



Appendix 13.2

ECOLOGY BASELINE REPORT

□ □ □ □ **r** □ □ □ □ **I** □ □ □ □ □ □ □ □ □ □ **D** □ □ □ □ **r** □ □ □ □

Ecology Baseline Report



BLANK PAGE





1	Summary	3
2	Introduction	4
3	Previous ecology survey work	6
4	Methods	7
5	Results and Evaluation	24
6	References	49
7	Figures	52
8	Photographs	53
9	Appendix 1: 2018 Ecology Report	57
10	Appendix 2: Consultation with CDC	58
11	Appendix 3: Target Notes	59
12	Appendix 4: Botanical Data	60
13	Appendix 5: Condition Assessment Data	65
14	Appendix 6: Hedgerow survey Data	67
15	Appendix 7: HSI Scores for Ponds	70
16	Appendix 8: Tree Assessment for Bats	71
17	Appendix 9: Aquatic Invertebrate Data	74



- 1.1 BSG Ecology was commissioned by Oxford University Development (OUD) in 2017 to undertake ecological surveys to provide baseline ecological information to inform an ecological assessment of development on land within part of the Cherwell Local Plan PR8 allocation site, east of the A44 at Begbroke, Oxfordshire. This work was then updated in 2021 and 2022. This report sets out the methods and results of this work.
- 1.2 'The Site' is shown in Figure 1; it is approximately 170 ha in extent and comprises part of the area allocated for development under Cherwell District Local Plan policy *PR8 - Land East of the A44*. Policy PR8 covers a new urban neighbourhood comprising up to 1,950 new homes, the expansion of Begbroke Science Park, a secondary school, two primary schools, and associated infrastructure.
- 1.3 Previous ecology-related work at the Site includes a 2015 biodiversity survey and badger survey, a 2016 statement of key constraints and opportunities, a 2017 soil survey, a 2018 hydrological study, a 2018 ecological baseline report and a 2018 constraints and opportunities report.
- 1.4 This report presents a comprehensive set of ecology baseline surveys carried out at the Site in 2021 and 2022, as well as relevant desk study information reviewed in early 2023. Information obtained from surveys in 2017 and 2018 is summarised where relevant, and the full 2018 survey report is provided in Appendix 1.
- 1.5 The scope of this work has been agreed with Cherwell District Council and includes: a desk study, Phase 1 habitat survey, habitat condition assessment, hedgerow survey, otter and water vole survey, freshwater invertebrate survey, white-clawed crayfish survey, preliminary bat roost assessment of buildings and trees, bat roost inspections and emergence/re-entry surveys, bat activity survey, dormouse survey, breeding bird characterisation survey, wintering bird survey, badger survey, reptile survey, great crested newt survey, and brown hairstreak butterfly survey.
- 1.6 A stream, the Rowel Brook passes east to west through the Site and joins the Oxford Canal which forms part of the Site's eastern boundary. The A44 Woodstock Road forms part of the western boundary of the Site, and is likely to present a significant barrier to many species (such as great crested newt and reptiles).
- 1.7 The main habitats present at the Site are arable land, poor semi-improved grassland, semi-improved woodland, hedgerows, streams, and ditches. Six ponds are present within the Site, as are numerous mature trees, and there are small areas of good semi-improved grassland, scrub, tall ruderal vegetation, amenity grassland, plantation woodland, and hardstanding. Buildings are present at Begbroke Science Park in the centre-north of the Site and at Parker's Farm in the north-east of the Site. Of these habitats, the woodland and hedgerows, and one of the ponds are classified as Habitats of Principal Importance in England. Of the 54 hedgerows present at the Site, 38 hedgerows are species-rich, and 31 are considered *Important* under wildlife and landscape criteria of the Hedgerow Regulations 1997.
- 1.8 The parts of the Site proposed for development are dominated by arable land. The parts of the Site proposed for green space include grassland and arable fields in the east, and arable land and the Rowel Brook (and adjacent woodland) in the north.
- 1.9 The results of surveys indicate that the Site supports the following protected species: badger (including setts), bats (roosting, foraging, and commuting), birds (ground and scrub/tree nesting), great crested newt, and reptiles (slow-worm, common lizard, and grass snake). The following further Species of Principal Importance are present: common toad, brown hare, brown hairstreak butterfly, and several bird species. Based on the surveys, dormouse and white-clawed crayfish are unlikely to be present. Freshwater invertebrate surveys indicate that the stream at the Site, the Rowel Brook, has fair to good water quality. Surveys in 2022 did not find evidence of water vole or otter at the Site. However, water vole is known to be present on the Oxford Canal which is adjacent to the east, and so could be present on the Rowel Brook in future years, and the Rowel Brook has the potential to support otter.

1 Introduction

1.1 Introduction

2.1 BSG Ecology was commissioned by Oxford University Development (OUD) in October 2017 to undertake ecological surveys to provide baseline ecological information in support of potential development on land east of the A44 at Begbroke, Oxfordshire. BSG Ecology was commissioned in early 2021 and early 2022 to undertake a series of update surveys. This report sets out the methods and results of this work.

1.2 Site Description

2.2 'The Site' proposed for development is shown in Figure 1; it is approximately 170 ha in extent and includes part of the area allocated for development under Cherwell District Local Plan policy PR8 - Land East of the A44 (Cherwell District Council, 2020).

2.3 The Site is located south and east of the village of Begbroke and extends south to the village of Yarnton and east to the Village of Kidlington. It includes Begbroke Science Park ('the Science Park') in its northern part and includes a former landfill site towards its centre. The A44 Woodstock Road forms part of the western boundary, and the Oxford Canal forms part of the eastern boundary. The Site is crossed east-west by the minor road Sandy Lane, and north-south by the Oxford to Banbury railway line.

2.4 The Site is comprised predominantly of arable farmland with hedgerows and some grassland. The only buildings within the Site boundary are at Begbroke Science Park, and two large modern barns and a smaller stone shed at Parker's Farm in the north-east corner of the Site.

2 Development Objectives

2.1 The Site is proposed for development by Oxford University Development into an innovation district centred on the existing Begbroke Science Park. The Proposed Development would be a mixed use development, comprising research & development and flexible employment uses, industrial uses, commercial and professional services, storage uses, residential dwellings, retail, leisure, local community and centre uses, entertainment venues, supporting social and physical infrastructure, and new and enhanced landscape and wildlife areas (including a new local nature reserve). The proposals are subsequently referred to as the 'Proposed Development'.

2.2 The PR8 Policy Map proposes that the north and east of the Site will be allocated for a variety of greenspace uses, including a new Local Nature Reserve along the Rowel Brook and a Nature Conservation Area east of the railway line.

3 Methodology

2.3 This report presents the results of update ecology surveys of the Site in 2021 and 2022, as well as relevant desk study information reviewed in early 2023. This work updated previous work carried out during 2017 and 2018, which is summarised here and described in full in the report in Appendix 1.

2.4 The overall purpose of the surveys and desk study work is to provide the ecology baseline information necessary to support the Ecological Impact Assessment of the Proposed Development at the Site. The impact assessment is set out in the Ecology chapter of the Environmental Statement, of which the current report forms an appendix.

2.5 The specific aims of the ecology baseline survey work are as follows:

- To establish whether any designated nature conservation sites are present within or close to the Site, and to provide a summary of their interest.
- To map and describe the habitats present within the Site, and to collect information to allow their condition to be assessed based on industry guidance (Natural England, 2022).

- To determine the potential of the Site to support any species that are legally protected or any species or species groups that are otherwise of conservation interest.
- To determine whether any such species or species groups are present at the Site and to provide information on their distribution within and their use of the Site.

□□ □r□□□□□□□□□□□□□□□□r□□□□□ □r□□

3.1 Previous relevant survey and desk study work is summarised below.

□□□□□□□□□□□□□□□□□□ □□□□r□ □□□r□□□□□□□□□□□□r□□

3.2 An ecological survey and assessment was carried out in support of the planning application for a new access road from the A44 Woodstock Road to Begbroke Science Park (Applied Ecology Ltd., 2010). This assessment covered a narrow corridor of land in the north-west of the Site, west of the Science Park, and was based on a habitat survey, a badger survey, and a ground-based assessment of buildings and trees to determine their potential to support roosting bats.

3.3 The assessment noted potential for great crested newt in ponds in the vicinity of the area surveyed, potential for bats to roost in two buildings, and the presence of a main badger sett and an outlier sett nearby. It specified appropriate ecology mitigation, including the installation of a badger tunnel under the new access road.

□□□□□□ □d□□r□□□□□□r□□□□

3.4 BSG Ecology carried out a biodiversity survey of the PR8 site in January 2015 (BSG Ecology, 2015a and 2015b) comprising a desk study, extended Phase 1 habitat survey, a badger survey, and an assessment of the likely ecological impacts and mitigation options for the development.

3.5 An updated desk study is reported in Section 6 of this report and therefore the 2015 desk study is not summarised here.

3.6 Habitats identified at the Site included arable land, semi-improved neutral grassland, species-poor semi-improved grassland, improved grassland, broad-leaved semi-natural woodland, plantation woodland, hedgerow, scrub, tall ruderal vegetation, swamp, running water (the Rowel Brook and an inflowing stream), ditches, ponds, mature and semi-mature trees, buildings, and hard standing.

3.7 Evidence of badger *Meles meles* (including badger setts) was found in several locations on and adjacent to the Site.

3.8 The Site was considered to have the potential to support the following protected or notable species: roosting, foraging and commuting bats, otter *Lutra lutra*, water vole *Arvicola amphibia*, dormouse *Muscardinus avellanarius*, breeding birds (including kingfisher *Alcedo atthis*, barn owl *Tyto alba* and farmland birds), reptiles and great crested newt *Triturus cristatus*. Surveys were recommended for these species. Surveys were also recommended to determine the nature conservation value of hedgerows and semi-improved grassland at the Site.

□□□□□□□□□□□□r□□□r□□□□r□ □□□r□□□□□□□□□□□□r□□

3.9 BSG Ecology carried out biodiversity surveys over the period January to June 2018 in support of a planning application for building works at Begbroke Science Park. These included a desk study, Phase 1 habitat survey, reptile survey and great crested newt survey (BSG Ecology, 2018a and 2018b). The great crested newt survey recorded a maximum count of two animals in the formal ponds at Begbroke Science Park and found no evidence of reptiles there. Since these surveys were updated in 2021 and 2022, the results are subsumed into Section 6 of this report.

□□□□□□□□□□□□□□□□□□ □□□□r□ □□□r□□□□□□□□□□□□r□□

3.10 BSG Ecology carried out a range of ecology surveys during 2021 in support of a planning application for building works at Begbroke Science Park. These included a desk study, extended Phase 1 habitat survey and a badger survey. The results of this work are the results are subsumed into Section 6 of this report.

Method

Introduction

- 4.1 BSG Ecology first carried out a desk study and an extended Phase 1 habitat survey of the PR8 Site in 2015. This work was reported to Oxford University. Since this 2015 work has been superseded by later work, it is not reported here.
- 4.2 BSG Ecology carried out an updated desk study, extended Phase 1 habitat survey, and a range of other ecology surveys at the Site over the period October 2017 to October 2018. These included a hedgerow survey and assessment, botanical survey, badger survey, bat surveys, dormouse surveys, water vole and otter surveys, breeding bird surveys, great crested newt (HIS, eDNA, population size class assessment surveys), white clawed crayfish survey, and aquatic invertebrate surveys (BSG Ecology, 2018a and 2018b). The methods and results of these surveys are set out in the report in Appendix 1.
- 4.3 The historical landfill Site towards the centre of the Site (south of Sandy Lane) did not form part of Oxford University's land ownership in 2018 and was not included in 2018 surveys. It was subsequently purchased by the University and has been included in the 2022 survey work.
- 4.4 The following sections describe the methods of ecology desk study and survey work, carried out in 2021 and 2022.

Design

- 4.5 In order to obtain information on designated wildlife sites in the vicinity of the Site, together with historical records of protected species and species of conservation importance, an updated data search was requested from the Thames Valley Environmental Records Centre (TVERC) on 06 January 2023. Data was received from TVERC on 06 January 2023, and included the following:
- Information on non-statutory wildlife sites within 2 km of the Site.
 - Records of protected, notable¹ and invasive species from within 2 km of the Site.
- 4.6 Species records from the last 10 years (i.e., from 2012 onwards) were reviewed in the desk study.
- 4.7 A search for statutory designated wildlife sites was carried out on 26 January 2023 by searching the UK Government MAGIC² website for the following:
- Information on International/European wildlife sites within 10 km of the Site.
 - Information on statutory wildlife sites within 5 km of the Site.
 - Information on ancient woodland within 3 km of the Site.
- 4.8 Great crested newts can use terrestrial habitat up to 500 m from breeding ponds (English Nature, 2001) and therefore searches were carried out in early 2017, March 2021, and February 2023 for ponds within 500 m of the Site using Ordnance Survey (OS) mapping available from the Multi-Agency Geographical Information for the Countryside (MAGIC) website.
- 4.9 Aerial imagery and OS mapping of the Site and surrounding area available at Bing Maps and Google Maps were accessed in January 2023 to provide background, location and mapping information.
- 4.10 The reports of previous surveys relating to the Site noted in section 3 *Previous ecology survey work*, above, were also reviewed as part of the ecology desk study.

