A1 in Northumberland: Morpeth to Ellingham

Scheme Number: TR010041

6.8 Environmental Statement – Appendix 9.4 Red Squirrel Report

Part B

APFP Regulation 5(2)(a)

Planning Act 2008

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

June 2020

Infrastructure Planning

Planning Act 2008

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

The A1 in Northumberland: Morpeth to Ellingham

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Environmental Statement - Appendix

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1. INTRODUCTION

1.1. INTRODUCTION

1.1.1. The A1 in Northumberland: Alnwick to Ellingham (Part B) aims to increase capacity along an approximately 8 km section of the existing A1 between Alnwick and Ellingham, in Northumberland. Part B includes widening the existing A1 from single carriageway to a dual carriageway. Part B also includes improving the existing junction at Charlton Mires with a new grade-separated junction and a new Heckley Fence Accommodation Overbridge. Part B aims to increase capacity, enhance resilience, improve safety and improve journey times along the route. Details of the Part B location are provided on the **Location Plan** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/2.1**).

1.1.2. Part B comprises dualling of the existing A1 single carriageway; a new southbound carriageway would be constructed to the east of the existing A1, and the existing A1 would become a new northbound carriageway. A number of private means of access would need to be stopped up and replaced with new access routes including new roads for East and West Linkhall, and from the B6347 and Rock South Farm. To facilitate the construction of Part B, sections of an extra high voltage cable, utility pipes and telecommunication cables would need to be diverted. Part B also includes new drainage features, new and extended culverts, and temporary and permanent Public Rights of Way (PRoW) diversions.

1.1.3. This appendix assesses potential effects on red squirrel *Scuirus vulgaris* as a result of construction and operation of Part B. This appendix (and its associated figures) is not intended to be read as a standalone assessment and should be read in conjunction with **Chapter 9: Biodiversity, Volume 3** of this ES (**Application Document Reference: TR010041/APP/6.3**) and **Chapter 2: The Scheme, Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).

1.1.4. Within this document, Part B comprises three elements. The Part B Main Scheme Area refers to the Order Limits north of Alnwick and south of Ellingham only. The Order Limits also includes the Lionheart Enterprise Park Compound (eastern and western sites), located to the south of Alnwick, and the Main Compound, which is located within the A1 in Northumberland: Morpeth to Felton (Part A).

1.2. ECOLOGICAL BACKGROUND

1.2.1. An extended Phase 1 habitat survey was undertaken in 2016 (**Ref. 1**) which identified habitats to broadly consist of arable/agriculture, semi-improved and improved grassland habitats including grazing pasture, interspersed within plantation broadleaved, coniferous, and mixed woodland adjacent to and beyond the existing carriageway.

1.2.2. Given the geographic location and presence of woodland habitats with potential to support red squirrel, 15 woodland areas (hereafter 'blocks') were identified within 150 m of the A1 carriageway, Lionheart Enterprise Park Compound (eastern and western sites) and Main Compound (hereafter the 'Survey Area') and subject to Habitat Suitability Assessment in 2018 and 2019.

1.2.3. Given the highly mobile behaviour of red squirrel and fragmented structure of woodland habitat across the landscape, a precautionary Survey Area extending to 150 m beyond the Order Limits was selected to ensure confidence in the habitat suitability of woodland and to identify conduit habitat for movement of red squirrel across the landscape. Red squirrel have been observed to travel distances of up to 160 m in areas with fragmented woodland pockets using hedgerows and standard trees (**Ref. 2**), of which the wider landscape beyond the existing carriageway is abundantly comprised.

1.3. BRIEF AND OBJECTIVES

1.3.1. The habitat suitability surveys have been completed in accordance with relevant good practice guidance and methods to:

a. Establish the suitability and thus potential for woodland to support red squirrel;
b. Incidentally identify signs of red squirrel in Survey Areas (i.e. woodland blocks); and
c. Evaluate the importance of the Survey Area and Order Limits for red squirrel and make recommendations as to how proposals should account for red squirrel with respect to legislation, planning and biodiversity policy.

1.3.2. The results of these surveys, and subsequent recommendations, are included within this report.

2. BASELINE IDENTIFICATION METHODOLOGY

2.1. DESK STUDY

2.1.1. Historical records of red squirrel within 2 km of Part B (hereafter known as the 'Study Area') were requested from the Environmental Records Information Centre (ERIC) North East in 2019. Only those records within the previous 10 years to date were considered ecologically relevant and were included within this assessment.

2.1.2. The Northumberland Biodiversity Action Plan (BAP) (**Ref. 3**) was additionally consulted to identify any known areas of high red squirrel density, or locations where they are targeted as a conservation priority in Northumberland.

2.2. FIELD SURVEY

2.2.1. A red squirrel habitat assessment was completed within 15 woodland blocks within the Survey Area during August 2018, with the Lionheart Enterprise Park Compound (eastern and western sites) survey completed in 2019. Each woodland block was assigned a unique identification number.

2.2.2. The approach to the survey was adapted from the Chartered Institute of Ecology and Environmental Management (CIEEM) technical guidance series for red squirrel, including:

a. Forestry Commission Research Information Note 255: Practical Techniques for Surveying and Monitoring Squirrels (**Ref. 4**);
b. Information on red squirrel in: BAP Mammals; Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation, (**Ref. 5**); and
c. 'A critical look at methods for monitoring red and grey squirrels' (**Ref. 6**).

2.2.3. The adapted methodology consisted of a single walkthrough of each woodland block, deviating from Forestry Commission guidance (**Ref. 4**), which recommends four visits. This deviation from Forestry Commission guidance is considered appropriate for the type of survey being undertaken (namely a habitat suitability assessment rather than full red squirrel survey) and proportionate to inform this assessment.

2.2.4. A single systematic walkover through each woodland block was used to characterise the woodland habitat, including canopy and ground flora, and assess an individual woodland's suitability to support red squirrel from an appraisal of the habitat type, vegetation structure and composition, and connectivity to wider habitat resource.

2.2.5. In addition, any indications of red squirrel activity or presence, such as the presence of live or dead squirrels, dreys, feeding signs or bark stripping were noted and their Geographical Positioning System (GPS) locations recorded.

2.2.6. Features of value to red squirrel associated with each woodland block were assessed in line with Gurnell *et al.* (**Ref. 4**), and are listed below:

a. Woodland type (e.g. coniferous plantation, semi-natural broad-leaved woodland);
b. Woodland use (e.g. commercial forestry, parkland);
c. Connectivity (whether or not connecting features such as canopy, or thicket-stage plantations were present);
d. Tree species present (e.g. Scots pine *Pinus sylvestris*, Sitka spruce *Picea sitchensis*, birch *Betula* spp.);
e. Dominant species;
f. Canopy species;
g. Age of woodland (over or under 25 years);
h. Understorey (presence of scrub layer providing cover); and
i. Ground flora (whether developed or poor, or presence of other foraging opportunities).

2.2.7. Following the field survey, woodland blocks were assigned as either 'Poor', 'Moderate' or 'High' suitability in accordance with the criteria in **Table 2-1** below. The criteria were developed based on professional experience in combination with Gurnell *et al.* (**Ref. 4)**.

Table 2-1 – Criteria used to Assess Woodland Suitability to Support Red Squirrel

Description of Typical Conditions	Suitability
Infrequent disturbance; single species plantation of around 25 years or younger; ground flora and understory undeveloped.	Poor
Some disturbance; approximately 80% Scots pine and 20% other species plantation over 25 years; ground flora developed; presence of understorey.	Moderate
Mature trees (50-100+ years) with cavities; approximately 80% Scots pine and 20% other species; mature ground flora with understorey; minimal human disturbance. Well connected to other woodland areas or large woodland block.	High

2.3. RED SQUIRREL ACTIVITY

2.3.1. Observations of red squirrel activity during field surveys were evaluated using a four-point scoring system (scores of 0-3, indicating low-high activity). Criteria used to assign these scores are detailed in **Table 2-2** below.

Table 2-2 - Red Squirrel Activity Scoring System

Score	Description
0	No signs (no signs of activity, no dreys present)
1	Few signs (no dreys, very few feeding signs)
2	Moderate signs (<4 dreys present, some scattered feeding signs)
3	Many signs (>4 dreys present, abundant feeding signs)

3. ECOLOGICAL IMPACT ASSESSMENT METHODOLOGY

3.1. BACKGROUND

3.1.1. This section describes the methodology used to identify significant effects or impacts on the relevant ecological receptor, latterly identifying mitigation to ameliorate/remove such effects or impacts. The Ecological Impact Assessment (EcIA) adopts guidance from CIEEM (**Ref. 7**) and the Design Manual for Roads and Bridges Interim Advice Note (IAN) 130/10 'Ecology and Nature Conservation: Criteria for Impact Assessment' (**Ref. 8**).

