	91	03.08.14	1	3	*M. mys*	F	Juvenile	Non-parous	4.50	35.72	
	92	03.08.14	1	3	*M. dau*	M	Juvenile	Non-parous	8.00	39.16	lots of mites
	93	03.08.14	1	3	*P. aur*	M	Juvenile	N/J	7.00	32.33	
32	94	03.08.04	1	3	*M. bec*	M	Adult	N/A	10.50	42.34	Ringed H5938; Radio-tagged 173.8590
	95	04.08.14	1	7	*P. aur*	M	Juvenile	N/A	6.50	38.27	
	96	04.08.14	1	7	*M. nat*	M	Juvenile	N/A	8.00	40.45	
	97	04.08.14	1	7	*P. pip*	M	Adult	N/A	4.00	31.70	
	98	04.08.14	1	7	*M. mys*	M	Adult	N/A	5.00	33.06	droppings collected for DNA
	99	04.08.14	1	7	*M. nat*	M	Adult	N/A	8.00	40.21	
	100	04.08.14	1	7	*M. nat*	M	Adult	N/A	8.50	40.23	
	101	04.08.14	1	7	*M. nat*	M	Juvenile	N/A	7.50	40.06	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	102	04.08.14	1	7	*M. dau*	M	Immature	N/A	7.50	38.95	
	103	04.08.14	1	7	*M. dau*	M	Immature	N/A	8.00	39.67	
	104	04.08.14	1	7	*P. aur*	M	Juvenile	N/A	6.50	38.27	
	105	04.08.14	1	7	*M. nat*	M	Juvenile	N/A	8.00	40.45	
	106	04.08.14	1	7	*P. pip*	M	Adult	N/A	4.00	31.70	
	107	04.08.14	1	7	*M. mys*	M	Adult	N/A	5.00	33.06	
	108	04.08.14	1	7	*P. aur*	M	Juvenile	N/A	5.00	38.03	
	109	04.08.14	1	7	*M. nat*	M	Juvenile	N/A	7.50	38.66	
	110	04.08.14	1	7	*P. pip*	M	Adult	N/A	4.50	30.99	
	111	04.08.14	1	7	*M. mys*	M	Adult	N/A	5.00	32.99	
33	112	26.08.14	2	11	*M. bec*	F	Juvenile	Non-parous	9.00	42.93	Ringed H5930: Radio-tagged 173.7257

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	113	26.08.14	2	11	*M. bra*	M	Juvenile	N/A	8.50	35.43	Droppings taken for DNA
	114	26.08.14	2	11	*P. aur*	M	Juvenile	N/A	8.00	39.10	
	115	26.08.14	2	11	*P. aur*	M	Juvenile	N/A	7.75	37.41	
	116	26.08.14	2	11	*P. aur*	M	Juvenile	N/A	8.00	38.36	
34	117	26.08.14	2	11	*P. aur*	F	Adult	Post Lactating	8.00	38.10	Ringed H5931; Radio-tagged 173.9651
	118	26.08.14	2	11	*P. aur*	M	Adult	N/A	7.50	37.94	
	119	26.08.14	2	11	*M. nat*	F	Juvenile	N/A	7.50	N/A	
	120	26.08.14	2	11	*M. bec*	M	Adult	N/A	7.50	38.39	Ring C1307
	121	26.08.14	2	11	*M. bra*	M	Adult	N/A	7.50	36.50	
	122	26.08.14	2	11	*P. aur*	M	Adult	N/A	8.00	38.21	
	123	26.08.14	2	11	*P. aur*	F	Juvenile	N/A	7.00	37.84	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	124	26.08.14	2	11	*P. aur*	M	Juvenile	N/A	N/A	N/A	Captured at the end of trapping session; released Immediately
	125	26.08.14	2	11	*P. aur*	F	Juvenile	N/A	N/A	N/A	Captured at the end of trapping session; released Immediately
	126	26.08.14	2	11	*P. aur*	M	Juvenile	N/A	N/A	N/A	Captured at the end of trapping session; released Immediately
	127	26.08.14	2	11	*P. pip*	M	Juvenile	N/A	4.60	29.50	
	128	27.08.14	2	6	*P. pip*	M	Juvenile	N/A	4.00	30.97	
	129	27.08.14	2	6	*P. aur*	M	Adult	N/A	7.50	38.22	
	130	27.08.14	2	6	*M. nat*	M	Immature	N/A	7.50	40.33	mites on wing
	131	28.08.14	2	2	*P. aur*	M	Juvenile	N/A	6.50	36.99	
	132	28.08.14	2	2	*P. aur*	M	Juvenile	N/A	8.50	37.44	
35	133	28.08.14	2	10	*M. bec*	F	Adult	Non-parous	9.00	N/R	Ringed: H5932; Radio-tagged 173.8310

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	134	28.08.14	2	10	*P. pyg*	F	Juvenile	N/A	4.00	31.50	
	135	28.08.14	2	12	*P. aur*	F	Juvenile	N/A	7.50	39.78	
	136	28.08.14	2	3	*P. pip*	M	Adult	N/A	4.50	30.70	
	137	28.08.14	2	3	*P. pyg*	F	Adult	N/A	5.50	31.50	
	138	28.08.14	2	3	*P. aur*	M	Adult	N/A	7.80	38.00	Ring A5274
	139	28.08.14	2	3	*P. pip*	M	Adult	N/A	4.90	31.90	
	140	28.08.14	2	4	*P. aur*	M	Adult	N/A	8.90	97.80	
	141	28.08.14	2	4	*P. pip*	M	Adult	N/A	4.70	30.70	
	142	28.08.14	2	4	*M. nat*	F	Juvenile	Non-parous	7.00	38.90	
	143	28.08.14	2	4	*M. nat*	F	Juvenile	Non-parous	7.30	38.20	
36	144	09.09.14	2	5	*M. bec*	F	Juvenile	Non-parous	8.50	40.09	Ringed H5933: Radio-tagged 173.7500
	145	09.09.14	2	5	*P. pip*	F	Adult	N/A	5.20	32.50	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	146	09.09.14	2	5	*P. aur*	M	Juvenile	N/A	7.40	37.10	
	147	09.09.14	2	6	*P. aur*	M	Juvenile	N/A	7.70	37.90	
	148	09.09.14	2	6	*P. aur*	M	Adult	N/A	8.40	36.60	Black Epid.
	149	09.09.14	2	6	*P. pyg*	M	Adult	N/A	4.50	31.30	
37	150	09.09.14	2	5	*M. nat*	F	Juvenile	N/A	8.20	38.90	Ringed H5929: Radio-tagged 173.8610
	151	09.09.14	2	6	*P. aur*	M	Adult	N/A	7.40	38.00	H1132
	152	09.09.14	2	6	*P. aur*	N/A	N/A	N/A	N/A	N/A	released Immediately on welfare due to weather
	153	10.09.14	2	11	*M. nat*	F	Immature	Non-parous	6.50	38.50	
	154	10.09.14	2	10	*M. nat*	F	Immature	Non-parous	7.50	40.50	
	155	10.09.14	2	10	*M. nat*	F	Immature	Non-parous	6.50	40.60	
	156	10.09.14	2	10	*M. nat*	M	Immature	N/A	7.00	38.50	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
45	157	10.09.14	2	11	*M. dau*	F	Immature	Non-parous	8.00	38.00	Ringed H5935; Radio-tagged 173.2425
	158	10.09.14	2	11	*M. nat*	F	Immature	Non-parous	7.00	39.00	
46	159	10.09.14	2	11	*M. nat*	F	Immature	Non-parous	8.00	39.28	Ringed H5934; Radio-tagged 173.4319
	160	10.09.14	2	11	*P. aur*	F	Immature	Non-parous	7.00	40.13	
	161	12.09.14	2	2	*P. aur*	F	Immature	Non-parous	7.50	38.16	
	162	12.09.14	2	2	*P. aur*	M	Immature	N/A	7.50	39.24	
	163	12.09.14	2	2	*P. aur*	M	Adult	N/A	8.50	37.31	
	164	12.09.14	2	1	*M. nat*	M	Immature	N/A	7.50	37.62	
	165	12.09.14	2	1	*M. nat*	M	Adult	N/A	7.50	39.31	
	166	12.09.14	2	2	*P. aur*	F	Juvenile	Non-parous	6.50	36.22	
	167	12.09.14	2	2	*P. pip*	F	Immat	Non-	4.50	30.99	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
							ure	parous			
	168	12.09.14	2	5	*M. nat*	F	Juvenile	Non-parous	7.50	38.51	Healthy
	169	12.09.14	2	5	*P. pip*	M	Adult	N/A	4.50	30.02	Hole in left wing
	170	12.09.14	2	4	*M. nat*	M	Juvenile	N/A	6.60	37.60	
	171	12.09.14	2	4	*P. aur*	M	Adult	N/A	8.30	37.80	Black Epid.
	172	12.09.14	2	4	*M. nat*	F	Adult	Parous	8.20	37.30	
	173	12.09.14	2	4	*P. pip*	M	Adult	N/A	4.80	31.80	
	174	12.09.14	2	4	*M. nat*	M	Juvenile	Non-parous	8.10	38.70	H1106* possibly Juvenile - Juvenile very advanced
	175	12.09.14	2	5	*P. pyg*	F	Juvenile	Non-parous	4.80	32.00	possible Juvenile - Juvenile very advanced
	176	13.09.14	1	4	*M. nat*	F	Immature	N/A	8.00	38.77	Ring H1160
	177	13.09.14	1	4	*M. nat*	M	Juvenile	N/A	7.50	37.80	Ring H1107
	178	13.09.14	1	4	*P. aur*	F	Adult	Parous	8.00	39.67	Ring Z2560

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
47	179	13.09.14	1	4	*M. nat*	F	Adult	N/A	8.00	40.21	Ring H1148; Radio-tagged 173.4530
	180	13.09.14	1	4	*M. nat*	M	Immature	N/A	7.50	40.90	H1104
	181	13.09.14	1	4	*P. aur*	F	Adult	Non-parous	8.00	39.22	H1119 v stressed
	182	13.09.14	1	4	*P. aur*	M	Adult	N/A	7.50	38.02	H1180
	183	13.09.14	1	4	*P. pip*	M	Adult	N/A	5.50	31.99	
	184	13.09.14	1	4	*M. nat*	M	Immature	N/A	7.50	39.44	
	185	13.09.14	1	4	*P. pyg*	M	Immature	N/A	5.00	32.00	
	186	13.09.14	1	4	*P. pip*	M	Immature	N/A	5.00	31.00	
	187	13.09.14	1	4	*M. nat*	M	Adult	N/A	9.00	39.32	
	188	13.09.14	1	4	*P. pyg*	M	Immature	N/A	4.00	30.99	
	189	13.09.14	1	4	*P. aur*	M	Immature	N/A	7.00	38.33	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	190	13.09.14	1	4	*P. aur*	M	Adult	N/A	8.00	39.12	
	191	13.09.14	1	4	*P. aur*	M	Immature	N/A	7.50	38.02	
	192	13.09.14	1	4	*P. pip*	M	Immature	N/A	5.00	31.06	
	193	13.09.14	1	4	*M. nat*	M	Immature	N/A	7.00	39.44	
	194	13.09.14	1	4	*P. pyg*	M	Adult	N/A	5.00	30.55	
	195	13.09.14	1	4	*M. dau*	M	Immature	N/A	8.00	38.31	
	196	14.09.14	2	10	*M. bec*	F	Juvenile	Non-parous	7.50	42.11	Ringed H5901
	197	14.09.14	2	10	*M. bec*	F	Adult	Post Lactating	8.50	40.37	Ringed H5907
	198	14.09.14	2	10	*M. bec*	M	Juvenile	N/A	7.50	40.83	Ringed H5902
50	199	14.09.14	2	10	*M. bec*	F	Adult	Post Lactating	9.00	41.15	Ringed H5906; Radio tagged 173.2669
49	200	14.09.14	2	10	*M. bec*	F	Adult	Post	9.00	43.42	Ringed H5905; Radio tagged 173.9445

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
								Lactating			
	201	14.09.14	2	10	*M. bec*	F	Adult	Non bred	10.00	42.95	Ringed H5912
	202	14.09.14	2	10	*M. bec*	F	Adult	Post Lactating	9.00	40.92	Ringed H5911
	203	14.09.14	2	10	*M. bec*	F	Adult	Post Lactating	9.00	42.67	Ringed H5910
51	204	14.09.14	2	10	*M. bec*	F	Adult	Post Lactating	9.50	41.72	Ringed H5904; Radio tagged 173.3509
	205	14.09.14	2	10	*M. bec*	F	Juvenile	Non-parous	7.50	41.49	Ringed H5909
	206	14.09.14	2	10	*M. bec*	F	Adult	Non-parous	10.00	43.41	Ringed H5908
	207	14.09.14	1	8	*P. pyg*	M	Adult	N/A	5.00	31.77	
	208	14.09.14	1	8	*P. aur*	M	Adult	N/A	7.00	39.01	
	209	14.09.14	1	8	*P. pyg*	M	Adult	N/A	5.00	30.98	
	210	14.09.14	1	8	*P. pyg*	M	Adult	N/A	5.50	32.01	
	211	14.09.14	1	8	*P. pyg*	M	Adult	N/A	5.50	31.96	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	212	14.09.14	1	8	*P. pyg*	F	Juvenile	Non-parous	6.00	32.21	
	213	14.09.14	1	8	*M. dau*	F	Juvenile	Non-parous	7.00	37.13	
	214	14.09.14	1	8	*P. aur*	M	Juvenile	N/A	7.50	39.08	
	215	14.09.14	1	8	*M. dau*	F	Juvenile	Non-parous	8.50	38.50	
	216	14.09.14	1	8	*P. pyg*	M	Juvenile	N/A	3.75	30.98	
	212	15.09.14	1	6	*M. dau*	F	Juvenile	Non-parous	7.75	36.12	
	213	15.09.14	1	6	*P. aur*	M	Juvenile	N/A	7.50	39.33	
	214	15.09.14	1	6	*M. dau*	F	Juvenile	Non-parous	8.50	38.50	
	215	15.09.14	1	6	*P. pyg*	M	Juvenile	N/A	4.75	30.98	
	216	15.09.14	1	6	*P. aur*	F	Juvenile	N/A	7.50	38.00	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	217	15.09.14	1	6	*P. pip*	M	Adult	N/A	5.00	31.20	
	218	15.09.14	1	6	*P.pyg*	F	Adult	N/A	5.00	31.50	
	219	15.09.14	1	6	*P. aur*	M	Adult	N/A	8.00	39.12	
	220	15.09.14	1	6	*P. pip*	M	Adult	N/A	5.00	32.00	
	221	15.09.14	1	6	*P. aur*	M	Adult	N/A	9.00	37.00	
	222	15.09.14	1	6	*P. pip*	M	Adult	N/A	4.70	31.30	
	223	15.09.14	1	6	*M. nat*	F	Juvenile	Non-parous	7.50	38.44	
	224	15.09.14	1	6	*M. nat*	F	Juvenile	Non-parous	8.00	38.20	
	225	15.09.14	1	6	*M. mys*	M	Juvenile	N/A	5.00	35.21	
	226	15.09.14	1	6	*P. aur*	F	Juvenile	N/A	7.50	38.48	
	227	15.09.14	1	6	*P. aur*	M	Immature	N/A	7.50	38.94	
	228	15.09.14	1	6	*P. pyg*	M	Adult	N/A	5.00	31.10	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	229	15.09.14	1	6	*N. noc*	F	Immature	Non-parous	30.00	53.33	
	230	15.09.14	1	6	*P. aur*	M	Adult	N/A	8.00	37.82	
	231	15.09.14	1	6	*M. dau*	M	Juvenile	N/A	9.00	37.97	
	232	15.09.14	1	6	*M. mys*	M	Juvenile	N/A	5.50	34.60	
	233	15.09.14	1	7	*P. aur*	F	Juvenile	N/A	7.50	38.48	
	234	15.09.14	1	7	*P. pyg*	M	Adult	N/A	5.00	31.10	
	235	15.09.14	1	7	*P. pyg*	M	Adult	N/A	4.50	30.99	
	236	15.09.14	1	7	*P. pyg*	M	Adult	N/A	5.00	31.06	
	237	15.09.14	1	7	*P. pyg*	M	Adult	N/A	5.00	32.03	
	238	15.09.14	1	7	*P. pyg*	M	Adult	N/A	5.00	31.75	
51	239	15.09.14	1	8	*M. dau*	F	Adult	Post Lactating	10.75	39.05	Ringed H5913; Radio-tagged 173.9730
52	240	3.10.14	1	4	*P. aur*	F	Immat	Non-	8.50	39.44	Ring H1124; Radio-tagged 173.3129

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
							ure	parous			
53	241	3.10.14	1	4	*M. nat*	F	Immature	Non-parous	8.00	40.07	Ring H1181; Radio-tagged 173.2340
	242	3.10.14	1	4	*P. aur*	M	Adult	N/A	8.50	38.51	Ring H1122
	243	3.10.14	1	4	*P. aur*	M	Adult	N/A	8.00	38.00	Ring A8243
	244	3.10.14	1	4	*P. aur*	M	Immature	N/A	7.50	38.47	Ring H1143
	245	3.10.14	1	4	*P. aur*	M	Immature	N/A	8.50	38.87	
	246	3.10.14	1	4	*M. nat*	M	Adult	N/A	9.00	40.03	
	247	3.10.14	1	4	*M.nat*	F	Immature	N/A	8.00	40.34	
	248	3.10.14	1	4	*P. aur*	F	Immature	N/A	7.50	39.00	
	249	3.10.14	1	4	*P. pyg*	M	Adult	N/A	5.50	31.00	
	250	3.10.14	1	4	*P. pyg*	F	Immature	N/A	5.00	31.20	
	251	3.10.14	1	4	*P. pyg*	M	Adult	N/A	5.50	31.06	

Radio-tagged bat number	Sequential Bat Number	Date	Tranche	Location	Species	Sex	Age	Breeding Status	Weight	Forearm	Notes
	252	3.10.14	1	4	*P. pyg*	M	Immature	N/A	5.00	31.99	
	253	3.10.14	1	4	*P. pyg*	M	Immature	N/A	5.50	30.87	
	254	3.10.14	1	4	*P. pyg*	M	Adult	N/A	6.00	31.22	
	255	5.10.14	1	6	*P. aur*	M	Immature	N/A	8.50	39.22	
	256	5.10.14	1	6	*P. aur*	F	Immature	N/A	9.00	38.08	
	257	5.10.14	1	6	*P. aur*	M	Immature	N/A	8.00	39.23	

Annex 8

Table 22 : Radio-tracking data for each individual animal, including home range data

Bat	Date Caught	No of nights radio-tracked	100% MCP(ha)	95% KDE (ha)	50% KDE (ha)
1	29/04/2014	3	144.3414	177.802	16.7505
2	29/04/2014	3	2.825536	N/A	2.26763
3	30/04/2014	3	95.57072	48.9636	4.7441
4	14/05/2014	3	169.0328	47.1189	6.56492
5	15/05/2014	4	348.1525	120.125	9.43217
6	15/05/2014	5	240.8271	47.2117	1.24501
7	16/05/2014	3	13.24606	N/A	7.48704
8	16/05/2014	5	41.50936	5.56492	0.07691
9	16/05/2014	2	8.2971	N/A	N/A
10	16/05/2014	1	6.76055	N/A	0.91927
11	18/05/2014	3	106.219	68.1426	4.99225
12	18/05/2014	n/a	n/a	n/a	n/a
13	02/06/2014	3	376.0762	N/A	N/A
14	03/06/2014	2	46.8851	N/A	N/A
15	03/06/2014	5	449.1601	97.5765	2.91657
16	03/06/2014	3	25.04425	N/A	12.6517
17	04/06/2014	4	484.4815	264.512	23.2664
18	07/06/2014	3	4.184294	N/A	N/A
19	07/06/2014	3	66.94226	72.3254	8.35929
20	07/06/2014	3	7.00085	N/A	9.18084
21	07/06/2014	3	5.604465	N/A	N/A

Bat	Date Caught	No of nights radio-tracked	100% MCP(ha)	95% KDE (ha)	50% KDE (ha)
22	07/06/2014	3	123.853	66.7006	5.78317
23	07/06/2014	3	14.37545	N/A	2.212
24	29/07/2014	2	70.57069	71.4698	8.15033
25	29/07/2014	9	826.8172	157.431	8.26424
26	29/07/2014	8	393.0098	72.4191	1.95378
27	29/07/2014	8	155.6076	58.5997	5.32989
28	29/07/2014	6	314.1937	124.301	10.4843
29	31/07/2014	3	54.53124	15.9722	1.38213
30	03/08/2014	4	447.1852	108.212	4.12096
31	03/08/2014	n/a	N/A	N/A	N/A
32	03/08/2014	3	38.80188	34.6959	3.2328
33	26/08/2014	5	124.1978	50.9696	8.33545
34	26/08/2014	4	126.9222	8.58401	0.27296
35	26/08/2014	7	994.8625	208.98	5.83602
36	09/09/2014	6	554.3701	67.6653	3.33238
37	09/09/2014	4	31.3474	N/A	27.188
38	08/09/2014	3	16.39345	N/A	5.90925
39	08/09/2014	0	N/A	N/A	N/A
40	08/09/2014	1	3.928842	N/A	N/A
41	08/09/2014	3	1.1137	N/A	N/A
42	08/09/2014	0	N/A	N/A	N/A
43	08/09/2014	5	24.13412	2.85403	0.19234
44	08/09/2014	9	226.1304	133.609	24.6056

Bat	Date Caught	No of nights radio-tracked	100% MCP(ha)	95% KDE (ha)	50% KDE (ha)
45	10/09/2014	1	304.4015	1.85722	0.09399
46	13/09/2014	7	955.8338	220.751	18.9254
47	13/09/2014	4	153.1688	0	41.7569
48	14/09/2014	2	203.1289	99.9661	12.273
49	14/09/2014	4	779.8462	69.1544	5.50101
50	14/09/2014	4	176.921	174.279	9.31157
51	15/09/2014	n/a	111.2648	14.8558	0.5845
52	03/10/2014	4	148.6616	117.708	8.59417
53	03/10/2014	4	49.93306	28.7435	3.46185

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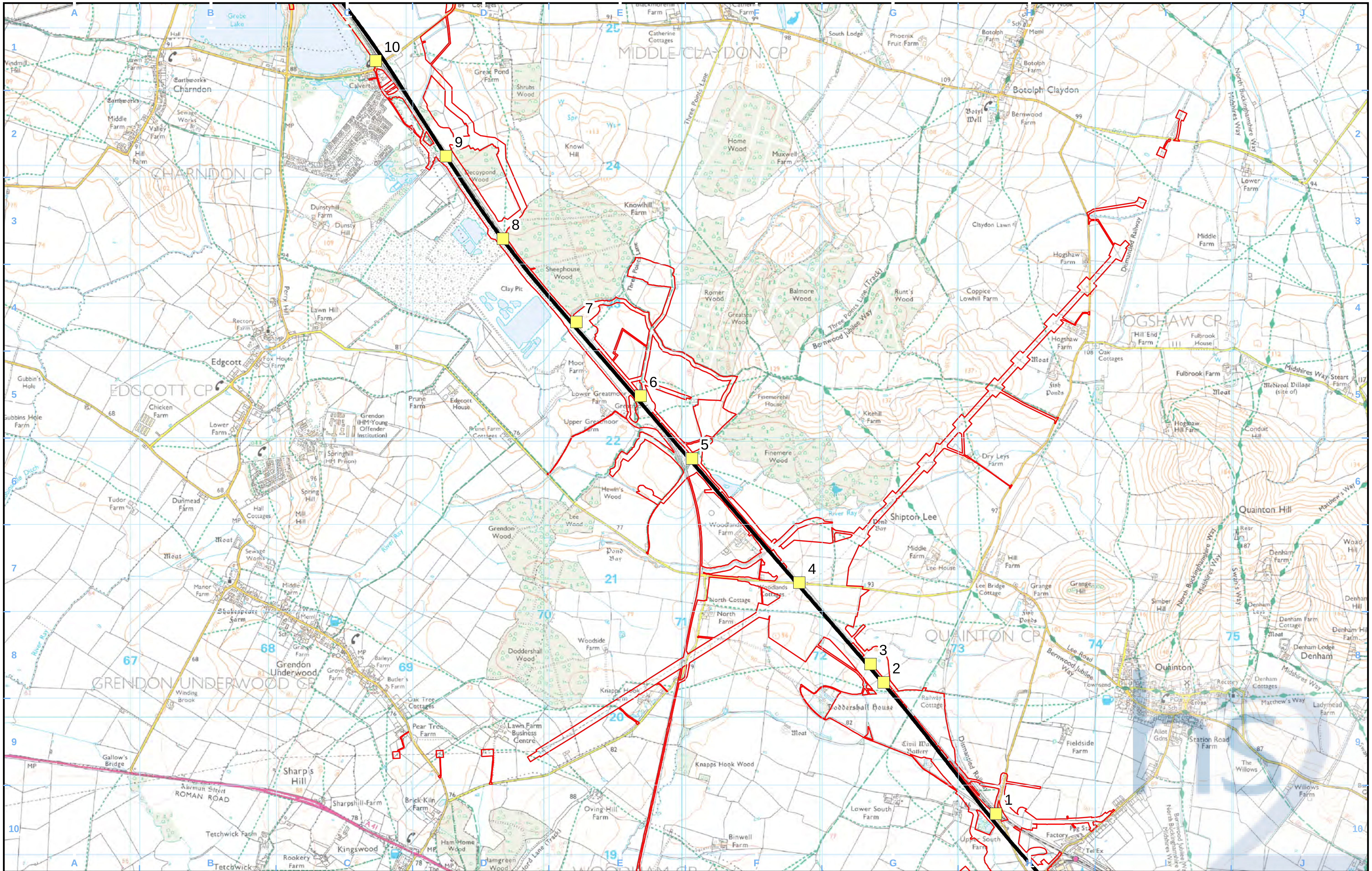
8 Figures



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Static detector

Map Number EC-22-005

Map Name Tranche 1 automated surveys 2014

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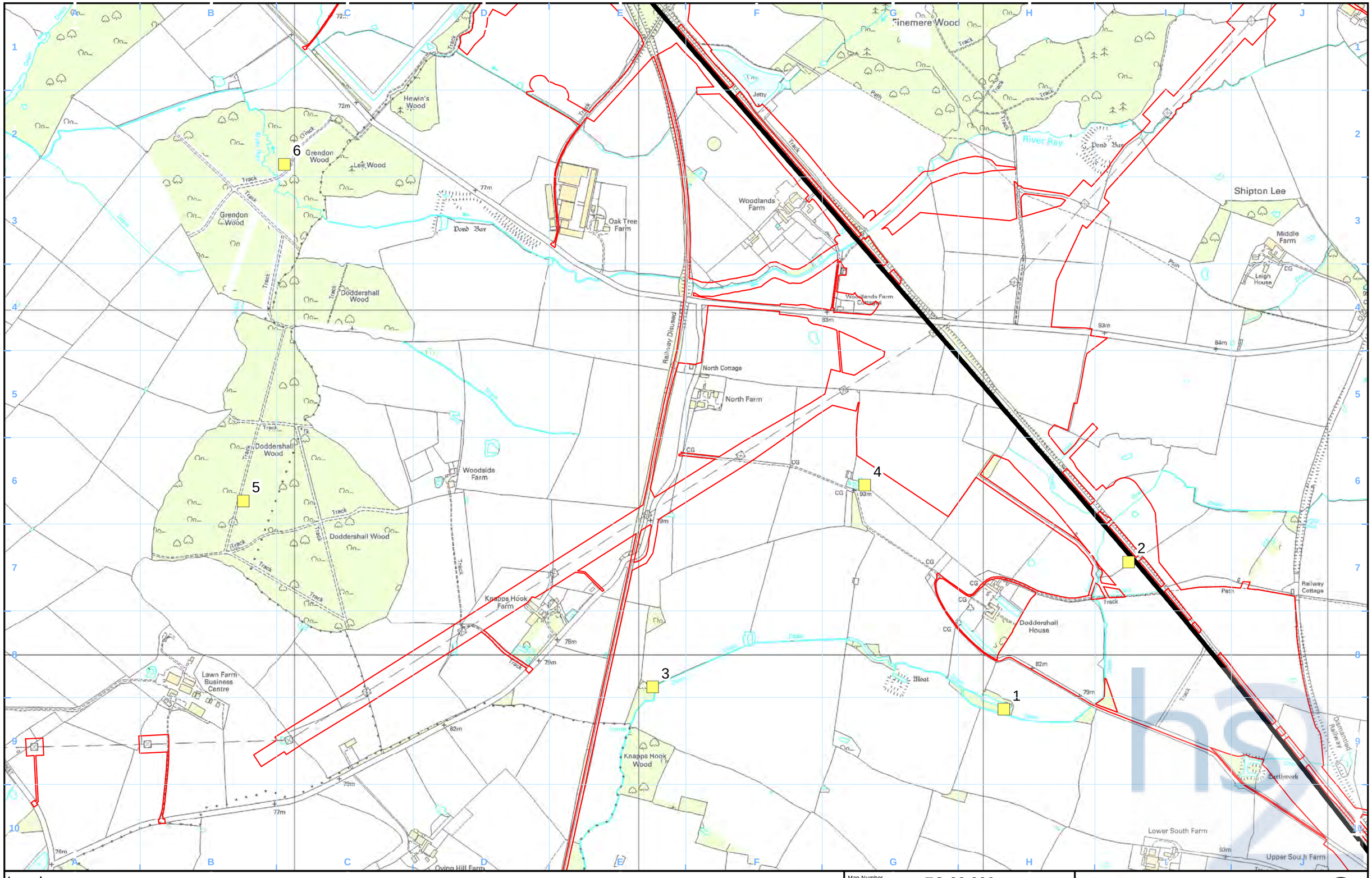

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Static detector

Map Number: EC-22-006

Map Name: Tranche 2 automated surveys 2014

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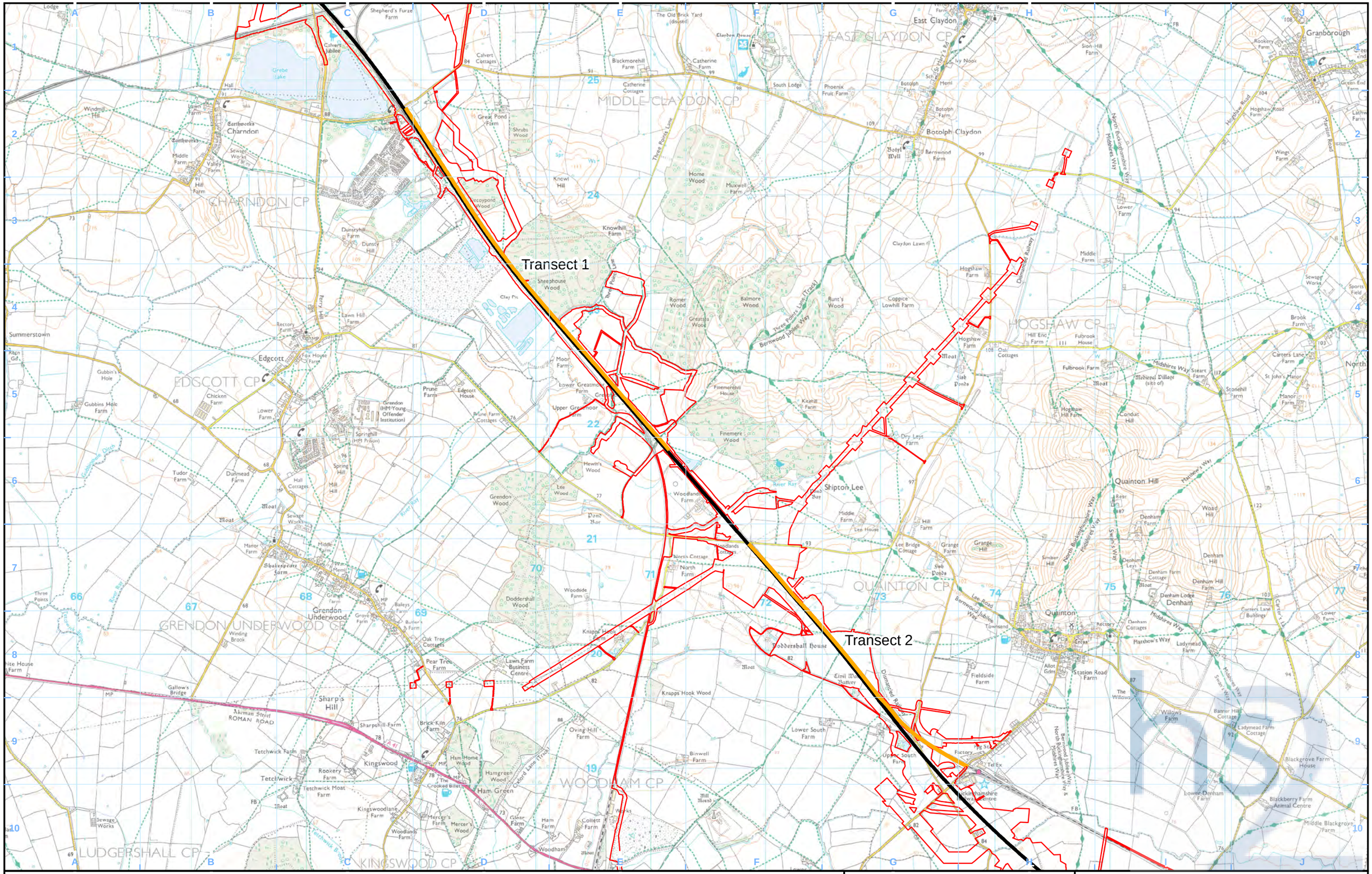