□

¹ "Notable" species in this context are those listed as notable in the TVERC database, indicating that they are included on any of various lists of species of conservation concern or priority at the local, regional or national level (e.g, the red data lists, Oxfordshire rare plants register, etc).

² Multi-agency Geographic Information for the Countryside: www.magic.gov.uk.

4.11-4.16 Habitat Survey

- 4.11 A Phase 1 habitat survey of the Site, based on standard industry guidance (JNCC, 2016), was carried out on 15 and 17 June 2022 by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology. This survey updated a previous Phase 1 habitat survey of the Site carried out by the same surveyor on both 16 and 17 April, and 23 and 31 May 2018.
- 4.12 The extent of the Phase 1 habitat survey is indicated in Figure 2.
- 4.13 Habitats present at the Site were identified and mapped onto an Ordnance Survey base map, with target notes describing any features of particular ecological interest.
- 4.14 Lists of dominant plant species were collected for all habitats of potential conservation significance in a series of target notes to accompany the Phase 1 habitat plan.
- 4.15 It should be noted that species lists derived from the target notes do not necessarily provide an exhaustive inventory of all species occurring at a Site; they are intended to indicate the character of habitats present, the general species richness of a particular areas, and to draw attention to any species that may be considered uncommon or unusual. The habitat surveys were conducted on days when the weather conditions were calm and dry, and the weather did not constrain this work. The survey visits were carried out within the optimal time-of-year for Phase 1 habitat surveys (JNCC, 2010).
- 4.16 The Phase 1 habitat survey was ‘extended’ to assess the potential of the habitats present on Site to support protected species or species of conservation interest. This included a preliminary appraisal of the potential value of the Site for bats.

4.17-4.21 Hedgerow Survey

- 4.17 In order to evaluate the conservation significance of hedgerows present at the Site, hedgerow surveys and assessments were carried out at the Site on 19 October 2021 by Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology and Chris Woolley, Ecologist at BSG Ecology. The surveys were undertaken at a suitable time of year for hedgerow surveys (Defra, 2007).
- 4.18 All hedgerows present were mapped on to Ordnance Survey base maps of the Site (for hedgerow locations see Figure 3). The average numbers of woody and woodland species (as defined in the Hedgerow Regulations 1997) were recorded for each hedgerow. Hedgerows were placed into the categories ‘species-rich’ or ‘species-poor’ by the surveyor, based on whether the average number of woody species present in a 30 m length was five or more (‘species rich’) or fewer than five (‘species poor’) (see Defra, 2007). Further information on the condition of hedgerows was collected, including the presence or extent of: a bank or wall, gaps, trees, woodland species, adjacent ditches, parallel hedgerows (within 15 m), and connections to other ecological features such as woodlands, ponds, and other hedgerows.
- 4.19 Freely available aerial imagery from Bing Maps (www.bing.com/maps) was used to aid in the locating and mapping of hedgerows by indicating their lengths and the presence of significant gaps.
- 4.20 The above information was used to identify hedgerows at the Site meeting the criteria for determining ‘Important’ hedgerows under *Wildlife and Landscape* in Schedule 1 of the Hedgerow Regulations 1997.
- 4.21 Hedgerows were also assessed to determine their habitat condition using the condition assessment criteria of Natural England (2022).

4.22 Grassland

- 4.22 In 2018, four fields in the east of the Site supported grassland. All four fields were classified as semi-improved grassland (either semi-improved neutral grassland or poor semi-improved grassland, see Appendix 1). In 2018 these fields were subject to a botanical survey based on the National Vegetation Classification to the determine grassland type in more detail. These fields were subject to a walkover

survey by an experienced botanist in 2022, to determine whether there had been any significant changes to the habitats. This was followed by a botanical condition assessment of these fields using Natural England's (2022) condition assessment criteria.

- 4.23 The botanical survey and habitat condition assessment were undertaken on 15 June 2022 by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology, and Jamie Townsend, Ecologist at BSG Ecology. The area subject to detailed botanical survey includes the four pasture fields at the east of the Site, a small area of grass and scrub adjacent to the west of the rail line, is indicated in Figure 4. The historical landfill Site was also included in the 2022 botanical condition assessment (having not been accessible in 2018).
- 4.24 Woodland at the Site was not subject to detailed botanical survey because its status as a valuable habitat to be retained in the Proposed Development was clear from the results of the Phase 1 habitat survey (in contrast to the areas of grassland, which required more detailed information for their conservation value to be determined).
- 4.25 The grassland condition assessment involved the surveyor marking out five quadrats (each 1 m x 1 m in size, marked out using tape measures) within typical stands of vegetation for each of the four survey fields to the east of the railway line and the former landfill site.
- 4.26 For the small area of grassland just east of the railway line, two quadrats were taken in grassland and two in tall ruderal vegetation. The small size of this area meant that further quadrats were considered unnecessary to characterise this vegetation. The area of scrub dominating the centre of this latter field was not subject to quadrat survey because the density of this scrub prevented access. A species list for this scrub was produced based on observations from the exterior, including estimation of relative abundance using the DAFOR³ scale.
- 4.27 For each quadrat, the surveyor identified all vascular plant species present and estimated their percentage cover classes using the Domin scale (Rodwell *et al*, 1992). Where noted, bryophytes (mosses and liverworts) were also recorded, though a detailed search/survey for these species was not carried out.
- 4.28 Quadrat data were tabulated using Microsoft Excel and sorted into floristic tables (as used in Rodwell *et al*, 1992). Data analysis involved the following methods:
- The vegetation community identification keys in Rodwell *et al* (1992) were used to identify plant communities, based on the data in the floristic table.
 - The floristic tables were compared (by inspection) with those of Rodwell *et al* (1992).
- 4.29 A written summary of each of the grassland in each of the surveyed fields was also produced.
- 4.30 The conservation value of the grassland in the survey area was evaluated with reference to the following:
- BRIG (2011) *UK Biodiversity Action Plan Priority Habitat Descriptions*. JNCC. This was used to identify Habitats of Principal Importance in England (HPIs), designated under Section 41 of the NERC Act, 2006.
 - Stroh *et al* (2014) *A Vascular Plant Red List for England*. BSBI.
 - TVERC & BMERC (2009) *Criteria for the Selection of Local Wildlife Sites in Berkshire, Buckinghamshire and Oxfordshire*. TVERC.
 - Oxfordshire Flora Group (2015). *Oxfordshire Rare Plant Register*. ANHSO.
- 4.31 A Natural England (2022) condition assessment form for grassland was completed for each field.

³ DAFOR is a scale of relative abundance that is frequently used in habitat and botanical surveys, with the following categories: D: dominant; A: abundant; F: frequent; O: occasional; R: rare.

4.32 Badger survey work carried out in 2022 and 2021 updated previous badger surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.32 Badger survey work carried out in 2022 and 2021 updated previous badger surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.33 In order to obtain information on the presence and use of the Site by badgers, and on the location of any badger setts, the Site was subject to a badger survey by Jamie Townsend, Ecologist at BSG Ecology, on 19 April 2022. The badger survey covered all areas within the Site. Where evidence of badger in adjacent areas was visible from the Site, or adjacent footpath, this was also recorded.

4.34 The badger survey involved searching for and mapping (using a hand-held GPS receiver) any field signs of badger, such as latrines, obvious pathways used by badger, and locations of setts. Several categories of badger setts have been identified, as described below (adapted from Neal and Cheeseman, 1996; Harris et al., 1994):

- Main sett - Normally where cubs are raised and in continuous and regular use throughout the year. Typified by large spoil heaps and well-trodden paths. There can be many entrances to the sett (often with some of these disused), although a main sett can sometimes only have a single entrance.
- Annexe setts - Intermediate-sized and may be used by breeding badgers. Normally close to a main sett and connected to it by obvious paths. They may not be in use all the time, even if the main sett is very active.
- Subsidiary sett - Similar to annexe setts but are likely to be further away (at least 50 m from the main sett) and not as well connected to the main sett as annexe setts. May only be used intermittently.
- Outlier setts - Small setts with one or two entrance holes which are used sporadically by badgers as a temporary refuge (Neal & Cheeseman, 1996). Spoil heaps are likely to be small and there may not be obvious paths connecting to other setts. Use may be sporadic. There may be several outlier setts within one badger social group's territory (Neal & Cheeseman, 1996).

4.35 For all badger sett entrance holes that were found, an indication of the level of activity was also recorded according to Harris et al. (1989), as follows:

- Active - active sett entrances contain no debris or vegetation, are obviously regularly used and often show signs of having been recently excavated.
- Partially used - partially used entrances are those not in regular use, and which may have debris (leaf litter, twigs, moss, etc.) around the entrance. However, they could potentially be used regularly in the future with minimal clearance necessary.
- Disused - disused sett entrances show signs of not having been used for a considerable period of time and would not be used again without extensive clearance by a badger.

4.36 Bat roost assessments of buildings carried out in 2021 and 2022 updated a preliminary roost assessment of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.36 Bat roost assessments of buildings carried out in 2021 and 2022 updated a preliminary roost assessment of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.37 A ground level roost assessment of buildings at the Site was carried out in April 2021 by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology and Oliver Kemp, Ecologist at BSG Ecology (who holds Natural England bat licences numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS).

4.38 The suitability of buildings for roosting bats was verified by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology and Kai Hayes, Ecologist at BSG Ecology, at various times between April and September 2022.

4.39 These surveys were carried out to determine the potential of buildings that could be affected by the Proposed Development to support roosting bats. These buildings included all of those at Begbroke Science Park, and two large metal agricultural barns and a low stone barn at Parkers Farm east of the Science Park. They were based on industry standard guidance (Chapters 4 and 6 of Collins, 2016). Buildings were inspected externally for the presence of any potential roost features or access points for bats. Buildings were allocated to the following categories of suitability for bats, based on the above guidance: Negligible, Low, Moderate or High. Notes of building structure and any potential bat roost features that were visible were also made during the surveys.

4.40 Various further off-site buildings that will be surrounded by the development were subject to an external assessment for bats from the Site or from public roads.

4.41 Bat roost assessments of trees

4.41 Bat roost assessments of trees carried out in 2021 and 2022 updated previous surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.42 A ground level roost assessment of trees at the Site was carried out in April 2021 by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology and Oliver Kemp, Ecologist at BSG Ecology (who holds Natural England bat licences numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS). Where necessary, accessible features were examined using an endoscope to search for signs of bats.

4.43 The suitability of trees for roosting bats was updated via a ground level assessment by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology and Kai Hayes, Ecologist at BSG Ecology, on 03 August and 07 September 2022, and by Hannah Smith, independent ecologist, on 01 March 2023.

4.44 These surveys were carried out to determine the potential of trees that could be affected by the Proposed Development to support roosting bats. The survey was based on industry standard guidance (Chapters 4 and 6 of Collins, 2016). Trees were inspected externally from ground level for the presence of any potential roost features or access points for bats. Trees were allocated to the following categories of suitability for bats, based on the above guidance: Negligible, Low, Moderate or High. Notes on tree structure and any potential bat roost features that were visible were also made during the survey.

4.45 Trees east of the railway line, and adjacent to and north of the Rowel Brook in the north of the Site, are likely to be retained within greenspace within the development and therefore were not subject to survey, since impacts on these trees are unlikely.

4.46 Bat emergence/re-entry surveys of buildings and trees

4.46 Bat emergence/re-entry surveys of buildings and trees carried out in 2022 updated previous such surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1). These surveys were as follows.

Parkers Farm

4.47 Emergence/re-entry surveys were carried out on a stone shed at Parker’s Farm (building A3 on Figure 6ci), in order to determine whether it is being used by roosting bats. In line with the guidance in Chapter 7 of Collins (2016) and the moderate bat potential assigned to this building, the survey involved one dusk emergence survey (on 19 July 2022) and one dawn re-entry survey (on 14 August 2022).

Begbroke Hill Farmhouse

4.48 Emergence/re-entry surveys were also carried out at the Begbroke Hill Farmhouse building complex at Begbroke Science Park (buildings 2a to 2e on Figure 6cii), which was assessed as having high

potential to support roosting bats. This historic building is to be retained in the Proposed Development, and therefore no direct effects on this building from the Proposed Development are anticipated. However, given the potential for this building to support a roost of high conservation significance (due to its age, size and the presence of potential roost features), and the fact that the Science Park (and hence this building) will be largely surrounded by new development under the Proposed Development, it was considered appropriate to obtain more information on the use of this building by bats. Internal surveys were not considered safe due to the known historical presence of asbestos in this building, and for this reason emergence/re-entry surveys were carried out instead. In line with the guidance in Chapter 7 of Collins (2016) and the high bat potential assigned to this building, the survey involved two dusk emergence surveys (on 14 June, and 20 July) and on dusk re-entry survey (on 24 August 2022).

Other buildings at Begbroke Science Park

- 4.49 Buildings at Begbroke Science Park with negligible suitability to support roosting bats were not subject to emergence/re-entry surveys. A building (B1) in the south-west corner of Begbroke Science Park building, initially assessed as having low suitability for roosting bats, may be subject to demolition under the Proposed Development. This building was not subject to emergence or re-entry surveys in 2022. It was subject to a detailed bat inspection on 01 March 2023 and its bat suitability upgraded to moderate. Bat emergence surveys of this building were carried out on 05 and 22 June 2023.