3.1.2. Ecological receptors have been subject to nature conservation evaluation. The significance of effects has then been assessed taking into account the characterisation of potential impacts (including duration, extent and reversibility) and their consequent effects on important ecological receptors.

3.2. NATURE CONSERVATION EVALUATION

3.2.1. Ecosystems, habitats and species within the Study Areas are assigned levels of importance for nature conservation based on the criteria detailed within CIEEM guidance (**Ref. 7**), IAN 130/10 (**Ref. 8**) and summarised in **Table 3-1** of this appendix. The rarity, ability to resist or recover from environmental change and uniqueness of an ecological receptor, function/role within an ecosystem and level of legal protection or designation afforded to a given ecological receptor are all factors considered in determining its importance. Consideration has also been given to the importance of the species or habitat and its conservation status at a geographic level taking population size, life cycle, rarity and/or distribution into account.

3.2.2. In addition, the importance of an ecological receptor takes into account any statutory or non-statutory designations, the intrinsic importance of the ecological receptor and whether it supports legally protected or notable species.

Woodland blocks assessed for their suitability to support red squirrel were assigned levels of importance for nature conservation based on the criteria set out in **Table 3-1**.

Table 3-1 - Importance Criteria

Importance	Criteria
International or European	Ecosystems and Habitats - Ecosystems or habitats essential for the maintenance of: - Internationally designated areas or undesignated areas that meet the criteria for designation; and/or - Viable populations of species of international conservation concern.

Importance	Criteria
	Species: - Species whose presence contributes to the maintenance of qualifying habitats, communities and assemblages that occur within internationally designated sites or within undesignated areas that meet the criteria for such designation. - Resident, or regularly occurring, populations of species that may be considered at an International or European level including those listed on Annexes II, IV and V of the Habitats Directive and Annex I of the Birds Directive, where: - The loss of the population would adversely affect the conservation status or distribution of the species at this geographical stage; or - The population forms a critical part of a wider population at this scale; or - The species is at a critical phase of its life cycle at this scale.
UK or National	Ecosystems and Habitats - Ecosystems or habitats essential for the maintenance of: - Qualifying communities and assemblages that occur within nationally designated sites or within undesignated areas that meet the criteria for such designation; and/or - Viable populations of species of national conservation concern. - Areas of ancient woodland. - Habitats listed for their principal importance for biodiversity (Section 41 of the NERC Act 2006). Species whose presence contributes to: - The maintenance of qualifying habitats, communities and assemblages that occur within nationally designated sites or within undesignated areas that meet the criteria for such designation; or - The maintenance and restoration of biodiversity and ecosystems at a national level, as defined in the Natural Environment and Rural Communities (NERC) Act 2006 Section 41 requirements. - Resident, or regularly occurring, populations of species that may be considered at an International/European (as detailed above), National or UK level including those receiving legal protection (listed within Schedules 1, 5 and 8 of the WCA) or listed for their principal importance for biodiversity or conservation status, where:

Importance	Criteria
	- The loss of the population would adversely affect the conservation status or distribution of the species at this geographical stage; or - The population forms a critical part of a wider population at this scale; or - The species is at a critical phase of its life cycle at this scale.
Regional	Ecosystems and Habitats - Ecosystems or habitats essential for the maintenance of: - Populations of species of conservation concern within the region. Species: - Species whose presence contributes to the maintenance and restoration of biodiversity and ecosystems within the region. - Resident, or regularly occurring, populations of species that may be considered at an International, European, UK or National level (as detailed above), where: - The loss of the population would adversely affect the conservation status or distribution of the species at this geographical stage; or - The population forms a critical part of a wider population at this scale; or - The species is at a critical phase of its life cycle at this scale.
County	Ecosystems and Habitats - Ecosystems or habitats essential for the maintenance of: - Populations of species of conservation concern within the authority area. Species: - Species whose presence contributes to the maintenance and restoration of biodiversity and ecosystems within a relevant area such as Northumberland. - Resident, or regularly occurring, populations of species that may be considered at an International, European, UK or National level (as detailed above), where: - The loss of the population would adversely affect the conservation status or distribution of the species at this geographical stage; or - The population forms a critical part of a wider population at this scale; or - The species is at a critical phase of its life cycle at this scale.

Importance	Criteria
Local	Ecosystems and Habitats - Ecosystems or habitats essential for the maintenance of: - Populations of species of conservation concern within the local area (for example a Local Nature Reserve). Species: - Species whose presence contributes to the maintenance and restoration of biodiversity and ecosystems at a local level. - Resident, or regularly occurring, populations of species that may be considered at an International, European, UK or National level (as detailed above), where: - The loss of the population would adversely affect the conservation status or distribution of the species at this geographical stage; or - The population forms a critical part of a wider population at this scale; or - The species is at a critical phase of its life cycle at this scale.
Less than Local	Ecosystems or habitats that do not meet the above criteria, i.e. supporting at least populations of species of conservation concern within the local area

3.3. IMPACT ASSESSMENT

CHARACTERISATION OF POTENTIAL IMPACTS

3.3.1. CIEEM (**Ref. 7**) notes that impacts that are likely to be relevant in an assessment are those that are predicted to lead to significant effects (adverse or beneficial) on important ecological receptors. Significant effects are those that undermine the conservation status[1] of important ecological receptors. Knowledge and assessment of construction methods and operational activities, together with the ecological knowledge of ecologists with experience of similar large-scale infrastructure

1 Conservation status for habitats is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and function as well as the long-term distribution and abundance of its population within a given geographical area. Conservation status for species is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its population within a given geographical area.

schemes, has been used to identify the potential impacts of the project on ecological receptors.

3.3.2. Habitats and species that are considered to have a nature conservation importance of less than local are not considered important ecological receptors[2] in the context of this assessment. Any impact on such a feature as a result of Part B is considered unlikely to have a significant effect on the conservation status of such habitats or species on a local, regional, national or international scale. Therefore, features assessed to be of less than local nature conservation importance have been scoped out of the EcIA.

3.3.3. Characterisation of potential impacts has considered the processes that could lead to effects on ecological receptors, using the range of standard parameters from IAN 130/10, as well as others deemed appropriate (informed by CIEEM's Guidelines). These included whether the impact was positive (beneficial) or negative (adverse), the probability of the impact occurring (certain, probable, unlikely), its complexity (direct, indirect, cumulative), extent, size, duration, reversibility and timing/duration.

SIGNIFICANCE OF EFFECTS

3.3.4. Having characterised importance and potential impacts, proposals for mitigation and compensation have been considered, with the aim of avoiding, preventing, reducing or, if possible, offsetting any identified significant adverse effects. After the application of mitigation proposals, where significant effects are likely to occur, the overall significance of the effect has been assessed.

3.3.5. IAN 130/10 does not prescribe a method for determining the significance of ecological effects but does propose significant effect categories which are aligned with other topic areas in the DMRB. These are Neutral, Slight, Moderate, Large or Very Large (Table 3 of IAN 130/10) and are reproduced in **Table 3-2** below.

3.3.6. In all instances, when determining the level of significance of the ecological effect, **Table 3-2** has been used as a guide in association with professional judgement (this is consistent with guidance in IAN 130/10). For example, an effect on an ecological receptor of county level importance could be considered Large if a particularly high proportion of the county resource were to be affected. To determine whether an effect is significant or not, CIEEM's Guidelines would also be considered (in lieu of comparable guidance in (**Fig. 7**)).

2 An ecological receptor is considered important based on many factors including its rarity, diversity, naturalness, context in the wider landscape, size and distribution as set out in A Nature Conservation Review (Ref. 9)

Table 3-2 - Significance Categories of Effects on Ecological Receptors

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

3.4. MITIGATION

3.4.1. The principles of the mitigation hierarchy have been applied when considering potential impacts and subsequent effects on ecological receptors through the following sequential actions:

a. Avoidance;
b. Mitigation;
c. Compensation; and
d. Enhancement.

3.4.2. For the purpose of this assessment, mitigation refers to measures that are considered essential to avoid and reduce adverse impacts of Part B. Compensation refers to measures taken to offset the loss of, or permanent damage to, ecological resources through the provision of replacement areas.

3.4.3. The mitigation measures described within this EcIA have been incorporated into the design and construction methodology and taken into account in the assessment of residual effects. The mitigation measures aim to avoid or negate impacts on ecological receptors in accordance with good practice guidance and UK, English and local government environmental impact, planning and sustainability policies. These mitigation measures include those required to achieve the minimum standard of established good practice together with additional measures to further reduce any adverse impacts of Part B. The mitigation measures include those required to reduce or avoid the risk of committing legal offences.