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Transect survey route

Map Number: EC-25-004

Map Name: Bat activity transect survey route 2014

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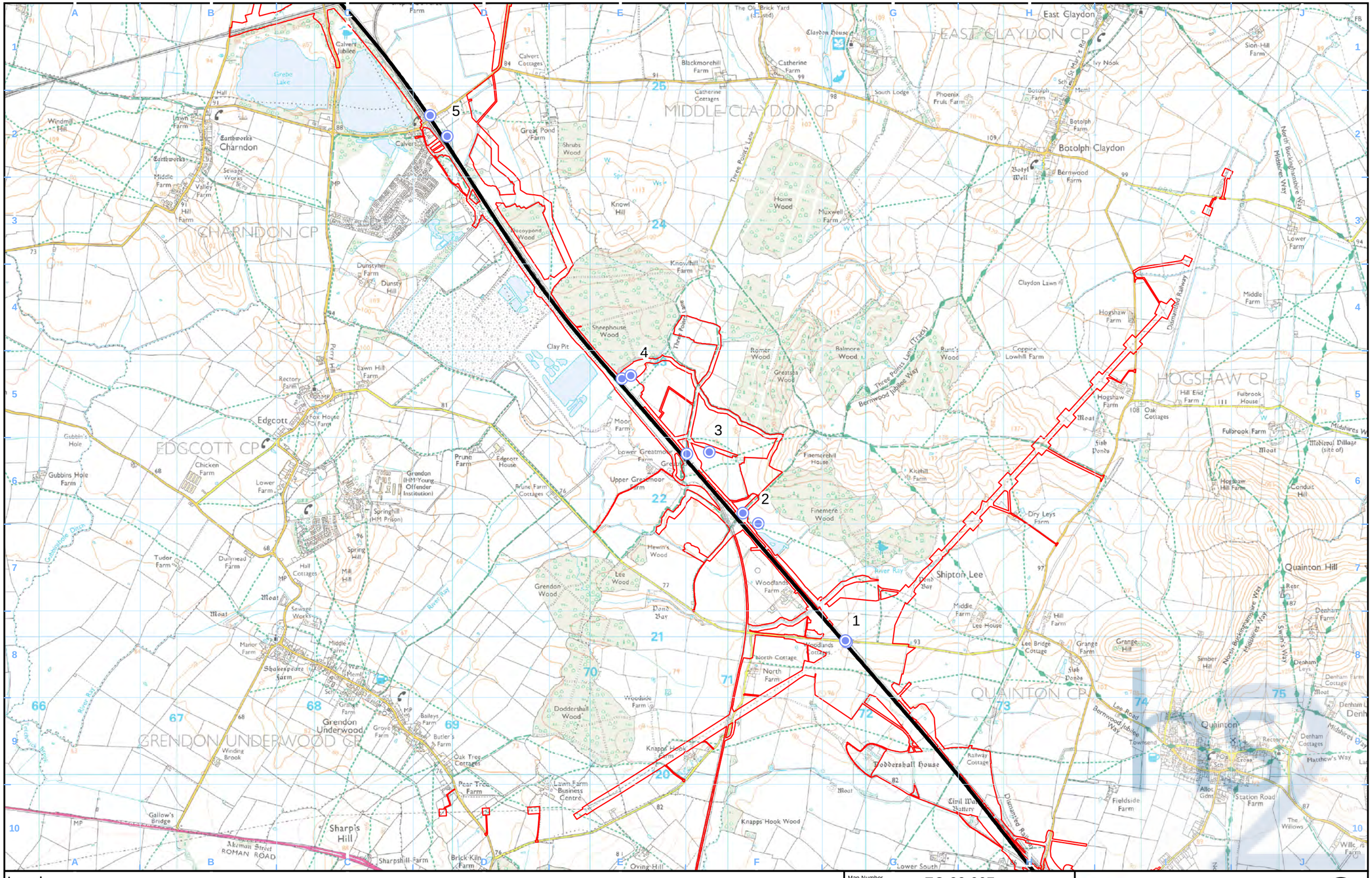

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Paired sampling location

Map Number: EC-22-007

Map Name: Paired sampling locations 2014

Scale at A3: 1:25,000

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Metres

Doc Number: C252-ETM-EV-MAP-020-003941-P01.00

Date: 03/02/15

Calvert Overbridge

Sheephouse Wood

Costello Underpass

Finemere hedgerow

Edgcott Road

CHARNDON CP

MIDDLE CLAYDON CP

EDGCOTT CP

QUAINTON CP

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Filming location

Map Number: EC-22-008

Map Name: Filming locations 2014

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Metres

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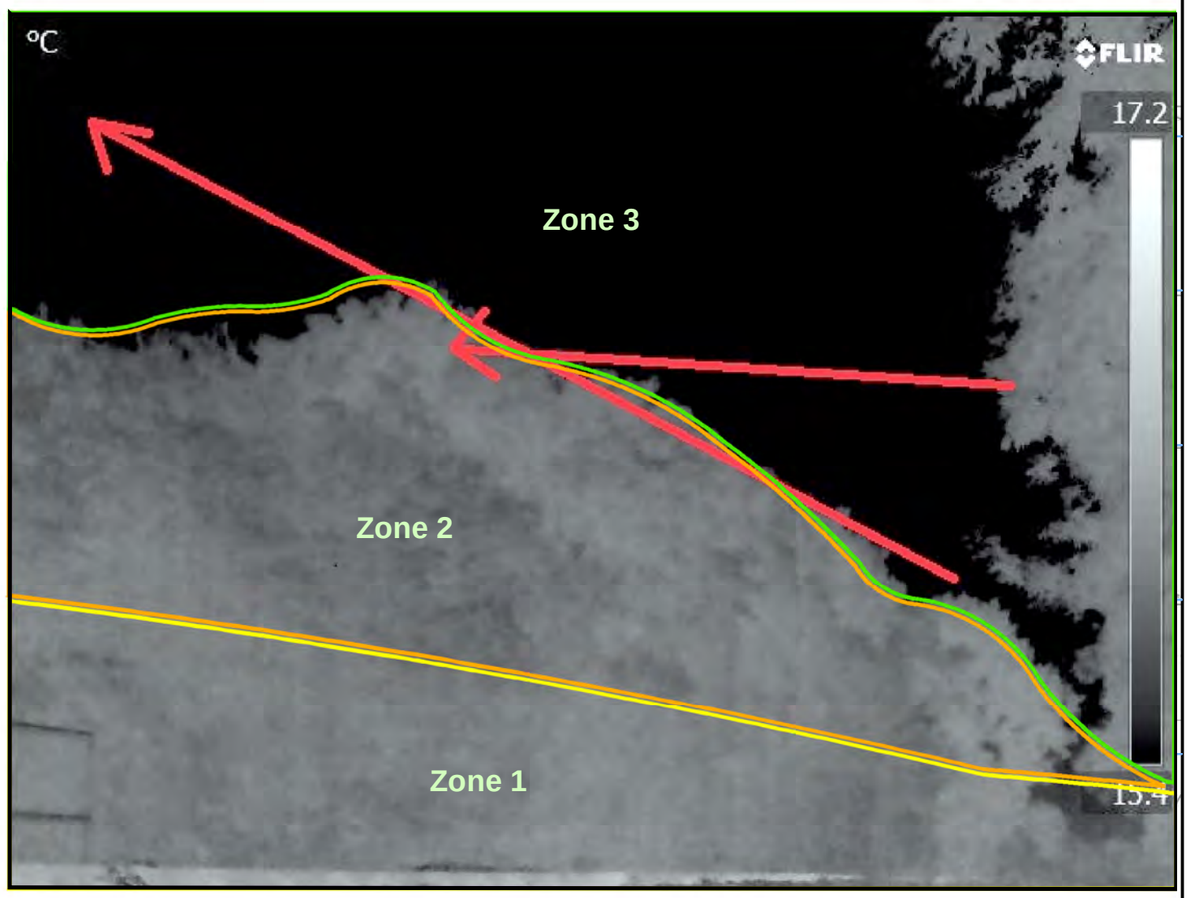

Edgcott Road Bridge south

Finemere Wood
River Ray
Woodlands Farm
Oak Tree Farm
Woodlands Farm Cottages
Railway Disused
North Cottage
North Farm
Jetty
Path
Track
Drain
CG
Doddershall House
Railway Cottage
Dismantled Railway
QUAINTON CP
Pavilion
Playing Field
Nursery
Townsend
Quainton
Windmill (dis)
Sch
Hall
Cross
Allot Gdns
Fieldside Farm
Station Farm
Knapps Hook
93m
84m
82m
79m
76m
87m
99m

Legend

Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Thermal Imaging location
- Thermal Imaging picture orientation

Thermal Image Legend
- Flightlines
- Zone 1: Ground level to mid-canopy
- Zone 2: Mid-canopy to tree top
- Zone 3: Above tree top

Map Number: EC-24-011

Map Name: Thermal Imaging flightlines at Edgcott Road overbridge south

Scale at A3: 1:10,000

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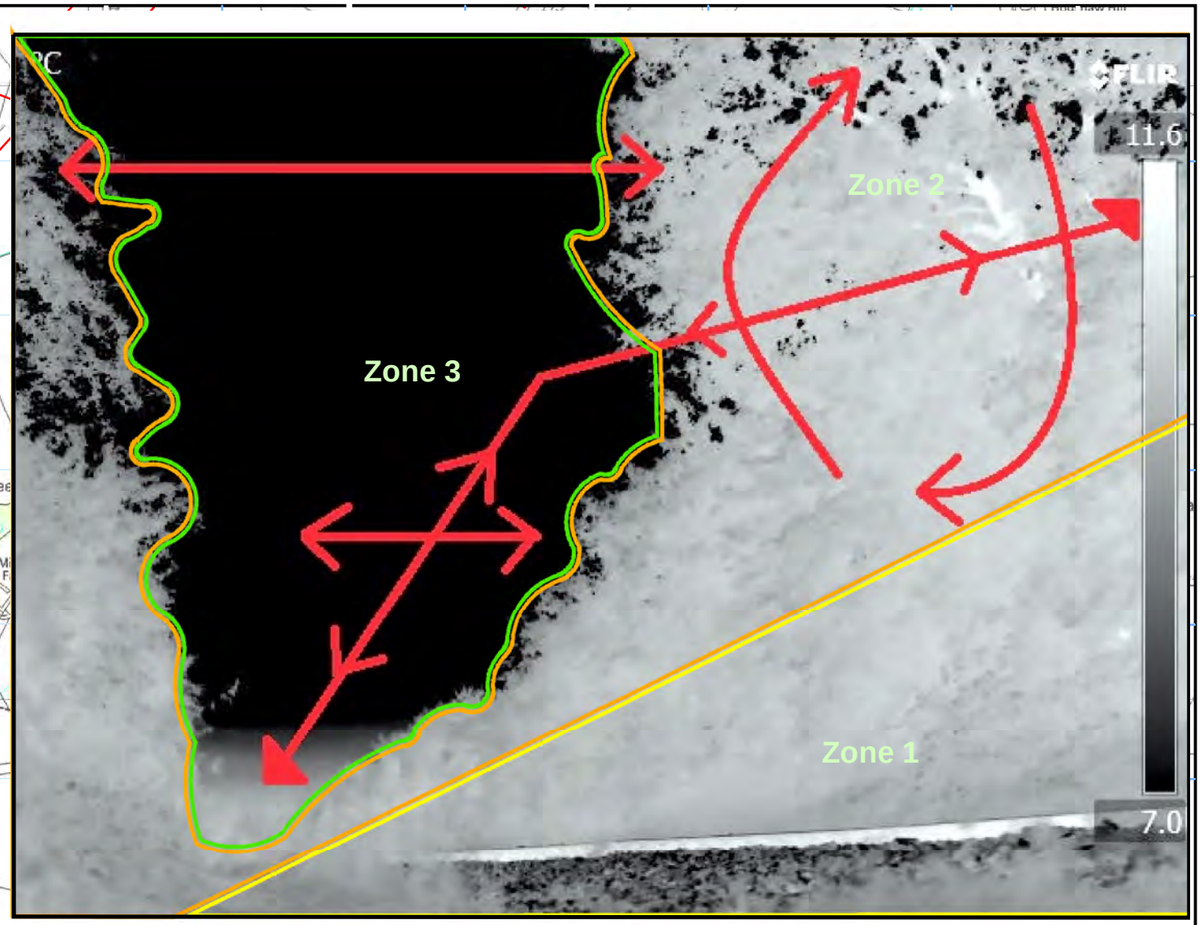

Edgcott Road Bridge north

Finemere Wood
Woodlands Farm
Oak Tree Farm
Shipton Lee
Leigh House
Woodlands Farm Cottages
North Cottage
North Farm
Railway Disused
Doddershall House
Railway Cottage
Earthwork
Dismantled Railway
QUAINTON CP
Pavilion
Playing Field
Nursery
Townsend
Quainton
Windmill (dis)
Sch
Hall
PO
PH
Allot Gdns
Fieldside Farm
Station Road Farm
Knapps Hook Wood

Legend

Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Thermal Imaging location
- Thermal Imaging picture orientation

Thermal Image Legend
- Flightlines
- Zone 1: Ground level to mid-canopy
- Zone 2: Mid-canopy to tree top
- Zone 3: Above tree top

Map Number: EC-24-010

Map Name: Thermal Imaging flightlines at Edgcott Road overbridge north

Scale at A3: 1:10,000

0 100 200 300 400 Metres

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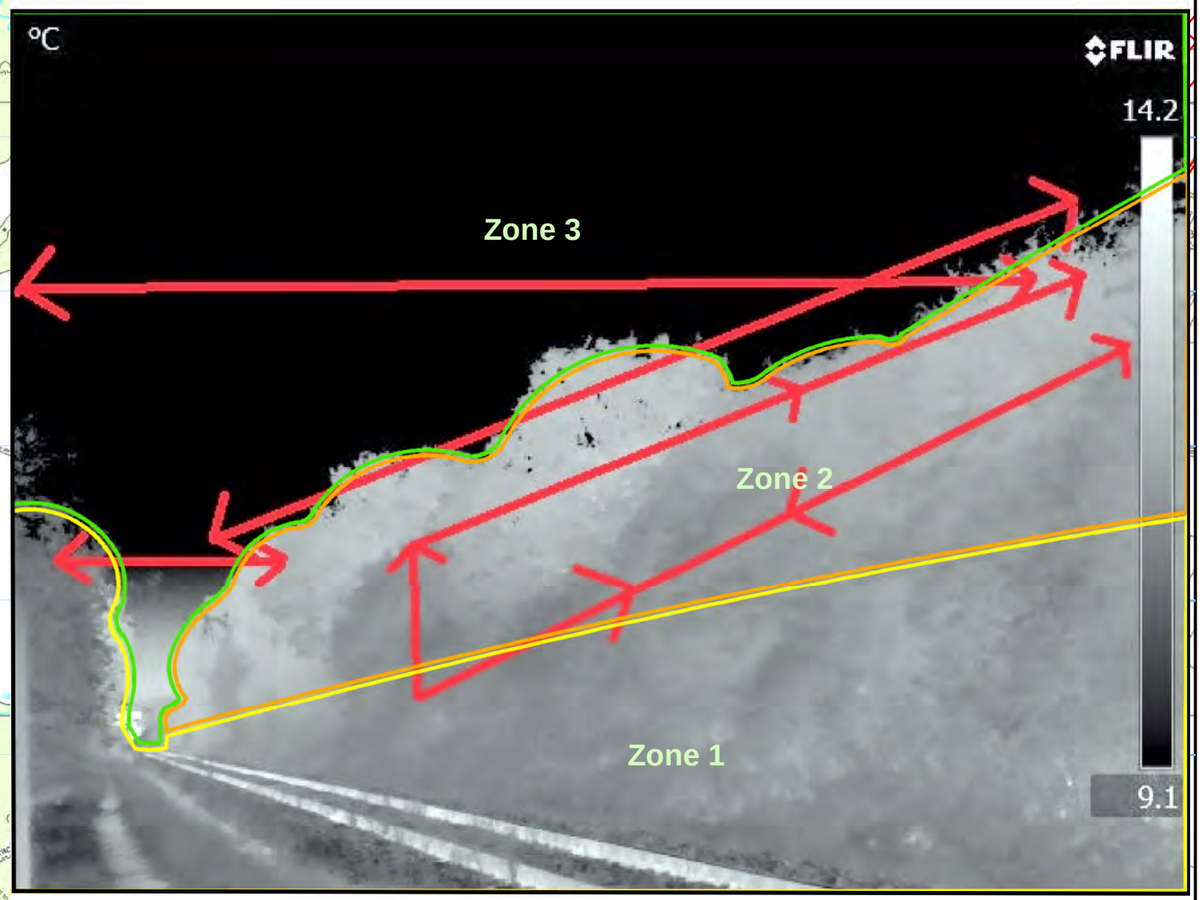

Bridleway QUA/36

Greatmoor
Upper Greatmoor Farm
Lower Greatmoor Farm
Clay Pit
Romer Wood
Greatsea Wood
Balmore Wood
Throg Points Land
Finemerehill House
Finemere Wood
Hewin's Wood
Grendon Wood
Lee Wood
Pond Bay
Oak Tree Farm
Woodlands Farm
Woodlands Farm Cottages
Doddershall Wood
Railway Disused
North Cottage
North Farm
Jetty
River Ray
Shipton Lee
Middle Farm
Leigh House
Hill Farm
Grange Farm
Fish Pond
Disused Railway
Path
Track
FB
CG
72m
79m
80m
85m
77m
83m
93m
84m
97m
99m

Legend

Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Thermal Imaging location
- Thermal Imaging picture orientation

Thermal Image Legend
- Flightlines
- Zone 1: Ground level to mid-canopy
- Zone 2: Mid-canopy to tree top
- Zone 3: Above tree top

Map Number: EC-24-012

Map Name: Thermal Imaging flightlines at Grendon Junction on Bridleway QUA/36

Scale at A3: 1:10,000

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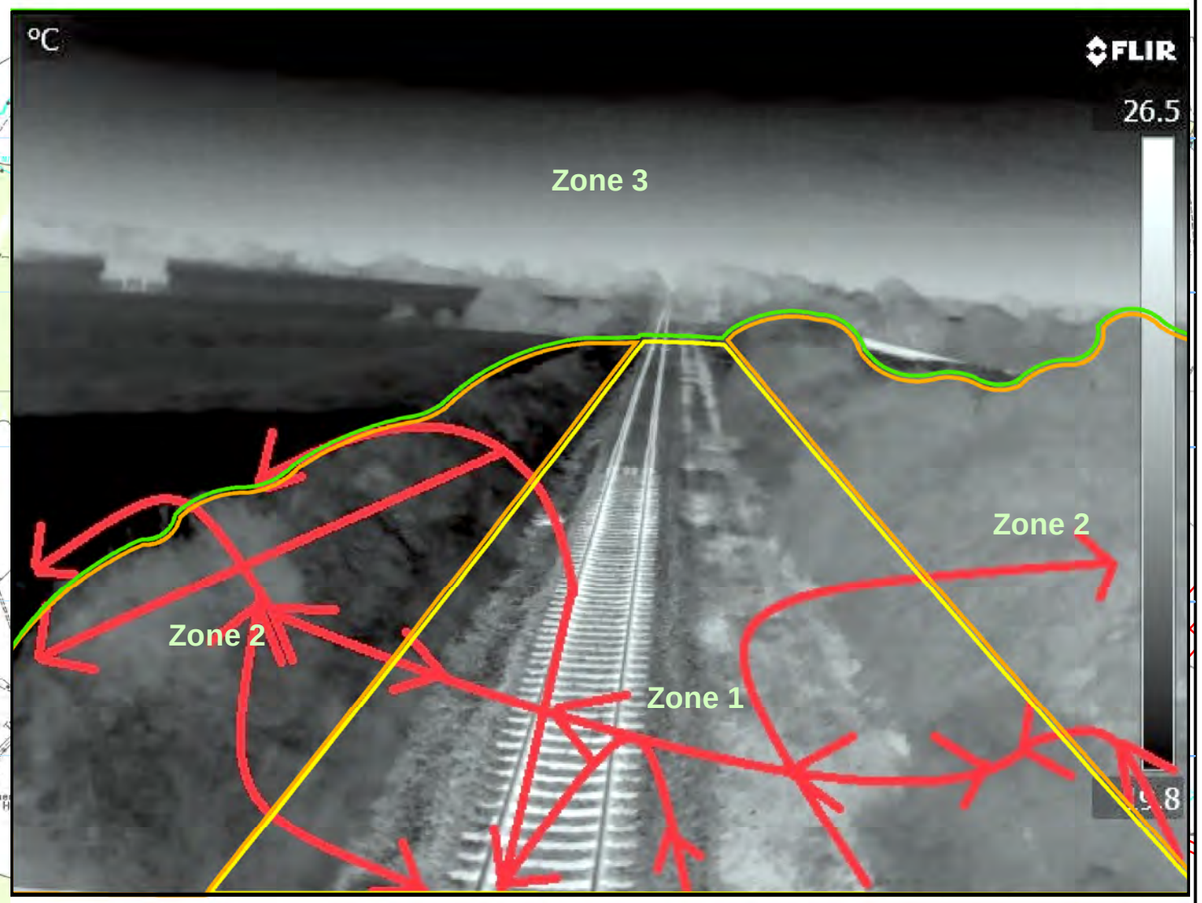

Bridleway GUN/28 south

Sheephouse Wood
Clay Pit
Greatmoor
Upper Greatmoor Farm
Lower Greatmoor Farm
Romer Wood
Greatsea Wood
Three Points Lane
Finemere Wood
Hewin's Wood
Grendon Wood
Lee Wood
Jetty
River Ray
Pond Bay
Woodlands Farm
Oak Tree Farm
Shipton Lee
Middle Farm
Dry Leys Farm
Dismantled Railway

Legend

Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Thermal Imaging location
- Thermal Imaging picture orientation

Thermal Image Legend
- Flightlines
- Zone 1: Ground level to mid-canopy
- Zone 2: Mid-canopy to tree top
- Zone 3: Above tree top

Map Number: EC-24-013

Map Name: Thermal Imaging flightlines at Benfield's overbridge (Bridleway GUN/28) south

Scale at A3: 1:10,000

0 100 200 300 400 Metres

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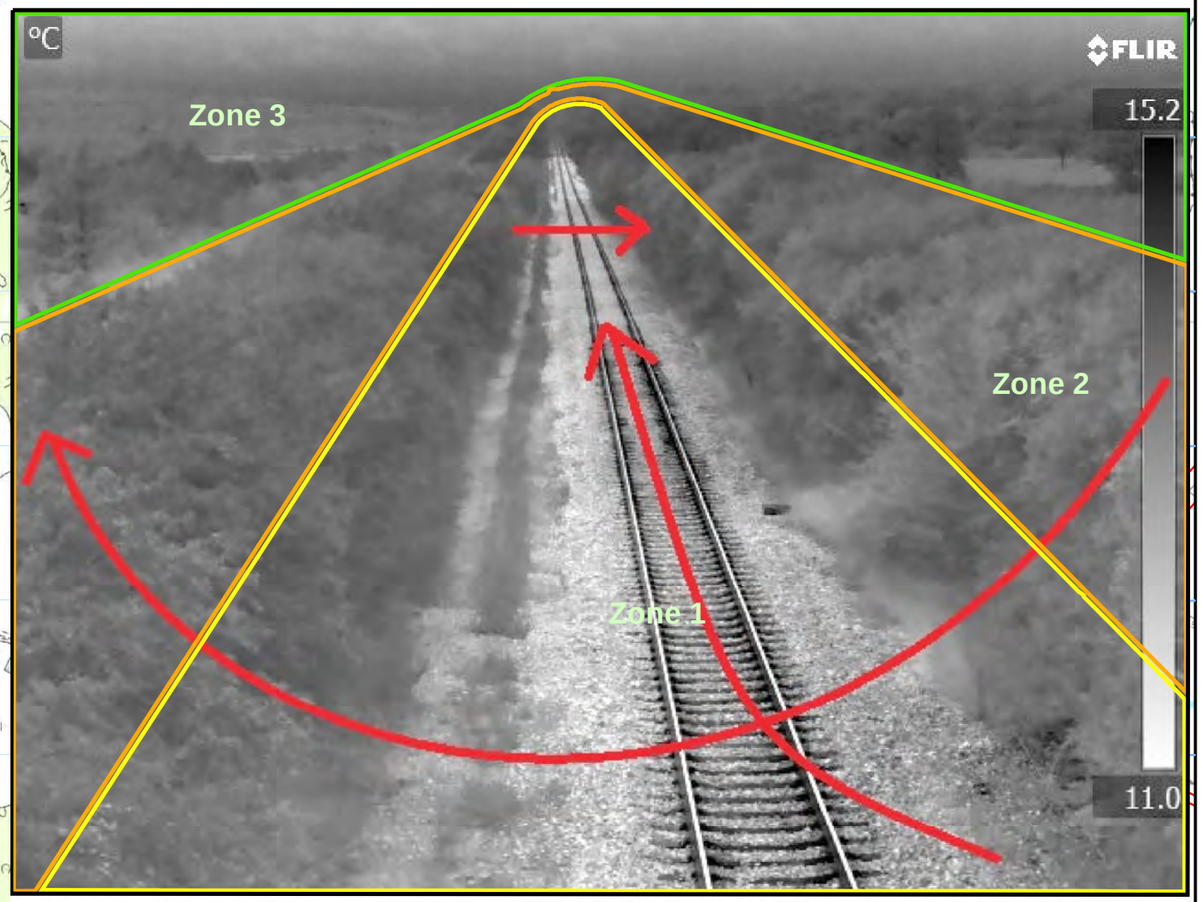

Bridleway GUN/28 north

Sheephouse Wood
Clay Pit
Romer Wood
Greatsea Wood
Three Points Lane
Greatmoor
Upper Greatmoor Farm
Lower Greatmoor Farm
Finemere Wood
Dry Leys Farm
Hewin's Wood
Grendon Wood
Lee Wood
Pond Bay
Woodlands Farm
Oak Tree Farm
Jetty
River Ray
Shipton Lee
Middle Farm
Leigh House
Hill Farm
Disused Railway
Doddershall

Legend

Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Thermal Imaging location
- Thermal Imaging picture orientation

Thermal Image Legend
- Flightlines
- Zone 1: Ground level to mid-canopy
- Zone 2: Mid-canopy to tree top
- Zone 3: Above tree top

Map Number: EC-24-014

Map Name: Thermal Imaging flightlines at Benfield's overbridge (Bridleway GUN/28) north

Scale at A3: 1:10,000

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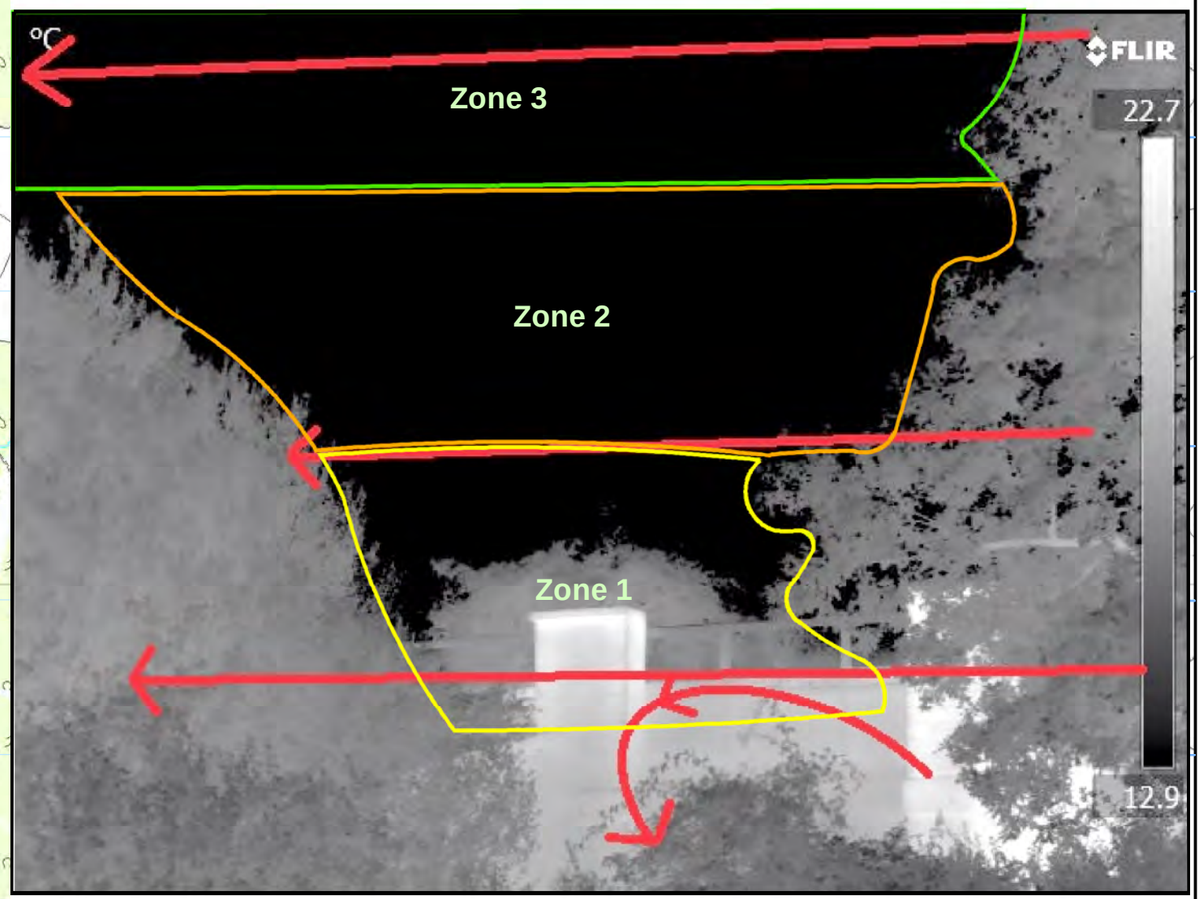

Muxwell Brook, the field south of Sheephouse Wood

Sheephouse Wood
Knowlhill Farm
Clay Pit
Romer Wood
Three Points Lane
Greatmoor
Upper Greatmoor Farm
Lower Greatmoor Farm
Finemere Wood
Finemerehill House
Jetty
Hewin's Wood
Dry Leys Farm
River Ray

Legend

Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Thermal Imaging location
- Thermal Imaging picture orientation

Thermal Image Legend
- Flightlines
- Zone 1: Ground level to mid-canopy
- Zone 2: Mid-canopy to tree top
- Zone 3: Above tree top

Map Number: EC-24-015

Map Name: Thermal Imaging flightlines at Costello underbridge

Scale at A3: 1:10,000

0 100 200 300 400 Metres

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Doc Number: C252-ETM-EV-MAP-020-003948-P01.00

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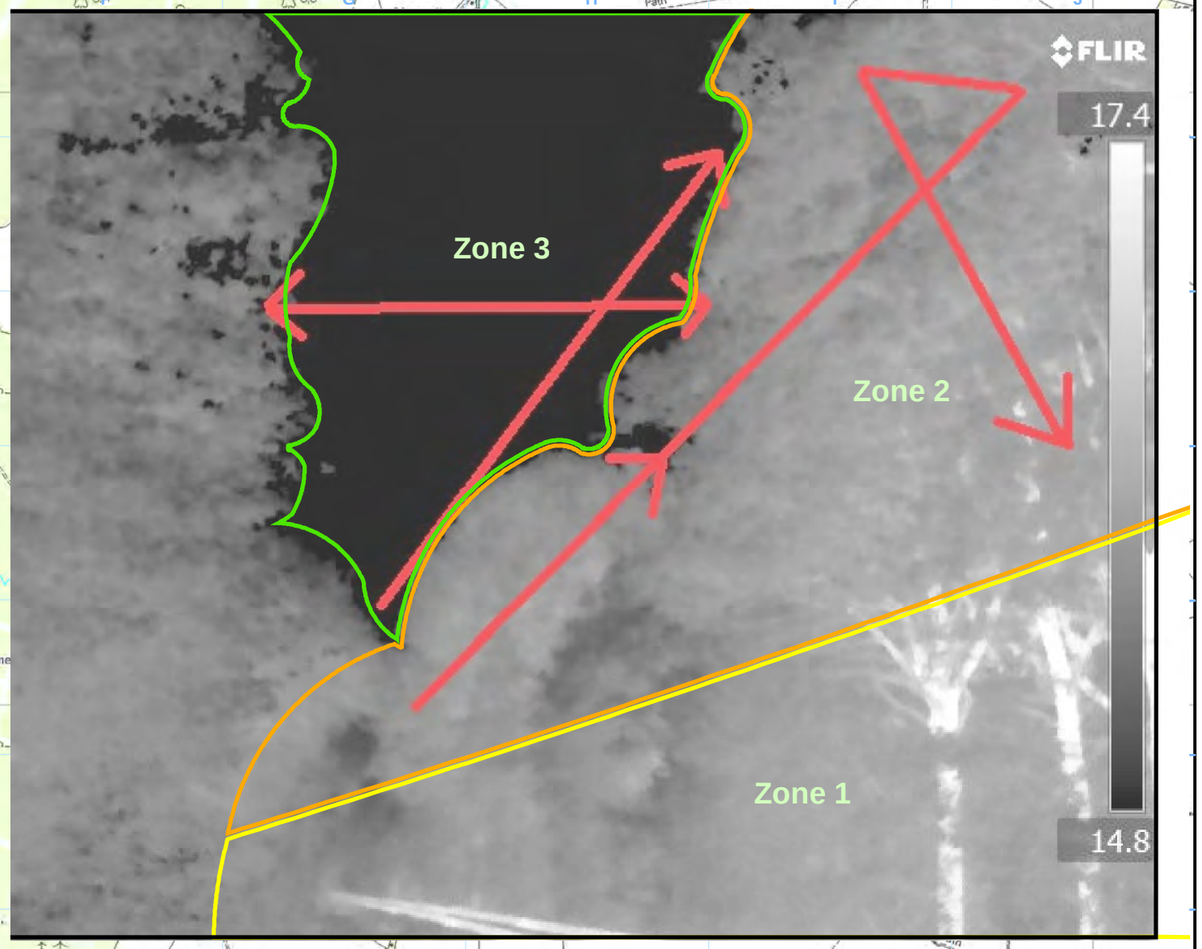

Sheephouse Wood Lineside south

Decoypond Wood
Sheephouse Wood
Knowlhill Farm
Clay Pit
El Sub Sta
Three Points Lane
Greatmoor
Edgcott House
Lower Greatmoor Farm
Upper Greatmoor Farm
Finemerehill House
Finemere Wood

Legend

Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Thermal Imaging location
- Thermal Imaging picture orientation

Thermal Image Legend
- Flightlines
- Zone 1: Ground level to mid-canopy
- Zone 2: Mid-canopy to tree top
- Zone 3: Above tree top