Trees

- 4.50 Industry guidance (Collins 2016, Chapter 6) indicates that trees identified as having suitability for roosting bats that are to be affected by development may require further survey work (e.g., detailed inspections and/or emergence/re-entry surveys). Based on the roost potential assessment described above, trees with moderate or high suitability for roosting bats were identified in four areas of the Site: (1) along the southern boundary, (2) on the eastern boundary of the landfill site, (3) one tree south of the Science Park, and (4) one tree in a hedgerow southeast of the landfill site.
- 4.51 The trees on the southern boundary of the Site (T13 to T25) were not subject to further survey as they are outside the Site boundary ditch and are shown as retained on the Green Infrastructure parameter plan.
- 4.52 Trees on the eastern boundary of the landfill site included three trees with moderate suitability for bats. This tree line was therefore subject to one dusk emergence and one dawn re-entry survey on 18 July and 16 August 2022, respectively.
- 4.53 The tree south of the Science Park (T3) was identified as having low/moderate suitability for bats, due to the presence of woodpecker holes. This was subject to a torch and endoscope inspection from the ground in March 2023 and to bat emergence surveys on 05 and 27 June 2023.
- 4.54 The tree southeast of the landfill site (T9) was considered to have high suitability for bats; this had been subject to an endoscope inspection in October 2018 which found no signs of bats (see Appendix 1). This tree was then subject to an endoscope inspection in September 2021 and a bat emergence survey on 27 June 2023.

Emergence/re-entry survey methods

- 4.55 The emergence and re-entry surveys were carried out in accordance with industry standard guidance (Chapter 7, Collins, 2016). Numbers and positions of surveyors for each survey visit were determined by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology and Dr Peter Shepherd MCIEEM, Director of BSG Ecology, who holds a Natural England Level 4 bat class licence: 2015-15520-CLS-CLS. Numbers of surveyors viewing each building on each survey visit and dates of survey visits are provided in Table 1. Buildings at the Site that were assessed as having negligible value for roosting bats and/or that will not be affected by the development, were not subject to these, or any further, surveys.

Table 1: Dates of emergence surveys and numbers of surveyors employed.

Location	Number of buildings	Number of trees	Suitability	Emergence/Re-entry Survey Dates		
				Start Date	End Date	Notes
Stone Barn at Parkers Farm	A3	2	Moderate	21/07/22 Dawn	23/08/22 Dusk	N/A
Begbroke Hill Farmhouse and adjacent buildings	B2b, B2c, & B2e	5	High	14/06/22 Dusk	23/08/22 Dusk	24/08/22 Dawn
Building south – west of Begbroke Hill Farmhouse	B2d	2	High	03/08/22 Dusk	23/08/22 Dusk	24/08/22 Dawn
Tree line east of landfill site	N/A	4	Low–moderate	18/07/22 Dusk	16/08/22 Dawn	N/A
L-shaped building in SW of Begbroke Science Park	B1	4	Moderate	05/06/2023 Dusk	22/06/22 Dusk	N/A
Tree 3	N/A	1	Moderate	05/06/23 Dusk	27/06/23 Dusk	N/A
Tree 9	N/A	2	Moderate	27/06/23	N/A	N/A

4.56 The numbers of emergence/re-entry survey visits in Table 1 met the number required under the industry guidance (Chapter 7 of Collins, 2016), i.e. three visits for buildings or trees with high suitability and two visits for buildings or trees with low suitability.

Additional Information

4.57 It became clear in early 2023 that a single storey building in the south-west of Begbroke Science Park, assessed externally in 2022 as having low suitability for bats, may require demolition under the Proposed Development. This building was subject to an additional external and internal inspection for bats on 01 March 2023. The inspection involved the use of a torch and endoscope to examine any potential roost features. The inspection was carried out by Hannah Smith, independent ecologist who holds a Natural England Level 2 bat licence (number 2015-12267-CLS-CLS).

Roost Inspections

4.58 Trees at the Site assessed as having moderate or high suitability to support bats (in the bat potential assessment), were subject to ground level or climbed roost inspections (as appropriate, depending on the height of any potential roost features) in 2018 (see Appendix 1), 2021 and 2021.

4.59 Ground level or ladder-based endoscope inspections of trees T5, T6 and T10, were carried out on 19 October 2018 by Helen Simmons ACIEEM (who holds Natural England bat licences (numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS), and on 28 September 2021 by Oliver Kemp.

4.60 Climbing inspections of the tree south-east of the landfill site (T9) were carried out by Karl Lofthouse, and by Steve Allen (independent licensed bat workers and trained tree climbers) on 26 October 2018 and 28 September 2021, respectively. Additionally, an emergence survey of it was undertaken in 2023 (see above).

4.61 Tree T3, south of the Science Park, was considered to have low-moderate bat potential, but was considered unsafe to climb, due to fungal rot being present. This tree is not indicated as retained on the Green Infrastructure parameter plan. It was subject to two emergence surveys in 2023 (see above).

□ □ □ □ A □ □ □ □ □ □ □ □ r □ □ □ □ □ □ □ □ □ □

- 4.62 Bat activity transect surveys carried out in 2022 updated previous such surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).
- 4.63 The part of the Site proposed for development was assessed as being of moderate suitability for foraging bats, due to the dominance of large arable fields. In line with industry guidance, monthly dusk walked activity transects were therefore undertaken at the Site between May and October 2022, including one dusk and dawn transect (Collins, 2016). The aim of these surveys was to identify the bat assemblage at the Site, and to interpret the behaviour and distribution of bats within the Site.
- 4.64 Dusk surveys commenced at sunset and continued for two hours after sunset, and dawn surveys commenced two hours before sunrise and continued until sunrise. These bat activity transect surveys repeated the level of survey effort employed in 2018 (see Appendix 1).
- 4.65 Each transect was walked by two surveyors, a least one of whom were experienced in bat activity surveys. The direction (i.e., clockwise or anticlockwise) of the transect route was altered to ensure that different parts of the Site were surveyed at different times of the night. This approach removes bias that could be introduced into the survey data if the transect was always walked in the same direction. The transects covered all suitable habitats within the Site, with a particular focus on hedgerows and woodland, which are likely to provide suitable commuting and foraging habitat for bats. Transect routes are shown on Figures 6d and 6e.
- 4.66 An Anabat Scout ultrasonic bat detector was used during each transect survey, which allows recording of bat calls for later analysis. Field notes were made during the survey, included a record of the time of each bat encounter, allowing results to be cross-referenced with the recorded data, and a record of any behaviours observed, such as or circling or hunting vocalisations (indicating foraging) or direct flight (indicating commuting).
- 4.67 Survey dates and weather conditions are listed in Table 2. Weather conditions during the surveys were suitable for bat activity.

Table 2: Dates, times and weather conditions recorded during the bat activity transect surveys

D □ □ □ □	□ r □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ r □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ r □ □ □ □ □ □ □ □ □ □ □ □ □ □	□ □ □ □ □ r □ □ □ □ □ □ □ □ □ □ □ □ □ □
28/04/2022 □	1 □	Kai Hayes & Hannah Smith □	20:24 – 22:24 □	Cloud 3/8. Wind Bf 1-1, no rain, and temperature: at start: 11°C, at end: 9°C □
28/04/2022	2	Tom Flynn & Thomas Scott	20:24 – 22:35	Cloud 7/8, Wind Bf 1-2. No rain, and temperature: at start: 12°C, at end: 8°C
30/05/2022	1	Kai Hayes & Alix Harrington	21:12 – 22:36	Cloud 7/8, Wind Bf 1-1, no rain, and temperature at start: 13°C, at end: 9°C
30/05/2022	2	Jamie Peacock & Thomas Scott	21:12 – 22:36	Cloud 7/8, Wind Bf 1-1, no rain, and temperature at start: 13°C, at end: 9°C
27/06/2022	1	Kai Hayes & Joe Bishop	21:28 – 23:38	Cloud 2/8, Wind Bf 2-0, no rain, and temperature at start: 15°C, at end: 13
27/06/2022	2	Sarah Joscelyne & Andy Hearn	21:28 – 23:30	Cloud 2/8, Wind Bf 2-0, no rain, and temperature at start: 15°C, at end: 13
26/07/2022	1	Philip Chapman & Louise Morton	20:23 – 23:04	Cloud 8-8, Wind Bf 1-1, no rain, and temperature at start: 22°C, at end 19°C
26/07/2022	2	Jamie Peacock & Thomas Scott	21:04 – 23:18	Cloud 3/8, Wind Bf 1-1, no rain, and temperature at start: 18°C, at end: 15°C
18/08/2022	1	Kai Hayes & Thomas Scott	20:23 – 22:23	Cloud 8/8, Wind Bf 4-4, light drizzle, and temperature at start: 21°C, at end: 19°C
18/08/2022	2	Jamie Peacock & Louise Morton	20:23 – 22:23	Cloud 8/8, Wind Bf 4-4, light drizzle, and temperature at start: 21°C, at end: 19°C

Date	Survey ID	Surveyors	Time	Weather
19/08/2022	1	Kai Hayes & Thomas Scott	03:56 – 05:56	Cloud 7/8, Wind Bf 5-2, some rain prior to survey, and temperature at start: 18°C, at end: 17°C.
19/08/2022	2	Jamie Peacock & Louise Morton	03:56 – 05:56	Cloud 7/8, Wind Bf 5-2, some rain prior to survey, and temperature at start: 18°C, at end: 17°C
20/09/2022	1	Jamie Peacock & Louise Morton	19:09 – 21:09	Cloud 8/8, Wind Bf 0-0, no rain, and temperature at start: 17°C, at end: 15°C
20/09/2022	2	Thomas Scott & Jennie Cadd	19:09 – 21:09	Cloud 8/8, Wind Bf 0-0, no rain, and temperature at start: 17°C, at end: 15°C
13/10/2022	1	Kai Hayes & Jamie Townsend	18:17 – 20:17	Cloud 3/8, Wind Bf 1-1, no rain, and temperature at start: 13°C, at end: 10°C
13/10/2022	2	Callum Waldie & Natalie Sabin	18:17 – 20:17	Cloud 3/8, Wind Bf 1-1, no rain, and temperature at start: 13°C, at end: 10°C

Automated bat surveys

- 4.68 Automated bat surveys carried out in 2022 updated previous such surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1). These involved fixed-point automated detectors, used to monitor bat activity over a more extended period than is possible via walked transects. The automated detectors were deployed each month between May and October 2022.
- 4.69 The four automated detectors were placed to complement the transect surveys and to capture higher quality habitat features likely to be used by bats, whilst also providing a good distribution over the part of the Site proposed for development. Detector locations, as follows, are shown on Figure 6a:
- L1 – southern entrance of the Science Park, near a low tree-lined double hedgerow.
 - L2a – western side of the railway embankment.
 - L2b – centre of the Site, on Sandy Lane.
 - L3 – southern boundary of the Site, on a hedgerow with trees.
- 4.70 The detectors recorded data for five consecutive nights in each deployment. They were programmed to begin recording half an hour before sunset until half an hour after sunrise, allowing continuous monitoring during the period when bats are active (i.e., sunset to sunrise). Survey hours varied throughout the survey season according to daylight hours and have been calculated for each recording session in order to accurately calculate activity rates. The automated detector surveys were conducted using Songmeter SM2 and SM4, and Anabat Swift bat detectors; these are full spectrum bat detectors used to automatically record bat echolocation calls.
- 4.71 Table 3 shows the dates the detectors were deployed and the number of nights of data analysed at each location across the survey season. This gives a total of 120 nights of survey.

Table 3: Dates and number of nights of data from automated detectors across the survey period.