3.4.4. Mitigation measures set out in this ES are captured in the **Outline Construction Environmental Management Plan** (**Outline CEMP**) (**Application Document Reference: TR010041/APP/7.3**) as environmental commitments to ensure implementation by the main contractor. The Outline CEMP would be used to inform an Outline Construction Environmental Management Plan (Outline CEMP) produced by the main contractor.

3.4.5. Impacts that are not significant (including those where compliance with regulation is required) would be expected to be avoided or reduced through the application of an Outline CEMP and good working practice (e.g. mitigation of potential pollution impacts through adherence to standard good practice and guidelines). Significant ecological impacts are expected to be mitigated through a combination of good practice and typical, proven mitigation methods along with mitigation targeted to specific locations as described in this assessment.

3.5. ASSUMPTIONS AND LIMITATIONS

3.5.1. The survey was undertaken with no access restrictions. Whilst the survey was completed outside of the recognised peak breeding period of red squirrel (r January to April) the survey was completed during the secondary breeding period (April to September). Although red squirrels usually breed during the former period above, in areas with ample foraging and food sources, a second litter may be reared. The timing of the survey is not considered a significant limitation to this assessment, given the primary assessment has been to establish habitat suitability to support red squirrel, which was further informed by evidence of presence/activity of red squirrel on an incidental basis including dreys which are present year-round where populations exist.

3.5.2. Whilst the Survey Area extended to 150 m beyond the Order Limits, it is acknowledged that red squirrel have been observed to travel up to 160 m between woodland utilising hedgerows similar linear habitat features. An assessment of each woodland block's connectivity to other suitable woodland habitat was completed during the survey, and therefore encompassed features located beyond the woodland block boundary (located in the 150 m Survey Area). This is not considered to have negatively impacted the results or conclusions of this assessment.

3.5.3. Third party data and records have informed this assessment. Whilst there may be an absence of records for a given area this does not preclude absence of a species. Species records and historic data has been assumed to be reliable for the purposes of this assessment, in the absence of being able to corroborate such records/results in the field directly.

4. RESULTS

4.1. DESK STUDY

The desk study undertaken in 2019 returned 13 records of red squirrel within 2 km of Part B, with the closest record 400 m from the Order Limits between Heiferlaw Bank and Holywell Cottage. Seventeen records were returned within 2 km of the Lionheart Enterprise Park Compound (eastern and western sites) with the nearest record 380 m west in woodland along the Cawledge Burn. One record of red squirrel was returned from 2012 located 1.5 km north east of the Main Compound.

4.1.1. The Northumberland BAP (**Ref. 3**) indicates that the area between Alnwick and Ellingham has a low red squirrel population density and does not lie within a red squirrel reserve. Within Northumberland county area, higher densities and red squirrel reserves are located to the north and west and are located over 14 km away from the Order Limits.

4.2. FIELD SURVEY

LANDSCAPE CONTEXT

4.2.1. The landscape within which the Survey Area is located is dominated by agricultural activity, including grazing (cattle and sheep) and crop production, with properties and farm buildings located across the predominantly agricultural landscape. Many farms have intact hedgerows between fields providing a green network across the landscape. Fields have been designed to be large to maximise efficiency, with individual trees remaining within boundary hedgerows. Areas of commercial forestry plantation are present within the Survey Area; however, semi-natural mixed woodland is abundant and is dominated by broadleaved species.

4.2.2. The majority of woodland blocks are isolated, with limited connectivity to the wider woodland network. Woodland blocks comprise those associated with properties and gardens, whilst others are of shelterbelt origin. Commercial woodland is isolated to small blocks or shelterbelts comprising mainly coniferous species such as pine *Pinus sp.* or larch *Larix decidua*.

HABITAT ASSESSMENT

4.2.3. Each of the 15 woodland blocks assessed are detailed in Table 4-1 alongside details of the overall suitability of each woodland block to support red squirrel. Woodland blocks subject to survey and assessment are additionally illustrated within **Figure 9.6: Woodland Survey Locations, Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**), with survey photographs presented in **Appendix A** of this report.

4.2.4. The Main Compound does not have any woodland blocks within 150 m. The Lionheart Enterprise Park Compound (eastern and western sites) has one woodland block within 150 m.

Table 4-1 - Woodland Block Habitat Suitability Assessment for Red Squirrel

Woodland Block	Woodland Relative Quality	Red Squirrel Activity/Presence	Woodland Assessment	Overall Suitability
WB1	Moderate	0	**Type:** Coniferous plantation woodland with no signs of red squirrel presence or activity observed. Woodland dominated by coniferous species such as Scot's pine, with occasional oak *Quercus sp.* and beech *Fagus sylvatica*. **Nature of woodland:** The woodland block had potential for drey creation, with coniferous trees presented a suitable height and structure, although canopy was not continuous. The woodland block was connected by hedgerows to other woodland blocks. **Influences/Disturbance:** No disturbance within the woodland, however, A1 carriageway located immediately east of woodland block, and thus it is subject to traffic associated noise disturbance.	Moderate
WB2	Moderate	0	**Type:** Semi-mature broadleaved woodland with isolated conifer trees. Thin trees offered limited potential for drey creation. Foraging resources (beech nuts and pine cones) were available but no evidence of feeding recorded. Species present included Scots pine, holly *Ilex aquifolium*, sycamore *Acer pseudoplatanus*, silver birch *Betula pendula* and larch. **Nature of woodland:** Tree canopy was dense offering connectivity within the woodland, although understorey was undeveloped. The block had poor connectivity to the wider woodland network, WB3 is nearby but separated by approximately 15 m of hardstanding. **Influences/Disturbance:** No disturbance within the woodland, with surrounding habitat comprised of grazing and arable fields.	Moderate
WB3	Moderate	0	**Type:** Thin strip of mature and semi-mature broadleaved trees, with species including lime *Tilia europaea*, horse chestnut *Aesculus hippocastanum* and beech. **Nature of woodland:** The canopy, whilst thin, offered full connectivity within the woodland. Trees were sparsely planted so woodland understorey was open. Woodland block had very little age variety with a lack of younger trees. Suitable drey building opportunities were few, with sparse branches at canopy level. No dreys or feeding evidence was recorded, however, foraging opportunities in the form of beech nuts and chestnuts were available. **Influences/Disturbance:** The surrounding habitat is dominated by agriculture, with grazing and arable fields bounding the woodland block. An estate road runs adjacent to the northern boundary of the woodland. Connectivity to further woodland was poor, with only one other small woodland block (WB2) nearby separated by approximately 15 m of hardstanding.	Moderate
WB4	Moderate	0	**Type:** WB4 comprised a large block of mixed woodland, dominated by coniferous species, stretching west from the A1 carriageway. Species included larch, copper beech *Fagus sylvatica f. purpurea*, sycamore and holly. **Nature of woodland:** The woodland presented a mostly continuous canopy with opportunities for drey creation and foraging abundant. Bird nests were present towards the northern edge of the woodland (TN1), which were occupied by corvids (previous incidental observations in summer 2018). Pine cones were present throughout, however, no evidence of feeding remains were observed. **Influences/Disturbance:** No disturbance within the woodland. Grazing fields bound the woodland therefore external disturbance is low.	Moderate