Map Number: EC-24-016

Map Name: Thermal Imaging flightlines at Sheephouse Wood Lineside south

Scale at A3: 1:10,000

0 100 200 300 400 Metres

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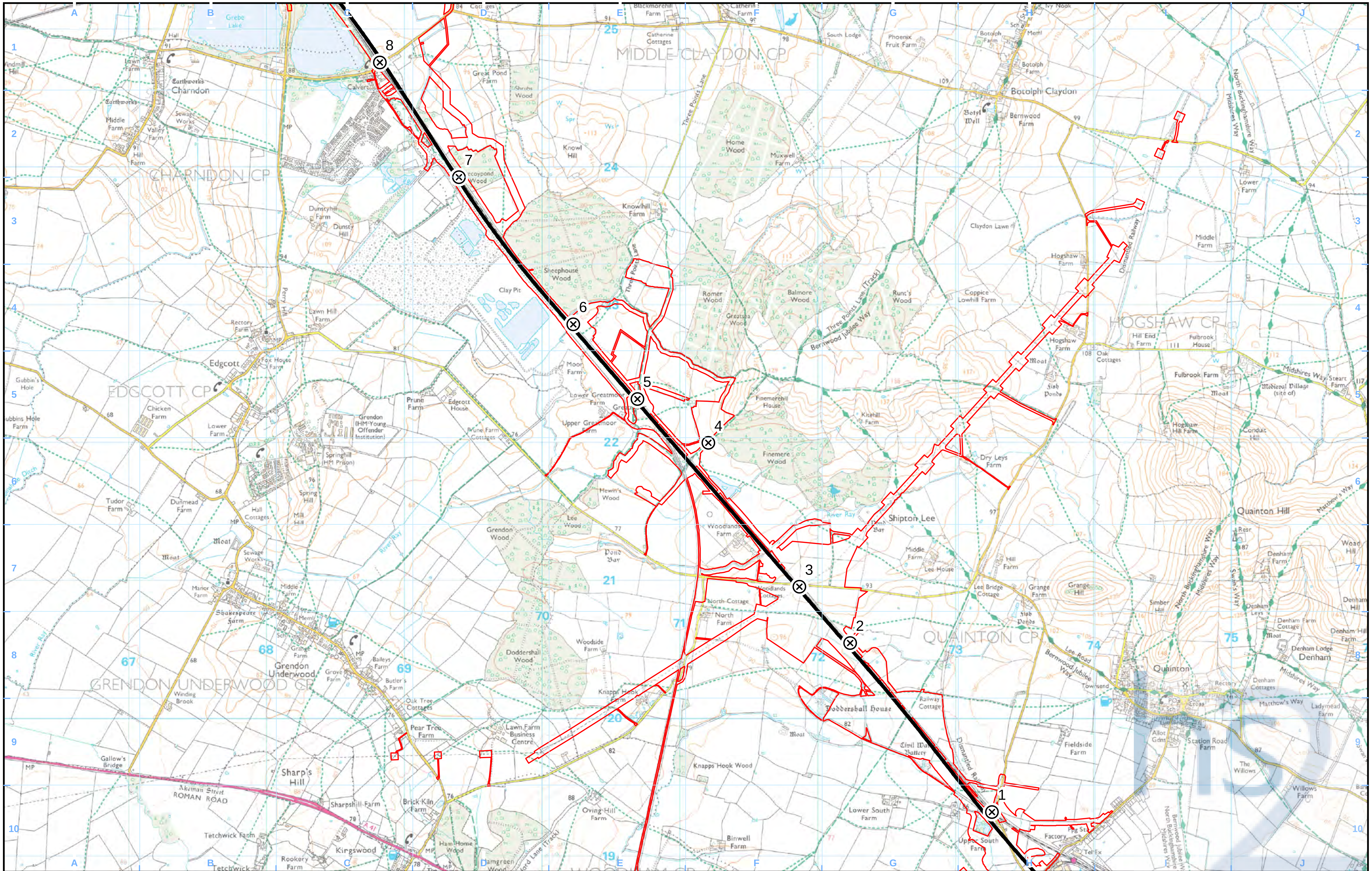
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003978-P01.00

Date: 04/02/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Trapping location

Map Number: EC-22-009

Map Name: Bat trapping locations April, May, June and July 2014

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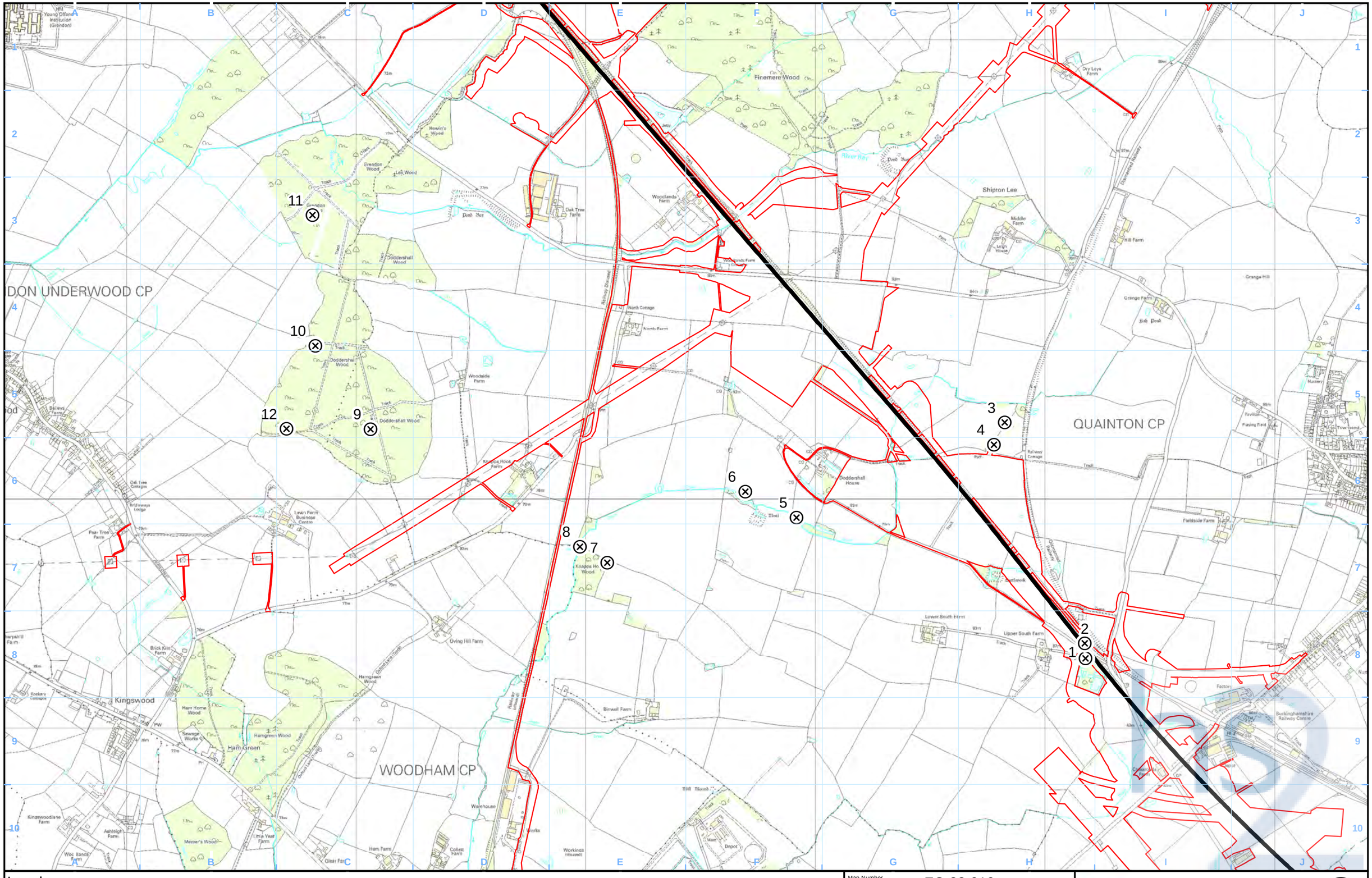
Doc Number: C252-ETM-EV-MAP-020-003943-P01.00

Date: 03/02/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

⊗ Trapping location

Map Number: EC-22-010

Map Name: Bat trapping locations August 2014

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Scale at A3: 1:15,000

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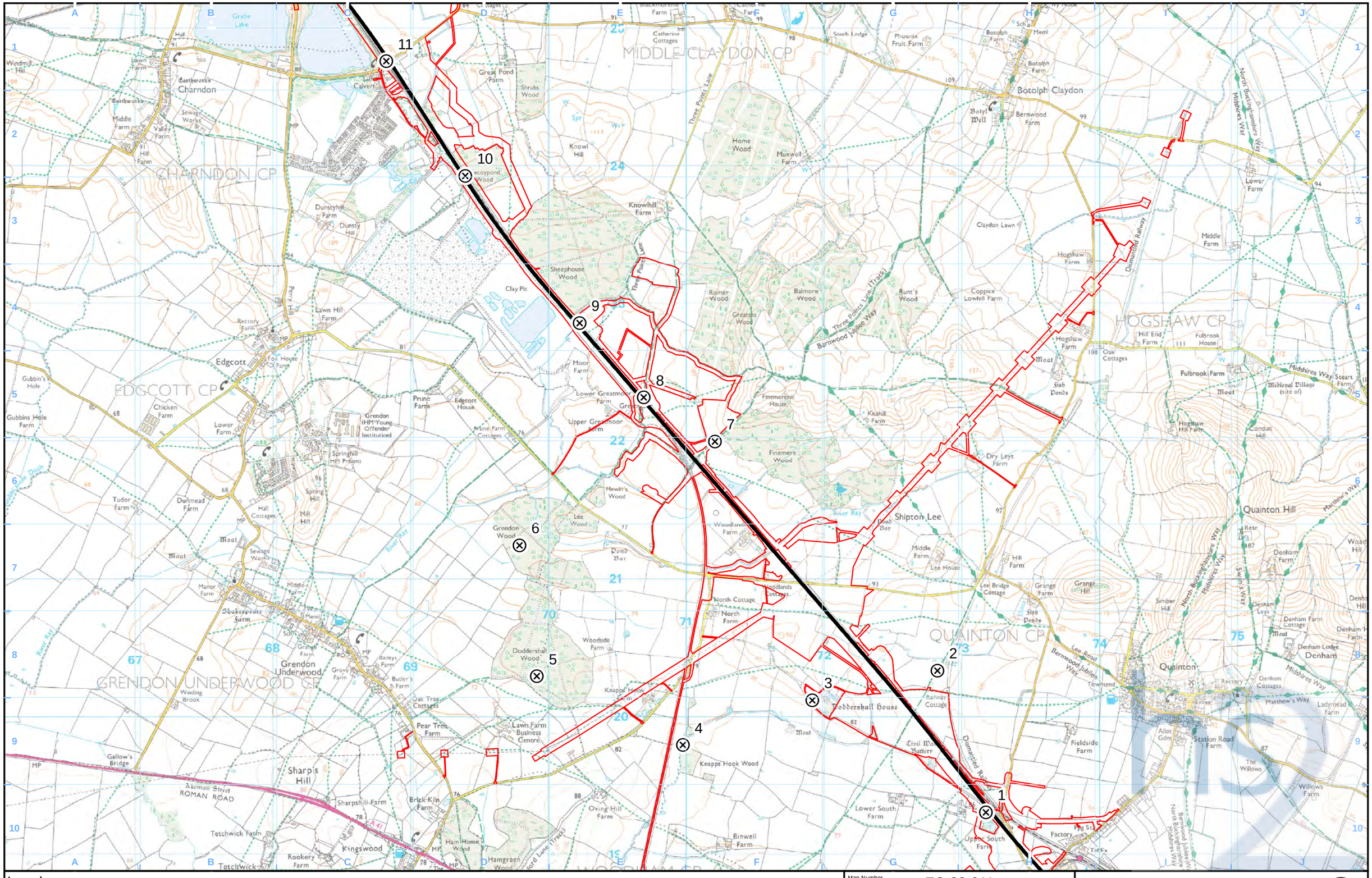
Metres

Doc Number: C252-ETM-EV-MAP-020-003944-P01.00

Date: 03/02/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

⊗ Trapping location

Map Number: EC-22-011

Map Name: Bat trapping locations September and October 2014

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

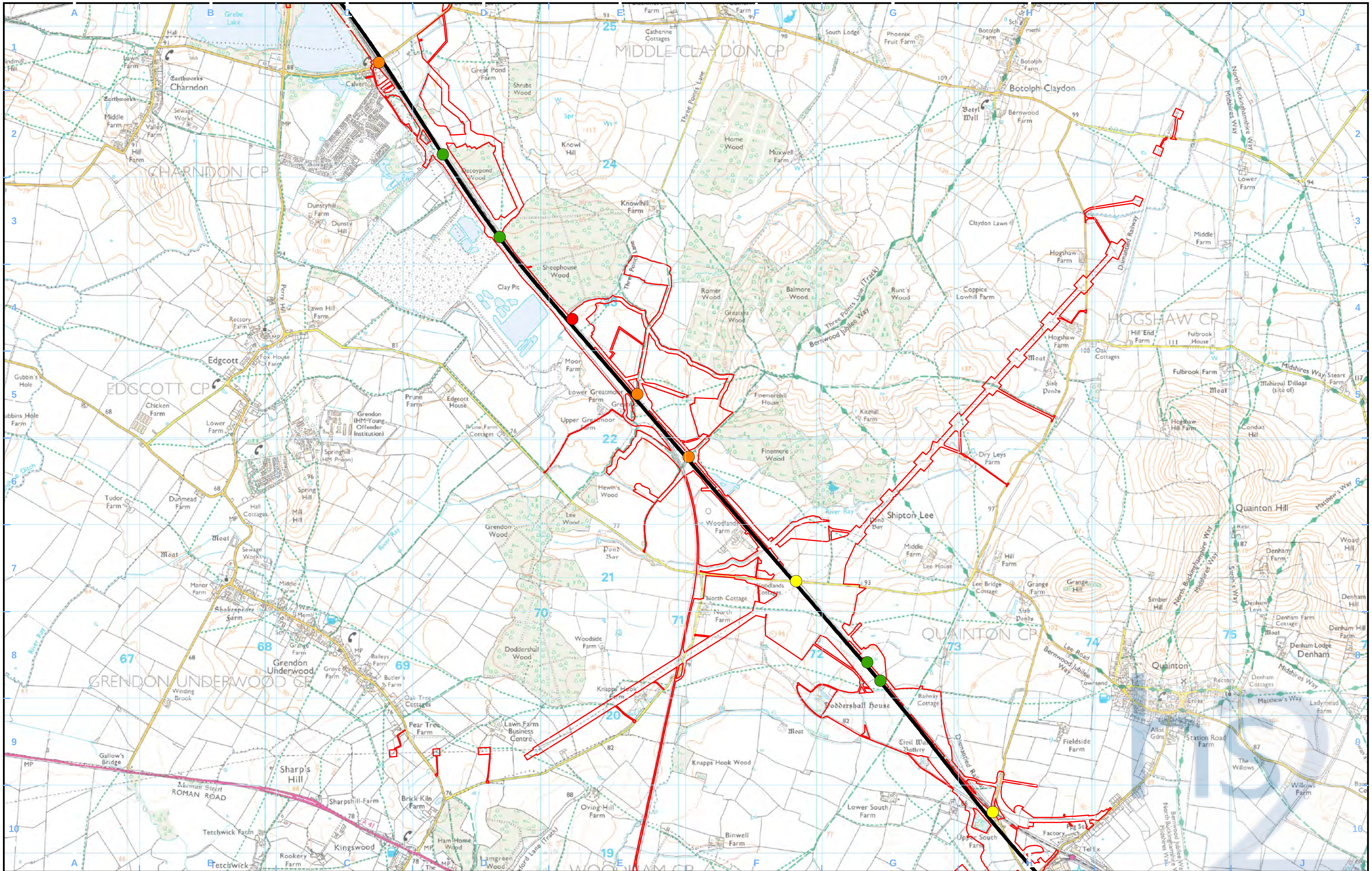
Scale at A3: 1:25,000

0 240 480 720 960

Metres

Doc Number: C252-ETM-EV-MAP-020-003945-P01.00

Date: 03/02/15



Legend

Route centreline

- Route in tunnel
- Route on surface
- Land potentially required during construction

Level of Activity

- Very low
- Low
- Moderate
- High
- Very high

Map Number: EC-22-015

Map Name: Bat activity intensity; automated survey Tranche 1 pre-maternity season 2014 (April - May)

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N

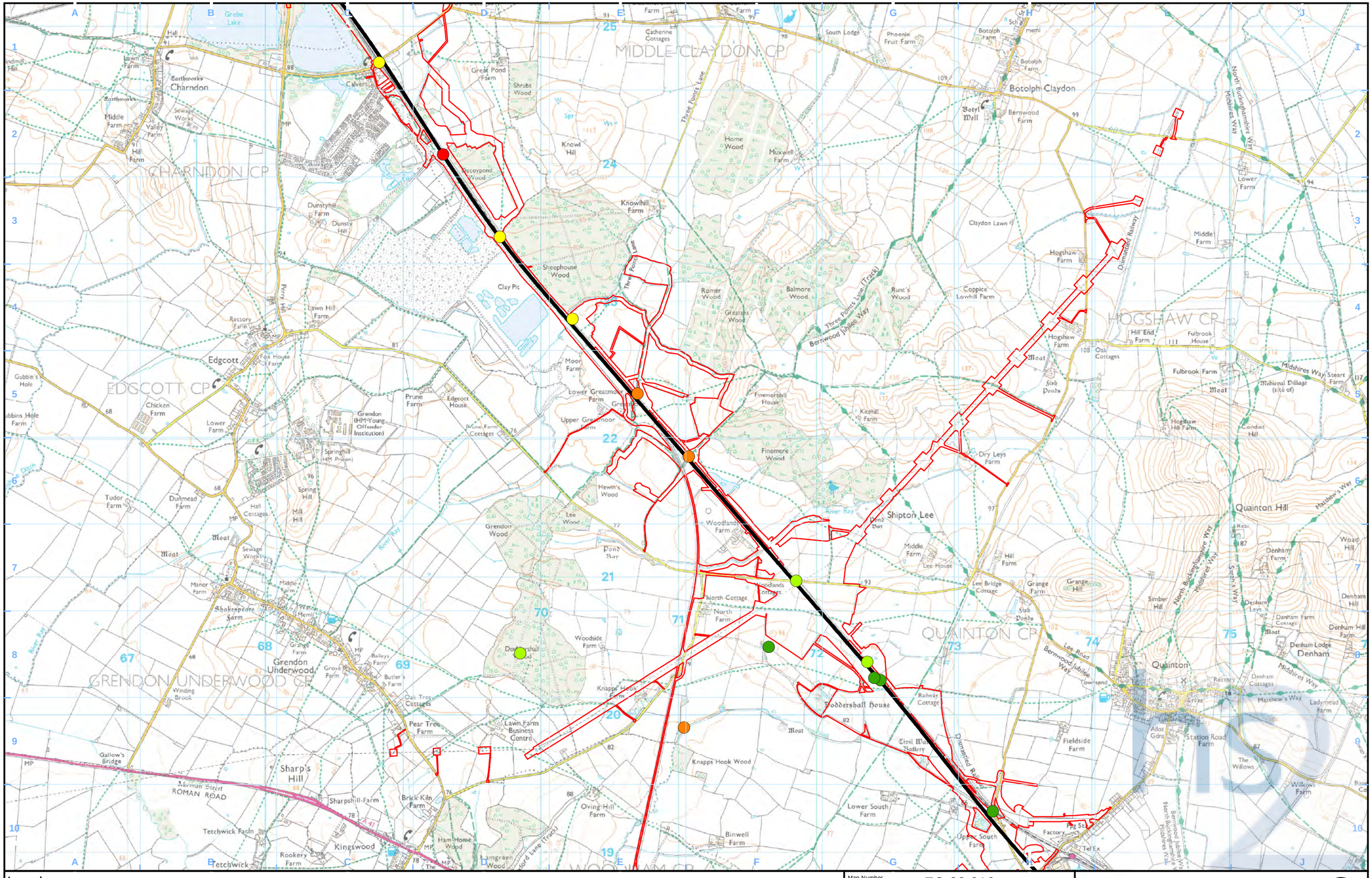
Scale at A3: 1:25,000

0 250 500 750 1,000 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003946-P01.00

Date: 27/01/15



Legend

Route centreline

- Route in tunnel
- Route on surface
- Land potentially required during construction

Level of Activity

- Very low
- Low
- Moderate
- High
- Very high

Map Number

EC-22-016

Map Name

Bat activity intensity; automated survey
Tranche 1 maternity season 2014
(June - July)

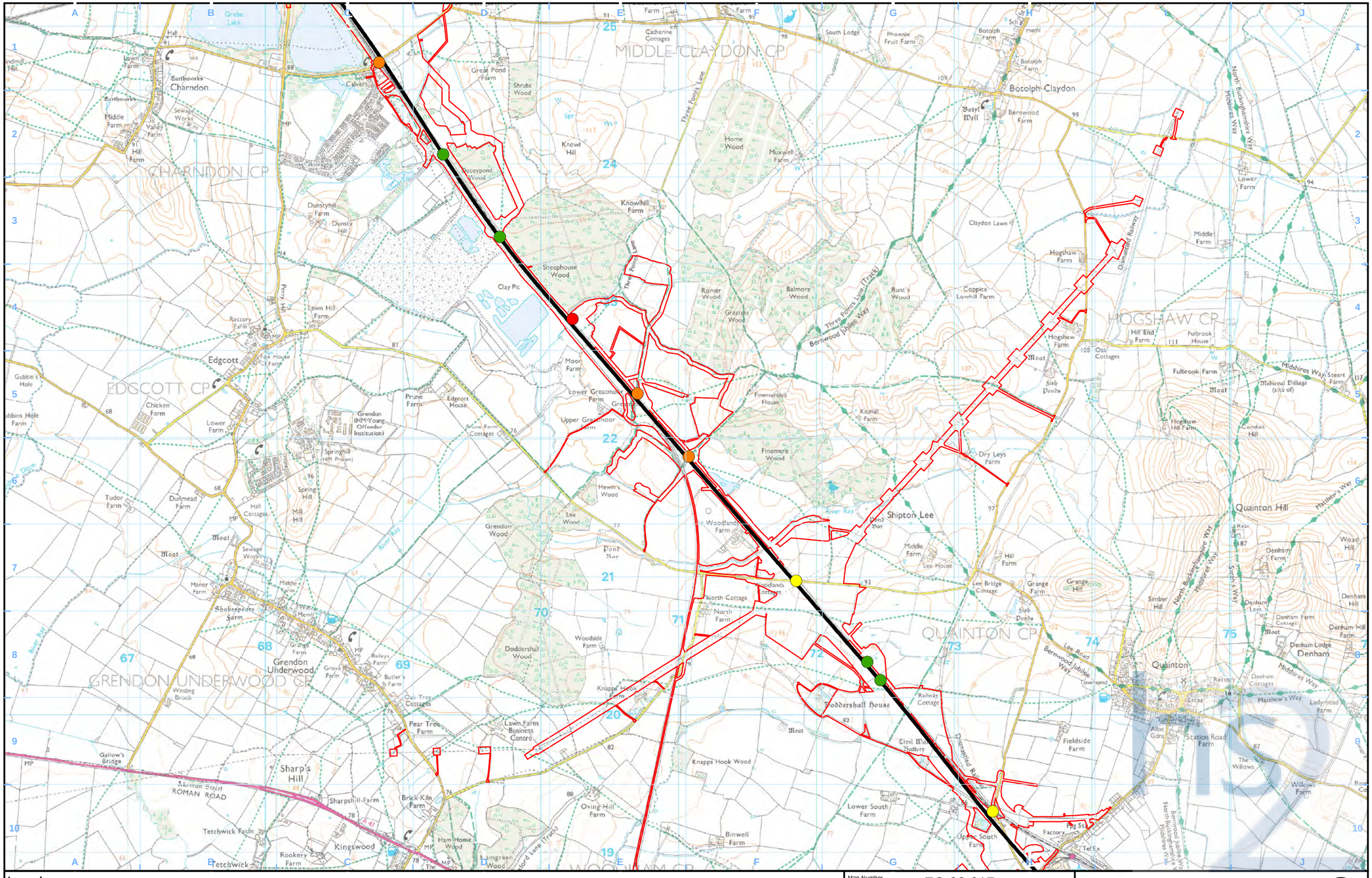
Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Scale at A3: 1:25,000

0 250 500 750 1,000 Metres

Doc Number: C252-ETM-EV-MAP-020-003947-P01.00

Date: 27/01/15



Legend

Route centreline

- Route in tunnel
- Route on surface
- Land potentially required during construction

Level of Activity

- Very low
- Low
- Moderate
- High
- Very high

Map Number: EC-22-017

Map Name: Bat activity intensity; automated survey Tranche 1 post-maternity season 2014 (September - October)

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Registered office: One Canada Square, London, E14 5AB.

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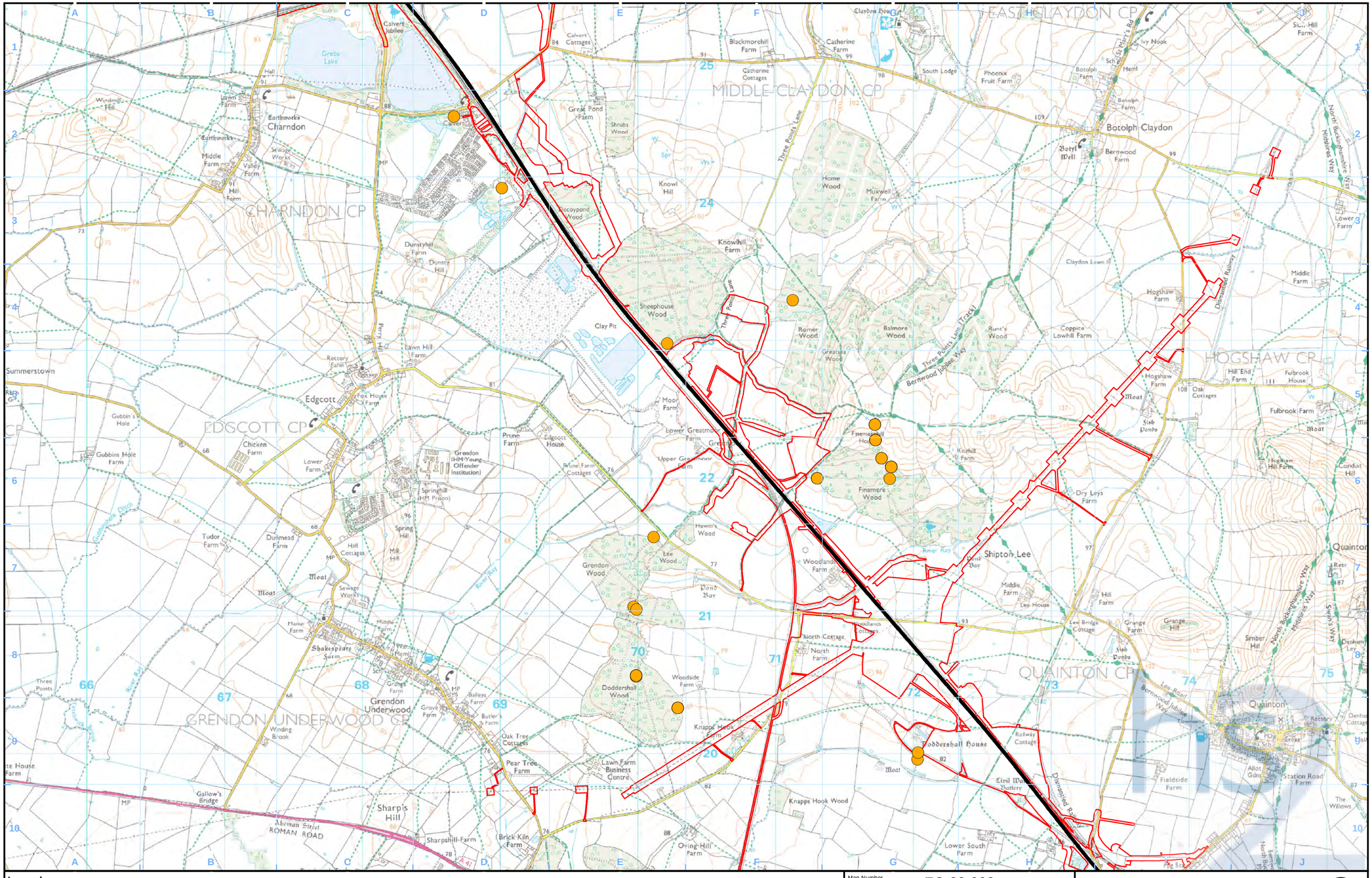
Doc Number: C252-ETM-EV-MAP-020-003948-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Roost location

Map Number: EC-23-003

Map Name: Bechstein's bat roost locations 2014

Scale at A3: 1:25,000

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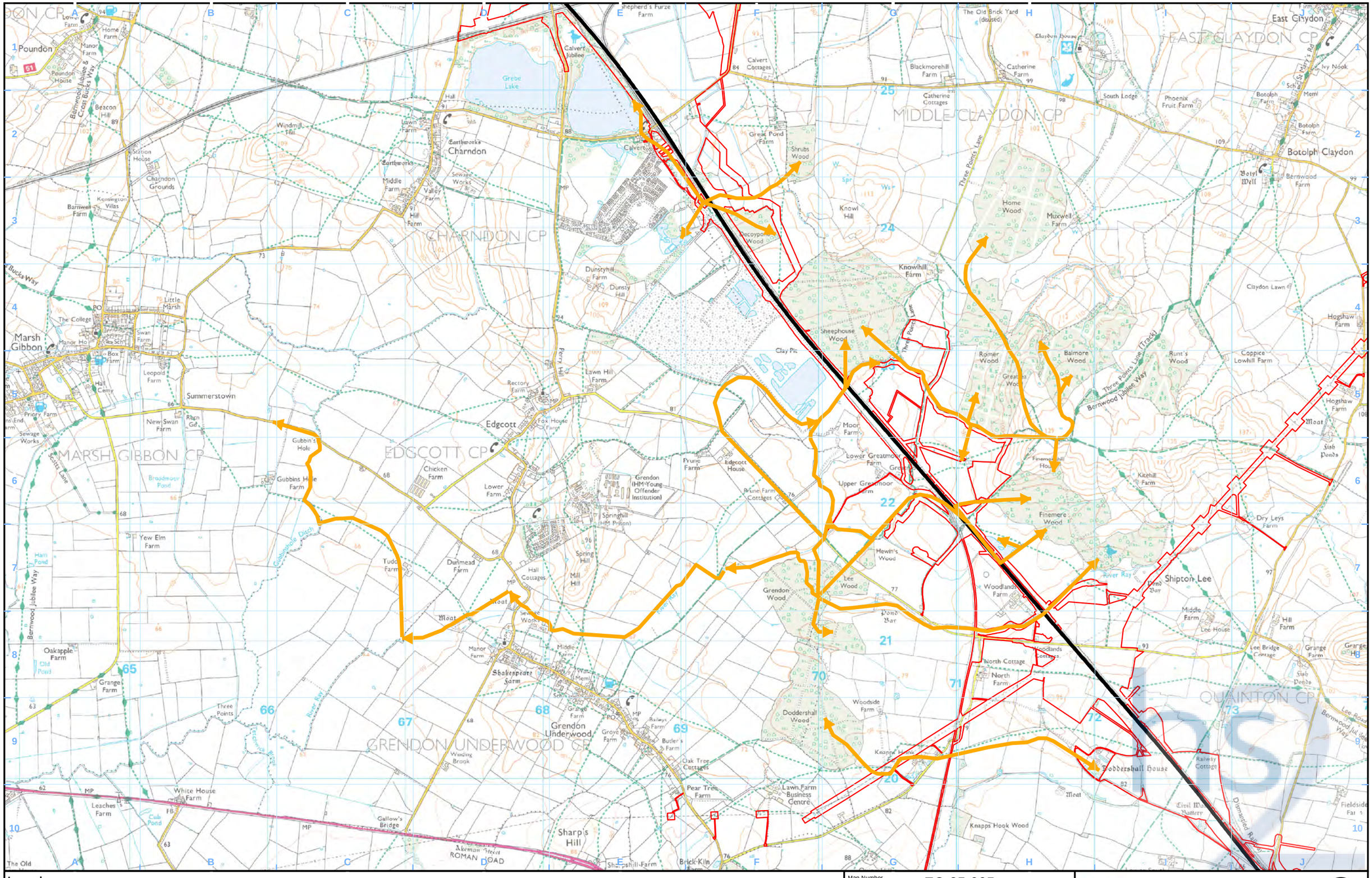
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003951-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

Map Number: EC-25-005

Map Name: Bechstein's flightlines 2014

Scale at A3: 1:25,000

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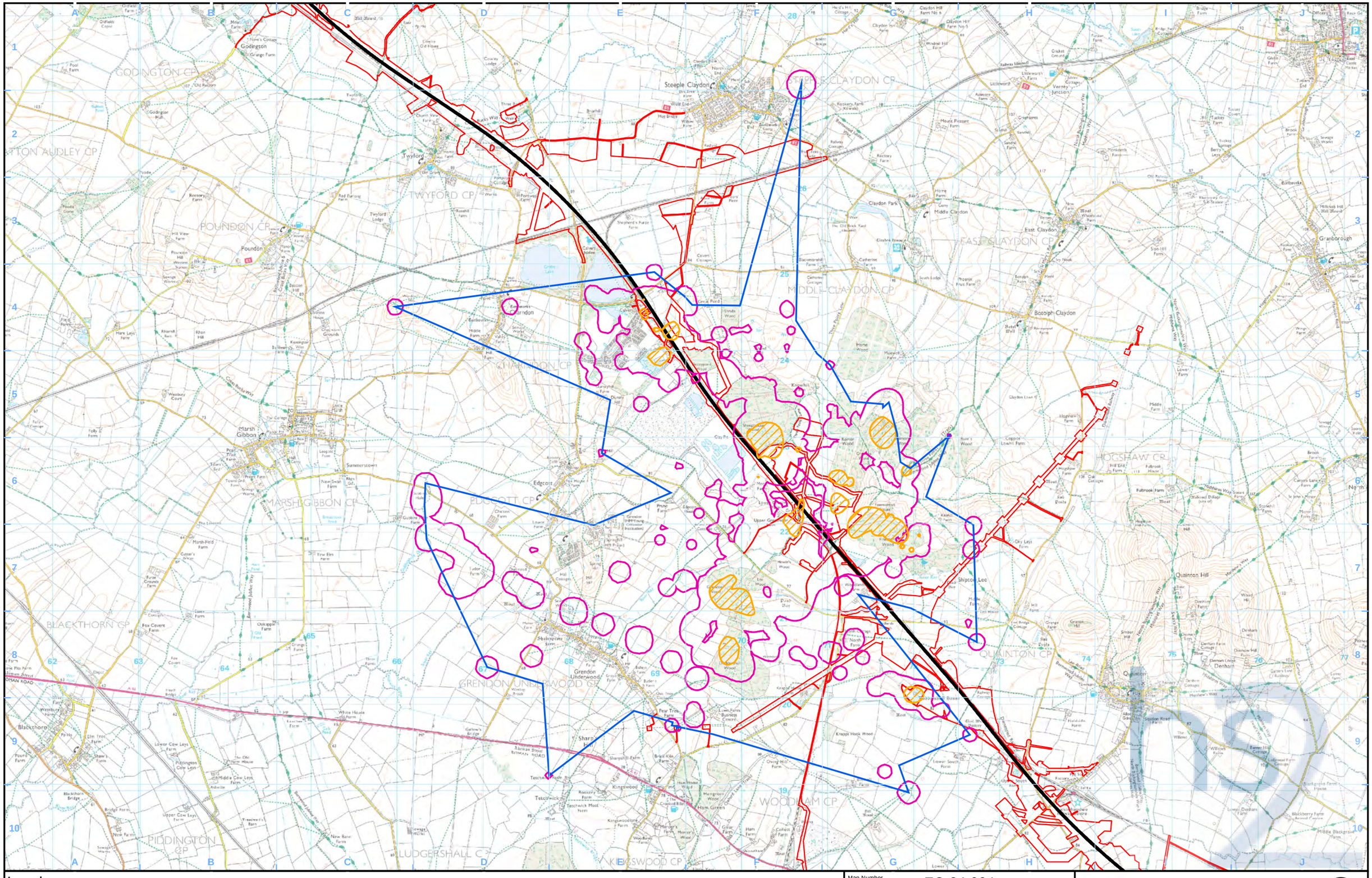
Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003970-P01.00