Month	Deployment Start	Deployment End	Locations	Nights
April	22/03/2022	29/03/2022	L1, L2a, L2b, L3	5
May	05/05/2022	12/05/2022	L1, L2a, L2b, L3	5
June	17/06/2022	24/06/2022	L1, L2a, L2b, L3	5
July	08/07/2022	15/07/2022	L1, L2a, L2b, L3	5
August	12/08/2022	19/08/2022	L1, L2a, L2b, L3	5
September	09/09/2022	16/09/2022	L1, L2a, L2b, L3	5

- 4.72 The bat detectors were set to record files in WAC format, which were later converted using Kaleidoscope (software created by Wildlife Acoustics) to files in ZC (Zero Crossing) format. The ZC output files were subsequently viewed and analysed using AnaLookW software (produced by Titley Electronics).
- 4.73 The Kaleidoscope analysis parameters used were as follows:
- Kaleidoscope Version 5.1.6.
 - Outputs – ZC files using a division ratio of 8.
 - Noise files were also filtered and kept (and scanned and checked in AnaLook).
 - Default signal of interest settings were used (16-120 kHz, 2-500 ms, minimum no. of calls = 2).
- 4.74 The calls were analysed using AnaLookW software to give an indication of the species of bat present and their relative levels of activity. This software enables analysis of the relative activity of different species of bats by counting the minimum number of bat calls recorded within discrete sound files. For the purpose of the analysis, a bat pass is defined as a single, uninterrupted sequence of echolocation calls lasting a maximum of 15 seconds. The species analysis follows the call parameters as described in Russ (2012). The assessment of relative bat activity between species is based on the relative abundance of recorded calls of each species within each survey period (i.e., each five-day period of automated monitoring per month) and across the combined study period.
- 4.75 It should be recognised that a series of separate sound files could represent multiple bats calling infrequently (e.g., as they each pass overhead moving in one direction) or a small number of bats (or even one individual) calling frequently (e.g., bats making repeated foraging passes up and down a feature). This cannot be determined unless bats can be directly observed at all times. Despite this, an indication of overall patterns of use of the Site by different species can be established based on the regularity of recording.
- 4.76 Where possible, bat calls were identified to species level. However, species of the genus *Myotis* are grouped together as their calls are similar in structure and have overlapping call parameters, making species identification problematic (Russ, 2012). For long-eared bats *Plecotus* species, calls of grey long-eared bats *Plecotus austriacus* and brown-long-eared bats *Plecotus auritus* cannot be distinguished due to overlapping call parameters. However, since grey long-eared bats are restricted to the extreme south of the UK (Harris & Yalden, 2008), any *Plecotus* calls recorded are assumed to be from brown long-eared bats.
- 4.77 The following criteria based on measurements of peak frequency were used to classify calls:
- | | | |
|--------------------------|----------------------------------|-----------------|
| • Common noctule | <i>Nyctalus noctule</i> | ≥ 20 – 25kHz |
| • Leisler's bat | <i>Nyctalus leisleri</i> | ≥ 25 kHz |
| • Serotine | <i>Eptesicus serotinus</i> | ≥ 27kHz |
| • Barbastelle bat | <i>Barbastella barbastellus</i> | ≥ 32kHz |
| • Nathusius' pipistrelle | <i>Pipistrellus nathusii</i> | ≥ 39kHz |
| • Common pipistrelle | <i>Pipistrellus pipistrellus</i> | ≥ 42 and <49kHz |
| • Brown long eared bat | <i>Plecotus auritus</i> | ≥ 45 – 50 kHz |
| • Soprano pipistrelle | <i>Pipistrellus pygmaeus</i> | ≥ 51kHz |
| • <i>Myotis</i> sp. | <i>Myotis</i> | ≥ 30 – 100 kHz |
- D** r □ □ □ □ □ □ □ □ r □ □ □ □ □
- 4.78 Surveys for dormouse *Muscardinus avellanarius* carried out in 2022 updated previous surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.79 The survey targeted hedgerows at the Site that provide suitable habitat for this species and are likely to be affected by the Proposed Development. Hedgerows in areas proposed for greenspace in the Green Infrastructure parameter plan were not surveyed; this plan indicates that all of these are to be retained, except for hedgerow 38 (see Figure 3), parts of which will require removal for the proposed road bridge over the rail line. Two hedgerows that run south of Begbroke Science Park (along the old access road) and a hedgerow along the south-eastern boundary of the Site were also not surveyed, as they are heavily managed by trimming, are species-poor, and are therefore considered to provide poor habitat for dormice.

4.80 The survey method and effort were based on industry standard guidance (Bright et al., 2006). A total of 194 dormouse nest tubes (of standard industry specification) were set out at approximately 20 m intervals in areas of suitable habitat on 22 April 2022 by Jamie Townsend and Tom Scott, Ecologists at BSG Ecology. Locations of tubes are shown in Figure 7. Survey visits to examine the nest tubes to look for signs of dormouse (e.g., characteristic nests or hairs, or the animals themselves) were carried out approximately monthly between May 2022 and late-September 2022 by Hannah Smith, independent ecologist, who holds a Natural England dormouse survey licence (number 2016-21251-CLS-CLS).

4.81 Survey tubes were checked for signs of dormouse on 25 May, 29 June, 20 July, 24 August, and 21 September 2022. Using the points-based system to assess survey effort of Bright et al. (2006), this survey achieved a score of 17.9 points (tubes were deployed for 70% of the month of September, so a corresponding proportion of the 7 points for that month were counted). Taking into account the fact that 194 (rather than the minimum number of 50) nest tubes were deployed, the score was doubled. The score, of 35.8 points is therefore above the minimum of 20 points recommended for determining absence of dormouse (Bright et al., 2006).



4.82 Water vole surveys carried out in 2022 updated previous surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.83 The water vole surveys were based on industry guidance (Dean et al., 2016) and covered all suitable habitat for this species on Site, comprising Rowel Brook in the north of the Site and a tributary which flows into this from the east. A ditch in the south of the Site was also surveyed due to the presence of water being noted here during some of the survey visits in spring 2022. The extent of the survey is shown on Figure 8.

4.84 The survey visits were undertaken on 16 May 2022, 12 September 2022, and 12 October 2022 by Kai Hayes, Jamie Townsend, and Tom Scott, Ecologists at BSG Ecology.

4.85 All accessible stretches of these watercourses within or on the boundary of the Site were surveyed. The survey involved systematically searching for evidence of water vole, including latrines (communal areas of droppings), feeding stations, grazed lawns, burrows, runs, and footprints. The habitats present were also assessed for their suitability to support the species (based on characteristics of the banks, channel depth, and vegetation cover). Survey timing and effort took into account the recommendations of standard industry guidance (Dean et al., 2016).

4.86 During the October survey, Rowel Brook held noticeably less water than the other two surveys due to an extremely dry and hot summer. This may have reduced the suitability of the watercourse for water vole

4.87 Ditches forming the southern boundary of the Site east of the railway line are outside the Site boundary and were not surveyed.



4.88 Otter surveys carried out in 2022 updated previous surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

- 4.89 In order to determine whether otter is present at the Site, an otter survey was conducted by searching for signs of this species at the same time as the water vole survey detailed above. The survey covered the same sections of watercourse as the water vole survey (see Figure 8). The otter survey was based on the survey method of the Environment Agency (2010). This involved searching for evidence of otter and other riparian mammal species (such as American mink *Neovison vison*) along the stream and ditch banks and around any bridges. Such evidence can include spraints (droppings), footprints, runs (paths worn through vegetation adjacent to the water) slides (areas of steep bank showing signs of regular use by otters to access the water), and holts (burrows).
- 4.90 Particular attention was paid to prominent bankside or in-stream features such as tree trunks, branches, rocks, areas of bare ground, culverts and inflowing ditches or pipes, since these types of structures are often used as sprainting sites (otter spraints are used to indicate territories). Areas of mud were inspected for the presence of footprints.
- r □ d □ □ □ □ r d □ □ r □ □ □ r □ □ □ □ □ □ □ r □ □ □ □
- 4.91 Breeding bird characterisation surveys carried out in 2022 updated previous surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).
- 4.92 In order to provide information on the use of the Site by breeding birds, a breeding bird characterisation survey was carried out over the period April–June 2022. This involved monthly visits to the Site during which all habitats at the Site were walked over, with attention being paid especially to linear features and woodland areas. Adjacent to and within areas of woodland/trees, frequent stops were made to listen and scan for singing and calling birds. Large open areas were covered either from the edges, through direct observation, or were crossed by the surveyors. Birds observed beyond the boundary of the Site were also noted in order to provide further contextual information. Bird locations were mapped and behaviour recorded using standard British Trust for Ornithology (BTO) codes and symbols on field maps during each survey. The maps obtained as a result of the three visits were then collated to produce a single territory map. Breeding was assumed for all species which displayed breeding behaviour (such as carrying nesting material or food) and for species displaying territorial behaviour in suitable habitat.
- 4.93 The survey visits were carried out on 25 April, 13 May, and 9 June 2022 by Natalie Sabin, Ecologist at BSG Ecology, Joe Bishop, Senior Ecologist at BSG Ecology, and Bill Haines, independent ecologist, all of whom are experienced field ornithologists. During all visits, the weather conditions were suitable for breeding bird surveys (i.e., no rain, or wind exceeding 5 on the Beaufort Scale).
- r □ □ □ □ r □ □ □ □ d N □ □ □ □ □ N □ □ □ r □ □ □ □
- 4.94 GCN surveys carried out in 2021 and 2022 updated previous surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).
- 4.95 GCNs breed in waterbodies and can be found within terrestrial habitat up to 500 m from (though typically within 250 m of) such aquatic habitat. Ponds within the Site and within 500 m of the Site were identified using Ordnance Survey maps.
- 4.96 Based on the most recent desk study and survey work, there are six ponds within the Site (numbered 1 to 6 on Figure 10). Seven further ponds outside the Site (numbered 7 to 13) were considered for their ecological linkage to the Site for GCN. The Oxford Canal at the east of the Site, and the A44 dual carriageway at the west of the Site are considered significant barriers to the movement of GCN. Therefore, ponds beyond these (such as ponds 9 and 10) were not surveyed.
- 4.97 All ponds within the Site were subject to the following sequential surveys for GCN: a HSI assessment (in 2018, updated in 2021), eDNA survey (in 2018, updated in 2021), and (where a positive eDNA result was obtained, indicating presence of GCN), overnight surveys (bottle trapping and torching; in 2018, updated in 2022). Where access was available, ponds outside the site with potential for ecological linkage to the Site for GCN were also subject to survey (this included pond 8).
- 4.98 Two ponds (ponds 11 and 12) to the southeast of the Site, beyond the railway line, have potential ecological connectivity to the Site for GCN but were not accessible for survey due to third-party

ownership. The part of the Site in closest proximity to these ponds was therefore subject to a terrestrial survey for GCN using artificial refuges.

- 4.99 A pond identified ca. 75 m west of the Site in 2018 (pond 7 on Figure 10) was found to have been filled in and no longer present in May 2021.
- 4.100 A pond ca. 15 m to the south of the Site (pond 13) is located adjacent to a part of the Site indicated as retained agricultural land on the PR8 policy map. This pond is ca. 540 m from the closest area proposed for built development in PR8. This pond was therefore not subject to survey.

Habitat Suitability Index Assessment

- 4.101 A HSI assessment was carried out for ponds 1, 2, 3, 4, 5, 6, and 8, based on site visits carried out in April 2021. Ponds 7, 9, 10, 11, 12, and 13 were not surveyed for the reasons discussed above.
- 4.102 HSI values are calculated by allocating scores to features associated with a pond such as size, quality of surrounding habitat, and presence of fish. These scores are then used to calculate the overall HSI score for each waterbody. The HSI score is a number between 0 and 1, with 0 being the least suitable and 1 being the most suitable for GCN. The HSI score allows each waterbody to be placed in one of five categories defining its suitability for GCN as follows: <0.5: poor; 0.5–0.59: below average; 0.6–0.69: average; 0.7 – 0.79: good; >0.80: excellent.

eDNA Survey

- 4.103 Ponds 1, 2, 3, 5, 6, and 8 were subject to an environmental DNA (eDNA) survey to detect the presence or absence of GCN in 2021. 'Environmental' DNA is DNA that is released into aquatic environments through the shedding of skin cells, urine, faeces and saliva. It can persist in water for several weeks and when water samples are collected, they can be tested for this DNA. Pond 4 was not surveyed due to the presence of this species already having being confirmed in 2018. Ponds 7, 9, 10, 11, 12, and 13 were not surveyed for the reasons discussed above.
- 4.104 The eDNA survey was undertaken on 14 May 2021 by Oliver Kemp and Jamie Peacock, Ecologists at BSG Ecology. Jamie Peacock holds a Natural England survey licence for GCN (number 2016-20471-CLS-CLS).
- 4.105 Natural England has approved a protocol for collecting and testing samples which, if followed, they will accept as evidence of presence or likely absence of GCN (Natural England, 2015). This protocol was followed in in this survey. Water samples were collected from the perimeter of ponds and sent to a certified laboratory (Surescreen Scientifics Ltd) to be analysed for presence of GCN DNA.

Overnight surveys

- 4.106 In order to provide an estimate of population size class, overnight surveys for GCN were carried out of pond 4. These surveys was limited to this pond only because GCN had been recorded form this pond in 2018, whereas all of the other ponds which were subject to eDNA survey returned negative results, indicating the absence of GCN.
- 4.107 The overnight surveys were based on industry standard guidance (English Nature, 2001). This recommends that to estimate population size class, six appropriately timed overnight survey visits should be undertaken. The overnight surveys should utilise two methods: torch survey and bottle-trapping. At least three of the overnight visits should be carried out between mid-April and mid-May.
- 4.108 Torch surveys involved searching for GCN after sunset using two Clulite 1 million candle power torches. All accessible parts of the pond's margins were slowly walked and searched.
- 4.109 Bottle trapping was also carried out. Bottle traps (constructed from 2 L plastic drinks bottles) were set in suitable parts of the pond at dusk and left in place overnight. Bottle traps were checked for amphibians the following morning within 12 hours of setting, and any animals caught were released at the point of capture. As pond 4 is lined with concrete, it was not possible to support traps on bamboo canes inserted into the pond base. Traps were therefore modified by adding weights to the

funnel end, allowing them to float vertically below the surface, supported by polystyrene floats at the top. Traps were tethered to the bank to avoid loss. Twelve bottle traps were used in the survey.

- 4.110 Egg searches were conducted to determine whether GCN were breeding in pond 4. This involved searching marginal and aquatic vegetation for the distinctive leaf folding pattern and egg size and colour produced by GCN. Results from egg searches are only useful for indicating presence/absence and breeding status, and not population size.
- 4.111 Overnight surveys were carried out on the dates and under the weather conditions listed in Table 4, which also shows surveyors. The surveys were led by Dr Tom Flynn MCIEEM, Principal Ecologist at BSG Ecology who holds a Natural England GCN survey licence (number 2015-17735-CLS-CLS) and has carried out surveys for this species since 2005. Other surveyors were Thomas Scott, Ecologist at BSG Ecology, Joe Bishop, Senior Ecologist at BSG Ecology, Kai Hayes, Ecologist at BSG Ecology, Hannah Smith, Independent Ecologist, and Jamie Townsend, Ecologist at BSG Ecology. A surveyor holding a Natural England survey licence for GCN, or their accredited agent, was present on each survey visit.