Woodland Block	Woodland Relative Quality	Red Squirrel Activity/Presence	Woodland Assessment	Overall Suitability
WB5	Poor	0	**Type:** This woodland block was isolated by arable/grazing fields to the north, west and south, and separated from woodland block WB6 by the A1 carriageway. The broadleaved plantation woodland was mature and comprised sycamore, birch, rowan *Sorbus aucuparia*, ash and beech. The understorey comprised hawthorn, rhododendron *Rhododendron sp.*, nettle *Urtica dioica* and *bramble Rubus fruictosus* forming dense pockets throughout, however, little ground flora was present. **Nature of woodland:** The canopy was patchy and not continuous, and the woodland block had poor connectivity to surrounding woodland. Pine cones and beech nuts were present throughout the woodland, but no evidence of squirrel foraging was recorded. **Influences/Disturbance**: There was a high level of human disturbance noted within the woodland. Several paths were recorded with signs of dog walking throughout the woodland. Evidence of a controlled fire was present, with garden waste and rubble in close proximity to a gate to an adjacent property.	Low
WB6	Poor	0	**Type:** The woodland was mostly broadleaved, with evidence that the coniferous species have been felled leaving a 'thinned' woodland. Species present included: birch (dominant), sycamore, rowan and ash. **Nature of woodland:** The canopy was very patchy due to the felling of conifers. No dreys or feeding evidence was recorded. Branches of trees were assessed as unsuitable for drey creation by virtue of their thin nature. The woodland parcel had connectivity with the wider area; extending 2.6 km to the east towards Rock village. **Influences/Disturbance:** Disturbance was high with farm vehicles evidently using fields to the north, east and south with the A1 carriageway present to the west, and thus it is subject to traffic affiliated noise disturbance.	Low
WB7	Moderate	0	**Type:** This woodland was a continuation of a woodland line containing WB6. A mixed woodland block with species including ash (dominant), lime, oak *Quercus* sp. and beech. **Nature of woodland:** Opportunities for drey creation were limited due to the young and thin nature of many of the trees. Additionally, the foraging resource is limited to beech nuts only. The canopy is continuous along the length of the woodland and consists exclusively of broadleaved species. **Influences/Disturbance:** A farm track was located through the centre of the woodland with the farm stead immediately adjacent to the western extent, bounded by a stone wall. Thus, disturbance levels are high due to loud wood-chipping activity at the farm and other farm activities.	Moderate
WB8	Moderate	0	**Type:** The woodland block was isolated amongst arable fields and comprised almost entirely of coniferous species, with occasional broadleaved species. Species present included pine (dominant) and sycamore. **Nature of woodland:** Trees were widely spaced resulting in an open woodland, which was further emphasised by selective felling/thinning. As a result, the canopy was thin and patchy. No dreys or feeding signs were recorded, however, opportunities to support red squirrel were present. **Influences/Disturbance:** Historic disturbance from felling activities would have had a major disturbance effect, with agricultural activities also being undertaken in fields surrounding the woodland.	Moderate
WB9	Moderate	Single drey at NGR NU 18197 18936 (drey of unconfirmed squirrel species)	**Type:** This mixed plantation block extended in a 'horseshoe' shape from the B6341 east and was consistently approximately 60 m wide. Connectivity adjacent to WB9 was poor due to isolation by the A1 carriageway to the east and B6341 to the west. Arable / grazing fields surrounded the woodland block therefore there was a reduced	Moderate

Woodland Block	Woodland Relative Quality	Red Squirrel Activity/Presence	Woodland Assessment	Overall Suitability
			possibility of movement between large woodland areas. Species present included rowan, holly, birch, conifer, sycamore and fir *Abies sp.* with sycamore dominating the canopy layer. **Nature of woodland:** All trees were around 25 years of age with the exception of a few small stands of immature trees within the woodland. The northern half of the woodland was predominantly coniferous with opportunities for drey creation and foraging; however, no evidence of red squirrel activity or presence was recorded. A stand of eight fir trees in the centre of the southern leg of the woodland presented suitable foraging and drey creating opportunities with close branches and pine cones recorded. One drey was recorded, however, from ground inspection it was not possible to identify what species (grey squirrel *Sciurus carolinensis* or red squirrel) or if in fact it was active; no squirrels were observed during the survey. The drey was located 110 m from Part B. **Influences/Disturbance:** There was no disturbance within the woodland, however, the A1 carriageway is located to the east of the woodland and thus it is subject to traffic affiliated noise disturbance. Grazing fields surround the other aspects.	
WB10	Poor	0	**Type:** The mixed plantation woodland block located east of the A1 formed of a strip of woodland running from Rock South Farm towards the A1 carriageway. Species present included sycamore, pine and an unconfirmed conifer species. The canopy was thin and discontinuous. **Nature of woodland:** The woodland presented foraging opportunities with the presence of pine cones, however, no evidence of foraging was recorded. Connectivity to surrounding landscape is afforded through the presence of thin strips of coniferous plantation woodland present to the south and east. **Influences/Disturbance:** Evidence of commercial activities within the woodland were noted, with the thinning of many of the larger coniferous trees throughout the woodland.	Low
WB11	N/A	N/A	No longer identified as woodland. This habitat was assessed to be unsuitable for red squirrel as woodland had been subject to felling.	N/A
WB12	Poor	0	**Type:** This woodland consisted of immature hawthorn, willow *Salix sp.*, oak and ash, planted in a strip along the edge of a field boundary adjacent to a hawthorn hedge. **Nature of woodland:** The area had been planted very densely with trees no more than 2.5 m tall and was clearly unmanaged due to a very thick bramble and rosebay willowherb *Chamaenerion angustifolium* scrub understorey. The woodland presents negligible drey creation opportunities due to the immature nature of trees present and lacked foraging opportunities beyond a limited number of fruit bearing trees/plants. Connectivity to surrounding woodland was afforded only through a hawthorn hedge bounding the A1 carriageway to connect this block to neighbouring woodland areas. **Influences/Disturbance:** The A1 carriageway was located adjacent to east with arable land to the west separated by a thin field margin. Thus, a certain degree of disturbance (short duration and sporadic) would be presented from agricultural operations in this field.	Low
WB13	Poor	0	**Type:** This woodland area can be divided into two distinct sections of mature and immature woodland, a large thin strip of young, immature woodland comprising hawthorn and ash, with the south-western corner defined by large, mature oak and ash trees.	Low

Woodland Block	Woodland Relative Quality	Red Squirrel Activity/Presence	Woodland Assessment	Overall Suitability
			Nature of woodland: The area of immature trees was considered unsuitable for drey creation and presented negligible foraging opportunities due to the small size of the trees present and particular species. The mature broadleaved trees were too large and open for drey creation with few foraging opportunities. The connectivity to surrounding woodlands was poor. **Influences/Disturbance:** Arable farmland and the A1 carriageway bound the area of woodland, therefore disturbance was assessed to be high.	
WB14	Poor	0	**Type:** This woodland block can be divided into two sections. To the east, mature pine and ash formed a dense stand surrounding a small watercourse. A thin strip of immature ash, sycamore, hawthorn and beech was present bounding the A1 carriageway, with a ruderal understorey. **Nature of woodland:** The mature trees offered moderate potential for drey creation due to suitably spaced branches; however, the canopy was very thin and not continuous. The immature woodland was assessed as unsuitable for red squirrel as the trees were smaller than required by red squirrels, in addition to a lack of foraging resource. **Influence/Disturbance:** Grazing fields bound the woodland to the east, and the A1 carriageway bounded the woodland to the west. There was likely to be a higher level of disturbance from the A1 carriageway side of the woodland owing to traffic affiliated noise.	Low
WB15	Moderate	Two signs of feeding in the form of chewed cones (indeterminate species) – NGR NU 19859 10930 and NU 19944 11041	**Type:** The woodland was primarily coniferous plantation woodland with a broadleaved boundary. **Nature of woodland:** The woodland offered potential for drey creation, more so within coniferous trees, with potential foraging opportunities also present. **Influence/Disturbance:** A Public Right of Way (141/014) was located through the woodland with a moderate level of disturbance.	Moderate

4.2.5. The total area of woodland assessed as of Moderate suitability was 24.8 ha (eight blocks), Low suitability was 7.5 ha (six blocks) and areas of Negligible suitability 1.19 ha (one block). No woodland habitat surveyed was assessed to be of High suitability to support red squirrel.

5. NATURE CONSERVATION EVALUATION

5.1. OVERALL HABITAT SUITABILITY

5.1.1. For its majority, woodland within the Survey Area has varying degrees of suitability to support red squirrel with mature, semi-mature and young woodlands common throughout the agricultural landscape. As discussed in Cresswell *et al.* (**Ref. 5**), red squirrel presence is more likely in older woodlands over 25 years old, where trees have features for drey creation and the ability to produce seeds. Additional factors including canopy structure and understorey should also be taken into account.

5.1.2. It was evident in woodland blocks with disturbed understories that a diverse mix of species and ages had not established, as favoured by red squirrels. Hedgerows are present across the Survey Area and offer potential commuting routes/corridors for red squirrel use, with red squirrel known to utilise such habitat to travel between fragmented woodland (**Ref. 2**).

5.2. WOODLAND BLOCK SUITABILITY

5.2.1. The woodland blocks in the Survey Area range in suitability due to the factors mentioned above. A thinner canopy from either felling activities or from human disturbance is likely to restrict squirrel movement and thus reduce suitability. In addition to this, the understorey canopy required for shelter and commuting within the woodland was not present in woodlands subject to a higher level of disturbance. The opportunities for drey creation varied greatly between woodland. Generally coniferous woodland presented more suitable drey creation habitat within the Survey Area. One drey was encountered in woodland block nine but without aerial access, it was not possible to identify species (red or grey squirrel) or confirming current use. None of the woodland blocks surveyed presented with habitat with characteristics to warrant classification in the ‘high suitability’ category. Given the sub-optimal nature of woodland blocks dedicated red squirrel survey was not considered required, with sufficient information gathered to inform this assessment and relevant mitigation.

5.3. NATURE CONSERVATION VALUATION

5.3.1. **Table 5-1** sets out the woodland blocks with Local, Less than Local and Negligible importance for red squirrel. These generally conform to Local importance originating from Moderate suitability, Less than Local from Low suitability and Negligible from the area with no red squirrel suitability.