Date: 27/01/15



Legend

- Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Bechstein's foraging 50% KDE
- Bechstein's foraging 95% KDE
- Bechstein's foraging 100% MCP

Map Number: EC-24-004

Map Name: Bechstein's home range 2014

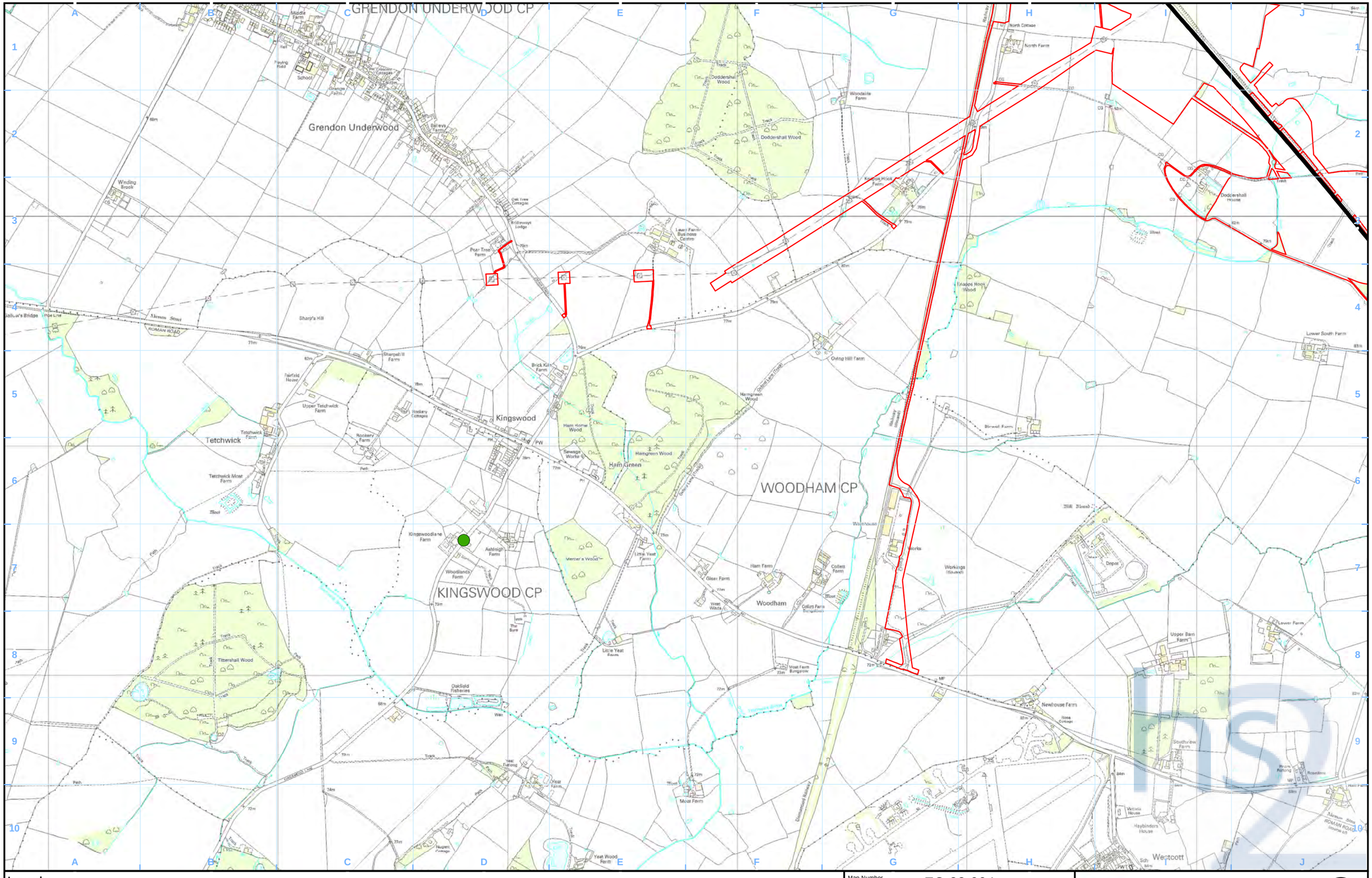
Scale at A3: 1:40,000

0 525 1,050 1,575 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003960-P01.00

Date: 29/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Roost location

Map Number: EC-23-004

Map Name: Brandt's bat roost locations 2014

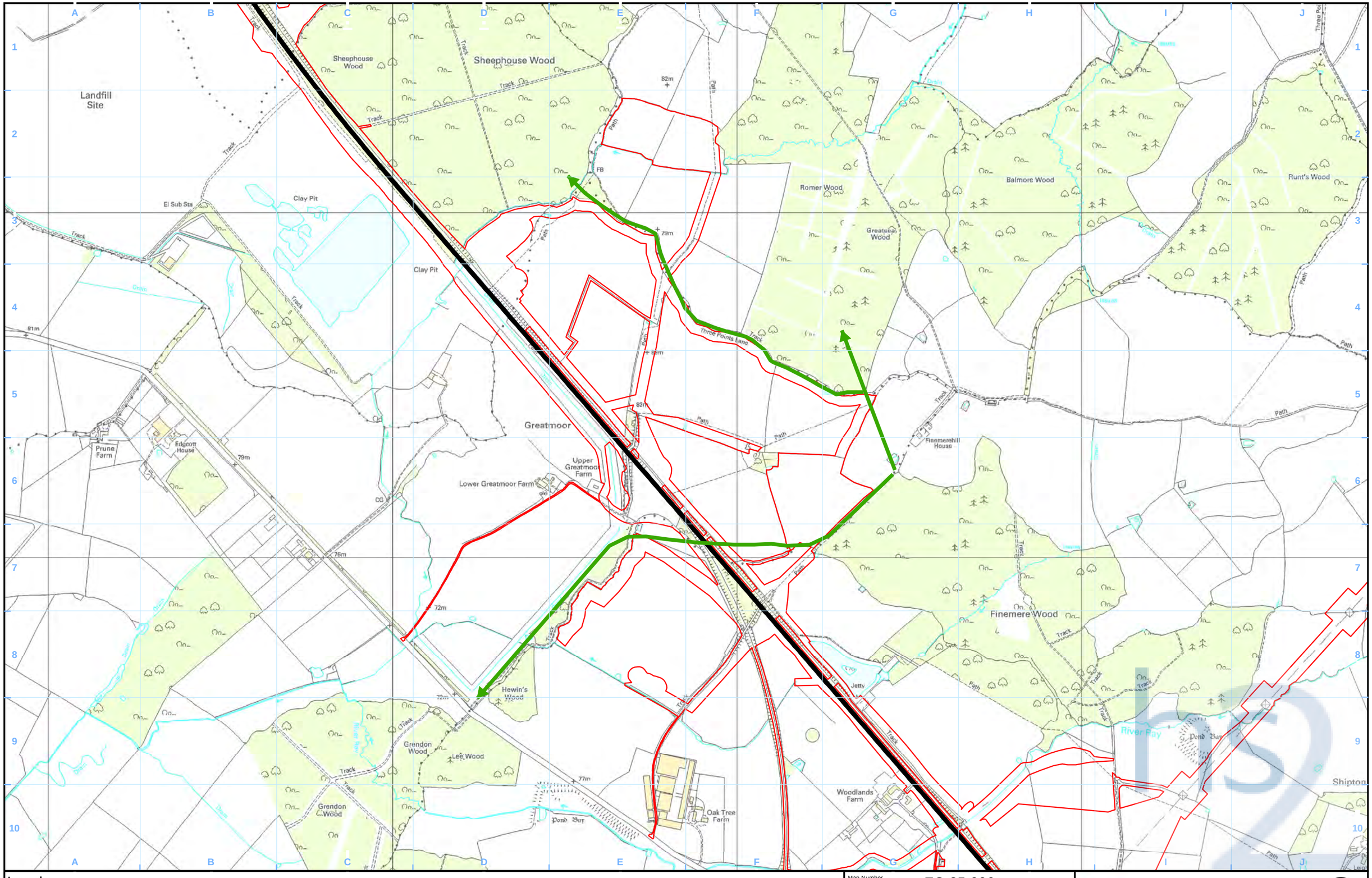
Scale at A3: 1:15,000

0 150 300 450 600 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003952-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

Map Number	EC-25-006
Map Name	Brandt's flightlines 2014

Scale at A3: 1:10,000

0 100 200 300 400

Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003971-P01.00

Date: 27/01/15

Legend

Route centreline
Route in tunnel
Route on surface
Land potentially required during construction

Brandt's foraging 50% KDE
Brandt's foraging 95% KDE
Brandt's foraging 100% MCP

Map Number
EC-24-005

Map Name
Brandt's foraging home range 2014

Scale at A3: 1:25,000

0 250 500 750 1,000
Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003961-P01.00

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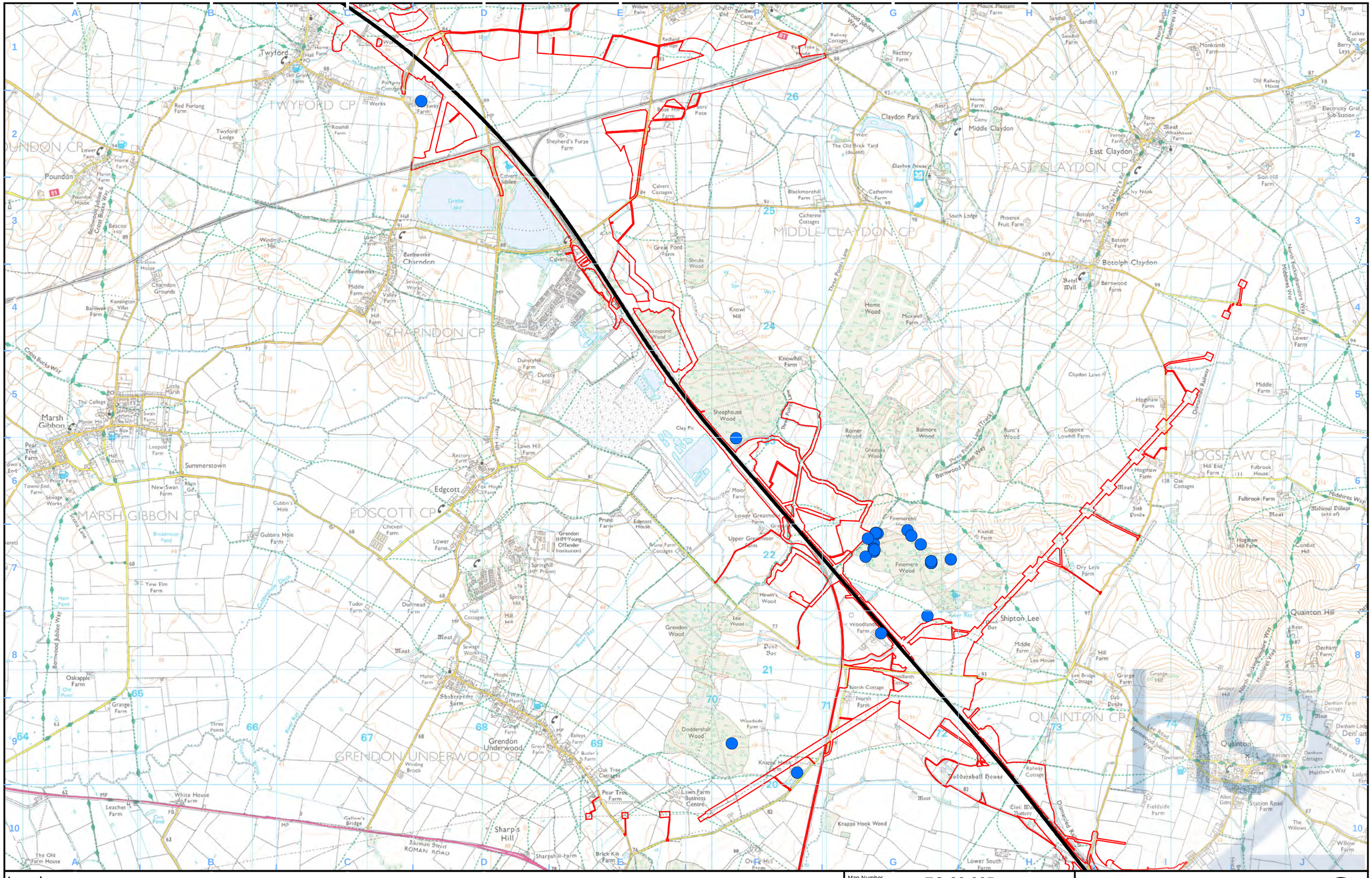


Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Roost location

Map Number: EC-23-005

Map Name: Brown long-eared bat roost location 2014

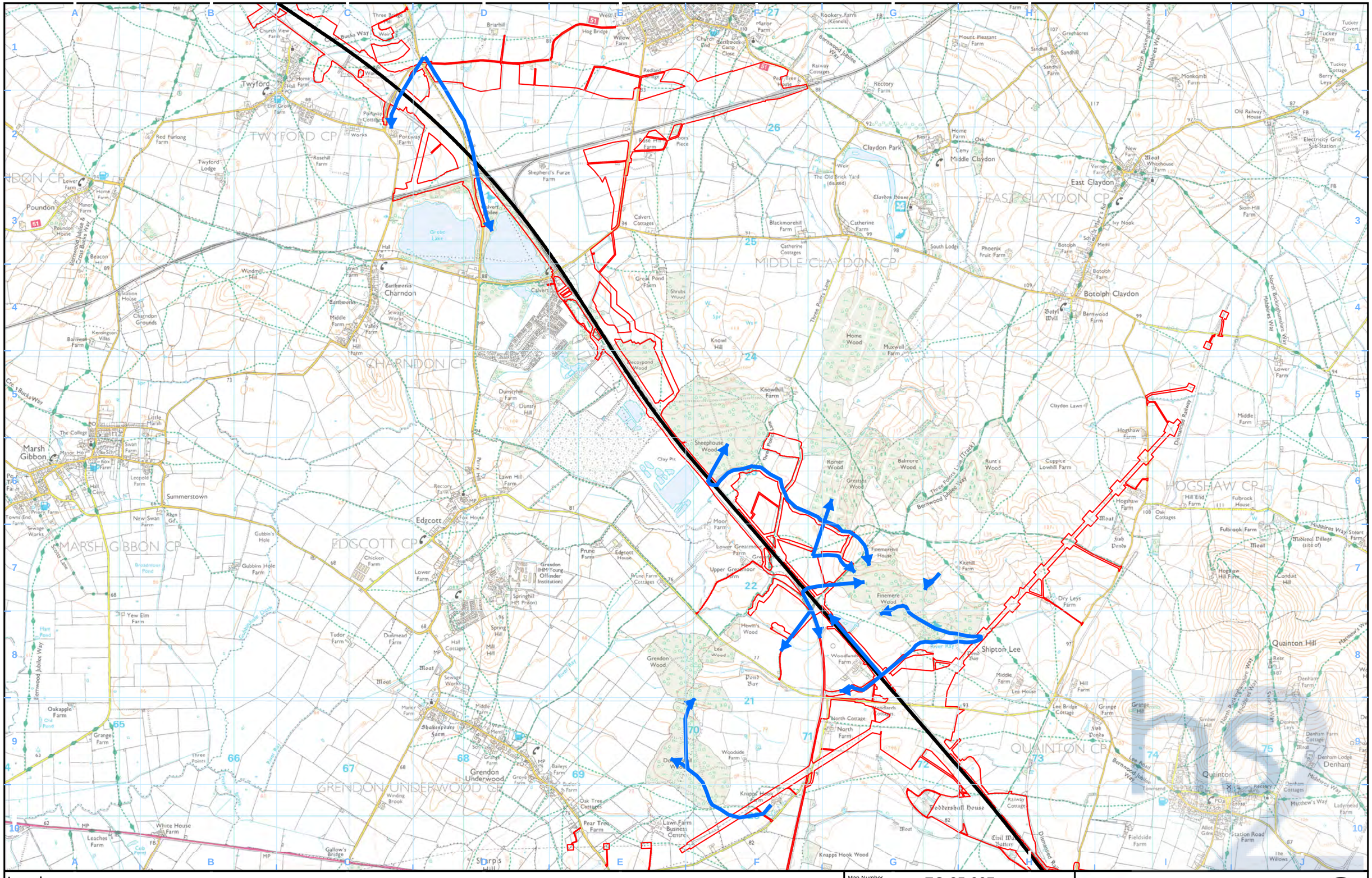
Scale at A3: 1:30,000

0 300 600 900 1,200 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003953-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

Map Number: EC-25-007

Map Name: Brown long-eared flightlines 2014

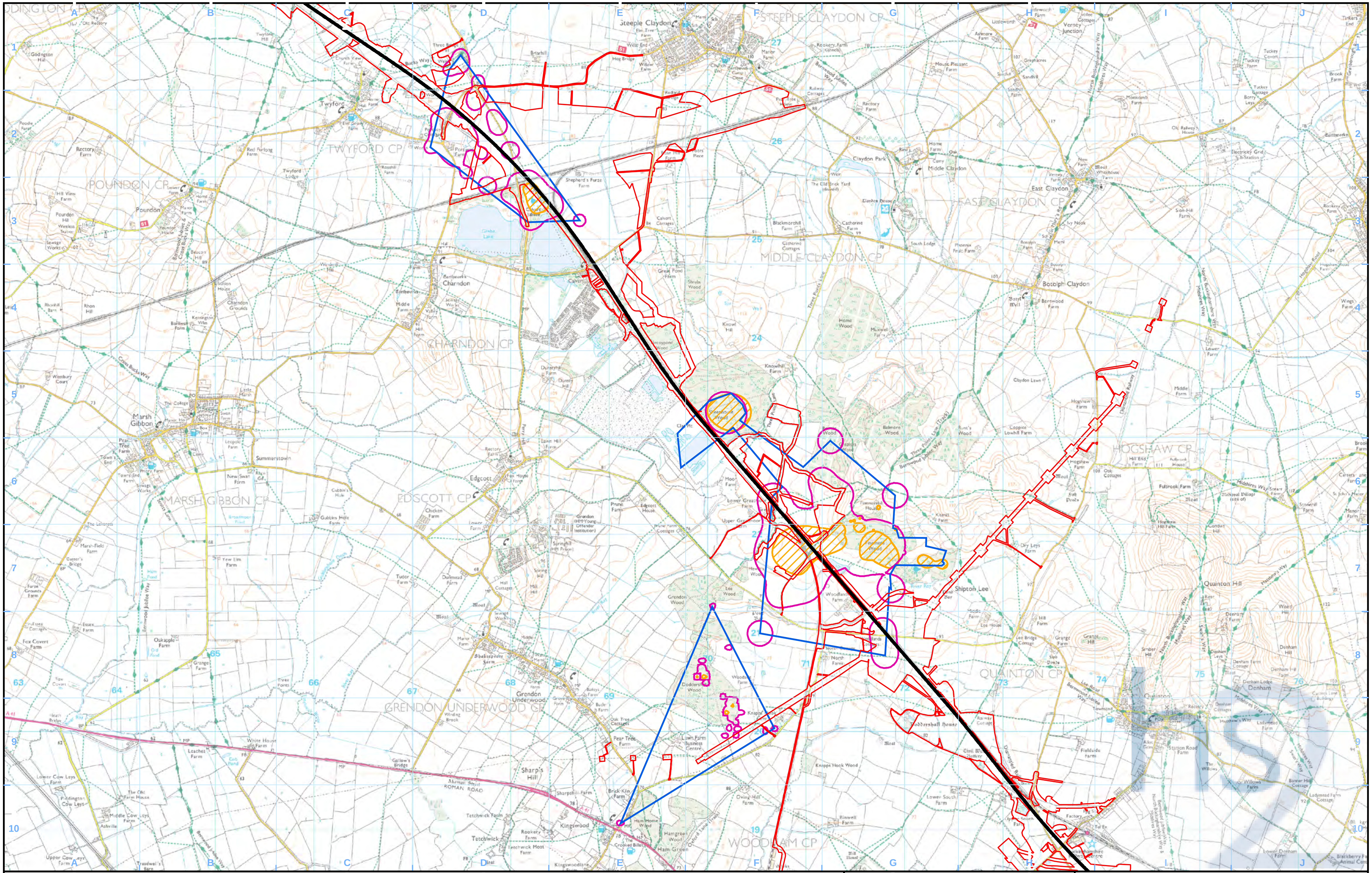
Scale at A3: 1:30,000

0 300 600 900 1,200 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003972-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Brown long-eared foraging 50% KDE

Brown long-eared foraging 95% KDE

Brown long-eared foraging 100% MCP

Map Number

EC-24-006

Map Name

Brown long-eared foraging home range 2014

Scale at A3: 1:35,000

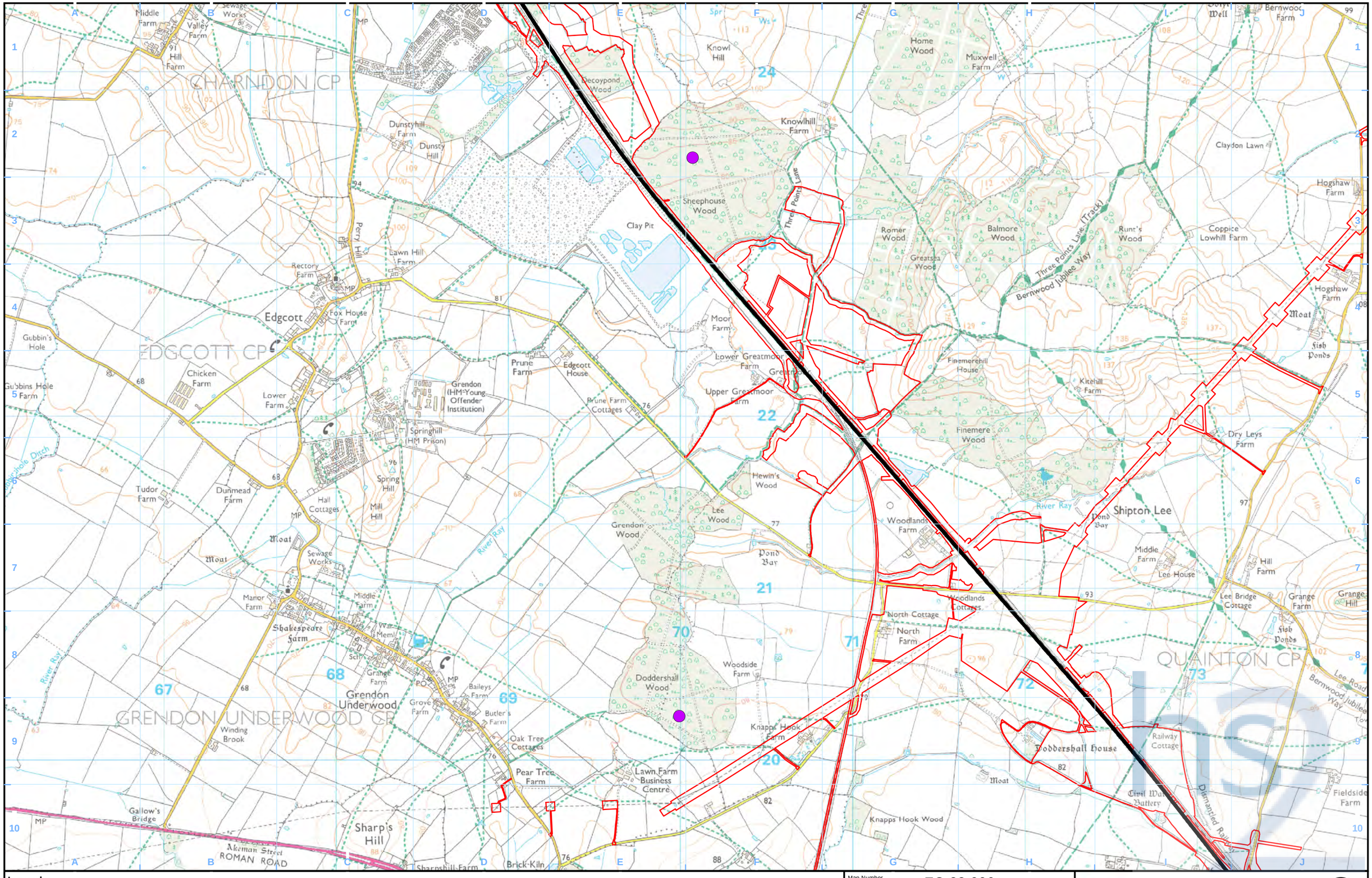
0 460 920 1,380

Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003962-P01.00

Date: 29/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Roost location

Map Number: EC-23-006

Map Name: Daubenton's bat roost locations 2014

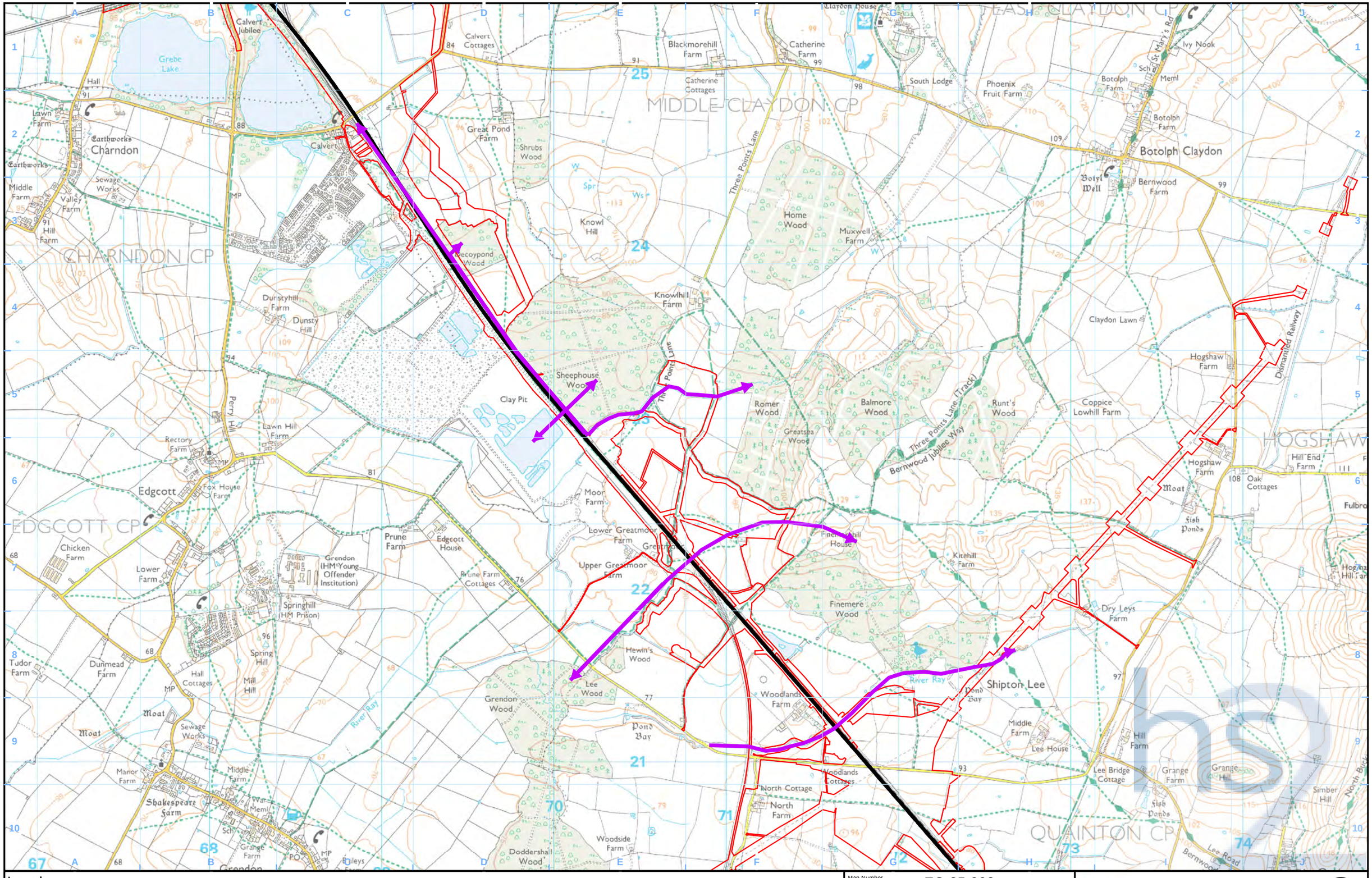
Scale at A3: 1:20,000

0 200 400 600 800 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003954-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

Map Number: EC-25-008

Map Name: Daubenton's flightlines 2014

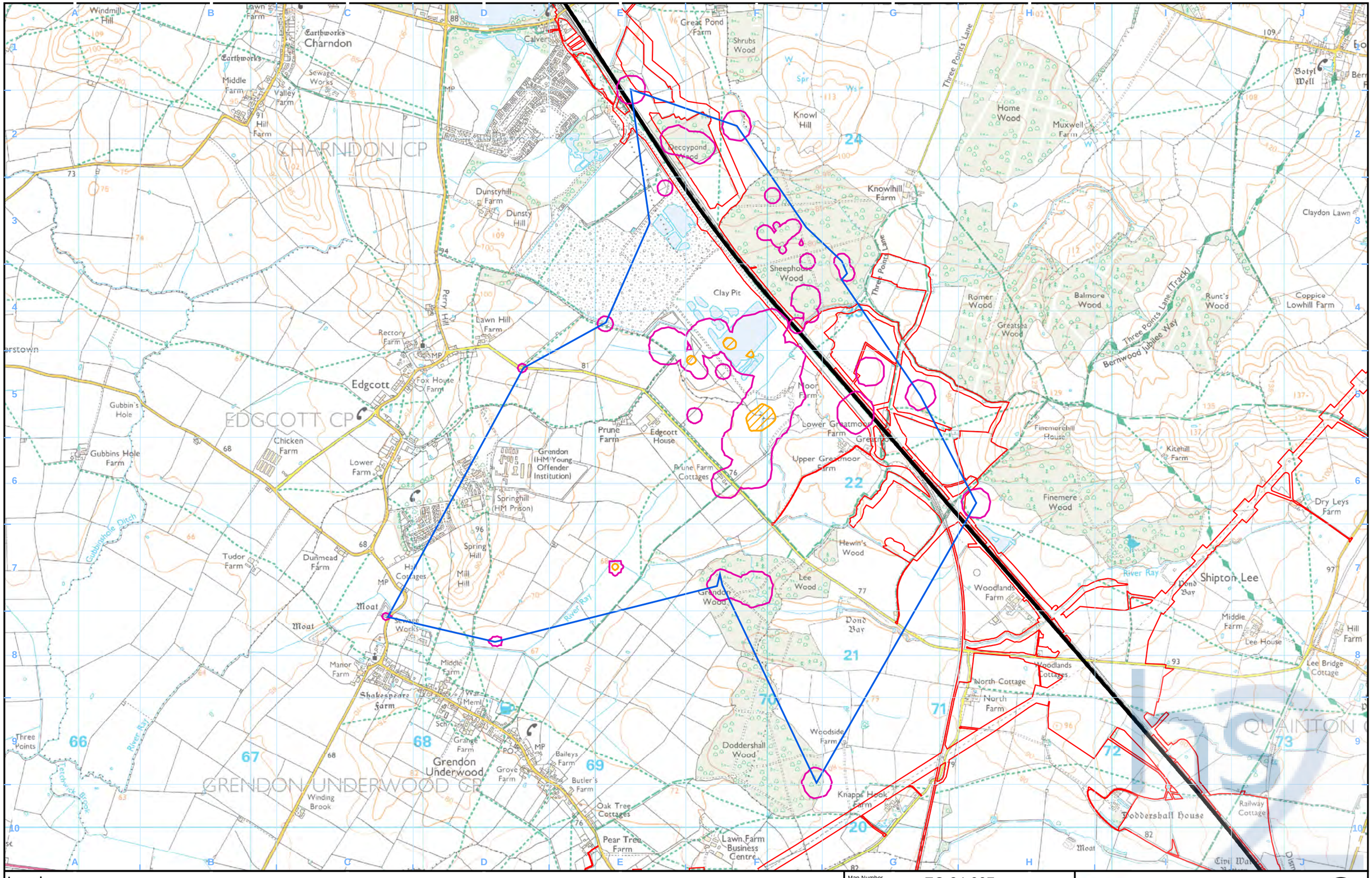
Scale at A3: 1:20,000

0 200 400 600 800 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003973-P01.00

Date: 27/01/15



Legend

- Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Daubenton's foraging 50% KDE
- Daubenton's foraging 95% KDE
- Daubenton's foraging 100% MCP

Map Number: EC-24-007

Map Name: Daubenton's foraging home range 2014

Scale at A3: 1:20,000

0 200 400 600 800 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003963-P01.00