Table 4: Survey dates, weather conditions and surveyors during overnight surveys for GCN

Visit	Date	Surveyors	Number of Traps	Number of GCN	Weather	Number of Eggs	Number of Larvae
1	19/04/2022	Tom Flynn and Thomas Scott	5	2	none	1	2
2	28/04/2022	Tom Flynn, Kai Hays and Hannah Smith	7	2	none	1	2
3	05/05/2022	Joe Bishops and Kai Hayes	8	5	none	1	2
4	12/05/2022	Kai Hayes and Thomas Scott	13	1	none	2	2
5	19/05/2022	Joe Bishops and Kai Hayes	10	1	heavy	2	2
6	26/05/2022	Kai Hayes, Joe Bishop and Jamie Townsend.	15	2	none	2	2

- 4.112 The above guidance recommends that to determine population size class, the peak count obtained from six survey visits should be used, with at least three of these visits carried out between mid-April and mid-May. GCN populations (which can include multiple ponds, depending upon the distance and habitats between them) can then be classed as 'small' for maximum counts of up to 10 adults, 'medium' for maximum counts between 11 and 100, and 'large' for maximum counts exceeding 100 adults.
- 4.113 Weather conditions during the survey visits (including temperature) were suitable for the surveys (see summary data in Table 2 above). Turbidity and vegetation cover were within acceptable limits for torchlight surveys on all six survey visits (the ranges were 1–2 and 2–2 respectively). There were no constraints or limitations on the effectiveness of the survey.

Terrestrial Survey for GCN

- 4.114 As off-site ponds P11 and P12 (see Figure 10) could not be surveyed due to no access being granted by the landowner, and these are within 250 m of Proposed Development, it was considered appropriate to carry out a terrestrial survey for GCN. The purpose of this survey was to determine whether GCN are using suitable terrestrial habitat within parts of the Site closest to ponds P11 and P12.
- 4.115 The closest terrestrial habitat suitable for GCN within the Site is a triangular shaped area of scrub and rough grassland in the south of the Site. This area is between 40 and 150 m from Ponds 11 and 12. To survey this area for terrestrial GCN, a total of 20 artificial refuges consisting of carpet tiles measuring 50 cm by 50 cm were placed around the perimeter of the area (the centre was inaccessible due to the presence of dense scrub). These tiles were in addition to 20 artificial reptile shelters placed in this area for the reptile survey (see *Reptile Survey* below), which also provided

suitable sheltering sites for GCN. The 40 artificial refuges were set out on 21 March 2022 and checked by surveyors on six occasions during daytime between 13 April 2022 and 20 June 2022.

4.116 The use of artificial refuges without the use of the dug-in drift fencing that is specified in industry standard guidance for terrestrial GCN survey (English Nature, 2001) was considered a proportionate level of survey effort, given the limited potential for ponds 11 and 12 to be breeding ponds and (from aerial photographs) the abundance of suitable terrestrial habitat in their vicinity outside the Site.

R

4.117 Reptile surveys carried out in 2022 updated previous surveys of the Site carried out by BSG Ecology in 2018 (see Appendix 1).

4.118 Areas of suitable reptile habitat on Site was identified from the results of the Phase 1 habitat survey and reptile surveys carried out in 2018 and 2022. Suitable reptile habitat at the site is limited to certain field margins, and some areas of rough grassland. To determine whether reptiles were present (and if so, which species), a presence/absence survey for reptiles was carried out in 2022, following industry standard guidance (Froglife, 1999).

4.119 A total of 110 artificial refuges (each comprising a piece of roofing felt 100 x 50 cm (i.e., 0.5 m²) were placed within areas of suitable habitat on Site on 21 April 2022 (see Figure 11 for locations). Due to the nature of the Site (predominantly arable fields) it is difficult to accurately map the area of suitable reptile habitat and hence to calculate the density of refuges that should be deployed. However, based on the recommendations of Froglife (1999), which refer to a refuge density of 5–10 refuges per hectare, the 110 refuges used were sufficient to cover 10–20 ha of suitable habitat (i.e., 5–11 % of the 177 ha Site), which is considered to be significantly more than the area of suitable reptile habitat on Site.

4.120 The artificial refuges were checked for reptiles on seven occasions between 05 May and 20 June 2022. Survey visits were carried out on the dates and under the weather conditions indicated in Table 5. The timing and weather conditions were suitable for reptile surveys (Froglife, 1999). All surveyors had previous experience and training in reptile survey. The surveyors were Jamie Townsend, Ecologist at BSG Ecology, Kai Hayes, Ecologist at BSG Ecology, and Thomas Scott, Ecologist at BSG Ecology.

Table 5: Dates and weather conditions of reptile survey visits

	D				
Setup	21/03/2022	JT & TS	N/A	N/A	N/A
1	06/05/2022	KH	14-18	2	Strong sun, light wind
2	13/05/2022	KH & TS	17-18	1	Strong sun and breeze
3	25/05/2022	KH	15-17	8	Occasional sun, light breeze
4	01/06/2022	TS	13-16	5	Occasional sun, light breeze
5	07/06/2022	KH	14-18	4	Strong sun, very light breeze
6	13/06/2022	KH	16-18	5	Occasional sun, very light breeze
7	20/06/2022	KH & TS	16-18	4	Strong sun, strong breeze

* Surveyors: JT: Jamie Townsend, Ecologist at BSG Ecology; KH: Kai Hayes, Ecologist at BSG Ecology; TS: Thomas Scott, Assistant Ecologist at BSG Ecology.

R

4.121 Winter bird characterisation surveys were carried out at the Site in over the period December 2021 to February 2022.

4.122 In order to provide information on the use of the Site by winter birds, a winter bird survey was carried out over the period January to February 2022 by Phil Chapman, Senior Ecologist at BSG Ecology,

4.133 At each sampling point, habitat details such as channel characteristics, adjacent land use, and macrophyte cover and composition were recorded on a standard form. In addition, water chemistry was measured using a multi-parameter meter. Recordings of conductivity, pH, total dissolved solids, and dissolved oxygen were taken.

Methodology

4.134 In the laboratory, aquatic macroinvertebrates were separated from material collected incidentally as a by-catch of the kick-sampling process. All macroinvertebrate individuals present in the sample were identified to family-level under a stereoscopic microscope (x70) using current identification keys.

4.135 Macroinvertebrate samples were identified by Jamie Peacock (and Louise Morton, under supervision and checking by Jamie Peacock), Ecologists of BSG Ecology. Jamie Peacock has training and experience in macroinvertebrate identification, and a qualification in family level identification from the Freshwater Biological Association.

Limitations

4.136 Any limitations to the desk study and surveys are discussed in the text above. These include a lack of access to survey the offsite ponds 11 and 12, and bat surveys of building B2 and tree 3 at Begbroke Science Park being limited to inspections rather than emergence surveys. These limitations will need to be taken into account in the ecological impact assessment of the Proposed Development, and in the specification of appropriate mitigation. However, given the extent of the survey effort for bats across the Site, particularly in the vicinity of the Science Park, and for GCN across the Site (particularly in on-site areas in the vicinity of ponds 11 and 12) these limitations are not considered to be significant constraints to a thorough ecological impact assessment of the PR8 planning application.

Consultation

4.137 The Ecology Officer at Cherwell District Council (Charlotte Watkins) was consulted by email on the scope of ecology baseline surveys for the PR8 planning application on 12 May 2021. She responded by email on 20 May 2021, noting that ‘*The proposed update surveys and justifications all look reasonable*’.

4.138 The Ecology Officer was consulted again on the scope for ecology baseline surveys for the PR8 planning application on 13 May, 30 May, and 19 October 2022. She responded by email on 20 October 2022, noting that ‘*The scope seems appropriate to me although I do not know this site particularly well. As long as anything omitted (such as Otter) is justified within your reports then I would not anticipate any issues with scope*’.

4.139 These consultation emails are provided in Appendix 2.

5.1 **R**

D

5.1 There are no statutory wildlife sites within the Site.

5.2 Statutory sites within the desk study search area are shown on Figure 1 and listed in Table 6.

Table 6: Statutory designated wildlife sites within 5 km of the Site.

Site Name	Designation	Description	Area (ha)	Distance (km)
Rushy Meadow	SSSI ¹	Damp meadow.	8.7	10 m NE
Oxford Meadows	SAC ²	Floodplain grassland, including grazed pasture and hay meadows.	267.4	1.8 km S
Pixey and Yarnton Meads	SSSI	Floodplain hay meadows.	85.6	1.8 km S
Wolvercote Meadows	SSSI	Floodplain hay meadows.	9.2	2.4 km S
Blenheim Park	SSSI	Oak-dominated pasture woodland and lakes.	225.2	2.5 km NW
Portmeadow with Wolvercote Common and Green	SSSI	Grazed floodplain grassland.	166.7	2.5 km S
Shipton on Cherwell and Whitehill Farm Quarries	SSSI	Notified for its geological interest: white limestone containing abundant and important fossils.	27.7	2.7 km N
Wytham Ditches and Flushes	SSSI	Ditches supporting species-rich eutrophic aquatic and fen flora.	5.7	2.7 km SW
Cassington Meadows	SSSI	Hay meadows and fen.	7.0	2.8 km SW
Hook Meadows and the trap Grounds	SSSI	A series of poorly-drained unimproved neutral meadows.	11.3	3.6 km S
Wytham Woods	SSSI	A complex of ancient woodland, wood pasture, common land and old limestone grassland.	426.5	3.6 km SW
Woodeaton Quarry	SSSI	Notified for its geological interest: a Bathonian section and white limestone formation.	6.4	4.0 km E
Shipton-on-Cherwell and Whitehill Farm Quarries SSSI	SSSI	Notified for its geological interest: a section from near the base of the White Limestone up to the Lower Cornbrash (with important fossil reptiles) at Shipton Quarry; and the highly fossiliferous Shipton Member of the White Limestone at Whitehill Quarry.	4	4.4 km N
Woodeaton Wood	SSSI	Woodland forming an intact relic of the ancient Shotover Forest.	14.1	4.8 km E
New Marston Meadows	SSSI	A series of agriculturally unimproved neutral meadows on the flood plain of the River Cherwell.	44.4	4.9 km SE
Long Hanborough Gravel Pit	SSSI	Notified for its geological interest: This site provides exposures in the gravel of the Pleistocene Hanborough Terrace of the Evenlode Valley.	4.3	5.0 km W

¹ Site of Special Scientific Interest

² Special Area of Conservation

5.3 Of these, one statutory wildlife site is within 1 km of the Site: Rushy Meadows Site of Special Scientific Interest (SSSI). This site lies close to the north-east of the Site, separated from the site by a bridgeway and double hedgerow. The citation for this site⁴ notes that Rushy Meadows SSSI consists of a series of unimproved alluvial grasslands alongside the Oxford Canal, and that the low-intensity, traditional management of this site has produced rich meadow and fen communities containing several uncommon plant species such as pepper saxifrage *Silva saxifraga*, devil's bit scabious *Succisa pratensis*, heath grass *Danthonia decumbens*, marsh valerian *Valeriana dioica*, betony *Stachys officinalis*, early marsh orchid *Dactylorhiza incarnata*, distant sedge *Carex distans* and water avens *Geum rivale*. It also notes that meadow habitats of this type are now both rare and under threat in Britain, particularly, in this district due to the pressures of agricultural improvement and urban development.

5.4 The next closest statutory wildlife site is Oxford Meadows Special Area of Conservation (SAC), ca. 1.8 km to the south of the site, beyond the A44 Woodstock Road, a railway line and the A40 road. This site supports unimproved lowland hay meadow and pasture, and is designated for the EU Annex I habitat Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) and the EU Annex II plant species creeping marshwort *Apium repens*. The SAC is made up of all or part of four SSSIs (specifically, Cassington Meadows SSSI, Pixey and Yarnton Meads SSSI, Wolvercote Meadows SSSI, and the majority of Portmeadow with Wolvercote Common and Green SSSI).

5.5 The Site is within the SSSI Impact Risk Zones for Rushy Meadow SSSI and Oxford Meadows SAC.

Ancient Woodland

5.6 The Site contains no sites listed on Natural England's Ancient Woodland Inventory (which includes ancient replanted woodland sites). There are six such sites within 3 km of the Site, listed in Table 7.

Table 7: Ancient Woodland within 5 km of the Site centre

Ancient Woodland Site	Distance from Site
Begbroke Wood	0.60 km W
Bladon Heath	0.90 km W
Worton Heath	1.1 km W
Burleigh Wood	2.4 km W
Busby's Spinny	2.9 km N
Wytham Wood (including various sub-compartments)	3.6 km SW

Local Wildlife Sites

5.7 Non-statutory designated sites within 2 km of the Site are listed in Table 8. The Site contains one non-statutory designated site: Lower Cherwell Valley Conservation Target Area (CTA), part of which occupies an arable field and a pasture field in the north-east of the Site (within areas of proposed greenspace). This CTA also extends along the Oxford Canal adjacent to the eastern boundary of the Site. There are 11 Local Wildlife Sites (LWSs) within 2 km of the Site, two Potential Local Wildlife Sites (PLWSs), one Conservation Target Area (CTA) and one Woodland Trust Reserve. Of these, the Woodland Trust reserve at Stratfield Brake is the nearest to the Site, being located 80 m east beyond the Oxford Canal.