5.3.2. The Moderate suitability of woodlands contributes to the maintenance of biodiversity at a local level, through the potential to support red squirrels. Woodland with Low suitability, where red squirrels are likely absent, have been assigned Less than Local importance as the important feature (i.e. red squirrel) is “considered absent” (**Table 3-1**) and their suitability to support red squirrel reduced by virtue of the characteristics of the woodland block. WB11 was assigned Negligible suitability owing to habitat

being reclassified (from woodland to grassland) and providing no suitability to support red squirrel.

Table 5-1 - Woodland Block Valuation for Red Squirrel

Woodland Block	Habitat Suitability	Importance Valuation	Rationale for Valuation
WB11	Negligible	Negligible	Habitat reclassified from woodland to grassland.
WB5, WB6, WB10, WB12, WB13, WB14	Low	Less than Local	Age and woodland structure are not conducive to support red squirrel. Generally, these woodlands are either very young, recently planted or very thin with a disconnected canopy and subject to higher disturbance (from traffic noise resulting from proximity to the A1 carriageway, human disturbance from walking or farm activities). Woodlands generally have limited foraging resources available, and poor connectivity within and between woodland. Generally, these woodlands have an understory not as developed as preferred by red squirrel. These woodland blocks also were absent of signs of red squirrel during survey.
WB1, WB2, WB3, WB4, WB7, WB8, WB9, WB15	Moderate	Local	Age and woodland structure present opportunities for drey creation. Many of these woodlands are of plantation origin. Foraging resources are available, and generally these woodlands present with a more developed understory. Generally subject to lower disturbance both within and surrounding the woodland blocks. A single drey was additionally recorded within WB9. Given a lack of confirmed red squirrel drey sightings or other signs/evidence of red squirrel activity, the woodlands have been assessed as moderate.

6. POTENTIAL IMPACTS

6.1. CONSTRUCTION

6.1.1. Potential construction impacts upon red squirrel associated with construction of Part B include:

a. Permanent loss of foraging and commuting habitat such as the removal of woodland;
b. Temporary loss of foraging and commuting habitat such as the removal of woodland;
c. Damage, loss or disturbance of resting sites through loss of supporting habitat;
d. Habitat fragmentation and severance through clearance of land to facilitate construction;
e. Injury/mortality of individual red squirrel through collision with construction traffic; and
f. Disturbance from high noise/vibration activities.

6.1.2. Disturbance is likely from activities causing high levels of noise or vibration such as piling or tree felling. The Lionheart Enterprise Park Compound (eastern and western sites) is likely to experience a high volume of construction traffic and therefore contribute towards high noise activities. However, given there would be no woodland removal associated with the Lionheart Enterprise Park Compound (eastern and western sites) it is unlikely that red squirrels would be directly affected and given the presence of the existing enterprise park, red squirrel in this area are likely habituated to a degree of noise/traffic disturbance. The Main Compound would again experience a high volume of construction traffic; however, it is located 250 m from any woodland parcels so is unlikely to disturb any red squirrels (if present). Red squirrel presence was noted in the 2016 (**Ref. 1**) desk study 500 m to the north east of the Main Compound, therefore it is possible that squirrels commute past/through the area of the proposed Main Compound.

6.1.3. Habitat loss would arise as a result of construction of Part B, with woodland WB2 felled to accommodate the new southbound carriageway. This is the only woodland with Moderate suitability that would be removed. Woodlands with low suitability would also be felled to facilitate construction at WB5, WB6, and WB14.

6.2. OPERATION

6.2.1. Operational impacts upon red squirrel as a result of Part B include:

a. Injury and mortality from vehicle and traffic collisions; and
b. Fragmentation and severance of habitat as a result of the operational Part B.

6.2.2. Red squirrel located in close proximity to the existing carriageway may be habituated to noise and therefore traffic-generated noise is not anticipated to represent a significant consideration.

6.2.3. Fatalities may occur from attempted road crossings during operation. Owing to the dualling of the carriageway, the relative time of exposure to traffic through attempts to cross the carriageway would increase from pre-construction levels owing to the increased width from two lanes to four. The extension of the carriageway would cause a greater severance by increasing this distance between areas of suitable habitat on either side of the road.

7. MITIGATION

7.1.1. The mitigation measures described below are included within a larger list of prescribed measures that would be adhered to throughout construction of Part B. A full list is provided in **Chapter 9: Biodiversity, Volume 3** of this ES (**Application Document Reference: TR010041/APP/6.3**); those measures of relevance to red squirrel are detailed in **Table 7-1** below.

7.1.2. Part B specific mitigation measures are illustrated in **Figure 7.10: Landscape Mitigation Plan, Volume 6** of this ES (**Application Document Reference: TR010041/APP/6.6**).

Table 7-1 - Design and Mitigation Measures and their Delivery Mechanisms

Measure Type	Measure Reference	Approximate Location	Timing of Measure	Description	Mitigation Purpose or Objective	Specific Consultation or Approval Required
Delivery Mechanisms and Preliminary Activities						
Delivery Mechanism and Preliminary Activity	EC01	Throughout Part B	Pre-Construction	All permits and assents would be requested and granted prior to the commencement of works. This may include for example, but not limited to, an Environment Agency Permit for works in and around watercourses.	To protect sites, habitats and fauna.	Natural England/Environment Agency
Delivery Mechanism and Preliminary Activity	EC02	Throughout Part B	Pre-Construction	Pre-construction surveys would be undertaken to verify and, where required, update the baseline ecological conditions set out in this ES. The scope of the pre-construction surveys would be discussed with Natural England prior to being undertaken and would be specific to each ecological receptor under consideration.	To update the baseline ecological conditions set out in this ES.	Natural England
Delivery Mechanism and Preliminary Activity	EC03	Throughout Part B	Pre-Construction	Prior to construction a suitably qualified (or team of suitably qualified) Ecological Clerk of Works (ECoW) and a named bat licensed ecologist would be appointed and would be responsible for implementation of the Ecological Management Plan (EMP) and measures within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) and subsequent CEMP prepared by the main contractor. The ECoW would: – Provide ecological advice over the entire construction programme, at all times as required; – Undertake or oversee pre-construction surveys for protected species in the areas affected by Part B; – Monitor ecological conditions during the construction stage to identify additional constraints that may arise as a result of natural changes to the ecological baseline over time.; – Provide an ecological toolbox talk to site personnel to make them aware of ecological constraints and information, identify appropriate mitigation developed do minimise impacts and make site personnel aware of their responsibility with regards to wildlife. The toolbox talk would include, as required, all ecological receptors considered within this ES; – Monitor the implementation of mitigation measures during the construction stage to ensure compliance with protected species legislation and commitments within this ES. The ECoW would have previous experience in similar ECoW roles, be approved by the Applicant, and be appropriately qualified for the role. The ECoW would be appointed in advance of the main	To ensure the implementation of the EMP.	None required

Measure Type	Measure Reference	Approximate Location	Timing of Measure	Description	Mitigation Purpose or Objective	Specific Consultation or Approval Required
				construction programme commencing to ensure pre-construction surveys are undertaken and any advance mitigation measures required are implemented.		
Delivery Mechanism and Preliminary Activity	EC04	Throughout Part B	Pre-Construction	The main contractor would obtain and comply with the requirements of any protected species derogation licences in respect of works that have the potential to breach applicable conservation legislation necessary to construct Part B. Licensing may be for UK and/or European protected species.	To comply with conservation legislation.	Natural England
Delivery Mechanism and Preliminary Activity	EC05	Throughout Part B	Pre-Construction & Construction	Any tree felling would be carried out by experienced main contractors to reduce direct mortality of protected species according to agreed felling methods between main contractors and the ECoW.	To protect fauna during removal of habitat.	None required
Delivery Mechanism and Preliminary Activity	EC06	Throughout Part B	Pre-Construction	A pre-commencement inspection by the ECoW would be undertaken within woodland prior to any felling to confirm the absence of dreys between February to September. Where deemed necessary, felling would be supervised by the ECoW.	To protect red squirrel.	None required
Delivery Mechanism and Preliminary Activity	EC07	Throughout Part B	Pre-Construction and Construction	Implementation of and adherence to the measures contained within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) that details efforts taken to avoid, minimise and reduce impacts as a result of Part B construction. This is considered particularly important for works in and around watercourses. This includes measures to avoid disturbance of sensitive species and habitats by noise, dust and air pollution. A pre-commencement walkover survey would be undertaken to confirm the absence of invasive non-native species. Should invasive species be recorded within the construction area, this would be addressed through implementation of the Biosecurity Method Statement (EC08), to be developed at detailed design. These measures have been included within the Outline CEMP.	To protect flora and fauna.	None required
General Mitigation						
General	EC09	Throughout Part B	Pre-Construction & Construction	Site/ vegetation clearance and tree felling would be kept to a minimum and only where essential to facilitate construction, to reduce the impacts of habitat loss and fragmentation. Areas of	To reduce the impact to fauna and flora.	None required