Date: 29/01/15

GRENDON UNDERWOOD CP

Grendon Underwood

QUAINTON CP

Greatmoor

Finemere Wood

Shipton Lee

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Roost location

Map Number: EC-23-007

Map Name: Natterer's bat roost locations 2014

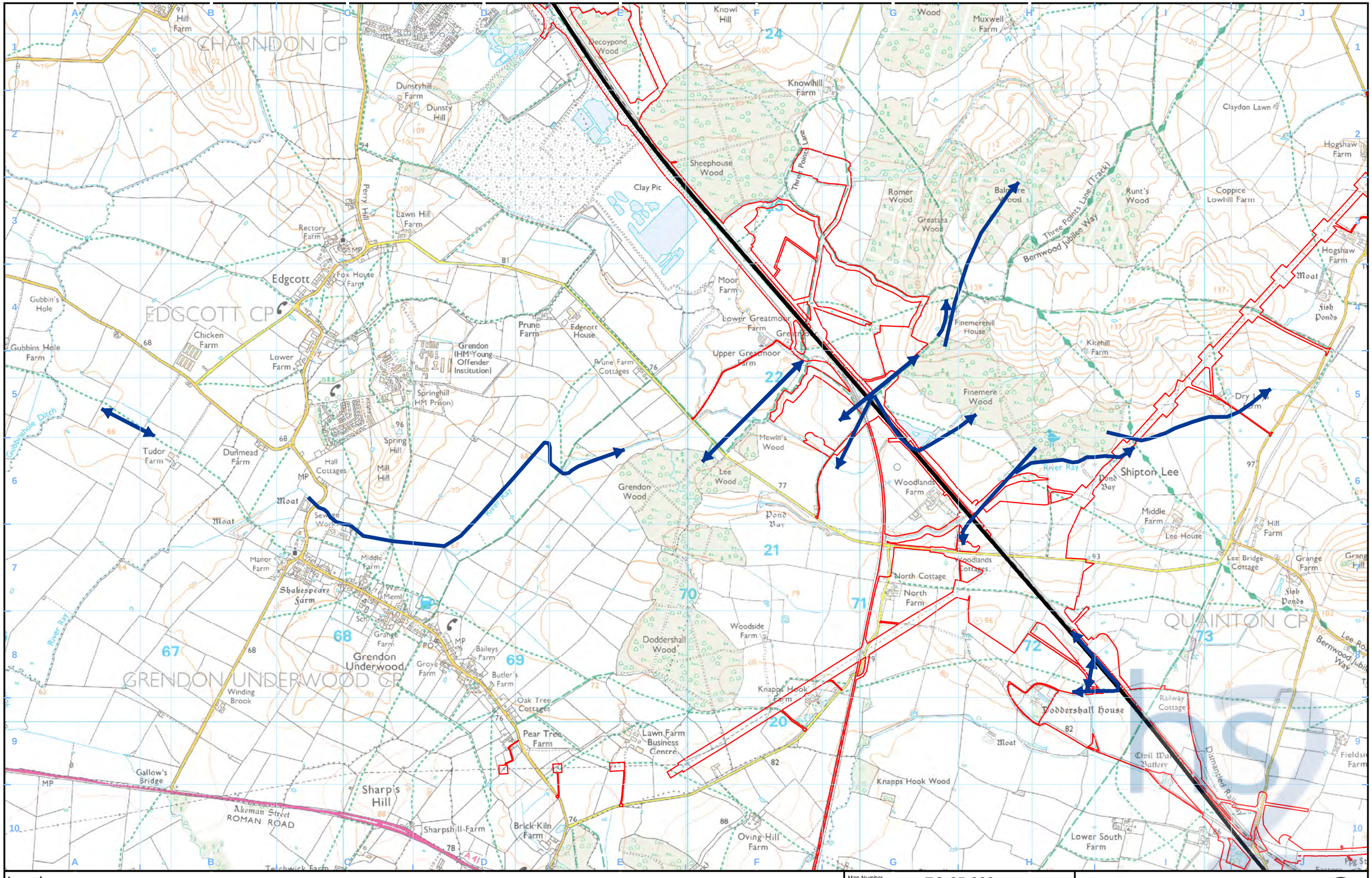
Scale at A3: 1:15,000

0 150 300 450 600 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003955-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

Map Number	EC-25-009
Map Name	Natterer's flightlines 2014

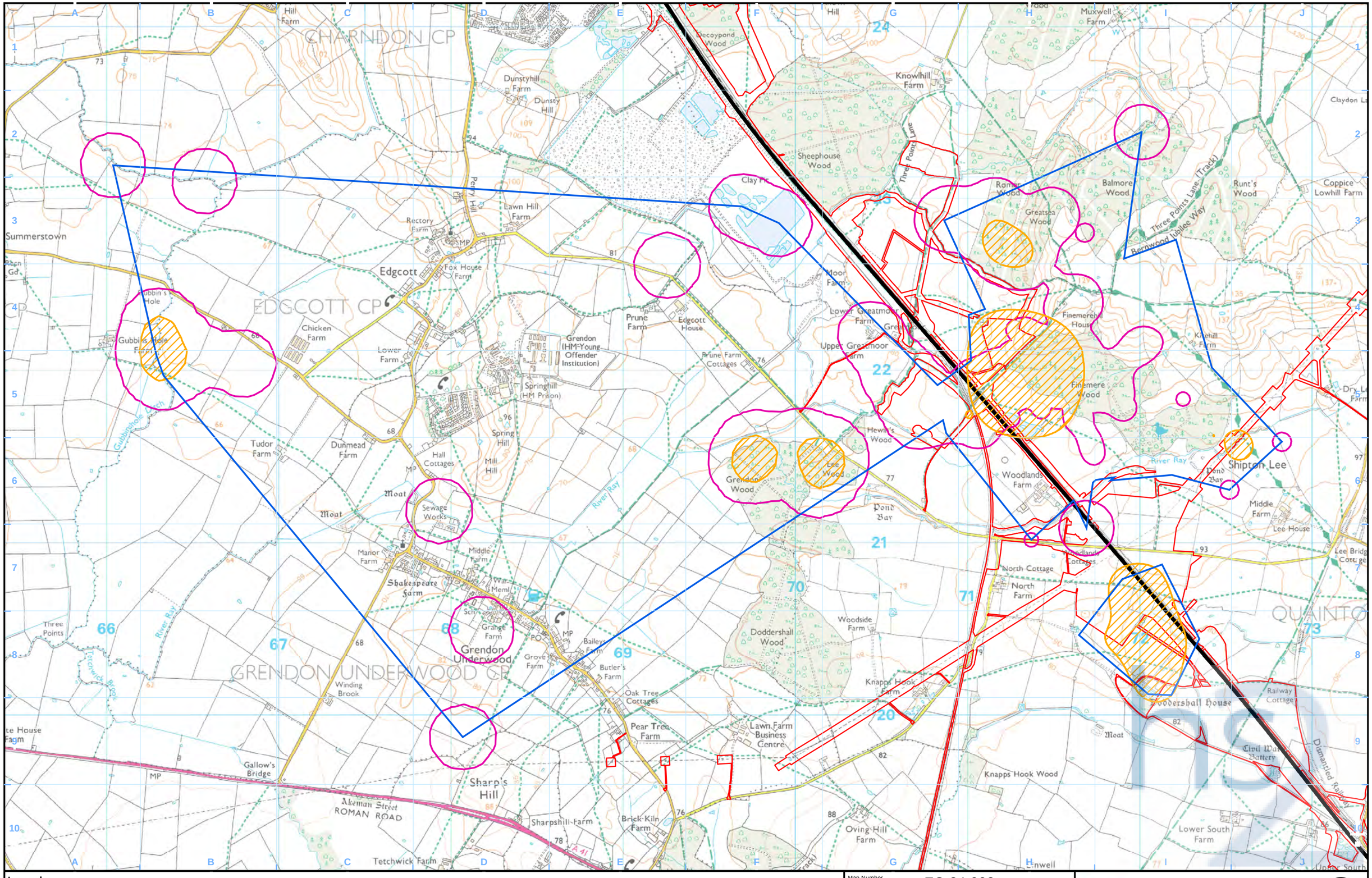
Scale at A3: 1:20,000

0 200 400 600 800 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003974-P01.00

Date: 27/01/15



Legend

- Route centreline
- Route in tunnel
- Route on surface
- Land potentially required during construction
- Natterer's foraging 50% KDE
- Natterer's foraging 95% KDE
- Natterer's foraging 100% MCP

Map Number: EC-24-008

Map Name: Natterer's foraging home range 2014

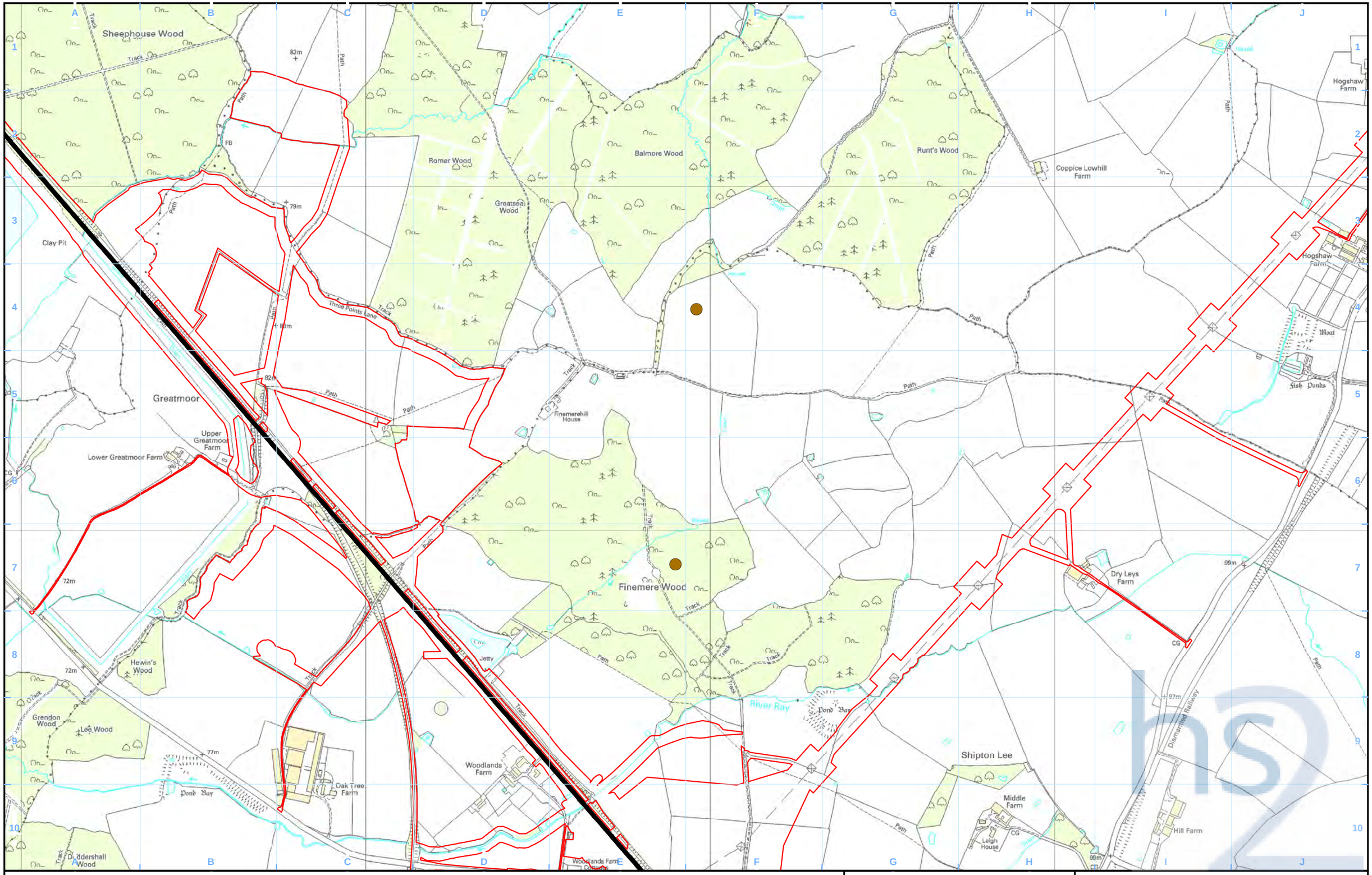
Scale at A3: 1:20,000

0 200 400 600 800 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003964-P01.00

Date: 29/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Roost location

Map Number: EC-23-008

Map Name: Whiskered bat roost locations 2014

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

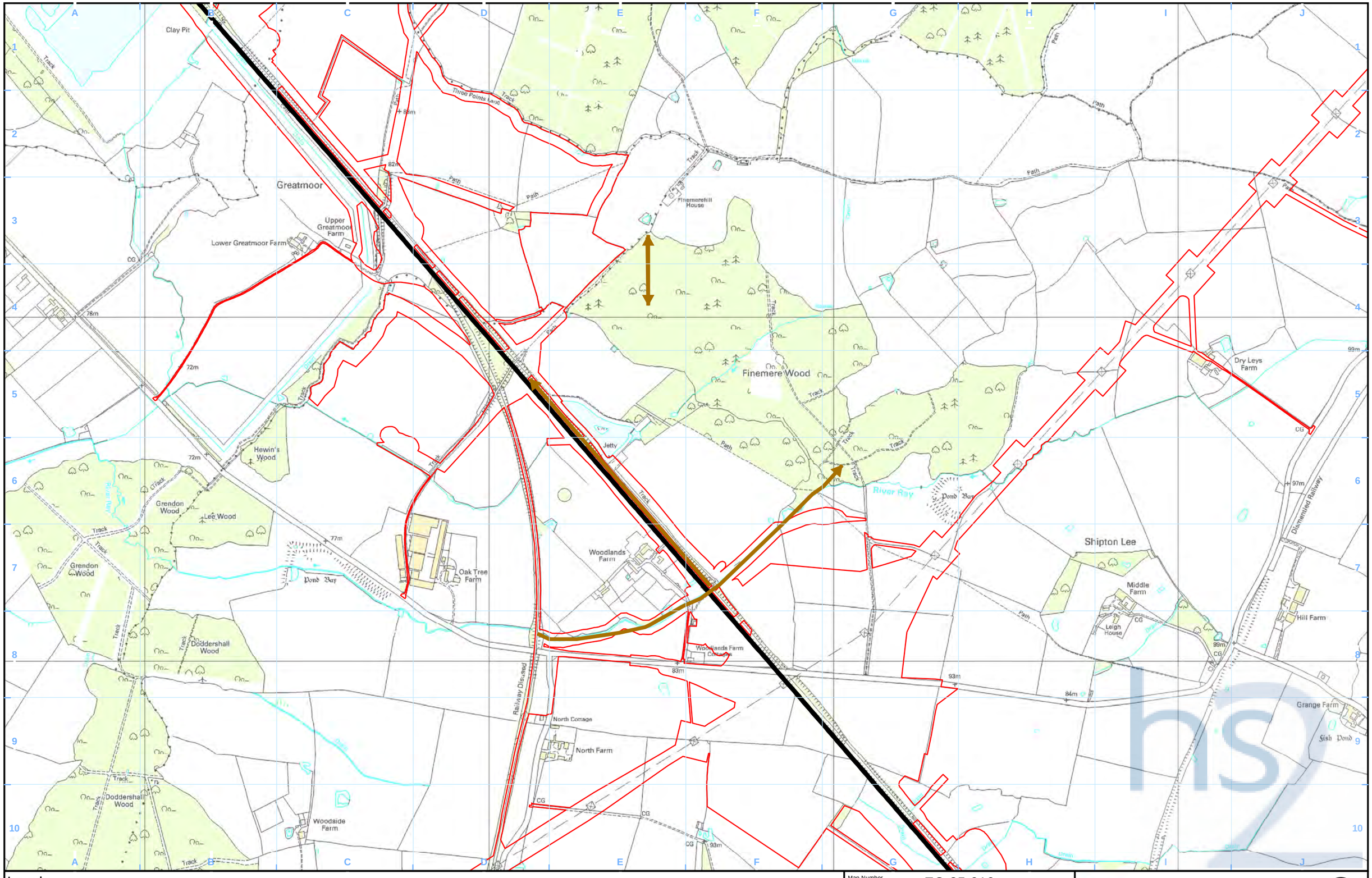
Scale at A3: 1:10,000

0 100 200 300 400

Metres

Doc Number: C252-ETM-EV-MAP-020-003956-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

Map Number: EC-25-010

Map Name: Whiskered flightlines 2014

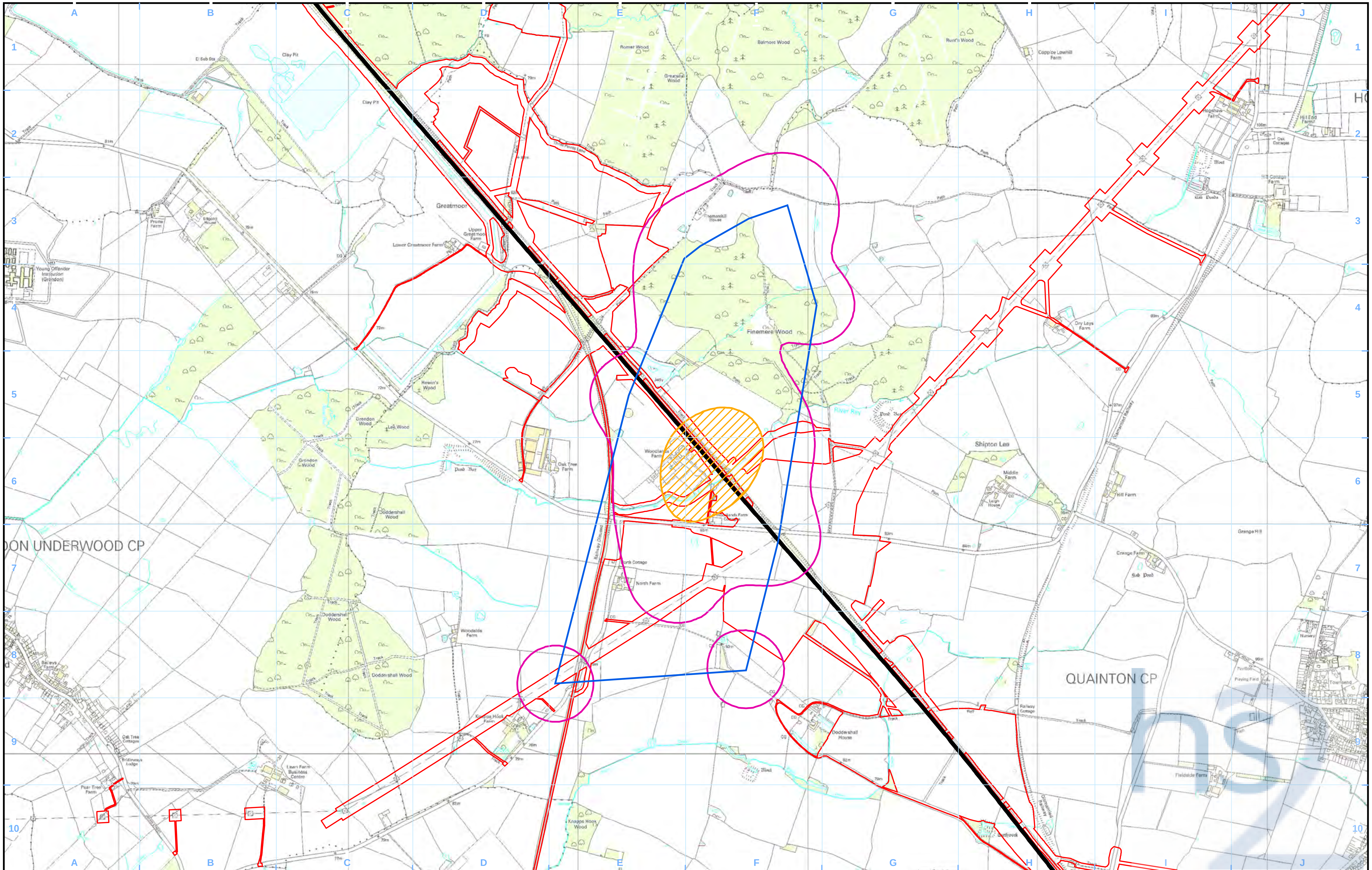
Scale at A3: 1:10,000

0 100 200 300 400 Metres

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003975-P01.00

Date: 27/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Whiskered foraging 50% KDE

Whiskered foraging 95% KDE

Whiskered foraging 100% MCP

Map Number: EC-24-009

Map Name: Whiskered foraging home range 2014

Scale at A3: 1:15,000

0 150 300 450 600

Metres

Doc Number: C252-ETM-EV-MAP-020-003965-P01.00

Date: 29/01/15

Volume 5: Technical Appendices

CFA 14: Bat trapping/radio-tracking project 2014 Radstone

Contents

List of tables

List of figures

1 Summary

1.1.1 A detailed bat survey comprising activity transects, emergence surveys, vantage point surveys, automated static detector surveys, trapping and radio-tracking was carried out in 2014 in Radstone, Northamptonshire in close proximity to the land required for the construction and operation of the original scheme.

1.1.2 The 2014 surveys focused on a large maternity colony of Natterer's bat present at the Church of St Lawrence, Radstone; and also serotine and Leisler's bats, due to their uncommon and scarce status respectively (Bat Conservation Trust, 2012).The 2014 surveys supplement the baseline surveys already collected at this location in 2013, in order to obtain additional information on how the three target species use the landscape affected by the scheme.

1.1.3 The 2014 surveys were undertaken in May, July and September to obtain pre-maternity, maternity and post-maternity data. A total of 88 bats from six species were caught, these included 46 Natterer's bats, and one Leisler's bat. There is no radio-tracking data for either Serotine or Leisler's bats; serotine bats were not caught and the Leisler's caught was a male and therefore was not the focus of these surveys. Fourteen female Natterer's bats were fitted with radio-transmitters and subsequently radio-tracked. Ten Natterer's roosts were recorded, of which eight were located to the north of the original scheme, and two were located to the south. All of the bats radio-tracked in May and July 2014 utilised the Church of St Lawrence exclusively, with a peak colony count of 222 bats recorded in July (including juveniles). During September the radio-tagged bats were recorded utilising roosts other than the church.

1.1.4 Seasonal variation in flightlines and foraging areas used by the colony of Natterer's bats was recorded. In May and July, all seven bats tagged used the Helmdon Disused Railway regularly for commuting and foraging, and crossed the original scheme using the railway. Later in the season during September, the colony of bats was recorded using the wider landscape to a greater extent, with six of the seven bats radio-tracked crossing the original scheme at five locations compared with one location in May and July.

1.1.5 Key foraging areas and commuting routes included watercourses, hedgerows, Helmdon Disused Railway, pasture to the south of the church and Halse Copse Local Wildlife Site (LWS). All 14 radio-tagged bats were recorded foraging north and south of the scheme, and therefore crossed the original scheme to access foraging areas.

1.1.6 The 2014 surveys indicate that the Helmdon Disused Railway, Radstone Brook and Halse Copse are important for the Natterer's colony at the Church of St Lawrence for foraging and commuting throughout season of bat activity. Therefore it is likely in the absence of mitigation, the construction and operation of original scheme would adversely affect the conservation status of this population. The effects would be through the severance and loss of roosting, commuting and foraging habitat and potential mortality as a consequence of collision with passing trains.

2 Introduction

2.1.1 Council Directive 92/43/EEC of the Conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive was adopted in 1992. The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those habitats and species of European importance.

2.1.2 The Conservation of Habitats and Species Regulations 2010 (as amended) (referred to as the 'Habitats Regulations') implement the Habitats Directive into national legislation. The Habitats Regulations seek to protect certain species (European Protected Species) and contain a range of prohibitions include deliberate capture or killing, deliberate disturbance and the deterioration or destruction of a breeding site or resting place of such an animal. All species of bat are fully protected under the Habitats Regulations as European Protected Species through their inclusion on Schedule 2. This report presents the findings of bat surveys carried out to provide information on a large colony of Natterer's bat *Myotis nattereri* that roost Church of St Lawrence, Radstone in Northamptonshire. The hybrid Bill Environmental Statement (ES) concluded that, in the absence of mitigation, the construction and operation of original scheme would adversely affect the conservation status of this population. The effects would be through the severance of commuting and foraging habitat and potential mortality as a consequence of collision with passing trains.

2.1.3 The original scheme crosses Helmdon Disused Railway Site of Special Scientific Interest (SSSI) to the southeast of Radstone and passes the southwest of Halse Copse. Both areas were identified as areas of high bat activity in the ES. Pasture, watercourses, intact hedgerows and additional woodlands present within and adjacent to the land required for the construction of the original scheme also provide habitat of potential value for roosting, foraging and commuting Natterer's bats.

2.1.4 The presence of a large Natterer's bat maternity colony in the Church of St Lawrence, Radstone was confirmed during 2013 field surveys. Up to 250 bats were recorded emerging from the church and approximately 60 individuals emerging from an adjacent property. Due to their close proximity, it was assumed that the two roosts are used by members of the same colony. The location of the roosts are shown in Figure EC-23-001. Natterer's bats are classified as common and widespread species in the UK, however a maternity colony of this size meets criteria for being of regional value (Wray, S., *et al.*, 2010).

2.1.5 During the 2013 field surveys, seven species of bat (in addition to Natterer's) were confirmed in this area. These included Leisler's bat *Nyctalus leisleri* and serotine *Eptesicus serotinus* which are scarce species, and one uncommon species - noctule bat *Nyctalus noctula*.

2.1.6 In 2013 a large numbers of the Natterer's colony were recorded flying north to north east away from the scheme, with a low number flying south. The ES highlighted the

linear nature of Helmdon Disused Railway was important to the Natterer's population in Radstone. In addition the ES details low numbers of Natterer's were recorded commuting and forging in and adjacent to Halse Copse North and South.

2.2 Project aims and approach

2.2.1 The 2014 surveys supplement the baseline survey already collected at this location in 2013. They focused on the Natterer's colony present at Church of St Lawrence, Radstone and also serotine and Leisler's bats, due to their scarce status. The purpose of the surveys was to obtain additional information on how bats use the landscape affected by the original scheme. In summary the aims of the 2014 surveys were to:

- catch bats using harp traps and mist nets with the assistance of an acoustic lure within woodland, at hedgerows and watercourses and along the Helmdon Disused Railway and to radio-tag and radio-track Natterer's, serotine and Leisler's bats to obtain detailed data on bat flightlines, roosting sites and foraging areas within the landscape;
- to ascertain the amount of bat activity at key locations within and adjacent to the original scheme through use of SM2 Bat+ recorder units;
- obtain detailed information on bat flight behaviour particularly crossing the scheme; and
- obtain data on all bats caught within and adjacent to the original scheme including numbers of individuals, species, sex, breeding status and condition.

2.2.2 The surveys for Natterer's bats also proposed to identify key roosts, flightlines and foraging habitats used pre-maternity, maternity and post maternity when colony disbands in the autumn, in order to better ascertain their use of the landscape in three of the lifecycle behaviours in the active season. Specifically, and where access permitted, the surveys aimed to:

- identify the presence of any additional roosts located in, or adjacent to, the original scheme ;
- obtain colony counts of known and any additional Natterer's roosts; and
- determine the areas used by the colony as foraging and commuting habitat within and adjacent to the land required for the construction of the scheme.

2.2.3 It was proposed to radio-tag adult female (both parous and non-parous) and juvenile bats (providing they were of an appropriate weight and in good condition) to a maximum of 20 Natterer's, ten serotine and ten Leisler's, in accordance with the Natural England licence conditions. The numbers of bats allowed for contingencies such as failed tags.

3 Methodology

3.1 Survey area

3.1.1 The survey area comprised the land adjacent to the original scheme extending from north of the A43 Oxford Road, near Fox Covert (approximate grid reference SP 59443 39328) to Halse Copse, north of Radstone (approximate grid reference SP 57403 41647) and adjacent land including the Helmdon Disused Railway SSSI, Radstone Village and adjoining agricultural land, watercourses and hedgerows; where access was permitted.

3.1.2 Vantage point surveys that were carried out to identify flightlines and commuting routes from known roosts. The survey area therefore encompassed habitat in close proximity to the Church of St Lawrence, Radstone (Grid Reference: SP 58796 40524, Figure EC-23-001).

3.1.3 The survey area for radio-tracking encompassed the wider landscape surrounding the original scheme which includes the Helmdon Disused Railway, Halse Copse, Shortgrove Wood and arable fields, watercourses, pasture and riparian habitats in the vicinity of Radstone. The broad habitat types are shown in the ES Phase 1 habitat maps EC-02-035b and EC-02-036.

3.2 Automated surveys

3.2.1 Automated surveys were carried out during May, July and September 2014. Detectors were set out for five consecutive nights in each month. The alignment of the scheme, 2013 survey data, aerial photographs and Ordnance Survey (OS) maps were used to determine the survey locations. Five locations were selected adjacent to habitat corridors comprising hedgerows, tree lines, watercourses and the Helmdon Disused Railway.

3.2.2 The locations for the static recorder unit were as follows (see Figure EC-22-001):

Location 1. Fox Covert (SP 59350 39501); on the western point of the small woodland situated to the south of Radstone and north of A43 Oxford Road;

Location 2. Helmdon Disused Railway south (SP 59071 39746), on Helmdon Disused Railway directly to the south of the scheme;

Location 3. Radstone Road (SP 58670 40227); where the original scheme will cross Radstone Road, south of Radstone;

Location 4. Helmdon Disused Railway north (SP 59083 40111); on Helmdon Disused Railway directly north of the scheme; and

Location 5. South of Halse Copse (SP 57686 241187); at a watercourse to the south of Halse Copse adjacent to the scheme.

3.2.3 The recorded WACo files were converted to WAV files and analysed using auto-identification based on selected call parameters using Kaleidoscope Pro Version 2.0.5. All files were subject to a secondary manual analysis (Russ, J., 2012) using Kaleidoscope Pro Version 2.0.5 to ensure identification was accurate.

3.2.4 Identification was also carried out to species level, with the exception of the *Myotis* bats, as they are often inseparable through sound analysis alone (Fitzsimons, P.J.R., 2005; Parsons, S., & Jones, G., 2000; Walters, C.L, *et al.,* 2012) and therefore were analysed to genus level only. Description of bat species assemblage therefore represent the minimum number present rather than a definite list of all species present.

3.3 Emergence survey

3.3.1 A preliminary emergence survey was carried out on the 29 May 2014 out at the Church of St Lawrence in order to identify the main emergence point of the Natterer's maternity roost. Subsequent emergence surveys were carried once a month, in each of, May, July and September 2014 to determine accurate maternity roost counts throughout the season. The first emergence survey was carried out by five surveyors, situated at suitable locations around the church. Once the emergence/entry point was confirmed subsequent surveys involved two surveyors and infra-red filming to ensure that all emergence points were adequately recorded.

3.3.2 Surveyors used both full spectrum and frequency division bat detectors (Elkon Batlogger and the Bat Box Duet detector with an Edirol digital recorder) to record the echolocation calls of emerging bats.

3.3.3 The recorded bat calls were analysed using computer software (Analook V3.5 or Kaleidoscope Pro software) for species identification. Additional notes were taken during the emergence survey including, emergence time, size of bat, species, flight height, type of activity and direction of flight.

3.4 Filming survey

3.4.1 Filming was carried out to record the behaviour of bats, such as flight height and frequency of passes, where the original scheme bisects the Helmdon Disused Railway (SP 59090 39808 and SP 59053 40505, shown in Figure EC-22-003). Filming was carried out once a month in May, July and September 2014, using a Canon XA-10 digital video recorder and an external infrared LED spot lamp (850 nm Wavelength) with a 150 m range and 40 degree angle. Bat calls were also recorded during the survey using an Elkon Batlogger, the calls were manually analysed (Russ, J., 2012) using Bat Sound software. This allowed comparison of data from filming and sound analysis to enable the behaviour recorded to be attributed to a bat species.

3.5 Trapping survey

3.5.1 The trapping surveys were carried out at ten locations as shown in Figure EC-22-004. These locations were selected with using the 2013 baseline data from the ES, aerial

photographs, OS maps and data obtained during a vantage point survey undertaken in May 2014 (see Figure EC-22-002).

3.5.2 Vantage point surveys were undertaken to help identify the directions of flight of the Natterer's bats emerging from the roost. Survey locations were selected to provide the best view of the potential commuting areas in close proximity to the church. This information subsequently used to establish locations to trap bats for radio-tracking surveys.

3.5.3 One harp trap was set up at each of the ten locations and was fitted with an acoustic lure that produced simulations of a variety of bat social calls, to increase the likelihood of trapping bats.

3.5.4 The locations for the harp traps were as follows (see Figure EC-22-004):

Location 1. Fox Covert (SP 59382 39471); in the southern tip of the small woodland situated to the south of Radstone and north of A43 Oxford Road;

Location 2. Helmdon Disused Railway (SP 59082 39821), where the original scheme crosses the railway;

Location 3. Radstone Road (SP 58618 40102); a small woodland adjacent to Radstone Road;

Location 4. Helmdon Disused Railway (SP 59086 40260); Helmdon Disused Railway directly north of the scheme;

Location 5. Radstone (SP 58887 40617); east of Church of St Lawrence;

Location 6. Helmdon Disused Railway (SP 59066 40664); east of Radstone and north of the scheme;

Location 7. Helmdon Disused Railway (SP 58939 41129); north of Radstone, Location 6 and the scheme;

Location 8. Helmdon Disused Railway (SP 58801 41577), north of Location 6 and 7, Radstone and the scheme; and,

Location 9 (SP 57368 41672) and Location 10 (SP57501 41710), both within Halse Copse.

3.5.5 Each of the ten locations were surveyed for three nights during 2014, with multiple locations being set up on each night Trapping was carried out on two nights in May, three nights in July and three nights in September 2014. The trapping commenced at sunset and lasted for a minimum of six hours on each survey night.

3.5.6 The bats caught in the harp traps were removed, by or under the direction of the licence holder, from the traps and transferred to a clean cloth bag. At the end of each trapping session the biometric information was obtained from all bats caught. Biometric data collection included, sex of the bat, weight obtained using a light line

spring scale (Pesola), forearm measurement using digital callipers (Sealey S0707), reproductive status and any other general health observations.

3.5.7 Bats that were selected were retained and a radio-transmitter was attached. All other bats were released immediately in close proximity to the site of capture during the hours of darkness. Droppings were collected from small *Myotis* bats for DNA analysis to verify species.

3.5.8 No underweight bats were tagged and the weight of the radio-tag was always less than 5% of the animal's weight. Female bats, in particular reproductive females, were selected for radio-tagging as they enabled the identification of flightlines associated with a maternity colony, likely to be the colony present at the Church of St Lawrence.

3.5.9 Radio-transmitters were attached with Skin-Bond® (Pfizer Inc.) to the area between the shoulder blades from which fur had been clipped. Recapture data indicates that the tags usually fall off the animals after 5 - 12 days. All animals were caught and handled under licence from Natural England (Dr Stephanie Murphy, Natural England Survey Licence No.2014-1045-SCI-SCI). The animals that were fitted with radio-transmitters were released on the same night of capture in close proximity to the capture site.