Table 8: Non-statutory wildlife sites within 2 km of the Site

Designation	Name	Description	Location
CTA	Lower Cherwell Valley	The Cherwell Valley from Lower Heyford to Kidlington and south of Kidlington along the Oxford Canal. Dominated by lowland meadows	Overlaps with north-eastern part of Site.

⁴ <https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1001685.pdf>

		but with other habitats including wetlands and quarry workings.	
Woodland Trust Reserve	Stratfield Brake	A small area of mature woodland and larger areas of young planted woodland. Includes an extension area to the north.	80 m E
LWS	Meadows west of Oxford Canal 41V18	Two fields adjacent to Oxford Canal containing lowland meadow and fen.	0.35 km S
LWS	Begbroke Wood 41 R03	Oak woodland with abundant bluebells, silver-washed fritillary butterfly, damp areas and an area of calcareous grassland.	0.47 km W
LWS	Langford Meadow 41S02	An area of tall herb fen, lowland meadow and rough grassland, supporting a range of plant species, and a locally important site for birds including reed bunting and snipe.	0.85 km N
LWS	Bladon Heath 41L02	A former heath that has been planted with conifers but retains some of its distinctive plant and invertebrate species, and has areas of semi-natural woodland, and fragments of slightly acid open ground along its rides.	0.90 km E
LWS	Loop Farm Flood Meadows 41V02	Two wet species-rich floodplain fields with species-rich hedgerows and a small area of reedbed between the railway line and Oxford canal and adjacent to Duke's Cut Pond.	1.3 km S
LWS	Wet Wood and Swamp Near Yarnton 41V08	Two small borrow pits either side of the railway line, supporting wet woodland, tall wetland vegetation and sedges. Also some drier ash woodland.	1.3 km S
LWS	Wet Woodland and Swamp south west of Yarnton 41V08	Two small borrow pits containing tall wetland vegetation, wet willow woodland, and a bank of ash woodland.	1.4 km S
LWS	Cassington to Yarnton Gravel Pits 41Q11	A series of river terrace gravel pits, with areas of silt bed, developing reed beds, and young plantation woodland. It has considerable bird interest, particularly for wintering waterfowl.	1.4 km S
PLWS	Kidlington Meadows 41X02	A large site on the floodplain of the River Cherwell, containing former pasture on which scrub and young plantation woodland is developing. The site also has some local bird interest.	1.5 km NE
PLWS	Branson's Lake and Scrub	Lake with reedbed and adjacent woodland and scrub along the river Cherwell. Attracts wildfowl.	1.5 km NE
LWS	Duke's Lock Pond 41V13	A pond providing a substantial area of reedbed north of Duke's Lock on the Oxford Canal. Abundant sedge and reed warbler present, and reed bunting.	1.5 km S
LWS	Wolvercote Mead	Five meadows which support unimproved grassland including areas of lowland meadow. Dominated by great burnet and meadowsweet.	1.6km S
LWS	Thrupp Community Woodland	Broadleaved plantation woodland, dominated by ash, hazel, and crack willow, and smaller amounts of silver birch and wild cherry. A range of bird species recorded here such as long-tailed tit, willow warbler, starling, and chiffchaff, as well as previous reports of breeding kingfisher, willow tit, grey wagtail etc.	1.8km NE
BBOWT Reserve	Oxey Mead	A field forming part of Pixey and Yarnton Meads SSSI. Supports invertebrates, wet meadow plants, skylark and wading birds.	1.8 km S
Oxford City SLINC	Linkside Lake	Lake on the site of an old clay pit.	1.9 km SE
LWS	Canalside Meadow (Oxford Canal Marsh)	Wet meadow grading into sedge-dominated fen alongside the Oxford Canal. Important for birds.	2.0 km S



- 5.8 The Site is dominated by arable fields with an extensive network of hedgerows. A stream, the Rowel Brook, passes across the north of the site, flowing west to east. There is an associated corridor of woodland, and an inflowing stream. There is a small block of mixed plantation woodland around several barns (Parker's Farm), east of Begbroke Science Park. Small areas of species-poor semi-improved grassland and amenity grassland are present at the Science Park, and there are fields of damp semi-improved neutral grassland in the north-east of the Site, east of the railway line. Ditches are mainly present east of the railway line. Several buildings are present, including large modern buildings and an old stone farmhouse and associated buildings at Begbroke Science Park.
- 5.9 A Phase 1 habitat plan of the Site is provided in Figure 2. Habitats present at the Site are listed and described in Table 9. Photographs are provided in section 8. Related target notes are included in Appendix 3. Botanical survey data is provided in Appendix 4, and habitat condition assessment data is provided in Appendix 5. Habitats at the Site which are Habitats of Principal Importance in England (HPIs) are indicated, and include woodland, hedgerows and ponds.

Table 9: Phase 1 habitats at the Site.

□ □ □ □ □ □ □ □ □ □	D □ □ □ □ r □ □ □ □ □ □ □ □
Arable land	<p>The Site is dominated by large arable fields which are of limited ecological value. See Photograph 1. Widespread arable weeds noted include field pansy <i>Viola arvensis</i>, field poppy <i>Papaver rhoeas</i>, hedge mustard <i>Sisymbrium officinale</i>, spear thistle <i>Cirsium vulgare</i>, prickly sow-thistle <i>Sonchus asper</i>, and mugwort <i>Artemisia vulgaris</i>. Two arable weeds with more restricted national distributions (corn marigold <i>Glebionis segetum</i> and common cudweed <i>Filago vulgaris</i>) were recorded) as present on arable field margins in the north-west and centre-south of the Site, respectively (see location on Figure 4) in 2018, but these species were not recorded in 2022. Field boundaries are formed by hedgerows (see below). There is also an area of public allotments in current use in the north-west of the Site adjacent to the A44 Woodstock Road (see Photograph 2). This habitat is not a HPI since it does not conform to the description of the Habitat of Principal Importance <i>Arable Field Margins</i> in BRIG (2011). Habitat condition assessment is not applicable to arable land.</p>
Good semi-improved neutral grassland	<p>Good semi-improved grassland (equivalent to Other neutral grassland under the UK Habitat Classification) is present in two fields at the east of the Site, the disused landfill and within a small triangular field in the south of the Site, and at Begbroke Science Park. Locations are shown on Figure 4. These areas were subject to detailed botanical survey to determine their habitat condition. Botanical data is provided in Appendix 4, and completed condition assessment sheets are provided in Appendix 5. These areas do not support the Habitat of Principal Importance <i>Lowland Meadows</i>, or any other HPI, based on the descriptions in BRIG (2011).</p> <p><u>Field A</u> in the north-east of the Site is dominated by the coarse grass false oat-grass <i>Arrhenatherum elatius</i>, and much of the margins are dominated with abundant ruderals (such as common nettle <i>Urtica dioica</i>) and <i>Rubus fruticosus</i> agg. scrub. See Photograph 3. These characteristics indicate a lack of recent management, and there was no evidence of mowing or other management on site visits in 2018, 2021 and 2022. The sward contains a number of other grass and forb species, including species such as tufted hair-grass <i>Deschampsia cespitosa</i>, abundant meadowsweet <i>Filipendula ulmaria</i>, and wild angelica <i>Angelica sylvestris</i>, that are indicative of damp conditions. Habitat condition assessment for grassland of medium (or higher) distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition. □</p> <p><u>Field D</u> in the east of the Site is dominated by a mix of false oat-grass and Yorkshire fog <i>Holcus lanatus</i>. See Photograph 4. Various other grasses are present including red fescue <i>Festuca rubra</i>, meadow foxtail <i>Alopecurus pratensis</i> and smooth meadow-grass <i>Poa pratensis</i>. A range of forbs is present, including hogweed <i>Heracleum sphondylium</i>, germander speedwell <i>Veronica chamaedrys</i>, common sorrel <i>Rumex acetosa</i>, creeping buttercup <i>Ranunculus repens</i>, and very occasional lesser stitchwort <i>Stellaria graminea</i> and greater burnet <i>Sanguisorba officinalis</i>. Several of these species are indicative of damp conditions. Most of these forbs are present at relatively low abundance, and much of the sward is grass-dominated and is not species-rich. Habitat condition assessment for grassland of medium (or higher)</p>

	<p>distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition. □</p> <p><u>Field E</u> in the south of the Site is dominated by scrub, but has grassland towards its edges. See Photograph 5. This is dominated by false oat-grass, with several other grasses and forb species present. Stands of common nettle are abundant. Habitat condition assessment for grassland of medium (or higher) distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition.</p> <p><u>Field F</u> is a former landfill site at the centre of the Site, apparently managed by one summer cut. It is dominated by the tall grasses false oat-grass and cock's-foot, with a few forbs present (especially hogweed <i>Heracleum sphondylium</i>). See Photograph 6. Common nettle is abundant in some areas. Habitat condition assessment for grassland of medium (or higher) distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition.</p> <p><u>Begbroke Science Park</u> had a small area of good semi-improved neutral grassland in the north prior to 2022. This area was cleared in 2022 and is currently being developed, with offsite habitat creation proposed in a 0.8 ha part of an arable field in the north of the Site. This area is mapped as bare ground.</p> <p><u>Lawn at Begbroke Hill Farmhouse</u>. Although closely-mown, this lawn contains a number of grass, forb and bryophyte species (e.g., smooth stalked meadow-grass <i>Poa pratensis</i>, common bent <i>Agrostis capillaris</i>, red fescue <i>Festuca rubra</i>, yarrow <i>Achillea millefolium</i> daisy <i>Bellis perennis</i>, common cat's-ear <i>Hypochaeris radicata</i> and springy turf-moss <i>Rhytidiadelphus squarrosus</i>). See Photograph 7. Habitat condition assessment for grassland of medium (or higher) distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition. □</p>
<p>Poor semi-improved neutral grassland</p>	<p>Several areas of poor semi-improved grassland are present at the Site, including two fields in the east of the Site. These have swards heavily dominated by grasses and are equivalent to Modified grassland under the UK Habitat Classification. □ The grassland in these areas is not a HPI, based on the descriptions in BRIG (2011).</p> <p><u>Field B</u> supports a range of grass species, and some forbs, dominated by Yorkshire fog <i>Holcus lanatus</i>. See Photograph 8. The sward is more diverse than was noted in 2018 (when it was dominated by Italian ryegrass <i>Lolium multiflorum</i> in most areas). This field was observed to be in a ploughed state during a visit by BSG Ecology in 2015, and it is assumed that it was sown to Italian ryegrass at or shortly after this time, and that this species has persisted for several years through self-seeding. It contains a large number of species of disturbed ground, rather than of permanent grassland. Habitat condition assessment for grassland of low distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition.</p> <p><u>Field C</u> in the east of the Site has a sward that is heavily dominated by tall fescue <i>Schedonorus arundinaceus</i>. See Photograph 9. Some Yorkshire fog is also present, as are a few other grasses and forbs including creeping cinquefoil <i>Potentilla reptans</i>, creeping buttercup <i>Ranunculus repens</i> and a little wild angelica. This field was noted to be very wet during site visits early in the season. The dominance of tall fescue is likely to have resulted from seeding (this species is occasionally grown as a hay crop in damp situations). Ploughing is likely to have occurred following January 2015, since this field was observed (on a visit by BSG Ecology) to support a rough mixed grass sward at that time (BSG Ecology 2015). Habitat condition assessment for grassland of low distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition.</p> <p>Other small areas of poor semi-improved grassland are present at the site, including areas at the Science Park, the Science Park entrance roads, and on road verges on Sandy Lane. These areas are also considered to be in Poor condition.</p>
<p>Improved grassland</p>	<p>An area of improved grassland dominated by perennial rye-grass <i>Lolium perenne</i> with some creeping buttercup <i>Ranunculus repens</i> is present in the south-west of the site. This grassland has a short sward and is used for deer farming. This habitat is equivalent to Modified grassland under the UK Habitat Classification. The grassland in this area is not a HPI, based on the descriptions in BRIG (2011). Habitat condition assessment for grassland of low distinctiveness under Natural England (2023) guidance indicates that this grassland is in Moderate condition.</p>