Measure Type	Measure Reference	Approximate Location	Timing of Measure	Description	Mitigation Purpose or Objective	Specific Consultation or Approval Required
				clearance, particularly those within temporary works, shall be identified within a method statement and agreed with the ECoW. Site clearance of dense vegetation would be undertaken carefully (use of hand tools) and by experienced main contractors to reduce the risk of mortality to wildlife. Care should be afforded to dense stands of bramble or similar vegetation, which may be used by sheltering hedgehog or other wildlife, particularly during the winter months.		
General	EC10	Throughout Part B	Pre-Construction, Construction & Post-Construction	Plant and personnel would be constrained to a prescribed working corridor through the use of, where practicable, temporary barriers to minimise damage to habitats and potential direct mortality and disturbance to animals located within and adjacent to the Order Limits.	To protect habitats and fauna.	None required
General	EC11	Throughout Part B	Pre-Construction & Construction	Stand-off distances around watercourses and other sensitive habitats (such as woodland) would be implemented prior to commencement of works and clearly demarked on site through the use of physical barriers (fencing, tape or similar). The buffer around trees/ woodland/ hedgerows would be in accordance with good practice to take into account root protection zones.	To protect habitats and fauna.	None required
General	EC12	Throughout Part B	Construction	Works during the construction period would be undertaken during daylight hours (07:00 to 19:00), Monday to Friday to reduce the impact to nocturnal and crepuscular species; particularly bats, barn owl and badger. However, extended hours, including nighttime, would be required for some construction operations. Should night working be required, this would be discussed with the ECoW and appropriate mitigation put in place (particularly concerning lighting). Appropriate mitigation would be determined by the ECoW but is likely to include: – Avoidance of direct lighting on any buildings or trees that contain bat roosts or barn owl nest/ roost sites; – Avoidance of artificial lighting of watercourses, particularly during the hours of darkness to prevent impacts to fish behaviour or passage; – Avoidance of light spill using directional and or baffled lighting; – The use of movement triggers, thus lighting only turns on when people (large objects) move through the area (use within compound); – Reducing the height of lighting columns to reduce light spill onto adjacent habitats;	To reduce disturbance impacts during construction.	None required

Measure Type	Measure Reference	Approximate Location	Timing of Measure	Description	Mitigation Purpose or Objective	Specific Consultation or Approval Required
				– Variable lighting regimes (VLR) - switching off when human activity levels are low i.e. 21:00 to 05:30; – Avoid use of blue-white short wavelength lights and high UV content. Work during hours of darkness would be avoided as far as practicable and where necessary directed lighting would be used to minimise light pollution/glare; – Temporary lighting used for construction would be switched-off when not in use and positioned so as not to spill on to adjacent land, sensitive receptors or retained vegetation within the area surrounding the works; – Directed lighting would be used to minimise light pollution/glare, including for construction compounds. – Lighting levels would be kept to the minimum necessary for security and safety.		
General	EC13	Throughout Part B	Construction	To prevent entrapment of wildlife, any trenches or voids would be excavated and infilled within the same working day. If this is not possible, the void would be securely covered overnight, or a suitable means of escape provided (such as a ramp at no greater than a 45º angle). Any void would then be visually inspected prior to re-starting works to confirm the absence of entrapped wildlife. All escape measures would be discussed and agreed with the ECoW to ensure they are suitable for the size of void and wildlife that may become trapped. If deemed appropriate, the ECoW may enforce additional measures, such as the installation of temporary amphibian/reptile fencing around the void to prevent entry.	To protect wildlife.	None required
General	EC14	Throughout Part B	Construction & Post-Construction	Planting of detention basins to include a diverse floral community and enhance their attraction to wildlife. A diverse floral community refers to providing a range and mixture of floral species, including flowering plants and grasses, that provide resources and niches to a variety of invertebrates which in turn provide a resource for species that prey on the invertebrates. This would be achieved using a native and locally appropriate seed mix.	To improve the value of detention basins to support biodiversity.	None required
General	EC15	Throughout Part B	Operation	Implementation of an Ecological/Environmental Management Plan to detail the monitoring and maintenance of habitat and mitigation/compensation features following creation and installation. The Ecological/Environmental Management Plan would be developed at detailed design. The requirement for an Ecological/Environmental Management Plan is captured within the	To maintain the ecological value of retained and created habitats long-term.	None required

Measure Type	Measure Reference	Approximate Location	Timing of Measure	Description	Mitigation Purpose or Objective	Specific Consultation or Approval Required
				Outline CEMP (**Application Document Reference: TR010041/APP/7.3**).		
Ecological Receptor Specific Mitigation						
Red Squirrel	RS01	Throughout Part B	Pre-construction & Construction	A (Species Protection Plan) SPP would be produced in consultation with Natural England during detailed design. The SPP would form the basis of a 'toolbox talk' to be given to main contractors to increase awareness of potential red squirrel presence and detail typical activity, feeding signs, and drey presence within woodlands. The SPP would detail the methodology for managing any red squirrels or dreys encountered during works. The SPP is identified within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**).	To protect red squirrel.	Natural England (if required)
Red Squirrel	RS02	Throughout Part B	Pre-construction	A pre-works inspection would be undertaken by the ECoW in all areas of woodland within 50 m from the works/compound boundary, in search of evidence of squirrel activity/presence, prior to any works taking place in any woodland habitat.	To protect red squirrel and their dreys.	None required
Red Squirrel	RS03	Throughout Part B	Pre-Construction	Tree felling within WB9, or any other woodland subsequently identified with dreys, would be timed out with the red squirrel breeding season recognised as between February to September inclusive. Where this cannot be achieved, all works would be discussed with, and overseen by, the ECoW prior to commencement.	To protect red squirrel.	None required
Terrestrial Habitats	HAB03	Throughout Part B	Pre-construction	Overall connectivity of new and existing habitats within the Order Limits would be increased to link up with the wider landscape including woodland, hedgerows, watercourses and ponds, where possible.	To link up existing and newly created areas of valuable habitat to allow increased movement of species between habitat parcels.	None required

8. RESIDUAL IMPACTS

8.1.1. This impact assessment assumes the adoption of the mitigation measures detailed in **Section 7** and as such detailed assessment is only provided on residual impacts. Pre-mitigation impact characterisation is provided for clarity, whilst those features assessed as of '**Less than Local'** importance (WB5, WB6, WB10, WB12, WB13 and WB14) have not been assessed further.

8.1.2. A summary of specific impacts, mitigation and residual impacts (if any) is provided within **Table 8-1**.

8.1. CONSTRUCTION

8.1.1. Disturbance of red squirrels within 50 m of construction activities during the breeding season (February to September inclusive) may result from high noise or high vibration works such as pilling or tree felling (**Ref. 11**). Additionally, the Lionheart Enterprise Park Compound may encounter a high volume of construction traffic contributing to increased noise/vibration activities. As a result of construction activities, red squirrel may avoid suitable woodland habitat owing to increased disturbance levels (noise or activity). However, red squirrel (if present) would likely already be somewhat habituated to a degree of noise associated with traffic movements along the existing A1 carriageway and movements/noise associated within the existing Lionheart Enterprise Park.

8.1.2. During construction activities, there is a potential risk of red squirrel mortality. This is most likely to occur during woodland felling works in woodland where there is an existing level of disturbance to which squirrels are already habituated. Furthermore, mortality may result from collision with construction affiliated traffic.

8.1.3. Habitat loss may be offset through proposed mitigation landscape planting after a period of time once the woodland has established.