3.6 Radio-tracking study

3.6.1 To determine the position of radio-tagged bats during the day (daytime roost locations) and night (commuting and foraging locations) the animals were tracked on foot and by car by a minimum of four surveyors using a Biotrack 'Sika' receiver and a Yagi 3-element antenna on a height-adjustable and portable mast. A Yagi 5-element was also used to provide information on daytime roosting locations. The position of each radio-tagged bat was determined by taking sequential paired bearings from various locations in the survey area, which resulted in data on the bats flightlines and foraging habitats. When a radio-tagged bat remained in a specific location for an extended period of time, a technique known as close-approach[1] was used to obtain more accurate bearings. Notes including time, compass bearing, GPS reading and weather were recorded on data sheets in the field. The radio-tracking teams followed the bats from sunset until sunrise.

3.6.2 Each animal was radio-tracked for between one and five days (depending on how long contact with each radio-tagged animal was maintained) to obtain estimates of home range. Bats were radio-tracked concurrently whereby the radio-tracking teams would switch between radio-tag frequencies in order to obtain estimates of locations for different animals. Data from each night of radio-tracking was added to a cumulative database and for each individual this was used to estimate the bat's home range area.

3.6.3 When a new roost location was identified emergence surveys were carried out at newly recorded roosts (where access was available) to establish a minimum colony

[1] Close approach technique involves the surveyors approaching the signal being emitted and get very close to the radio-transmitter. It is useful for when an animal is not moving or foraging in discrete areas.

size. The emergence surveys allowed flightlines between roosts and foraging areas to be recorded. Where roosting locations were identified on land where access was prohibited, this was addressed by using the techniques described in Sections 3.8.

3.7 Home range analysis

3.7.1 Pairs of compass bearings, and the locations they were taken from, were used to estimate the bat's position in the landscape (termed fix) by triangulation with the software package LOAS (version 2.12, Ecological Software Solutions, 1998 – 2003). The fixes obtained from LOAS were imported into Biotas (version 2.0 Ecological Software Solutions, 1998 – 2003) Ranges 7 (version 1.8, Anatrack Ltd, 2006) and ArcGIS 9 (version 9.2, ESRI, 2006) which were used to produce visual representations of the estimated ranging areas.

3.7.2 The home range of an individual animal is typically constructed from a set of fixes collected over a period of time that identify the multiple locations of an individual. A variety of analytical tools exist to estimate home ranges, these can be divided into two major classes: (i) minimum linkage approaches that describe ranges as polygons with minimised distances between edge locations; and (ii) probabilistic approaches that estimate the density of locations throughout a range (Harris *et al.*, 1990; White and Garrott, 1990; Kenward, 2001). Current analytical studies on animal home range tend to use both methodologies (Nicholls and Racey, 2006; Murphy *et al.*, 2012).

3.7.3 Two range estimators were used to calculate total range estimates for each individual animal including 100% Minimum Convex Polygon (100%MCP) and 95% Kernel Density Estimator (95%KDE). The Minimum Convex Polygon (MCP) simply connects the outermost points on the scatter of mapped locations such that the sum of linkage distances between edge points is minimised. KDE (Silverman, 1986; Worton, 1987; Worton, 1989) is a nonparametric estimator that describes home ranges by means of hierarchical probabilities for the intensity of habitat utilisation, termed isopleths. Series of isopleths can be plotted around the smallest area where the cumulative probability reaches a particular value. For example, the 95% isopleth encompasses the area where the probability of finding an animal is 95%.

3.7.4 Studies on various species' home ranges show that, for a number of environment-related reasons, certain portions within the home range are visited more frequently than others (Adams and Davis, 1967; Dixon and Chapman, 1980). The centre of activity can be defined as the area within the home range in which the most fixes occurred during the radio-tracking period and can give an indication of which part of the range the bat used more intensively. Areas of more intensive use have been termed as the 'core area of the home range' of the animal and may be related to the greater availability of food resources and refuges (Samuel *et al.*, 1985; Thompson *et al.*, 2007).

3.7.5 Core areas can be a useful concept when describing patterns of behaviour or identifying particularly resources (Harris *et al.*, 1990; Powell, 2000). The 50% isopleth (median value) was adopted as an indicator of core area use. The use of 50% KDE for bats radio-tracked in this study, would also make it comparable with other radio-

tracking studies on woodland bats, for example, Bechstein's *Myotis bechsteinii* (Dietz and Pir, 2009; Kerth and Melber, 2009) and brown long-eared *Plecotus auritus* (Murphy *et al* 2012). The 50% isopleth was, therefore, adopted as an indicator of core bat foraging areas.

3.7.6 The fixes, MCP, 95% KDE and 50% KDE were plotted onto an OS map to produce visual representations of the home range of each bat radio-tracked.

3.8 Constraints

3.8.1 Restricted access reduced the accuracy of the bearings taken for some roost locations and fixes of flight lines when radio-tracking bats. It was not possible to carry out emergence counts of the numbers of bats using roosts in areas where access for surveys had not been granted.

3.8.2 The radio signal of radio-tracked bat was occasionally lost for one or more of the survey teams; this was usually caused by the nature of the surrounding topography, the unpredictable behaviour of bats, and range limitations with the equipment. These constraints were addressed in the following ways:

where bats were roosting in land where access was prohibited, multiple bearings were taken from a variety of different locations;

where radio-tracking data on bats was deficient, subsequent surveys focused on those bats for which data was limited;

where radio signals were lost, bearings would be taken by a single survey team or with another team until such time as a better position in the landscape was possible or signal was regained; and

if the bat was foraging in an area of land where the signal strength was weak, then the radio-tracking surveyors would move to higher areas of land to get an omnidirectional bearing on the bat being tracked and re-adjust their positions to achieve a clearer signal.

3.8.3 Therefore, with the exception of roosts counts in buildings or trees where access was not permitted, it was considered that access restrictions had no significant impact on the findings of this study.

3.8.4 Bad weather, including heavy rain and storms caused the cancellation of one trapping survey in May, one night in July, and one September survey being terminated after four hours trapping. All surveys were rescheduled, with the exception of September due to continued bad weather. Therefore, poor weather had no significant impact on the findings of this study.

3.8.5 Tagging bats was contingent on trapping bats in suitable condition. In September a high proportion of bats caught were juvenile bats that were not of an adequate weight to radio-tag. However, sufficient numbers of bats (approximately 10% of the colony) of the correct weight were caught and radio-tagged (fourteen female bats from

Natural England's maximum allowance of twenty), therefore this constraint had no impact on the findings of the study.

3.8.6 The static recorder unit located at the Helmdon Disused Railway south failed in September and recorded only static noise, most probably as a result of a microphone failure. The lack of ultrasound data affects the conclusions that can be made from surveys in September regarding the movement of bats where the original scheme crosses the Helmdon Disused Railway SSSI. Therefore subsequent comparisons of bat activity in September at the north and south locations of the Helmdon Disused Railway cannot fully be quantified. However, data was obtained from four of the five static detector units as well as from other survey methods.

3.8.7 MCPs are very sensitive to outlier fixes and require large data sets for accurate estimations of home range size (Powell, 2000). Furthermore, they give no information about how the animal is using its home range (Harris *et al.*, 1990). The limitations to using MCP to identify the home range were addressed by also using KDE, a probabilistic approach to home ranges analysis, whereby the density of fixes was estimated throughout the area used by the animal.

4 Results

4.1 Automated surveys

4.1.1 The total bat passes per night (ppn) recorded for all species during the 2014 field surveys was 12,962 (see Table 1). The highest number of calls throughout the entire survey season was in May when 4529 calls were recorded.

4.1.2 In May the highest numbers of bat passes were recorded at Location 1 and Location 2 where 254 and 258 average ppn respectively. A lower number of calls were recorded at Location 5 in May, with an average of 140 ppn. Numbers of bat passes recorded at Location 3 and Location 4 were lower again with an average 94 and 125 ppn.

4.1.3 In July the highest number of bat passes was at recorded Location 1 with an average of 237 ppn; the number was lower at Location 2 with an average of 165 ppn. Locations 3, 4 and 5 had similar numbers of passes to those recorded in May.

4.1.4 In September there was no data recorded at Location 2 due to a technical fault with the detector. The highest number of bat passes recorded was at Location 4 with an average of 347 ppn, compared with averages of between 43 and 83 ppn at the other three locations.

4.1.5 The average *Myotis* bat passes per night at each survey location in 2014 is discussed below and shown in Section 9, Figure 1. The highest numbers *Myotis* bats recorded, including Natterer's bat, was at Location 5 in September, with an average of 45 ppn. There were lower numbers of calls at this location in May and July when an average of 15 ppn and 13 ppn respectively.

4.1.6 The number of *Myotis* passes was low in May at all locations, with the highest number recorded at Locations 4 and 5, with an average of 9 and 15 ppn respectively. The

number of passes increased from May to July at Locations 1, 2 and 3, most markedly at Location 2 (refer to Table 1 and Figure 1). The number of passes in September remained similar to July at all locations with the exception of Location 5 where they increased. The surveys recorded a steady increase in the number of *Myotis* bat passes from May to September at Location 4.

4.1.7 At least eight species, other than *Myotis* bats, were recorded over the entire survey period by static detector units, the location and number of passes of different species is as follows:

barbastelle bat *Barbastella barbastellus* were recorded occasionally in September with a total ppn of one, three and five at Locations 1, 3 and 4 respectively;

the highest number of Leisler's bats were recorded at Location 3 with a total of three bat passes in July. In May two passes of Leisler's bats in total were recorded, both at Location 5, and no Leisler's passes were recorded in September;

the highest numbers of noctule bats were recorded at Location 5 with a total of 32 bat passes in July;

serotine bat was recorded on one occasion with a total of one pass at Location 3 in September;

brown long-eared were recorded occasionally at all five survey locations. The peak count was at Location4 with 27 ppn recorded in July;

common pipistrelle *Pipistrellus pipistrellus* were the most commonly recorded species with the highest numbers of this species recorded at Location 4 in September with an average of 298 ppn. High levels of common pipistrelles were also recorded at Location 1 in May and July with totals 254 and 216 ppn respectively;

Nathusius' pipistrelle *Pipistrellus nathusii* bat was recorded at an average 18 ppn at Location 5 in July; and

soprano pipistrelle *Pipistrellus pygmaeus* was the second most commonly recorded species, with the highest number of ppn being 225 in July at Location 2.

Table 1 : Automated survey results; Locations 1 to 5 for May, July and September 2014

Month	Species[2]	Location									
		1. Fox Covert		2.Helmdon Disused Railway south		3. Radstone Road		4. Helmdon Disused Railway north		5. South of Halse Copse	
		Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night
May	B. barb	0	0	0	0	0	0	0	0	0	0
	E. ser	0	0	0	0	0	0	0	0	0	0
	P.pyg	9	2	49	12	11	3	7	2	68	14
	P.pip	1016	254	961	240	340	85	455	114	542	108
	P.nat	0	0	0	0	1	<1	0	0	2	<1
	P.aur	0	0	0	0	0	0	2	1	8	2

[2] P.pip - common pipistrelle, P pyg - soprano pipistrelle, P.nat - Nathusius' pipistrelle, P sp. - Pipistrelle bat species, Myotis sp. Myotis bat species includes the following species; Bechstein's bat, Daubenton's bat, Natterer's bat, whiskered bat, Brandt's bat and alcathoe bat. P.aur -brown long-eared bat, B. barb - barbastelle bat, N.noc - noctule bat, N.Leis - Leisler's bat, E.ser - serotine bat.

Month	Species[2]	Location									
		1. Fox Covert		2.Helmdon Disused Railway south		3. Radstone Road		4. Helmdon Disused Railway north		5. South of Halse Copse	
		Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night
	Myotis sp	2	<1	2	<1	18	5	34	9	73	15
	N.noc	3	<1	3	<1	7	2	<1	0	7	1
	N.leis	0	0	0	0	0	0	0	0	2	<1
	Total[3]	1030	258	1015	254	377	94	499	125	702	140
July	B. barb	0	0	0	0	0	0	0	0	0	0
	E. ser	0	0	0	0	0	0	0	0	0	0
	P.pyg	34	7	255	51	31	6	82	16	46	9
	P.pip	1081	216	421	84	295	59	415	83	310	62

Month	Species[2]	Location									
		1. Fox Covert		2.Helmdon Disused Railway south		3. Radstone Road		4. Helmdon Disused Railway north		5. South of Halse Copse	
		Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night
	P.nat	0	0	0	0	1	<1	0	0	92	18
	P.aur	0	0	16	3	0	0	27	5	9	2
	Myotis sp	64	13	128	26	22	4	104	21	64	13
	N.noc	5	1	4	1	27	5	7	1	32	6
	N.leis	2	<1	1	<1	3	1	2	<1	2	<1
	Total	1186	237.2	825	165	379	75.8	637	127.4	555	111
September	B.barb	1	<1	Equipment malfunction		3	<1	5	1	0	0
	E. ser	0	0			1	<1	0	0	0	0
	P.pyg	46	7			28	4	110	16	96	19
	P.pip	161	23			380	54	2086	298	90	18

Month	Species[2]	Location									
		1. Fox Covert		2.Helmdon Disused Railway south		3. Radstone Road		4. Helmdon Disused Railway north		5. South of Halse Copse	
		Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night	Total No. Passes	Av. passes/night
	P.nat	0	0			1	<1	0	0	0	0
	P.aur	3	0			4	1	14	2	3	<1
	Myotis sp	59	8			47	7	195	28	223	45
	N.noc	31	4			9	1	21	3	1	<1
	N.leis	0	0			0	0	0	0	0	0
	Total	301	43			473	68	2431	347	413	83

4.2 Emergence survey

4.2.1 An emergence survey, at the Church of St Lawrence, Radstone was carried out on the 30 May, 18 July and 23 September 2014, with peak counts of Natterer's bats at 142, 222 and 44, respectively.

4.3 Filming survey

4.3.1 Four nights of filming surveys were carried out at two locations between 31 May and 24 September 2014. The date, location and data from the surveys is detailed in Annex 1 and the locations are shown on Figure EC-22-003.The filming survey carried out on 1 June 2014 east of Radstone at SP 59053 40505 recorded *Myotis* bats flying along scrub habitat at the edge and at the centre of the Helmdon Disused Railway at heights of between 2m and 2.5m. The three subsequent surveys carried out on 19 and 20 July and on the 24 September 2014 were at the point where the original scheme bisects the Helmdon Disused Railway at SP 59090 239808. These surveys recorded *Myotis* sp. flying at 5 m, and common pipistrelle and *Pipistrelle* sp. flying between 3 m and 7 m, all species were flying along vegetation at the top of cutting of Helmdon Disused Railway. Brown long-eared and noctule bats were also recorded but not seen by the surveyor or recorded on the infra-red digital recorder.

4.4 Trapping survey

4.4.1 On eight nights between 28 May 2014 and 24 September 2014 a total of 88 bats were caught, which included 46 Natterer's bats. The species, sex and biometric data for all bats caught are detailed in Annex 2.

4.4.2 Six species were caught, including 19 common pipistrelles, nine brown long-eared, eight whiskered (confirmed by DNA analysis), five soprano pipistrelle and one Leisler's bat. Serotine bat, one of the target species of the radio-tracking study, were not caught, consequently there is no data on this target species.

4.4.3 One sexually active male Leisler's bat was caught in Halse Copse in July. Leisler's bat was one of the target species identified for radio-tracking however, male bats often travel greater distances than female bats and Leisler's in particular are known to travel in excess of 10km from their roosting sites. It was therefore decided not to tag this bat as the adverse effect the animal's welfare would outweigh the value of the data it would provide. No further Leisler's bats were caught; consequently there is no data on this target species.

4.4.4 Natterer's were caught exclusively at locations north of the scheme, at Locations 4 to 10. Of the Natterer's caught 85% were caught in close proximity to the Church of St Lawrence, at Locations 5, 6 and 7. Of the eighteen juvenile Natterer's bats caught, 45% of them were at location 7.

4.5 Radio-tracking study

Roosts

4.5.1 Of the ten roosts recorded during the survey, eight were located to the north of the scheme, and two were located to the south. The ten are summarised in Table 2 and Figure EC-23-002.

4.5.2 All of the bats radio-tracked in May and July roosted in the Church of St Lawrence exclusively. However, by comparison in September there was greater evidence of a variety of roosts used being utilised within the wider landscape including roost switching during the radio-tracking period. For example, bat 11 used two roosts, bat 12 used three roosts and bat 14 used four roosts over four nights.

4.5.3 Of the additional roosts recorded in September six were recorded in trees adjacent to the original scheme at Halse Copse, two roosts were recorded 250 m and 300m south of the original scheme at Hall Farm and a tree east of Radstone, respectively, and one roost was recorded 2.5 km north of the Scheme at a tree in Shortgrove Wood. Emergence surveys were not undertaken at these locations due to other survey types taking priority, therefore the size of these roosts could not be determined.

Flightlines

4.5.4 Regularly used flightlines in proximity to the Church of St Lawrence, Radstone and the original scheme between roost sites and foraging sites were identified for a number of individuals. These flightlines are detailed in EC-25-001, EC-25-002, and EC-25-003.

4.5.5 In total the surveys recorded six flightlines that crossed the scheme; as detailed below:

Helmdon Disused Railway was used by all seven of the tagged bats in May and July;

Radstone Brook was used by four of the tagged bats (bat 8, 9, 10, 11) in September;

Halse Copse was used by two of the tagged bats (bat 12 and 14) in September;

Hedgerow north west of Radstone was used by bat 12 in September;

an arable field to the west of Radstone was used by bat 8 in September; and

Fox Covert was used by bat 11 in September.

4.5.6 In May and July the flightlines of all bats tagged crossed the original scheme using Helmdon Disused Railway. In September the flightlines of all tagged bats, except bat 13, crossed the original scheme using five different locations.

Foraging

4.5.7 Descriptions of foraging areas are provided below for each bat, these are based on the MCP and KDE analysis as described in the methodology. Table 2 summarises the

MCP, and KDE data for each bat radio-tracked bat. The 100%MCP, 95%KDE and 50%KDE foraging range representation is shown on Figures EC-24-001, EC-24-002 and EC-24-003.

Table 2: Radio-tracking data for each individual animal, including home range data

Bat	Date Caught	No of nights radio-tracked	No of roosts used in tracking period.	100% MCP(ha)	95% KDE (ha)	50% KDE (ha)
1	28/05/2014	2	1	31.56	N/A	N/A
2	28/05/2014	3	1	154.31	74.87	9.86
3	14/07/2014	4	1	148.81	63.76	7.97
4	14/07/2014	4	1	202.89	212.72	48.51
5	15/07/2014	3	1	286.22	221.63	20.80
6	15/07/2014	4	1	76.61	127.02	45.16
7	15/07/2014	3	1	371.50	167.12	20.62
8	22/09/2014	5	1	232.05	301.64	66.71
9	23/09/2014	2	1	321.43	N/A	N/A
10	23/09/2014	1	1	10.36	N/A	N/A
11	23/09/2014	4	2	303.01	227.95	48.61
12	23/09/2014	4	3	668.28	557.31	28.71
13	23/09/2014	4	1	486.54	353.03	9.18
14	24/09/2014	3	4	407.44	154.47	11.78

Bat 1

4.5.8 A pregnant female, was caught on 28 May 2014 at Location 5, close to the main roost at Church of St Lawrence, Radstone. Bat 1 roosted in the church for the duration of the survey period. After emergence, bat 1 was recorded flying east from the church to the Helmdon Disused Railway Line before flying south along it. Bat 1 was recorded to the west of Foxhill Spinney, indicating that the bat had crossed the original scheme at the Helmdon Disused Railway Line.

4.5.9 The home range analysis shows Bat 1 used Helmdon Disused Railway Line and was recorded foraging along a watercourse to the west of Foxhill Spinney, to the southwest of the original scheme.

Bat 2

4.5.10 A pregnant female, was caught on 28 May 2014 at Location 5, close to the main roost at Church of St Lawrence, Radstone. Bat 2 roosted in the church for the duration of the survey period. After emergence bat 2 was recorded flying east from the church to the Helmdon Disused Railway. Bat 2 commuted south along the disused railway line and crossed the original scheme to reach Foxhill Spinney where bat 2 crossed the A43 (Oxford Road).

4.5.11 The home range analysis shows Bat 2 was recorded foraging close to the Helmdon Disused Railway north of Foxhill Spinney, to the south of the original scheme. Bat 2 travelled across the A43 (Oxford Road) to forage along a watercourse to the east of the A43. It was not possible to access the land where bat 2 was foraging south of the A43 as access was restricted.

Bat 3

4.5.12 Bat 3 was caught on 14 July 2014 at Location 5, close to the main roost at the Church of St. Lawrence, Radstone. Bat 3 roosted in the church for the duration of the survey period. The first night after emergence bat 3 was recorded flying south across the pasture field south of the church towards a mature hedgerow at the southern edge of the pasture field. Bat 3 was also recorded flying east from the church, following emergence, to Helmdon Disused Railway before flying south along the railway.

4.5.13 The home range analysis shows Bat 3 was recorded foraging within the pasture field south of the church and along the Radstone Brook to the south of the church where the original scheme crosses Radstone Brook. Bat 3 was also recorded foraging along watercourses to the east of Radstone, to the northeast of the original scheme.

Bat 4

4.5.14 Bat 4 was caught on 14 July 2014 at Location 6, under a bridge on the Helmdon Disused Railway. Bat 4 roosted in the Church of St. Lawrence, Radstone for the duration of the survey period. After emerging bat 4 was recorded flying east from the church then south along a tree line before flying south and north along the Helmdon Disused Railway.

4.5.15 The home range analysis shows Bat 4 was recorded foraging within the pasture field south of the church and along the Radstone Brook to the southeast of Radstone, to the northeast of the original scheme. Bat 4 was also recorded foraging in the pasture field south of Radstone Brook where the original scheme crosses the field. Bat 4 was also recorded foraging along the Helmdon Disused Railway both to the north of Radstone and the scheme, and to south of Radstone where the original scheme crosses the Helmdon Disused Railway.

Bat 5

4.5.16 Bat 5 was caught on 15 July 2014 at Location 6, under a bridge on the Helmdon Disused Railway Line. Bat 5 roosted in the Church of St. Lawrence, Radstone for the duration of the survey period. After emerging bat 5 was recorded flying east from the church then south along a tree line before flying south along the Helmdon Disused Railway. Bat 5 was not recorded flying across the original scheme and remained east of the original scheme. Bat 5 was also recorded flying north along the Helmdon Disused Railway Line before flying along a stream and woodland to the east.

4.5.17 The home range analysis shows Bat 5 was recorded foraging within the pasture field south of the church as well as Radstone Brook to the southeast of Radstone, which lies to the northeast of the original scheme.Bat 5 foraged north along the Helmdon Disused Railway before foraging along watercourses to the east and west, which lie north of the original scheme.

Bat 6

4.5.18 Bat 6 was caught on 15 July 2014 at Location 4, on the Helmdon Disused Railway Line to the south of Radstone. Bat 6 roosted in the Church of St. Lawrence, Radstone for the duration of the survey period. Bat 6 was recorded flying south from the church after emerging, across the pasture field south of the church towards a mature hedgerow. Bat 6 was also recorded following the same flightline as bats 4 and 5 by flying east from the church, south along a tree line before entering the Helmdon Disused Railway and flying south crossing the original scheme.

4.5.19 The home range analysis shows Bat 6 foraged close to Radstone, primarily within the pasture field south of the church, along Radstone Brook and within the pasture field to the south of Radstone Brook where the original scheme crosses the field. Bat 6 was also recorded foraging along the Helmdon Disused Railway where the original scheme crosses the Helmdon Disused Railway.

Bat 7

4.5.20 Bat 7 was caught on 15 July 2014 at Location 4, on the Helmdon Disused Railway Line to the south of Radstone. Bat 7 roosted in St. Lawrence, Radstone for the duration of the survey period. One night after emergence bat 7 was recorded flying south across the pasture field south of the church towards a mature hedgerow at the southern edge of the pasture field where bat 7 foraged, in a similar location to bat 3 in May. Bat 7 was also recorded flying east from the church, following emergence, to the Helmdon Disused Railway.

4.5.21 The home range analysis shows Bat 7 utilised the pasture field south of the church as well as Radstone Brook to the south of the church to the northeast of the original scheme. Bat 7 foraged within the pasture field to the south of Radstone Brook where the original scheme crosses the field, as well as along the Helmdon Disused Railway and the watercourses to the east of the Helmdon Disused Railway. Bat 7 was also recorded foraging in the northwest of Shortgrove Wood which lies to the northeast of

the original scheme but the precise route that the bat travelled between the watercourse and Shortgrove Wood was not ascertained as there was no contact between the transmitter and the receiver when the bat was commuting.

Bat 8

4.5.22 Bat 8 was caught on 22 September 2014 at Location 5, close to the main roost at the Church of St. Lawrence, Radstone. Bat 8 roosted in the church for the duration of the surveys. After emerging bat 8 was recorded travelling east, using the same route as bats 4, 5 and 6 and subsequently flying south across the pasture field south of the church similar to bat 7 before travelling west across the Radstone Road and south west across fields, crossing the scheme, then travelling south. Bat 8 was also recorded flying west along the Radstone Brook, and to the north of the small patch of woodland that lies to the west of the Radstone Road.

4.5.23 The home range analysis shows, unlike the majority of the other bats, bat 8 did not fly south down the Helmdon Disused Railway. Instead bat 8 foraged in the pasture field directly south of the church and along Radstone Brook to the southwest of Radstone where the original scheme crosses the brook, and in the open fields adjacent to brook.

Bat 9

4.5.24 Bat 9 was caught on 23 September 2014 at Location 5, close to the main roost at the Church St. Lawrence, Radstone. Bat 9 was recorded roosting within Shortgrove Wood to the north east of Radstone. From Shortgrove Wood bat 9 travelled along a hedgerow that runs from the southwest tip of the wood, towards the Radstone Brook. Bat 9 travelled west along Radstone Brook and crossed the scheme, and Radstone Road.

4.5.25 The home range analysis shows Bat 9 foraged down a hedgerow that runs from the southwest tip of Shortgrove Wood, towards a watercourse. Bat 9 foraged west along Radstone Brook, where the original scheme crosses the brook, and crossed the Radstone Road to the west of the original scheme. Bat 9 disappeared from contact with the receiver on numerous occasions so its range is likely to be under-represented.

Bat 10

4.5.26 Bat 10 was caught on 23 September 2014 at Location 5, close to the main roost at the Church St. Lawrence, Radstone. Bat 10 was subsequently recorded roosting within the church. After emerging bat 10 was recorded travelling east, using the same route as bats 4, 5, 6 and 8, as well as travelling south across the pasture field south of the church, similar to bat 7 and 8. However, Bat 10 crossed the original scheme at Radstone Road.

4.5.27 The home range analysis shows Bat 10 was recorded foraging along Radstone Brook directly south of the church and along this watercourse to the west where the original scheme crosses the brook. Bat 10 disappeared from contact with the receiver numerous times so the range is likely to be under-represented.

Bat 11

4.5.28 Bat 11 was caught on 23 September 2014 at Location 5, close to the main roost at the Church of St. Lawrence, Radstone. Bat 11 was subsequently recorded roosting within the church as well as Hall Farm which is located directly south of the church. After emerging from the church bat 11 was recorded travelling south across the pasture field south of the church. When emerging from Hall Farm bat 11 was recorded travelling north, northwest and southeast all across fields. When travelling north from Hall Farm bat 11 was crossing the original scheme through arable fields. Bat 11 was also recorded travelling east from the roost to the Helmdon Disused Railway Line.

4.5.29 The home range analysis shows Bat 11 primarily foraged in arable and pasture fields surrounding its roost at Hall Farm, and along the watercourse to the northwest of Hall Farm to the south of the original scheme. Bat 11 was also recorded foraging in the pasture field to the south of the church and the pasture field to the south of Radstone Brook, where the original scheme crosses the field.

Bat 12

4.5.30 Bat 12 was caught on 23 September at Location 5, close to the main roost at the Church of St. Lawrence, Radstone. Bat 12 was subsequently recorded roosting within two separate tree roosts in the southern part of Halse Copse and within a tree on a hedgerow to the south. Bat 12 was recorded commuting southeast from these roosts across fields towards Radstone, in addition to flying across fields to southwest and north-northeast, which involved crossing the original scheme.

4.5.31 The home range analysis shows Bat 12 utilised a large foraging range which was primarily around its roost in Halse Copse, in fields to the southwest of Halse Copse where the original scheme crosses the fields, to the southeast of Halse Copse which lies to the north of the scheme, and fields to the west of Radstone which are crossed by the original scheme crosses.

Bat 13

4.5.32 Bat 13 was caught on 23 September at Location 5, close to the main roost at the Church of St. Lawrence, Radstone and was subsequently recorded roosting within the church. Bat 13 was recorded emerging from the church and travelling east across Helmdon Disused Railway and in field to the east, before meeting a ditch that feeds into the Great River Ouse and travelling east towards Pimlico. Bat 13 was also recorded travelling north and south along the hedgerow to the south of Shortgrove Wood, along the eastern boundary of Whistley Wood and a field to the west of Radstone, to the south of the original scheme.

4.5.33 The home range analysis shows Bat 13 was recorded foraging north along Helmdon Disused Railway. From there bat 13 travelled east along a watercourse to forage to the southeast. Bat 13 also foraged east of Radstone, both over fields and along watercourses and in Shortgrove and Whistley Wood, to the east of the original scheme.

Bat 14

4.5.34 Bat 14 was caught on 24 September at Location 10, in Halse Copse south and was subsequently recorded in four different tree roosts, three of which were located in the northwest of Halse Copse south and one which was located in the southeast of Halse Copse south. Bat 14 was recorded travelling north along the western boundary of the Halse Copse south where bat 14 crossed the original scheme.Bat 14 also travelled along the watercourse to the northeast of Halse Copse south towards the Halse Copse north, then along the southern and northern edges of this copse and along the watercourse to the east. Bat 14 was also recorded to the north of Welsh Lane.

4.5.35 The home range analysis shows Bat 14 primarily foraged within the two sections of Halse Copse and along surrounding watercourses. Bat 14 was recorded foraging to the west of Halse copse where the original scheme crosses. Bat 14 was also recorded foraging north of Welsh Lane, foraging at two waterbodies, one adjacent to Spring Farm (SP 57654 42706) and one further north, both to the north of the scheme.

5 Discussion

5.1 Automated Surveys

5.1.1 A total of 12,962 passes from at least eight species of bat were recorded from automated surveys in Radstone during 2014. Species from six genera were identified, including; two *Nyctalus, Eptesicus*, three *Pipistrellus*, at least one *Myotis, Plecotus*, and *Barbastella* species. Barbastelle, and Nathusius' pipistrelle bats have not previously been recorded in this area. Overall the data indicates that the five survey locations are used by at least nine bat species for commuting and foraging bats from July to September, inclusive.

5.1.2 The target species, *Myotis* and Leisler's bats, were recorded at every survey location whilst the serotine bat was recorded at Location 3 only. The peak counts of *Myotis* species were recorded in September at Location 5 and in July, at Locations 2 and 4. Due to the low number of passes of Leisler's and serotine there is no evident peak count. The lack of data recorded for Leisler's and serotine indicates that the survey area is not the core habitat for either species, but is likely to be used by individuals to commute through the landscape.

5.1.3 *Myotis* bats were consistently recorded throughout the survey period and at all survey locations in 2014. A significant proportion of the passes recorded are likely to be Natterer's bats (corroborated by trapping data) and therefore, the data recorded in 2014 indicates that the colony of Natterer's in the church of St Lawrence uses the landscape around Radstone to forage and commute.

5.1.4 The 2013 data was similar to 2014 at Location 5 with a peak in the number of passes in September. There was an increase in the number of passes recorded throughout 2014 at location 4 in comparison with 2013.

5.2 Emergence survey

5.2.1 In May the pre-maternity colony count was 142 bats, confirmed following post survey analysis of the infra-red digital recorder. The emergence location was from the eaves at the northern elevation of the Church of St. Lawrence, the majority of the bats flew immediately south.

5.2.2 In July the colony count was confirmed, following post survey analysis, as 222 (which included juveniles). In September the colony count was confirmed, following post survey analysis, as 44 bats. This reduction in numbers is likely to typical behaviour of colony disbandment at this time of year and this is further reflected by the number of additional roosts located by radio-tracking in the wider landscape in September.

5.3 Filming

5.3.1 The filming surveys provided footage of *Myotis* bats, flying at a height of 5m, in relation to current ground level, at the point where the original scheme would cross the Helmdon Disused Railway. Filming surveys were also undertaken north of this location and recorded *Myotis* bats flying at heights of between 2 m and 2.5 m. This is the flightline to the east of the Church of St Lawrence where the Natterer's bats commute to meet the Helmdon Disused Railway line. This is typical for this species, which is often recorded flying at heights of up to 5m (BCT, 2010). The differences in flight heights are likely due to the differences in vegetation height in the two filming locations, with taller vegetation at the point where the original scheme would cross the Helmdon Disused Railway.

5.4 Trapping Survey

5.4.1 All 14 of the Natterer's bats caught were in trapping locations north of the scheme; this aligns with the 2013 survey data which concluded that the majority of the population utilised the landscape to the east and north of the original scheme and the Church of St Lawrence. However, when all the survey types are analysed together it is clear the colony utilises the land to the south of the original scheme as well as the north.

5.5 Radio-tracking

Roosts

5.5.1 The survey data indicates that a proportion of the population of Natterer's in Church of St Lawrence move closer to the original scheme during September and therefore are likely to be at an increased risk of the effects of severance of habitat and potential mortality as a consequence of collision with passing trains. The data supports the results of flightlines analysis described below.

Flightlines

1.1.1 A proportion of the regular flightlines of 13 of the 14 tagged bats crossed the original scheme. In May and July all seven of the tagged bats crossed the original scheme using the Helmdon Disused Railway. In September six of the seven tagged bats crossed the original scheme at five locations in the wider area, with the four bats crossing at Radstone Brook.

5.5.2 The survey data indicates that Helmdon Disused Railway is the flightline that the colony relies upon throughout the year. The flightlines at Radstone Brook and Halse Copse were used in September by four and two bats, respectively. These flightlines are used to a lesser extent than Helmdon Disused Railway but are important to the colony during the autumn when the colony's range expands. The remaining flightlines were used in the autumn by individual bats; indicating they are less significant than the flightlines at Radstone Brook and Halse Copse.