Amenity grassland	Various areas of amenity grassland (lawn) are present around the Science Park and on associated road verges. These are closely mown, and species-poor. equivalent to Modified grassland under the UK Habitat Classification. The grassland in these areas is not a HPI, based on the descriptions in BRIG (2011). Habitat condition assessment for grassland of Low distinctiveness Grassland under Natural England (2023) guidance indicates that this grassland is in Moderate condition.
Broad-leaved semi-natural woodland	This woodland contains oak <i>Quercus robur</i> , ash <i>Fraxinus excelsior</i> , abundant sycamore <i>Acer pseudoplatanus</i> in some areas, alder <i>Alnus glutinosa</i> and crack willow <i>Salix fragilis</i>). See Photographs 10 and 11. Where present, the shrub layer contains hazel <i>Corylus avellana</i> , goat willow <i>Salix caprea</i> and hawthorn <i>Crataegus monogyna</i> , and the field layer is dominated by bramble and ivy <i>Hedera helix</i> . This woodland is natural in character and has distinct shrub and field layers of native species. The non-native invasive plant species variegated yellow archangel <i>Lamium galeobdolon</i> ssp. <i>argentatum</i> in present in the western part of this woodland, presumably having escaped from a garden at Begbroke (Target note 4). This habitat is considered to conform to the description of <i>Lowland Mixed Deciduous Woodland</i> in BRIG (2011) and therefore is a HPI. Habitat condition assessment for Woodland Natural England (2023) guidance indicates that this grassland is in Moderate condition.
Plantation woodland	A small area of planted woodland containing mixed mature (mainly non-native) trees is present around modern and old barns at Parker's Farm, east of the Science Park. See Photograph 12. There is also a belt of young deciduous planted woodland surrounding the Science Park. Due to its young age, lack of mature canopy or woodland ground flora, and dominance of non-native tree species, this habitat is not considered to conform to the description of <i>Lowland Mixed Deciduous Woodland</i> in BRIG (2011) and therefore is not a HPI. Habitat condition assessment for Woodland under Natural England (2023) guidance indicates that this grassland is in Moderate condition.
Hedgerows	There is a network of agricultural hedgerows across the site, mostly dominated by hawthorn but containing a range of native shrub species (including blackthorn <i>Prunus spinosa</i> , spindle <i>Euonymus europaeus</i> , buckthorn <i>Rhamnus cathartica</i> , dogwood <i>Cornus sanguinea</i> , hazel, elder <i>Sambucus nigra</i> , English elm <i>Ulmus procera</i> , crab apple <i>Malus sylvestris</i> , and dog rose <i>Rosa canina</i>), and in some cases, trees (such as ash, crack willow <i>Salix fragilis</i> , pedunculate oak and (on the northern boundary of the Site) turkey oak <i>Quercus cerris</i>). See Photographs 1, 4, 6, 13, and 14. The majority of the hedgerows are species-rich, containing five or more woody species. Some are defunct (i.e., not stock-proof). Because they are all composed of 80% or more of native species, all of the hedgerows at the Site represent the HPI <i>Hedgerows</i> . For further details of hedgerows at the Site, including habitat condition assessments, see the section <i>Hedgerows</i> below. Habitat condition assessment for Hedgerows under Natural England (2023) guidance indicates that the majority of the hedgerows at the Site are in Good condition, with some in Moderate condition (see Hedgerows section below and Appendix 6).
Scrub	Several areas of the Site support areas of dense scrub, dominated by hawthorn <i>Crataegus monogyna</i> and bramble <i>Rubus fruticosus</i> agg., with some blackthorn and other woody species. This habitat is equivalent to mixed scrub in the UK Habitat Classification. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI. Habitat condition assessment under Natural England (2022) guidance for scrub indicates that this habitat is in Poor condition, due to a limited range of species being present and a uniform structure.
Introduced Shrub	Small areas of introduced ornamental shrubs are present within the Science Park. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI. Condition assessment is not applicable to this habitat type.
Tall Ruderal vegetation	Tall ruderal vegetation is present as stands of common nettle in the north-east of the Site, and of hemlock <i>Conium maculatum</i> and other species on bunds just east of Parker's Farm. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI. Habitat condition assessment under Natural England (2022) guidance for Urban habitat indicates that this habitat is in Poor condition, due to a limited range of plant species being present and a uniform structure.
Swamp	A small area of swamp surrounds part of pond P1 in the North of the Site, with abundant common reed <i>Phragmites australis</i> . This habitat is considered to be fen under the UK Habitat Classification. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI. Habitat condition assessment under Natural England (2022) guidance for wetland habitat indicates that this habitat is in Moderate condition, due to a limited range of species being present, and a high cover by crack willow <i>Salix fragilis</i> .
Running water	A small stream, the Rowel Brook, flows west to east across the north of the Site. See Photographs 10 and 11. The stream flows into the Oxford Canal on the north-eastern boundary

	of the site. A smaller stream flows north-west and enters the Rowel Brook towards the north-east of the Site. A short artificial stream is present at the east of the Site flowing around a lock on the Oxford Canal. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI. Invertebrate assessment indicates that the water quality is fair (see invertebrate survey results below). On a precautionary basis, this habitat is considered to be in Good condition.
Ditches	Ditches are present adjacent to many of the hedgerows at the Site, particularly in the east of the Site. Many of these ditches held water during survey visits early in the year, but all were dry by late spring in 2018, 2021 and 2022. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI. Habitat condition assessment under Natural England (2022) guidance for Ditches indicates that this habitat is in poor condition, due to the absence of aquatic and marginal vegetation, dense shading by trees in most areas, and a lack of water in the summer.
Ponds	Six ponds are present within the Site. Of these, the presence of GCN makes the pond at Begbroke Science Park (pond 4; see Photograph 15) a HPI, despite the fact that it is a formal pond with ornamental fish and heavy pumped ultraviolet filtration. See Photograph 15. The other ponds within the Site do not conform to any of the habitat descriptions in BRIG (2011) and are therefore not HPIs. For photographs of other ponds, see Appendix 1. Habitat condition assessment under Natural England (2022) guidance for Ponds indicates that pond 4 is in Moderate condition (it fails Good condition due to the pumped filtration, ornamental fish, and lack of surrounding semi-natural habitats). Pond 3 is in Moderate condition (it fails Good condition due to insufficient surrounding semi-natural habitat, and extensive shading). Other ponds at the Site are also in Moderate condition, due to shading by trees and a lack of wetland vegetation.
Trees	In addition to the woodland described above, there are various mature and semi-mature trees at the Site. The Science Park itself has some mature trees and abundant semi-mature trees. There is also a line of mature poplars on the western boundary of the disused landfill site (see Photograph 16). In the remainder of the Site, mature trees are only present in woodland or hedgerows. Individual trees do not conform to any of the habitat descriptions in BRIG (2011) and are therefore not a HPI. However, in most cases, trees at the Site form part of woodland or hedgerow habitat which are HPIs. The habitat condition of trees varies across the Site.
Buildings and hard standing	A range of buildings is present at Begbroke Science Park; these include a stone farmhouse and associated buildings (see Photograph 7) and various modern buildings (see Photograph 18). The only buildings at the Site outside the Science Park are two large modern agricultural barns (see Photograph 18) and a low stone barn or animal shelter (see Photograph 12), all at Parker's Farm. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI. Condition assessment is not applicable to this habitat type.

5.10 Hedgerows

Hedgerows (some with accompanying ditches) separate the majority of the fields at the Site and are present adjacent to various roads and footpaths. These hedgerows comprise almost entirely native species and have varying species-richness. Many hedgerows in the east of the Site are somewhat overgrown, with sections that are defunct (i.e., no longer stock-proof). Hedgerows towards the centre and west of the Site are generally heavily managed by annual trimming. The locations of the hedgerows at the Site are shown on Figure 3.

A total of 54 hedgerows were identified within the Site. Of these, 38 are species-rich and the remainder are species-poor. A total of 31 may be classified as 'Important' under the criteria listed under 'Wildlife and Landscape' in Schedule 1 of the Hedgerow Regulations 1997. This is summarised in Table 10.

Table 10: Summary of hedgerow survey results.

Hedgerow type	Number of hedgerows	Number of species-rich hedgerows	Number of Important hedgerows
Species-rich	29	9	3
Species-poor	2	14	3
Total	31	23	6

- 5.12 The total number of woody species in each hedgerow varies between one (i.e., hawthorn only in Hedgerow H17) and 14 (in Hedgerow H46). The average number of woody species per hedgerow (based on one or more 30 m sample lengths) varies between 1 (for hedgerow H17) and 10 (for hedgerow H49). Hedgerows in the east of the Site, east of the railway line are particularly rich in woody species and trees. Hedgerow H39, which forms part of the southern boundary of the Site, also contains abundant trees. The dominant hedgerow shrub across the Site is hawthorn, and the dominant hedgerow tree is pedunculate oak. Other woody species present include ash, English elm, spindle, elder, honeysuckle *Lonicera periclymenum*, hazel, dog rose, crack willow, goat willow *Salix caprea*, wild privet *Ligustrum vulgare*, crab apple, blackthorn, guelder rose, dogwood, buckthorn, and holly *Ilex aquifolium*.
- 5.13 Woodland ground flora species noted growing in hedgerow bases, particularly towards the east of the Site include dog's mercury *Mercurialis perennis*, lords-and-ladies *Arum maculatum*, and herb Robert *Geranium robertianum*.
- 5.14 A summary of the criteria under 'Wildlife and Landscape' in Schedule 1 of the Hedgerow Regulations which are met by Important hedgerows at the Application is provided in Table 11.

Table 11: Summary of Important hedgerows.

Criteria	Hedgerow IDs
Average of seven woody species.	H1, H4, H9, H16, H25, H31, H34, H35, H36, H42, H44, H45, H46, H47, H48, H49, H50, H51
Average of six woody species plus three additional features (as defined in Section 6 of Schedule 1 of the Hedgerow Regulations).	H33, H37, H39, H40, H41, H43, H54
Average of five woody species plus four or more additional features.	H8, H52
Present adjacent to a public road or other right of way and with an average of four woody species plus two or more additional features.	H5, H10 H23, H24

- 5.15 Further details of all of the hedgerows at the Site are included in Appendix 6.

6. Ponds

- 5.16 Six ponds are present within the Site, these are indicated as Ponds 1–6 on Figure 10. Descriptions of these ponds are provided in Table 10, along with all other ponds within 250 m of the Site. Ponds P10, P11, P12 and P13 were not accessed: the information presented for these was obtained from Ordnance Survey mapping and aerial photographs. Significant changes from the 2018 results for these ponds are noted in the table.

Table 10: Description of Ponds. Details for ponds within the Site are highlighted in grey.

ID	Description	Location	Area
1	Onsite. Shaded pond with some lesser duckweed <i>Lemna minor</i> , and abundant leaf litter and some dead wood. Margins support areas of swamp dominated by common reed and lesser pond sedge. Concrete dam and weir fitted, with metal outlet pipe. Size ca. 9 m x 6 m, with channel extending north-east. Depth to ca. 35 cm. The facilities manager at Begbroke Science Park mentioned that this pond was created as a water source for irrigation at the Weeds Research Organization which formerly occupied the Science Park. Heavily dominated by common reed <i>Phragmites australis</i> . Little open water present.	Within Site	80 m
2	Onsite. Series of four artificial rectangular ponds separated by narrow earth dams. Total size ca. 10 m x 4 m. Shaded by trees with abundant leaf litter. No vegetation. Maximum water depth noted. 25 cm. Dry by May 2018 and June 2021 and 2022..	Within Site	80 m

3	Onsite. Series of three artificial rectangular ponds separated by narrow earth dams. Total size ca. 10 m x 4 m. Shaded by trees with abundant leaf-litter. No marginal or aquatic plants visible. Maximum water depth noted ca. 25 cm. Dry by May 2018 and June 2021 and 2022..	Within Site	60 m
4	Onsite. Formal pond within Begbroke Science Park. Paved margins. Abundant marginal plants at southern end, including reedmace <i>Typha latifolia</i> , unbranched bur-reed <i>Sparganium erectum</i> , bogbean <i>Menyanthes trifoliata</i> , water horsetail <i>Equisetum fluviatile</i> , lesser duckweed <i>Lemna minor</i> , and water mint <i>Mentha aquatica</i> . Abundant aquatic plants, including hornwort <i>Ceratophyllum demersum</i> and Canadian pondweed <i>Elodea canadensis</i> . Large external filter system with UV unit. Ornamental fish present (many goldfish <i>Carassius auratus</i> and one large carp <i>Cyprinus carpio</i>). Size ca. 5 m x 15 m. See Photograph 15.	Within Site	20 m
5	Onsite. Pond under large multi-stemmed crack willow. Leaf litter present. Minimal wetland vegetation present. Shaded. Depth to ca. 25 cm. Size ca. 11 x 6 m. Dry by late May 2018 and June 2022.	Within Site	220 m
6	Onsite. Pond forming part of ditch network, adjacent to canal towpath. Bramble scrub adjacent. Minimal wetland vegetation noted. Shaded. Size ca. 12 x 4 m. Dry by mid-June 2018 and 2022.	Within Site	320 m
7	Offsite. No longer present. Large pond identified within grounds of the Ley Community residential centre in Yarnton in 2018. Turbid water and no aquatic plants noted. Banks steep/engineered in places. Population of large koi carp present. Ca. 35 x 15 m. This site had been redeveloped by June 2021, and the pond filled in.	80 m W	80 m
8	Offsite. Large naturalistic landscape pond surrounded by mature crack willows within a modern housing development. Various marginal vegetation present, including water mint. Ca. 80 m x 18 m.	10 m W	40 m
9	Offsite. Farm field pond surrounded by mature crack willows. Ca. 22 x 10 m. Located beyond the A44 dual carriageway which is considered a significant barrier to GCN connectivity with the Site. Accessed in 2018 but not considered necessary to survey in 2021/2022 due to A44.	50 m W	80 m
10	Offsite. Large pond in school grounds. Ca 85 x 20 m. Rowel Brook flows through this pond. Not accessed. Located beyond the A44 dual carriageway which is considered a significant barrier to GCN connectivity with the Site.	260 m N	260 m
11	Offsite. Presumed to be a defunct settlement pond or similar, located at a defunct water treatment works. Now supports willow woodland. Ca 70 m x 10 m. Not accessed.	40 m E	40 m
12	Offsite. Presumed to be a defunct settlement pond or similar, located at a defunct water treatment works. Now supports willow woodland. Ca 70 m x 10 m. Not accessed.	60 m E	60 m
13	Offsite. Small farm field pond associated with field ditch network. Visible from the Site. Not accessed. Ca. 10 m x 8 m.	10 m S	530 m

□□□□□

- 5.17 The desk study returned records of 42 species of higher plants from the search area, within the last 10 years.
- 5.18 Two of these were found within the site: corn marigold *Glebionis segetum*, was recorded from an arable field in the north of the Site in 2017, this species was also recorded from the Site during surveys by BSG Ecology (see below); snakehead fritillary was recorded from woodland adjacent to the Rowel Brook and gardens in the north of the Site, this species was listed as Nationally Scarce by Stewart et al (1994), although is now regarded as non-native (Stroh et al 2020). Field scabious *Knautia arvensis*, a species listed as *Near Threatened* in *A Vascular Plant Red List for England* (Stroh et al (2014) was recorded from 2017 from the verge of the A44 just outside the south-western boundary of the Site.