Table 8-1 – Summary of Specific Impacts, Mitigation and Residual Impacts (Construction)

Feature	Potential Impact	Characterisation of Impact	Mitigation Incorporated into The Design	Residual Impact
WB1 Value: Local	Disturbance	Extent: - Disturbance of squirrels within woodland during construction. Effect: Indirect adverse Duration: Temporary Frequency and timing: For duration of construction works Reversibility: Irreversible Likelihood: Probable	EC02, EC03, EC05, EC08, EC09 EC10, EC11, EC12, RS01, RS02	Neutral (Not Significant)
WB2 Value: Local	Habitat Loss	Extent: - Habitat Loss from woodland removal. Effect: Direct adverse Duration: Permanent Frequency and timing: One-time event Reversibility: Irreversible Likelihood: Certain	EC02, EC03, EC04, EC05, EC09, EC10, EC08, EC06, EC11, EC12, EC13, RS01, RS02, HAB03	Neutral (Not Significant)
WB3 Value: Local	Disturbance	Extent: - Disturbance of squirrels within woodland during construction. Effect: Indirect adverse Duration: Temporary Frequency and timing: For duration of construction works Reversibility: Irreversible Likelihood: Probable	EC02, EC03, EC05, EC08, EC09, EC10, EC11, EC12, RS01, RS02	Neutral (Not Significant)
WB4 Value: Local	Disturbance	Extent: - Disturbance of squirrels within woodland during construction. Effect: Indirect adverse Duration: Temporary Frequency and timing: For duration of construction works Reversibility: Irreversible Likelihood: Probable	EC02, EC03, EC05, EC08, EC09, EC10, EC11, EC12, RS01, RS02	Neutral (Not Significant)

Feature	Potential Impact	Characterisation of Impact	Mitigation Incorporated into The Design	Residual Impact
WB7 Value: Local	Habitat loss	Extent: - Removal of thin strip of woodland. Effect: Direct adverse Duration: Permanent Frequency and timing: One-time event Reversibility: Irreversible Likelihood: Certain	EC02, EC03, EC04, EC05, EC06, EC08, EC09, EC10, EC11, EC12, EC13, RS01, RS02, RS03, HAB03	Neutral (Not Significant)
WB7 Value: Local	Disturbance	Extent: - Disturbance of squirrels within woodland during construction. Effect: Indirect adverse Duration: Temporary Frequency and timing: For duration of construction works Reversibility: Irreversible Likelihood: Certain	EC02, EC03, EC05, EC08, EC09, EC10, BI01, RS01, RS02	Neutral (Not Significant)
WB8 Value: Local	Disturbance	Extent: - Removal of thin strip of woodland. - Disturbance of squirrels within woodland during construction. Effect: Direct adverse Duration: Permanent/Temporary Frequency and timing: For duration of construction works Reversibility: Irreversible Likelihood: Certain	EC02, EC03, EC05, EC06, EC08, EC10, EC011, EC012, RS01, RS02	Neutral (Not Significant)
WB9 Value: Local	Disturbance	Extent: - Disturbance of squirrels within woodland during construction. Effect: Indirect adverse Duration: Temporary Frequency and timing: For duration of construction works Reversibility: Irreversible Likelihood: Certain	EC02, EC03, EC05, EC08, EC09 EC10, EC11, EC12, RS01, RS02, RS03	Neutral (Not Significant)

Feature	Potential Impact	Characterisation of Impact	Mitigation Incorporated into The Design	Residual Impact
WB14 Value: Local	Disturbance	Extent: - Disturbance of squirrels within woodland during compound use. Effect: Indirect adverse Duration: Temporary Frequency and timing: For duration of construction works Reversibility: Irreversible Likelihood: Certain	EC02, EC03, EC05, EC08, EC09 EC10, EC11, EC12, RS01, RS02	Neutral (Not Significant)

8.2. OPERATION

8.2.1. Direct effects from the road operation are likely to be limited and have been summarised below. Disturbance of woodland habitat directly adjacent to the carriageway boundary from road traffic movements may result during operation of Part B. In the event red squirrel are present in the area, they would likely be habituated to a degree of noise associated with the existing A1 carriageway. As no significant increase in noise is anticipated from Part B (refer to **Chapter 6: Noise and Vibration, Volume 3** of this ES (**Application Document Reference: TR010041/APP/6.3**)), the effect is considered **Neutral** (**not significant**).

8.2.2. A secondary consideration is the risk of red squirrel fatalities through road traffic collisions during attempts to cross the carriageway. Part B would increase severance between habitat either side of the carriageway, particularly in the case of woodland that is present on both sides. Red squirrel attempting to cross the carriageway would be subject to increased exposure and potential to traffic collision owing to the widened carriageway. However, given the widening of the carriageway, red squirrel may cease to attempt crossing of the carriageway altogether owing to the increased distance and exposure. Taking into account a lack of evidence of the species in this area the effect is considered **Neutral** (**not significant**).

9. CONCLUSIONS

9.1.1. No woodland blocks within the Survey Area were assessed to provide high suitability to support red squirrel. However, eight woodland blocks were assessed to provide moderate suitability, six low suitability, and one which was reassessed as grassland, and of negligible suitability.

9.1.2. Woodland blocks of low suitability were assessed to be of Less than Local importance as no evidence was observed in addition to the woodland blocks being assessed as less than suitable to support red squirrel by virtue of their characteristics. Woodland blocks of Moderate suitability were assessed to be of Local importance given the lack of evidence of red squirrel presence, with only a single drey (of indeterminate species) recorded during the survey, 110 m from Part B in WB9, and taking into account a lack of red squirrel records returned during the desk study, and confirmation of the area between Alnwick and Ellingham supporting a low red squirrel population density (as informed by the Northumberland BAP).

9.1.3. Potential impacts on red squirrel have been assessed as not significant given the low number of desk study records returned and the lack of woodlands of high suitability to support red squirrel. Woodland loss would result from construction of Part B, however, with the implementation of proposed mitigation this has been assessed as not significant in the context of Part B.

9.1.4. Proposed mitigation is considered sufficient to minimise and reduce the risk of impacts upon red squirrel as a result of construction of Part B. Habitat loss would occur to facilitate construction of Part B. Pre-works/tree felling inspections of woodland for the presence of dreys should be undertaken in accordance with mitigation prescribed herein, particularly in respect of the red squirrel breeding season. The implementation of a red squirrel SPP would ensure that works personnel are informed of potential red squirrel presence, the signs to be aware of, and actions to follow in the event of discovery.

9.1.5. Residual impacts from increased disturbance during operation of Part B are anticipated. In addition, potential risk of red squirrel mortality would occur during construction, owing to construction vehicle traffic movements, and operation, as a result of increased risk of collision with road traffic given the increased likely level of exposure associated with the widened carriageway.

REFERENCES

Ref. 1 Jacobs (2018). *A1 in Northumberland – Extended Phase 1 Habitat Survey Report (Version 2)*.

Ref. 2 Stevenson-Holt, Claire D. (2008). *Modelling red squirrel population viability under a range of landscape scenarios in fragmented woodland ecosystems on the Solway plain, Cumbria*. University of Cumbria and PTES.

Ref. 3 Northumberland Wildlife Trust (2018). *Northumberland Biodiversity Action Plan*. Northumberland Wildlife Trust. Available at: https://www.nwt.org.uk/sites/default/files/2018-10/Nland_Biodiversity_Action_Plan.pdf [Accessed 20/02/2019].

Ref. 4 Gurnell J., Lurz P., McDonald R. and Pepper H.W. (2009). *Practical techniques for surveying and monitoring squirrels*. Available at: https://www.forestry.gov.uk/website/publications.nsf/DocsByUnique/EE26235D2871ED4780257EBB0046F9A6 (Accessed 22/08/17).

Ref.5 Cresswell, W., Birks, J., Dean, M.D., Pacheco, M., Trewhella, W., Wells, D., Wray, S. (Eds.) (2012). *UK BAP Mammals; Interim Guidance for Survey Methodologies, Impact Assessment and Mitigation.* The Mammal Society, Southampton, pp. 9-21.

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Ref. 9 Ratcliffe, D. A. (1977) *A Nature Conservation Review*, Cambridge University Press.