Foraging

5.5.3 Radio-tracking data indicated that all 14 bats tagged foraged south of the scheme, and eight of the 14 radio tagged Natterer's bats foraged at Helmdon Disused Railway. As such Helmdon Disused Railway is important habitat for foraging as well as commuting Natterer's bats.

5.5.4 The habitats present in the Helmdon Disused Railway included unimproved calcareous grassland, scrub and mature trees which are likely to support high invertebrate biomass, providing good foraging opportunities for Natterer's bat.

5.5.5 The Radstone Brook and its tributaries, and the watercourses associated with the River Great Ouse provided foraging habitat five of the radio-tracked bats. This behaviour is typical of Natterer's bats which are frequently associated with watercourses (Smith, P.G., & Racey, P.A., 2008) and, as such, the watercourses in proximity to the original scheme are likely to provide important foraging habitat. Two radio-tracked Natterer's bats also used the arable fields to the west of Halse Copse south.

5.5.6 The pasture field and hedgerow to the south of Church of St Lawrence was used by seven of the 14 bats radio-tracked including four of the five bats radio-tracked in July. This indicates the habitats in close proximity to the Church of St Lawrence are of importance to the Natterer's bats, most likely due to lactating females making multiple returns to the roost to feed their pups.

5.5.7 The foraging data demonstrates the Natterer's bats in Church of St Lawrence have a strong association with Radstone Brook and its tributaries, hedgerows, Helmdon Disused Railway, pasture to the south of the church and Halse Copse LWS. All 14 radio-tagged bats were recorded foraging north and south of the scheme, and therefore crossed the original scheme to access foraging areas.

5.5.8 The 2014 surveys indicate that the Helmdon Disused Railway, Radstone Brook and Halse Copse are important for the Natterer's colony at the Church of St Lawrence for foraging and commuting. Helmdon Disused Railway provides a flightline for the colony throughout the year. Therefore it is likely in the absence of mitigation, the construction and operation of original scheme would adversely affect the conservation status of this population. The effects would be through the severance and loss of roosting, commuting and foraging habitat and potential mortality as a consequence of collision with passing trains.

6 Annexes

Annex 1

Table 3 : Filming Data

Date	Easting	Northing	Time	Species	Height (m)	Notes
01/06/2014	459053	240505	21:55	Myotis	2.5	
01/06/2014	459053	240505	22:10	Myotis	2	
01/06/2014	459053	240505	22:12	Myotis	2.5	
01/06/2014	459053	240505	22:16	Myotis	2-2.5	
01/06/2014	459053	240505	22:17	Myotis	2-2.5	
01/06/2014	459053	240505	22:18	Myotis	2-2.5	
01/06/2014	459053	240505	22:19	Myotis	2-2.5	
01/06/2014	459053	240505	22:21	Myotis	2-2.5	
01/06/2014	459053	240505	22:56	Myotis	2.5	
01/06/2014	459053	240505	23:07	Myotis	2	
19/07/2014	459090	239808	21:52	P.pip	5	North to south down disused railway
19/07/2014	459090	239808	21:54	P.pip	Not seen	South to north on Western edge of disused railway, by trees
19/07/2014	459090	239808	21:55	P.pip	5	North to south on Western edge of disused railway, by trees
19/07/2014	459090	239808	21:56	P.pip	4	
19/07/2014	459090	239808	21:57	P.pip	Not seen	
19/07/2014	459090	239808	22:00	P.pip	6	North to south on Western edge of disused railway, by trees
19/07/2014	459090	239808	22:03	P.pip	6	North to south on Western edge of disused railway, by trees
19/07/2014	459090	239808	22:05	P.pip	5	South to north, crossed from eastern edge of disused railway to W

Date	Easting	Northing	Time	Species	Height (m)	Notes
19/07/2014	459090	239808	22:08	P.pip	Not seen	
19/07/2014	459090	239808	22:09	P.pip	7	North to south on Western edge of disused railway, by trees
19/07/2014	459090	239808	22:12	P.pip	Not seen	
19/07/2014	459090	239808	22:13	N.noc	Not seen	
19/07/2014	459090	239808	00:10	P.aur	Not seen	
19/07/2014	459090	239808	00:12	P.aur	Not seen	
19/07/2014	459090	239808	00:12	P.pip	Not seen	
19/07/2014	459090	239808	00:16	P.pip	Not seen	
20/07/2014	459090	239808	21:57	Pip sp	3	Near marker
20/07/2014	459090	239808	21:55	P.pip	Not seen	
20/07/2014	459090	239808	21:58	P.pip	7	
20/07/2014	459090	239808	22:05	P.pip	5	
20/07/2014	459090	239808	22:27	*Myotis*	Not seen	
20/07/2014	459090	239808	22:30	P.pip	Not seen	Regular foraging
20/07/2014	459090	239808	22:38	N.noc	Not seen	
20/07/2014	459090	239808	22:52	P.pip	5	
20/07/2014	459090	239808	22:52	*Myotis*	5	
24/09/2014	459090	239808	19:42	Bat	4	
24/09/2014	459090	239808	22:34	Bat	4	
24/09/2014	459090	239808	22:34	Bat	4	
24/09/2014	459090	239808	22:47	P.pip	6	

Annex 2

Table 4 : Location and biometric data for all Natterer's bats caught in 2014

Date	Bat number	Location	Easting	Northing	Species	Sex	Reproductive status	Weight (g)	Forearm (mm)
15/07/2014	24	4	459086	240260	M.nat	F	Post-lactating	8	40.91
15/07/2014	25	4	459086	240260	M.nat	F	Post-lactating	9.5	41.06
15/07/2014	26	4	459086	240260	M.nat	M	Juvenile	6.5	39.23
28/05/2014	4	5	458887	240617	M.nat	F	Pregnant	9.5	41.06
28/05/2014	5	5	458887	240617	M.nat	F	Pregnant	10	42.04
14/07/2014	6	5	458887	240617	M.nat	M	Juvenile	6.5	35.51
14/07/2014	8	5	458887	240617	M.nat	F	Post-lactating	9	39.64
14/07/2014	10	5	458887	240617	M.nat	M	Juvenile	5	36.81
14/07/2014	11	5	458887	240617	M.nat	F	Post-lactating	9	40.19
22/09/2014	47	5	458887	240617	M.nat	F	Juvenile	8	40.78
23/09/2014	55	5	458887	240617	M.nat	F	Non-parous	7.5	40.61
23/09/2014	56	5	458887	240617	M.nat	F	Non-parous	6.5	41.57
23/09/2014	57	5	458887	240617	M.nat	F	Non-parous	6.75	40.88
23/09/2014	58	5	458887	240617	M.nat	F	Non-parous	8.75	41.44
23/09/2014	59	5	458887	240617	M.nat	F	Non-parous	6.25	41.73
23/09/2014	60	5	458887	240617	M.nat	F	Non-parous	8.5	40.74
23/09/2014	61	5	458887	240617	M.nat	F	Non-parous	7.75	39.72
23/09/2014	62	5	458887	240617	M.nat	F	Non-parous	7.5	40.44-
23/09/2014	63	5	458887	240617	M.nat	F	Non-parous	7.75	39.85
23/09/2014	64	5	458887	240617	M.nat	M	Adult	6	37.29
23/09/2014	65	5	458887	240617	M.nat	F	Non-parous	9	39.65
23/09/2014	66	5	458887	240617	M.nat	F	Non-parous	7.75	40.2
23/09/2014	67	5	458887	240617	M.nat	F	Non-parous	7	38.65
23/09/2014	68	5	458887	240617	M.nat	F	Non-parous	7.5	40.06
14/07/2014	9	6	459066	240664	M.nat	M	Juvenile	6	39.7
15/07/2014	22	6	459066	240664	M.nat	F	Post-lactating	7	40.92
15/07/2014	28	6	459066	240664	M.nat	F	Lactating	7	40.01
15/07/2014	29	6	459066	240664	M.nat	F	Non-parous	7	38.5
15/07/2014	30	6	459066	240664	M.nat	F	Post-lactating	7.5	39.67
15/07/2014	31	6	459066	240664	M.nat	F	Post-lactating	8	40.7
15/07/2014	32	6	459066	240664	M.nat	M	Juvenile	6.5	41.6
16/07/2014	39	6	459066	240664	M.nat	F	Post-	7	37.09

Date	Bat number	Location	Easting	Northing	Species	Sex	Reproductive status	Weight (g)	Forearm (mm)
							lactating		
16/07/2014	40	6	459066	240664	M.nat	M	Juvenile	6	8.94
15/07/2014	13	7	458939	241129	M.nat	M	Juvenile	7	40.92
15/07/2014	14	7	458939	241129	M.nat	F	Juvenile	6.5	41.14
15/07/2014	15	7	458939	241129	M.nat	F	Juvenile	7.5	40.3
15/07/2014	16	7	458939	241129	M.nat	M	Juvenile	6	39.42
15/07/2014	17	7	458939	241129	M.nat	M	Juvenile	7	40.69
15/07/2014	18	7	458939	241129	M.nat	M	Juvenile	6	41.07
15/07/2014	19	7	458939	241129	M.nat	F	Juvenile	6	39.29
15/07/2014	20	7	458939	241129	M.nat	M	Juvenile	6	38.64
15/07/2014	21	7	458939	241129	M.nat	F	Juvenile	7	40.41
16/07/2014	42	8	458801	241577	M.nat	M	Juvenile	6.5	39.13
16/07/2014	45	8	458801	241577	M.nat	M	Juvenile	7	39.8
24/09/2014	85	8	458801	241577	M.nat	F	Non-parous	7	39.09
24/09/2014	83	10	457501	241710	M.nat	F	Parous	9	40.26

Table 5 : Biometric data

Date	Bat number	Location	Easting	Northing	Species	Sex	Reproductive status	Weight (g)	Forearm (mm)
28/05/2014	1	5	458887	240617	P.pip	M	N/A	N/A	N/A
28/05/2014	2	5	458887	240617	P.pip	M	N/A	N/A	N/A
28/05/2014	3	5	458887	240617	P.pip	M	N/A	N/A	N/A
28/05/2014	4	5	458887	240617	M.nat	F	Pregnant	9.5	41.06
28/05/2014	5	5	458887	240617	M.nat	F	Pregnant	10	42.04
14/07/2014	6	5	458887	240617	M.nat	M	Juvenile	6.5	35.51
14/07/2014	7	6	459066	240664	P.pyg	M	Adult	5	31.34
14/07/2014	8	5	458887	240617	M.nat	F	Post-lactating	9	39.64
14/07/2014	9	6	459066	240664	M.nat	M	Juvenile	6	39.7
14/07/2014	10	5	458887	240617	M.nat	M	Juvenile	5	36.81
14/07/2014	11	5	458887	240617	M.nat	F	Post-lactating	9	40.19
15/07/2014	12	8	458801	241577	P.pyg	F	Non-parous	5.5	33.3
15/07/2014	13	7	458939	241129	M.nat	M	Juvenile	7	40.92
15/07/2014	14	7	458939	241129	M.nat	F	Juvenile	6.5	41.14
15/07/2014	15	7	458939	241129	M.nat	F	Juvenile	7.5	40.3
15/07/2014	16	7	458939	241129	M.nat	M	Juvenile	6	39.42
15/07/2014	17	7	458939	241129	M.nat	M	Juvenile	7	40.69
15/07/2014	18	7	458939	241129	M.nat	M	Juvenile	6	41.07
15/07/2014	19	7	458939	241129	M.nat	F	Juvenile	6	39.29
15/07/2014	20	7	458939	241129	M.nat	M	Juvenile	6	38.64

Date	Bat number	Location	Easting	Northing	Species	Sex	Reproductive status	Weight (g)	Forearm (mm)
15/07/2014	21	7	458939	241129	M.nat	F	Juvenile	7	40.41
15/07/2014	22	6	459066	240664	M.nat	F	Post-lactating	7	40.92
15/07/2014	23	7	458939	241129	P.aur	F	Post-lactating	8	39.16
15/07/2014	24	4	459086	240260	M.nat	F	Post-lactating	8	40.91
15/07/2014	25	4	459086	240260	M.nat	F	Post-lactating	9.5	41.06
15/07/2014	26	4	459086	240260	M.nat	M	Juvenile	6.5	39.23
15/07/2014	27	6	459066	240664	P.pyg	F	Lactating	4.5	30.18
15/07/2014	28	6	459066	240664	M.nat	F	Lactating	7	40.01
15/07/2014	29	6	459066	240664	M.nat	F	Non-parous	7	38.5
15/07/2014	30	6	459066	240664	M.nat	F	Post-lactating	7.5	39.67
15/07/2014	31	6	459066	240664	M.nat	F	Post-lactating	8	40.7
15/07/2014	32	6	459066	240664	M.nat	M	Juvenile	6.5	41.6
15/07/2014	33	2	459082	239821	P.aur	M	Adult	8	36.86
15/07/2014	34	2	459082	239821	P.pip	F	Post-lactating	5	31.33
15/07/2014	35	6	459066	240664	P.pip	M	Adult	5	32.93
15/07/2014	36	6	459066	240664	P.pip	M	Adult	4.5	31.36
15/07/2014	37	6	459066	240664	P.pip	M	Adult	5.0	30.97
16/07/2014	38	6	459066	240664	P.pip	F	Non-parous	5.5	32.69
16/07/2014	39	6	459066	240664	M.nat	F	Post-lactating	7	37.09
16/07/2014	40	6	459066	240664	M.nat	M	Juvenile	6	8.94
16/07/2014	41	8	458801	241577	M.mys	F	Non-parous	5.5	33.37

Date	Bat number	Location	Easting	Northing	Species	Sex	Reproductive status	Weight (g)	Forearm (mm)
16/07/2014	42	8	458801	241577	M.nat	M	Juvenile	6.5	39.13
16/07/2014	43	6	459066	240664	P.pip	F	Post-lactating	5.5	33.11
16/07/2014	44	8	458801	241577	P.pip	F	Post-lactating	6	31.81
16/07/2014	45	8	458801	241577	M.nat	M	Juvenile	7	39.8
16/07/2014	46	9	457368	241672	N.lei	M	Adult	15	42.78
22/09/2014	47	5	458887	240617	M.nat	F	Juvenile	8	40.78
22/09/2014	48	6	459066	240664	M.mys	M	Juvenile	5	34.07
22/09/2014	49	5	458887	240617	M.mys	F	Parous	4.75	36.31
22/09/2014	50	6	459066	240664	P.pyg	F	Non-parous	5.75	31.82
22/09/2014	51	6	459066	240664	P.aur	M	Juvenile	7.5	38.02
22/09/2014	52	6	459066	240664	M.mys	M	Juvenile	4.5	32.53
23/09/2014	53	6	459066	240664	P.pip	F	Non-parous	5	31.9
23/09/2014	54	6	459066	240664	P.pyg	M	Adult	5.5	31.78
23/09/2014	55	5	458887	240617	M.nat	F	Non-parous	7.5	40.61
23/09/2014	56	5	458887	240617	M.nat	F	Non-parous	6.5	41.57
23/09/2014	57	5	458887	240617	M.nat	F	Non-parous	6.75	40.88
23/09/2014	58	5	458887	240617	M.nat	F	Non-parous	8.75	41.44
23/09/2014	59	5	458887	240617	M.nat	F	Non-parous	6.25	41.73
23/09/2014	60	5	458887	240617	M.nat	F	Non-parous	8.5	40.74
23/09/2014	61	5	458887	240617	M.nat	F	Non-parous	7.75	39.72
23/09/2014	62	5	458887	240617	M.nat	F	Non-parous	7.5	40.44-

Date	Bat number	Location	Easting	Northing	Species	Sex	Reproductive status	Weight (g)	Forearm (mm)
23/09/2014	63	5	458887	240617	M.nat	F	Non-parous	7.75	39.85
23/09/2014	64	5	458887	240617	M.nat	M	Adult	6	37.29
23/09/2014	65	5	458887	240617	M.nat	F	Non-parous	9	39.65
23/09/2014	66	5	458887	240617	M.nat	F	Non-parous	7.75	40.2
23/09/2014	67	5	458887	240617	M.nat	F	Non-parous	7	38.65
23/09/2014	68	5	458887	240617	M.nat	F	Non-parous	7.5	40.06
23/09/2014	69	5	458887	240617	P.pip	M	Adult	6.5	31.66
23/09/2014	70	6	459066	240664	P.pip	M	Adult	7.5	30.17
23/09/2014	71	6	459066	240664	P.pip	F	Non-parous	5	31.35
23/09/2014	72	6	459066	240664	P.pip	F	Parous	6	30.38
23/09/2014	73	6	459066	240664	P.pip	M	Adult	6	33.14
23/09/2014	74	6	459066	240664	M.mys	F	Parous	7	34.85
23/09/2014	75	6	459066	240664	P.aur	M	Immature	7.5	38.9
23/09/2014	76	6	459066	240664	P.pip	M	Immature	6	31.14
23/09/2014	77	6	459066	240664	P.aur	M	Immature	4.75	38.09
23/09/2014	78	6	459066	240664	M.mys	M	Immature	4.75	35.39
23/09/2014	79	2	459082	239821	P.aur	M	Immature	6.5	38.64
23/09/2014	80	2	459082	239821	P.aur	M	Immature	6.75	37.75
23/09/2014	81	2	459082	239821	P.pip	M	Adult	5.5	31.19
23/09/2014	82	2	459082	239821	P.pip	F	Non-parous	6	31.45
24/09/2014	83	10	457501	241710	M.nat	F	Parous	9	40.26

Date	Bat number	Location	Easting	Northing	Species	Sex	Reproductive status	Weight (g)	Forearm (mm)
24/09/2014	84	10	457501	241710	P.aur	F	Non-parous	8.5	39.81
24/09/2014	85	8	458801	241577	M.nat	F	Non-parous	7	39.09
24/09/2014	86	9	457368	241672	M.mys	M	Immature	4.75	34.7
24/09/2014	87	9	457368	241672	P.aur	M	Immature	6.75	37.65
24/09/2014	88	8	458801	241577	M.mys	F	Immature	5	35.24

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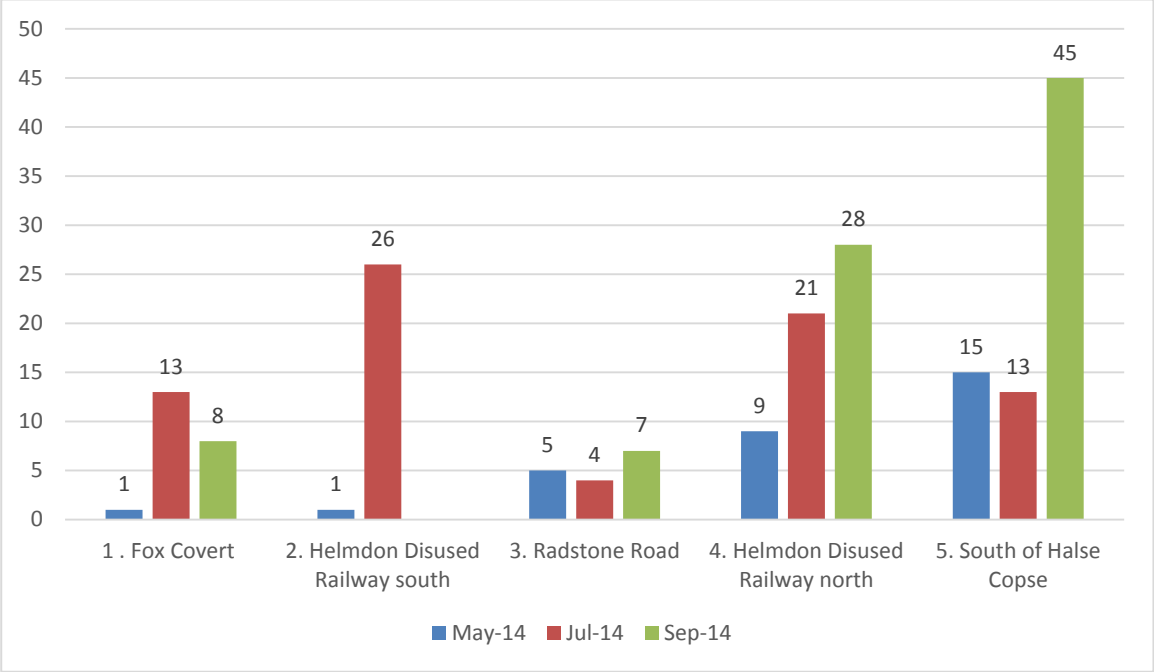
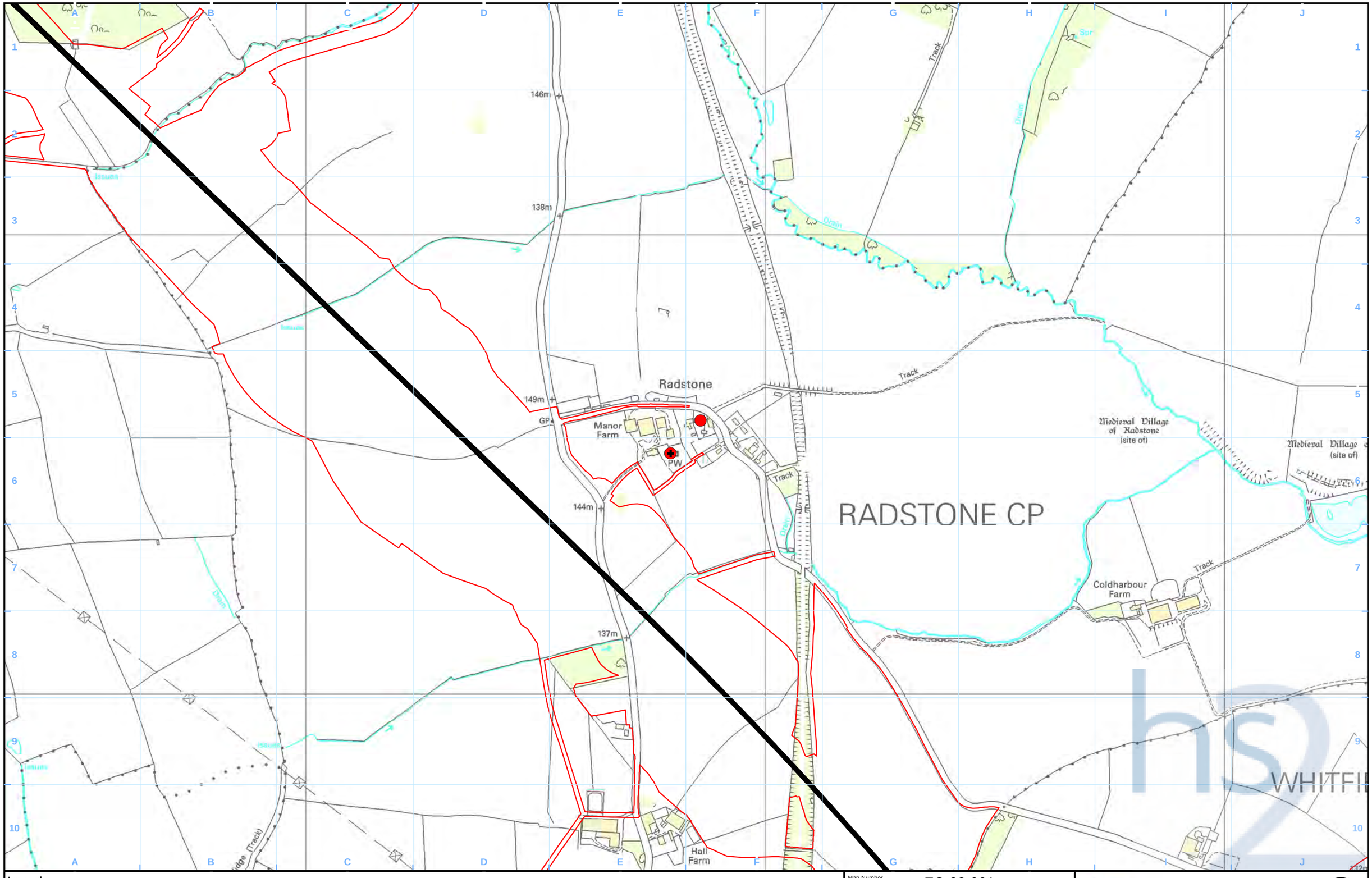
8 Figures

Figure 1 : Average Myotis bat passes per night at each survey location in 2014





Legend

Route centreline
Route in tunnel
Route on surface
Land potentially required during construction

Roost location
Maternity roost location in Church of St. Lawrence

Map Number: EC-23-001

Map Name: Known Natterer's bat roost locations 2013

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Scale at A3: 1:7,500

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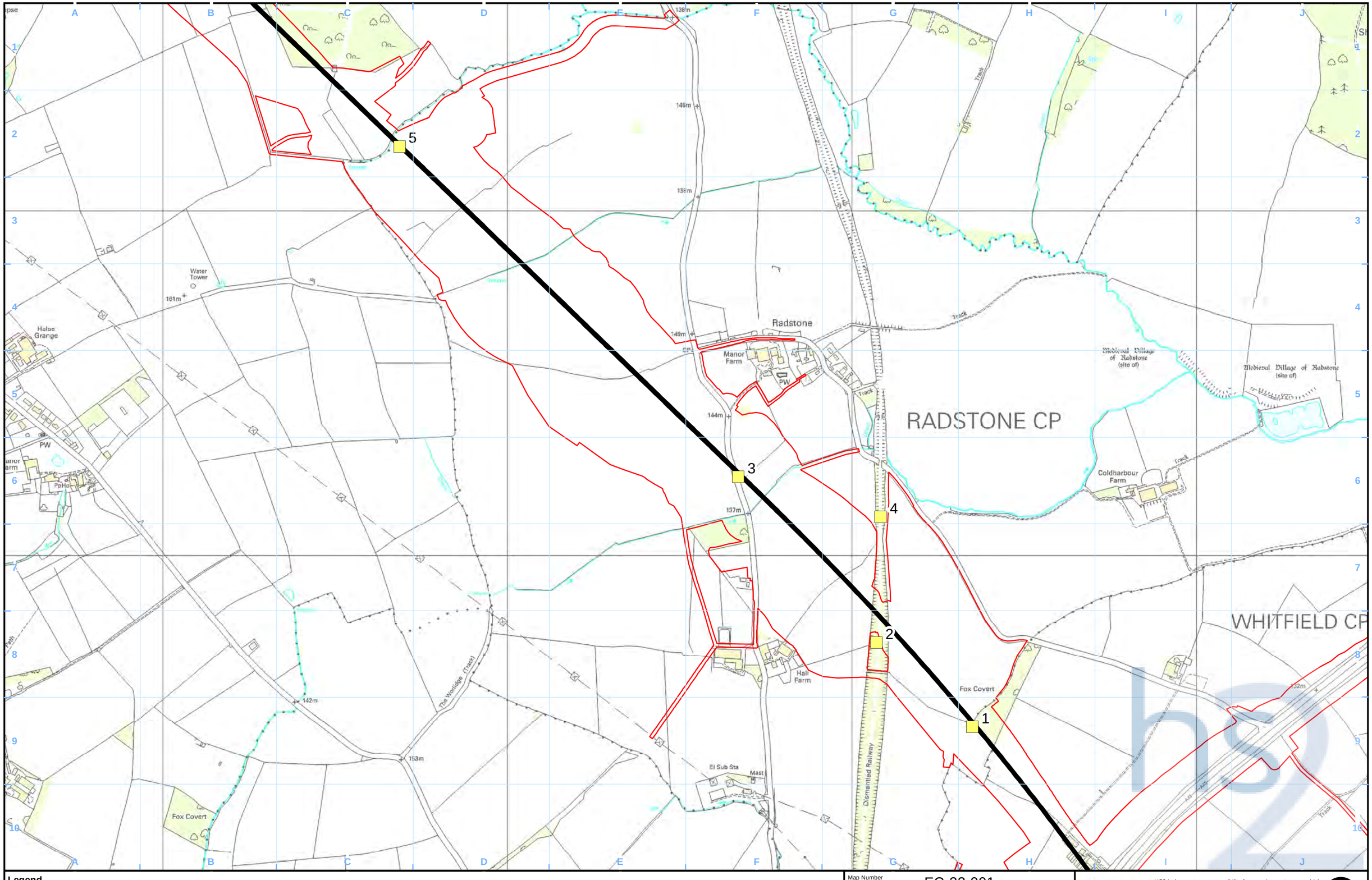
Date: 28/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Static detector

Map Number: EC-22-001

Map Name: Automated survey locations 2014

Scale at A3: 1:10,000

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Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003932-P01.00

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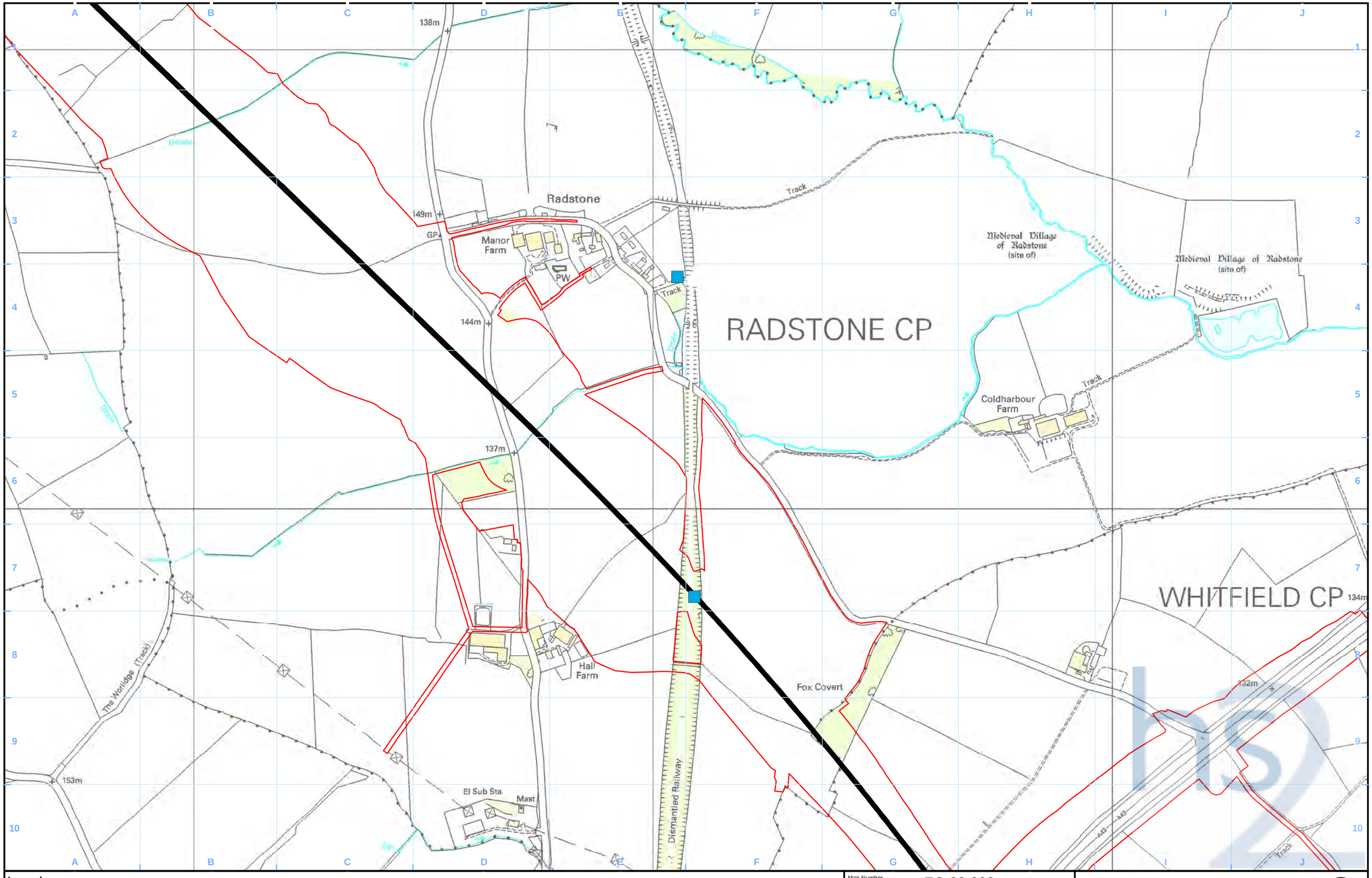

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Filming location

Map Number: EC-22-003

Map Name: Filming locations 2014

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Scale at A3: 1:7,500

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Metres

Doc Number: C252-ETM-EV-MAP-020-003934-P01.00

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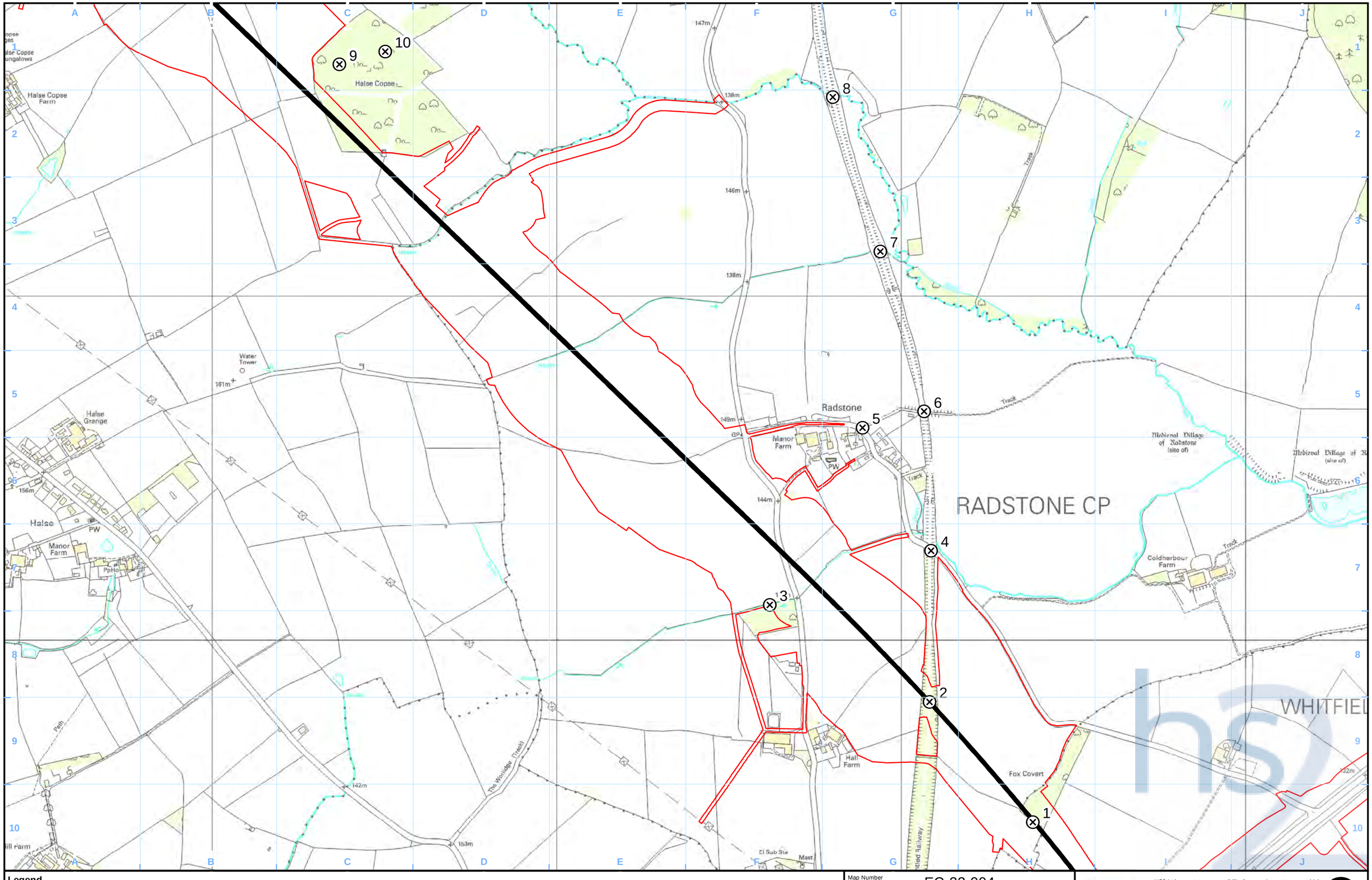

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Trapping location

Map Number: EC-22-004

Map Name: Trapping locations 2014

Scale at A3: 1:10,000

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Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

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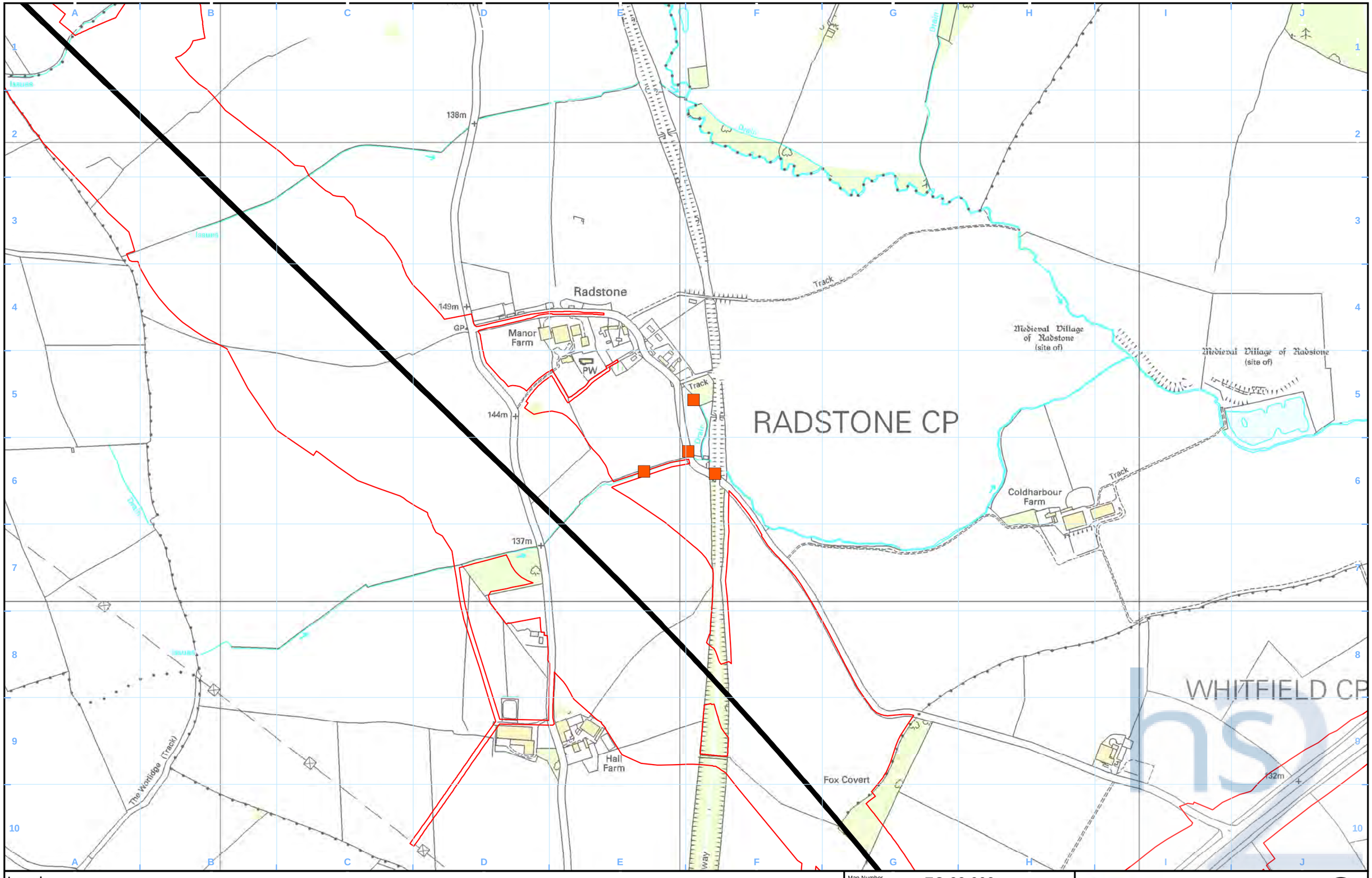

Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Vantage point

Map Number: EC-22-002

Map Name: Vantage points survey locations 2014

Scale at A3: 1:7,500

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Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

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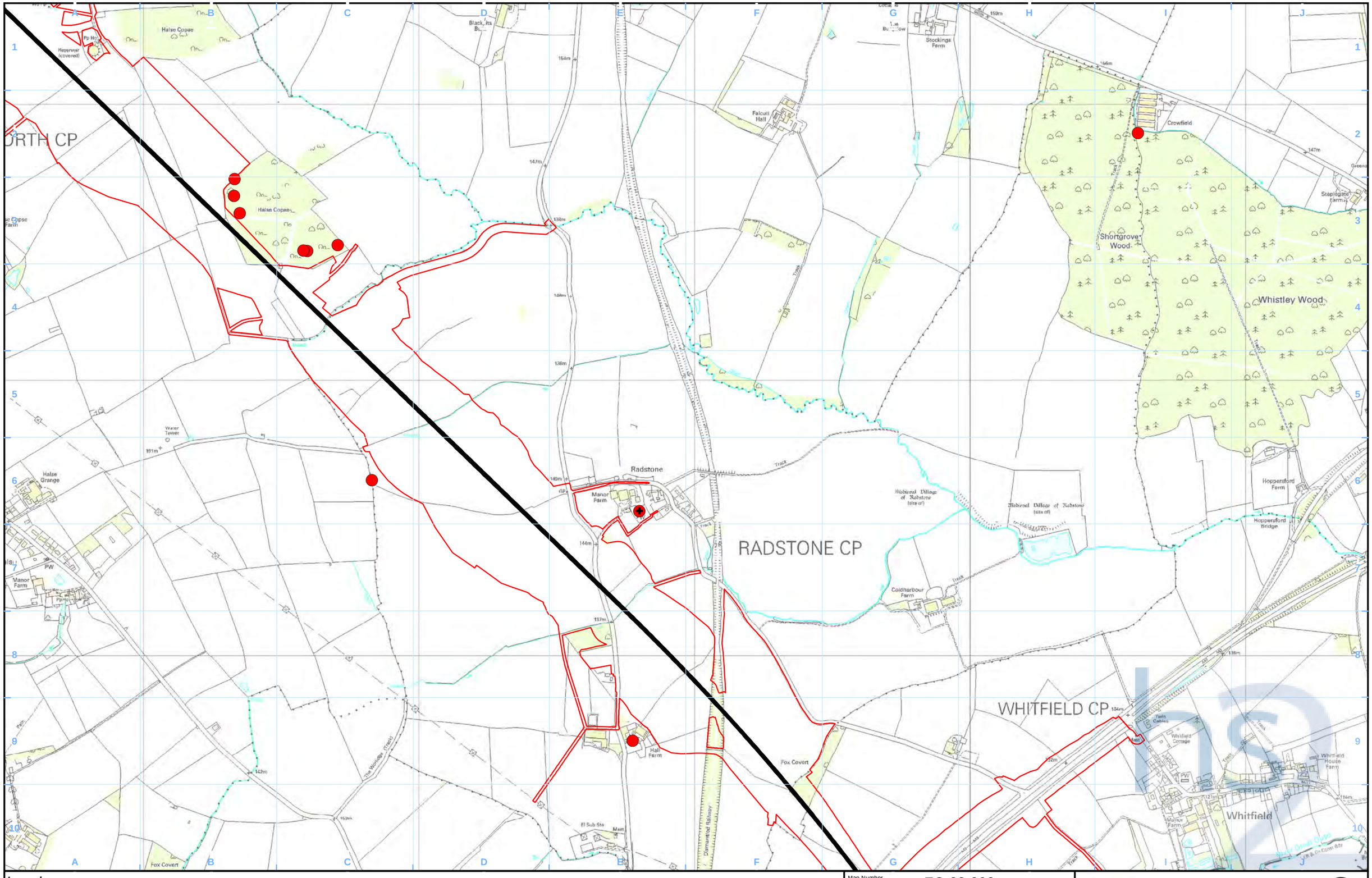
Date: 28/01/15



Legend

Route centreline
Route in tunnel
Route on surface
Land potentially required during construction

Roost location
Maternity roost location in Church of St. Lawrence

Map Number: EC-23-002

Map Name: Natterer's bat roost locations 2014

Scale at A3: 1:12,500

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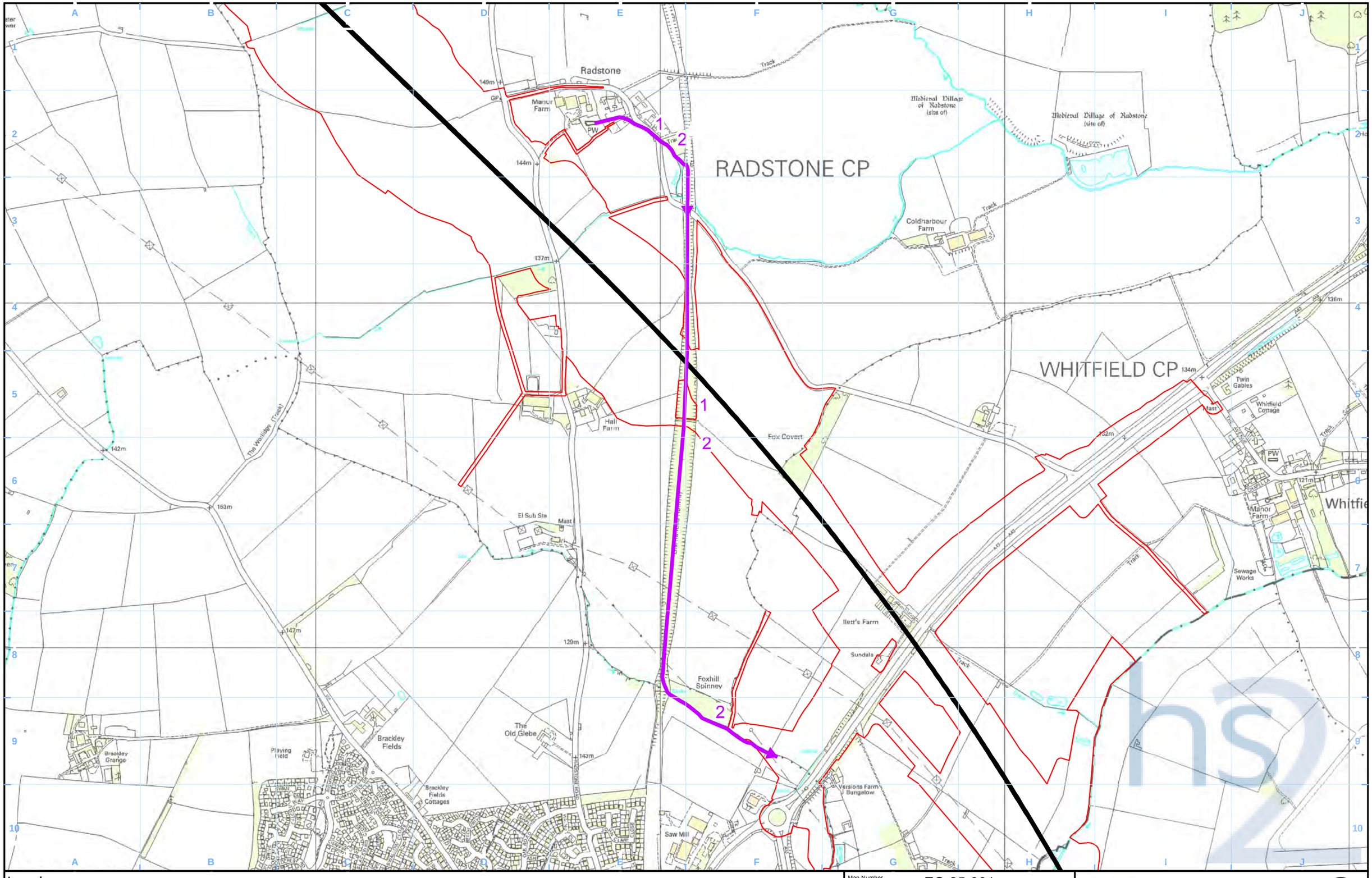
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003950-P01.00

Date: 28/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

No. - Natterer's bat radio-tag number

Map Number: EC-25-001

Map Name: Natterer's flightlines May 2014

Scale at A3: 1:10,000

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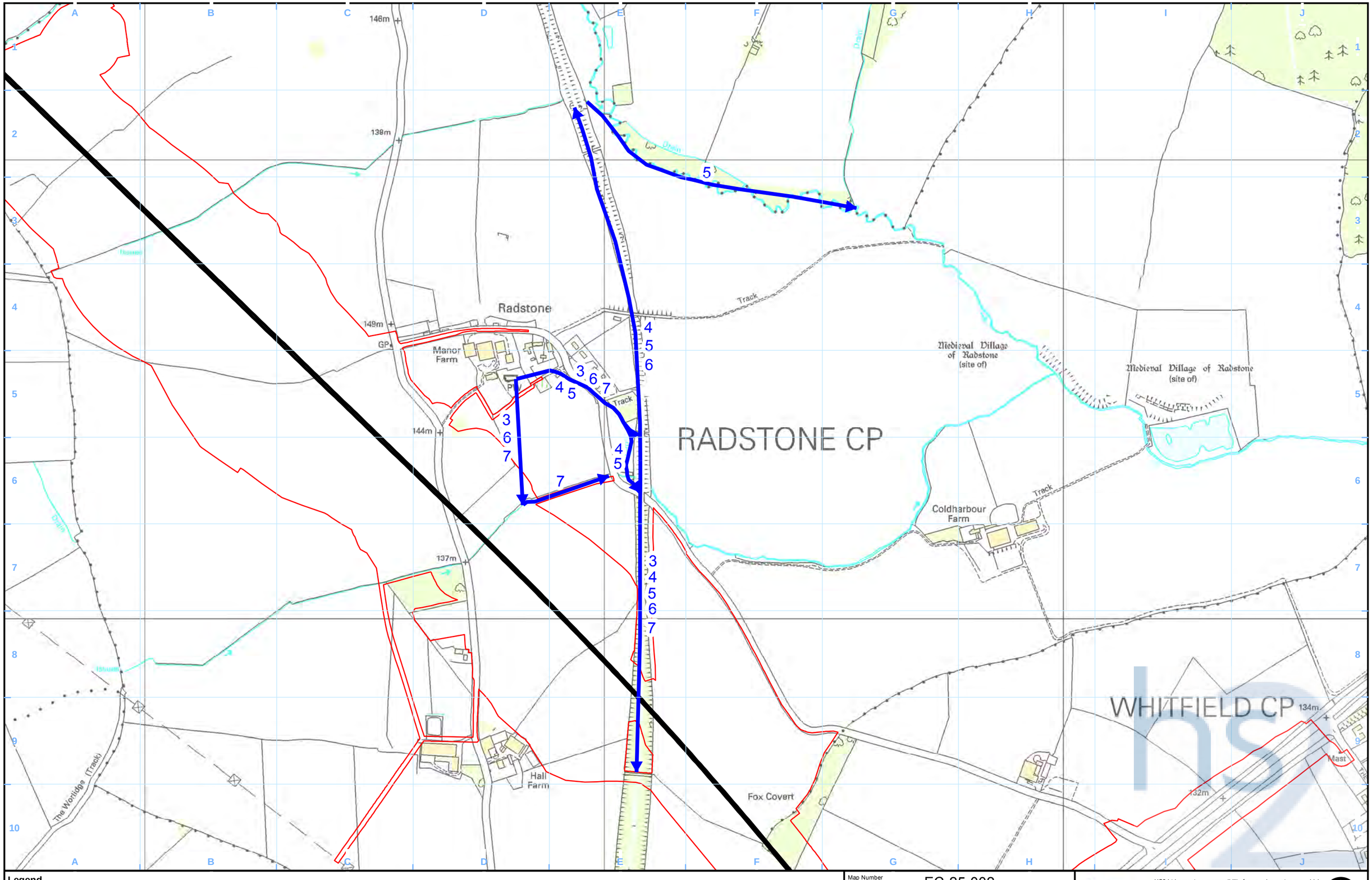
Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003966-P01.00

Date: 28/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

No. - Natterer's bat radio-tag number

Map Number: EC-25-002

Map Name: Natterer's flightlines July 2014

Scale at A3: 1:7,500

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Registered in England. Registration number 06791686.
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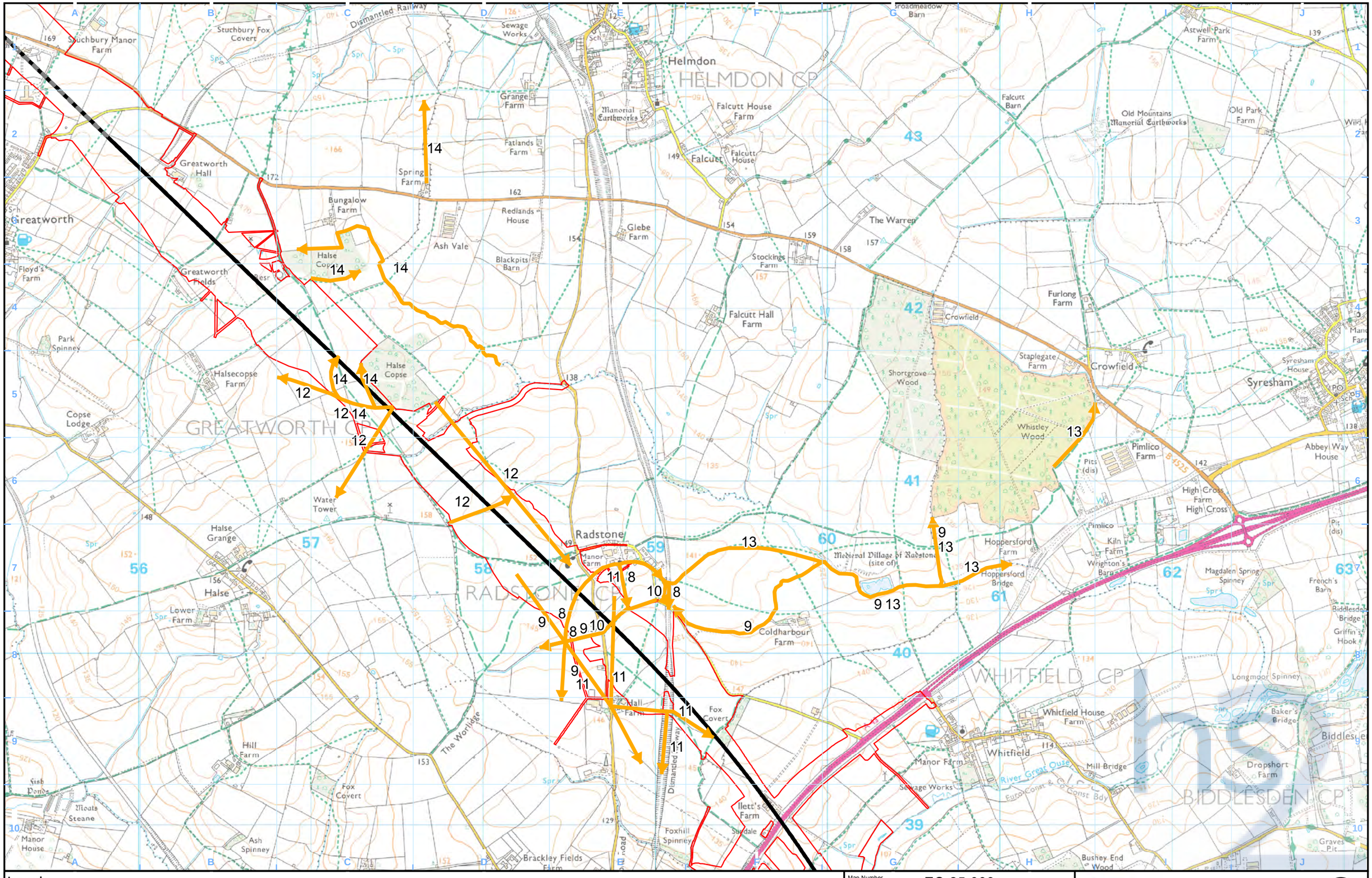
Doc Number: C252-ETM-EV-MAP-020-003967-P01.00

Date: 28/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Flightline

No. - Natterer's bat radio-tag number

Map Number: EC-25-003

Map Name: Natterer's flightlines September 2014

Scale at A3: 1:20,000

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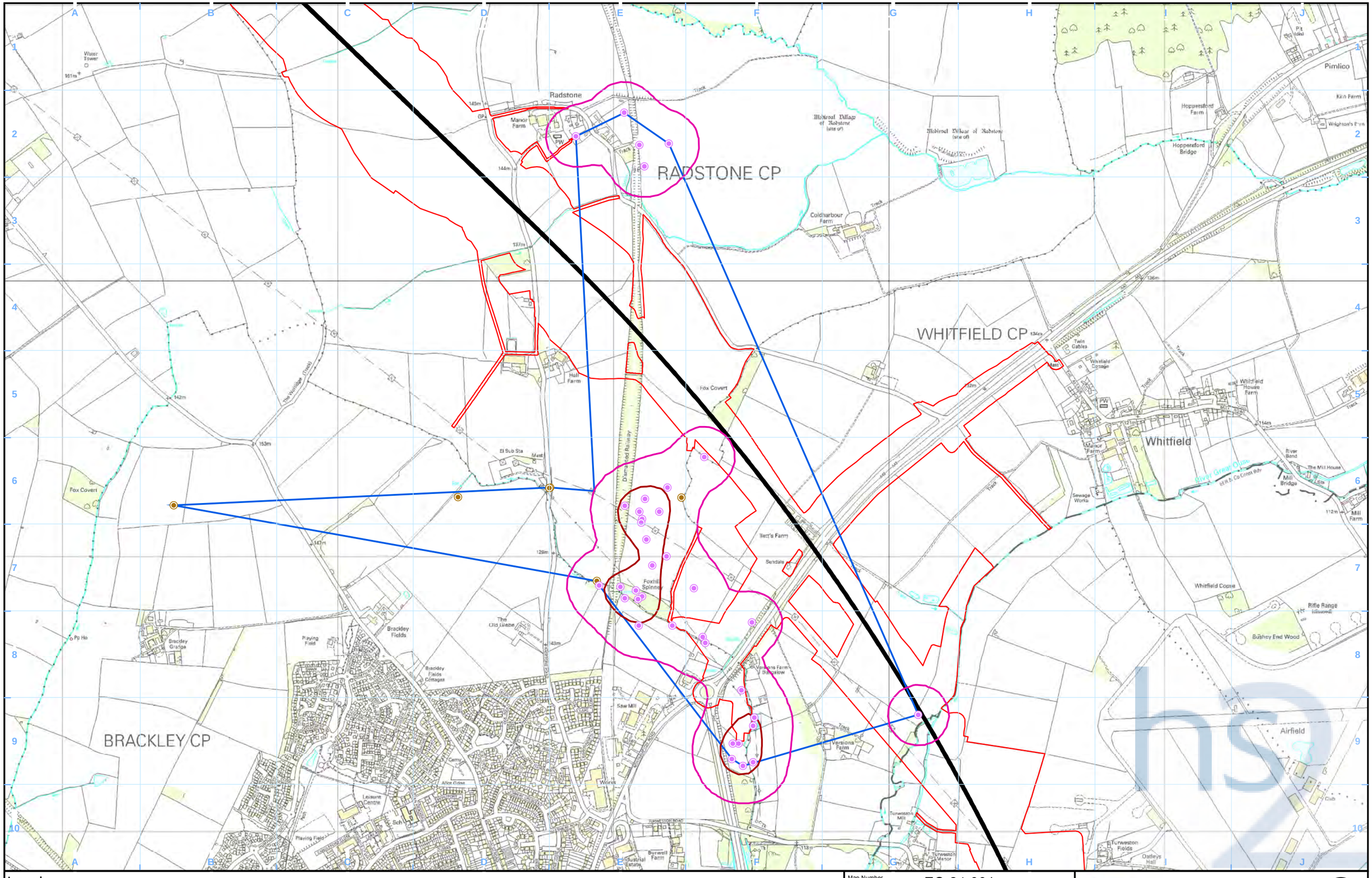

Legend

Route centreline
Route in tunnel
Route on surface
Land potentially required during construction

Natterer's foraging 50% KDE
Natterer's foraging 95% KDE
Natterer's foraging 100% MCP

Fixes
Bat 1
Bat 2

Map Number: EC-24-001

Map Name: Natterer's home range May 2014

Scale at A3: 1:12,500

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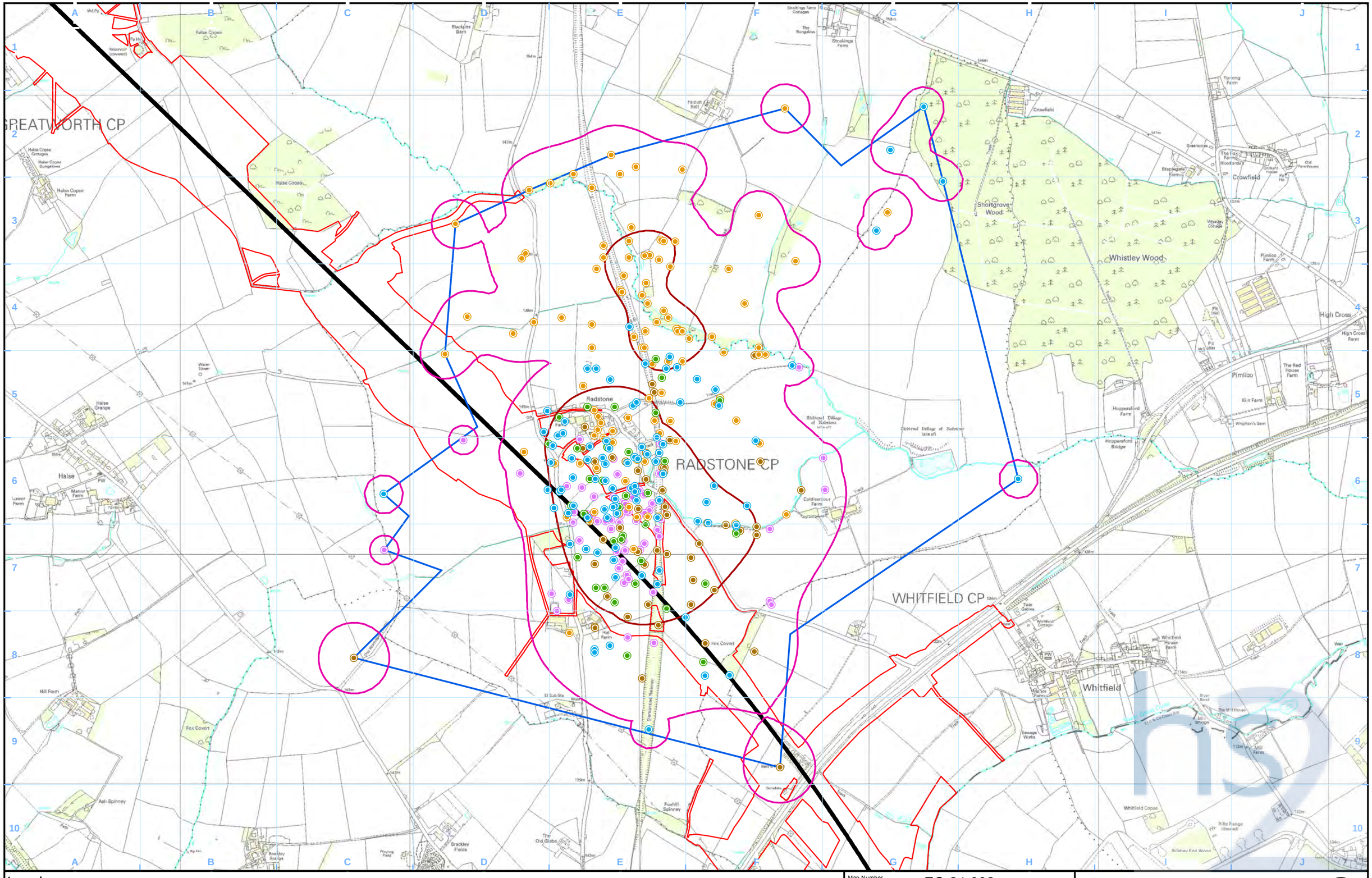
Doc Number: C252-ETM-EV-MAP-020-003957-P01.00

Date: 28/01/15



Legend

Route centreline
Route in tunnel
Route on surface
Land potentially required during construction

Natterer's foraging 50% KDE
Natterer's foraging 95% KDE
Natterer's foraging 100% MCP

Fixes
Bat 3
Bat 4
Bat 5
Bat 6
Bat 7

Map Number: EC-24-002

Map Name: Natterer's home range July 2014

Scale at A3: 1:15,000

0 150 300 450 600 Metres

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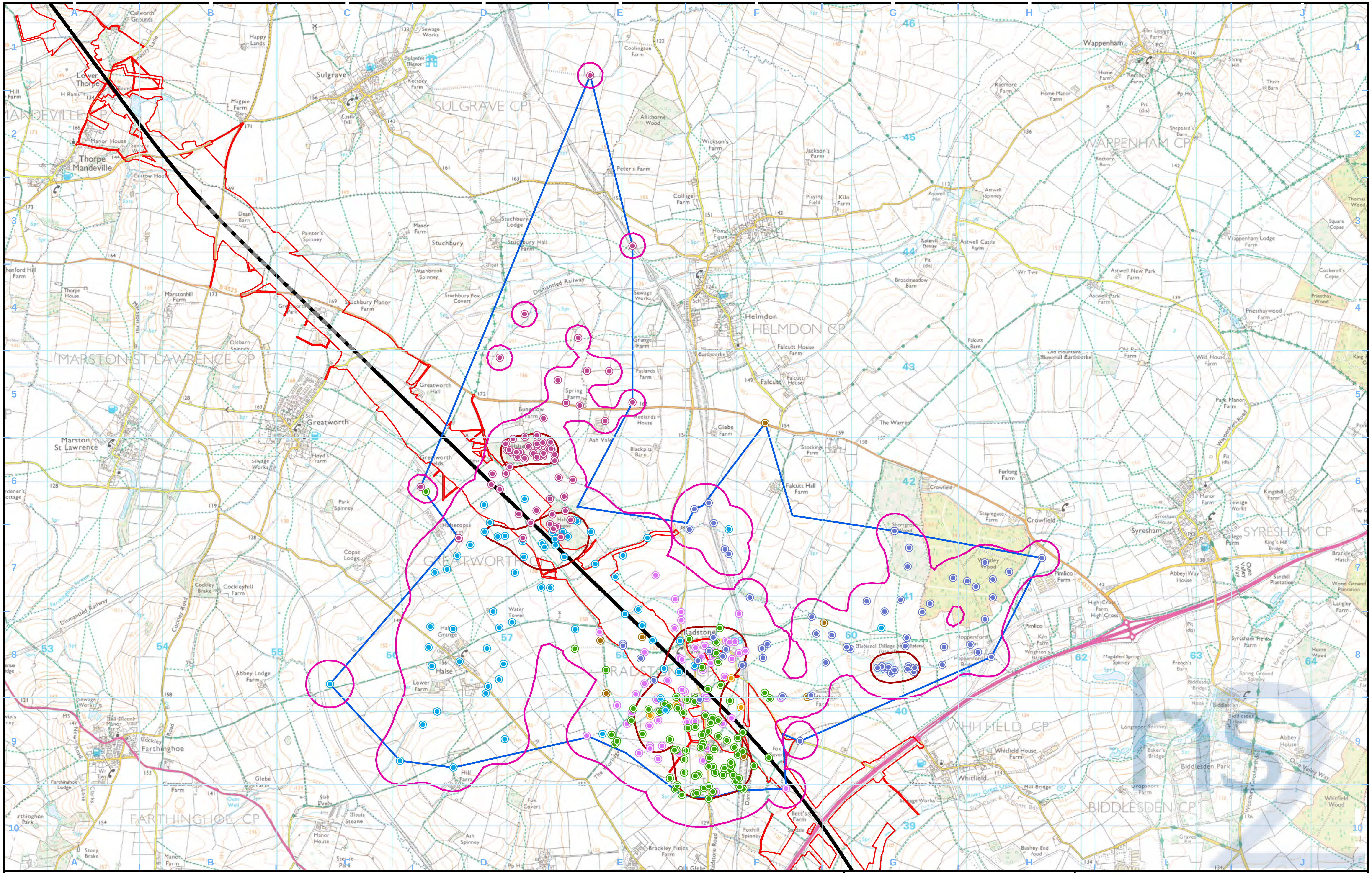
Registered office: One Canada Square, London, E14 5AB.

Doc Number: C252-ETM-EV-MAP-020-003958-P01.00

Date: 28/01/15



Legend

Route centreline

Route in tunnel

Route on surface

Land potentially required during construction

Natterer's foraging 50% KDE

Natterer's foraging 95% KDE

Natterer's foraging 100% MCP

Fixes

Bat 8

Bat 9

Bat 10

Bat 11

Bat 12

Bat 13

Bat 14

Map Number

EC-24-003

Map Name

Natterer's home range
September 2014

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