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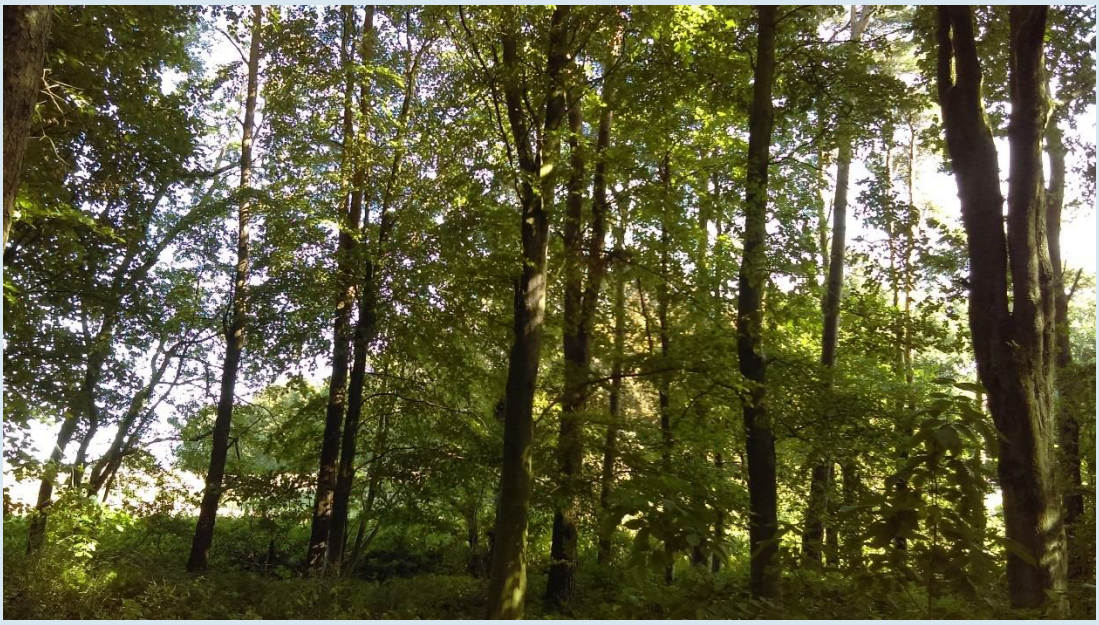
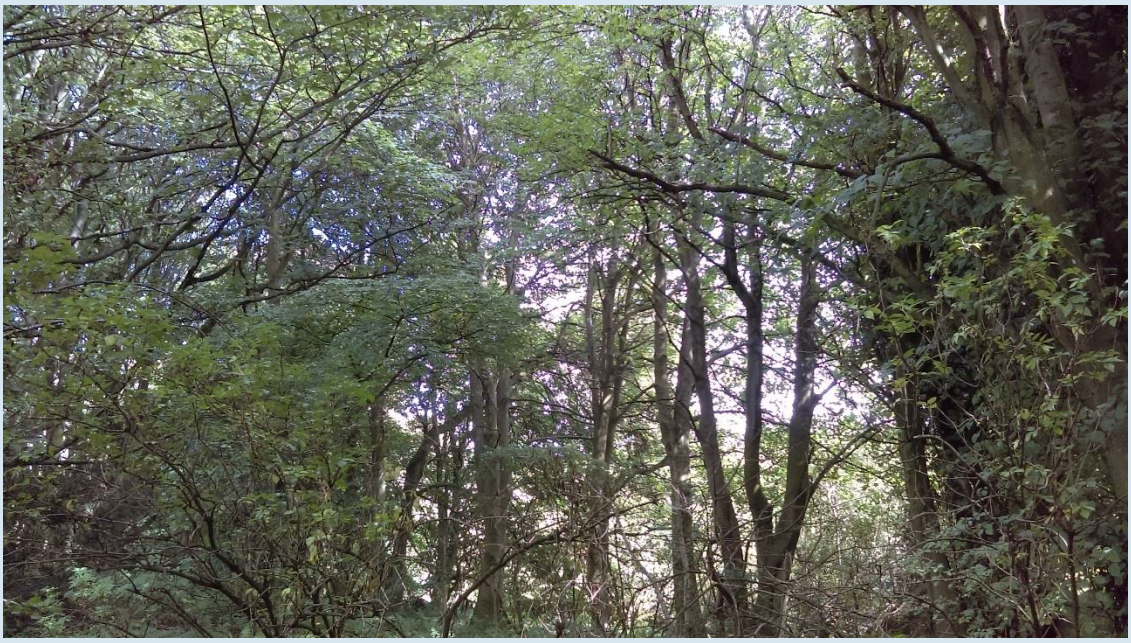
Ref. 11 Scottish Natural Heritage (2018). *Protected Species Advice for Developers: Red Squirrel*. Available at: https://www.nature.scot/sites/default/files/2018-09/Species%20Planning%20Advice%20-%20red%20squirrel.pdf [Accessed 14/11/2019]

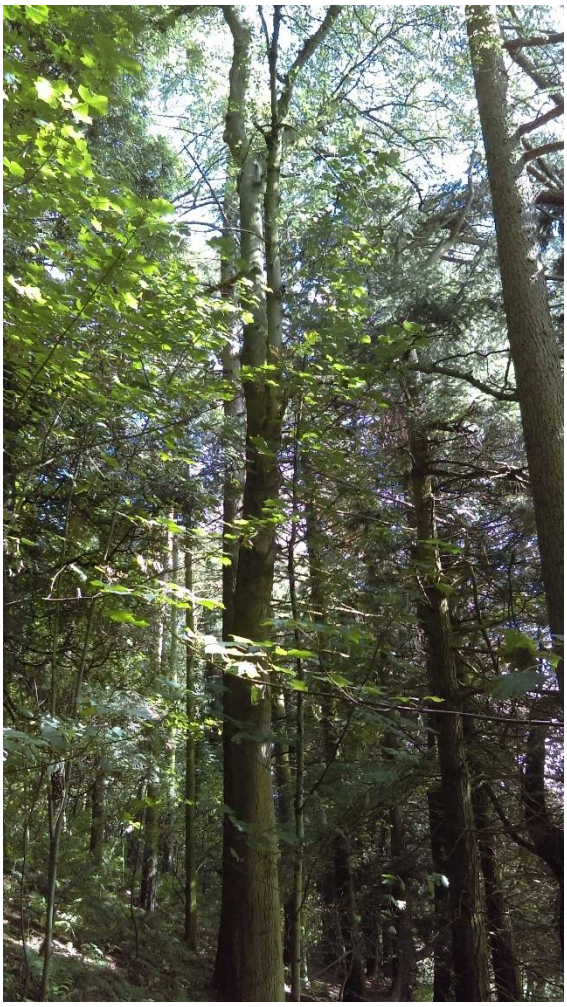
Appendix A

SURVEY PHOTOGRAPHS

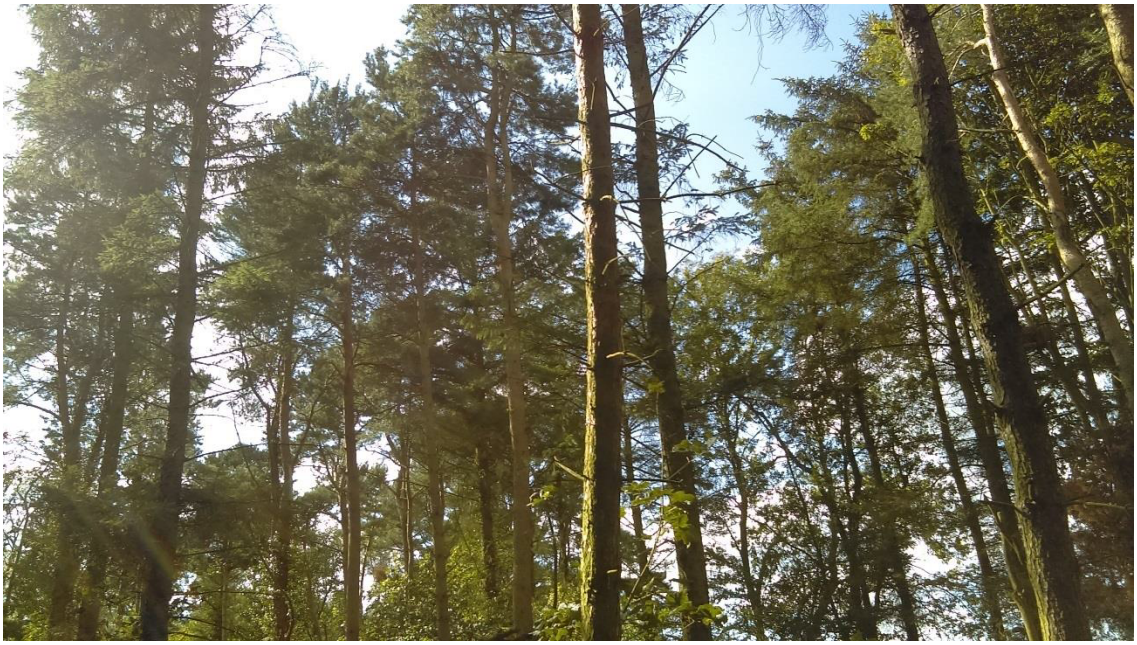
Survey Photographs

Woodland ID	Photograph
WB1	
WB2	

Woodland ID	Photograph
WB3	

Woodland ID	Photograph
WB4	

Woodland ID	Photograph
WB5	
WB6	

Woodland ID	Photograph
WB7	
WB8	

Woodland ID	Photograph
WB9	
WB10	

Woodland ID	Photograph
WB11	
WB12	

Woodland ID	Photograph
WB13	 

Woodland ID	Photograph
WB14	
WB15	

Appendix B

TARGET NOTES

TN Ref	OS Grid Reference	Comment
TN1	NU 17367 21152	40 Corvid nests within WB4.
TN2	NU 18197 18936	Single drey within WB9, located in group of fir trees in centre of woodland. No other evidence noted. Not confirmed red or grey squirrel, active or inactive.
TN3	NU 19859 10930	Feeding signs observed within the woodland at NU 19859 10930 and NU 19944 11041 consisting of foraged cones. Unable to determine prey species.

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