5.19 The desk study records include two Species of Principal Importance in England (SPI): tubular water-dropwort *Oenanthe fistulosa* (three records, 2017, 2019, and 2020, from meadows north-east of Oxford, ca. 2 km south-west of the Site) and white helleborine *Cephalanthera damasonium*, recorded multiple times (2018 to 2021, from Cassington quarry, ca. 1.4 km southwest of the Site). Neither of these species were recorded from the Site during the survey work carried out by BSG Ecology.

5.20 During the habitat and hedgerow surveys, corn marigold and common cudweed were recorded in the margins of arable fields at the Site. Their locations are shown in Figure 4. Corn marigold is listed as *Vulnerable* in the England Red List. It is listed as “not scarce in Oxfordshire” and is described as “still widely found in Oxfordshire on non-calcareous soils” in *Oxfordshire’s Threatened Plants* (Erskine et al, 2018). Common cudweed is listed as *Near Threatened* in the England Red List. In *Oxfordshire’s Threatened Plants* it is listed as “not scarce in Oxfordshire” but “scarce in vice county 23” (vice county 23 covers Northern and Eastern Oxfordshire and includes the Site), the description reads “In vice county 23 there is not much suitable habitat and it has declined here steadily”.

□ □ d □ r □ □

5.21 A total of 41 records of badger were obtained in the desk study from 2013 onwards.

5.22 The Site provides suitable habitat for badger, and the desk study clearly indicates that this species is present in the local area.

The 2022 badger survey identified a very large active main sett towards the centre of the Site. There is an associated large annex to the west of the main sett, and several outlier sett / individual holes in the vicinity.

5.23 As second main sett is present on the Site boundary in the north-west of the Site, which has multiple entrance holes and nearby outlier setts.

5.24 Outlier setts are also present in the south-west, the south-east and the north of the Site. Various badger signs (including snuffle holes, runs, latrines, and hairs) were identified across the Site.

5.25 Sett locations are shown on confidential Figure 5.

□ □ □ □ □

5.26 The desk study returned 206 records of bats from the search area from 2013 to 2023. These included two records of bats from within the Site (a common pipistrelle *Pipistrellus pipistrellus* and a noctule *Nyctalus noctula*). They did not include any records of bat roosts within the Site.

5.27 Most of the records were from around Kidlington and Yarnton. They included records of *Myotis* species, Natterer’s bat *Myotis nattereri*, noctule *Nyctalus noctula*, common pipistrelle, brown long-eared bat *Plecotus auritus*, and soprano pipistrelle *Pipistrellus pygmaeus*. Roosts mentioned in the data include roosts of common pipistrelle in North Oxford.

5.28 The above records indicate that several species of bat are present in the local area of the Site. BSG Ecology has also confirmed the presence of at least 11 species of bats from the Woodstock area during surveys at other sites, including roosts of pipistrelle, soprano pipistrelle, Nathusius’ pipistrelle *Pipistrellus nathusii*, barbastelle bat *Barbastella barbastellus*, Natterer’s bat, Daubenton’s bat *Myotis daubentonii*, noctule, brown long-eared bat, and lesser horseshoe *Rhinolophus hipposideros*.

5.29 All bat species in the UK are European Protected Species. Seven species (barbastelle, Bechstein’s bat, noctule, soprano pipistrelle, brown long-eared bat, and greater and lesser horseshoe) are also Species of Principal Importance (SPIs).

5.30 The Site is located adjacent to the Oxford Canal, which is likely to provide important local foraging and commuting habitat for bats. Wet grassland at Rushy Meadows SSSI to the north of the Site may also provide valuable foraging habitat, and woodland at Bladon Heath and Begbroke Wood to the west, and Blenheim Park to the north is likely to provide valuable foraging and roosting habitat. Buildings at Yarnton, Begbroke, and Kidlington may provide roosting sites.

- 5.31 The Site provides habitat suitable for foraging bats, particularly the woodland along Rowel brook in the north of the Site and areas of damp grassland in the east of the Site. The network of hedgerows provides potential commuting routes across the Site, between the above foraging areas and may link roosting sites within and around the Site with foraging areas within and near the Site. The double hedgerows along Sandy Lane (east-west across the centre of the Site) and along a green lane south of Sandy Lane in the east of the Site may provide particularly valuable routes for bats due to their width and the shelter they provide shelter. The Site is currently not subject to a high level of lighting, except around Begbroke Science Park which has several floodlights.
- 5.32 The results of bat surveys presented below are broadly similar to those obtained in the 2018 survey work (see Appendix 1).

Bat Roost Potential of Buildings

- 5.33 Two clusters of buildings are present within the Site (Begbroke Science Park and Parkers Farm). These were subject to bat roost potential assessment along with several other buildings that are in close proximity to the Site. Together these constitute 19 separate buildings, listed in Table 11 and indicated on Figures 6ci and 6cii. Their suitability for roosting bats ranges from negligible to high.

Table 11: Potential of buildings to support roosting bats

Location	Number	Description	Potential
Parkers Farm (on-Site)	A1	Large agricultural barn. Concrete block lower walls and corrugated metal upper walls and roof.	Negligible
	A2	Large agricultural barn. Concrete block lower walls and corrugated asbestos upper walls and roof.	Negligible
	A3	Low stone barn/animal shelter with corrugated metal roof. Open side to south.	Moderate
Begbroke Science Park (on-site)	B1	Single-storey office building. 20 th Century. Block and wood cladding walls and corrugated metal pitched roof. Some gaps under fascia on northern elevation. Building comprises offices on the eastern side with suspended ceilings throughout and offices on the western side with only a small area of suspended ceiling, the rest of the roof space is open. A boiler room is present in the southern side of the building. Various potential access points around the eaves and under fascias of the building. Presence of a roof void on the eastern side and possible cavity wall on the western side	Moderate
	B2a	Single storey brick and stone farm outbuildings, refurbished to offices. Pitched roof with slate tiles. Small gaps present under ridge tiles.	Low
	B2b	Single-storey stone farm outbuildings, refurbished to offices. Pitched roof with slate tiles. Gaps under some roof tiles, potential for access at eaves.	High
	B2c	Two storey stone farm outbuildings, refurbished to offices/reception. Pitched roof with uneven limestone slate tiles. Multiple potential bat access points. Also gaps under fascia and under soffit box.	High
	B2d	Small single-storey stone and brick building. Date plaque indicates 17 th century. Pitched roof with stone tiles. Gaps behind fascia on both gable ends. Moss on roof limits access under tiles.	High
	B2e	Begbroke Hill Farmhouse. Large three-storey 17 th century farmhouse. Gaps under fascia on west elevation. Some gaps under tiles.	High
	B2f	Single-storey stone building with slanted and pitched roof. With concrete tiles. Gaps behind fascia and soffit box into roof space on North-west elevation.	Moderate
	B3	Large modern two storey office building. 21 st century. Clad with wood and metal.	Negligible
	B4	Hirsch Building. Late 20 th century office building of brick, metal, glass and stone. Metal roof.	Negligible
	B5	Institute of Advanced Technology. 21 st century. Metal and wood cladding.	Negligible

L	N	D	R
	B6	Store building. Late 20 th century. Stone walls and asbestos and metal roof.	Negligible
	B7	Store building. 21 st century later. Metal walls and roof.	Negligible
	B8	Electrical switch room near to building B1. No roof void identified, well-sealed internally. The only possible access identified was under the eaves/fascia boards. The internal elevations are constructed from breeze block with wooden boarding externally so there is a possibility of a small cavity between the two.	Low
Two semi-detached houses on Sandy Lane (off-Site)	C1	Two two-storey semi-detached houses south off Sandy Lane. Rendered wall, pitched tile roofs with some missing tiles. Gaps under ridge tiles. Loft space may be present. Property and grounds not accessed, viewed from within the PR8 Site, hence precautionary assessment.	Moderate–High
House on Woodstock Road (off-Site)	D1	Blenheim Edge Guest House. Modern two-storey brick house. Tiled roof with some missing tiles and gaps under ridge. Plastic soffit boards. Appears to have loft space, but no obvious access points for bats. Property and grounds not accessed, viewed from within the Site.	Low
Houses near level crossing (off-Site)	E1	Stone two-storey cottage east of level crossing. Pitched slate roof. Loft space. Property and grounds not accessed, viewed from within the Site/Sandy Lane.	Moderate
	E2	Two modern mobile homes. Property and grounds not accessed, viewed from within the Site/Sandy Lane.	Negligible

5.34 Within the Site, Begbroke Farmhouse and associated buildings (four buildings in total: B2b, B2c, B2d, and B2e) have high suitability, two further buildings at the Science Park (B1 and B2f) and a stone barn (BA3) at Parker’s Farm have Moderate suitability, and two further buildings at the Science Park (B1 and B2f) have low suitability. All other buildings on-site have negligible suitability for bats.

5.35 Of the off-site buildings that were assessed, a pair of semi-detached houses south of Sandy Lane (C1) has moderate to high suitability, a stone cottage at the level crossing (E1) has moderate suitability and a house on the A44 Woodstock Road (D1) has low suitability. The only other building (E2) that was assessed has negligible suitability (E2).

5.36 On-site buildings with bat suitability that are indicated as buildings that may be demolished on the Building Demolition Plan were subject to further surveys, as described below.

Emergence/re-entry survey of Buildings

5.37 The results of the emergence and re-entry surveys of buildings carried out by BSG Ecology in 2022 are provided in Table 12. These indicate that day roosts of small numbers of common pipistrelle bats are present in two buildings at Begbroke Science Park: Begbroke Hill Farmhouse (B2e) and an adjacent stone building (B2e). The maximum number of bats observed emerging on any one survey visit from each of these buildings was one.

Table 12: Results of bat emergence and re-entry surveys of buildings.

L	N	D	R
Stone Barn at Parkers Farm	A3	Moderate	None
Begbroke Hill Farmhouse and adjacent buildings	B2d	High	possible emergence

L	N	H	R	R	R	R
			from south-western corner	floor window. NE side of the building	windows. NE side of the building	
Building south-west of Begbroke Hill Farmhouse	B2e	High	possible emergence from northern side	None	None	Day roost
Tree line east of landfill site	n/a	Low-Moderate	None	None	a/a	n.a
L-shaped building in SW of Begbroke Science Park	B1	Moderate	None	None	n/a	
Tree 3	n/a	Moderate	None	None	n/a	n/a
Tree 9	n/a	Moderate	None	None	n/a	n/a
* Based on Table 3.1 in Collins (2016).						

5.38 The 2022 survey results differed from the 2018 results in that a maximum of six bats were observed to emerge from Begbroke Hill Farmhouse in 2018 (one soprano pipistrelle, four common pipistrelles and one unidentified bat).

Bat Roost Suitability of Trees

5.39 There is some potential for bats to roost within trees at the Site. Results of the preliminary ground level roost assessment are provided in Appendix 8, and indicated on Figure 6b, which also incorporates the results of follow-up ground-based and climbed endoscope inspections (these were carried out on Trees 5, 6 and 10, and on tree 9, respectively). Trees east of the railway line, around and north of the Rowel Brook

5.40 A total of 70 trees either within or immediately adjacent to the Site have potential to support roosting bats. Two trees have high potential, nine have moderate potential, and 59 have low potential.

5.41 All other trees at the Site are considered to have negligible suitability to support roosting bats or are present within proposed greenspace and are unlikely to be affected by the Proposed Development.

5.42 The line of trees at the eastern edge of the disused landfill site (towards the centre of the Site) were subject to emergence surveys for bats (see Table 12 above).

Bat activity transect surveys

5.43 A summary of the walked bat transect survey data is provided in Table 13 (and where bat locations were noted in the field, on Figures 6d and 6e). This indicates that at least eight species of bat were recorded during the transect surveys, including common pipistrelle (867 passes in total), soprano pipistrelle (332 passes), noctule (251 passes) Nathusius’ pipistrelle (8 passes), *Myotis* species (26 passes), brown long-eared bat (5 passes), Leisler’s bat (3 passes), and serotine (1 pass). The highest number of passes was recorded during the April transect (326 passes) and the lowest activity was in June (56 passes).

Table 13: Summary of bat transect data showing bat passes per transect and total numbers of passes.

Species	Bat passes per transect									Total passes
	A	M	J	J	A	A	S	S	M	
Common pipistrelle	171	126	85	197	61	145	66	16	108.4	
Soprano pipistrelle	62	65	53	68	3	40	27	14	41.5	
Noctule	89	46	35	15	19	12	16	19	31.4	
<i>Myotis</i> species	1	9	2	5	-	1	4	4	3.3	
Nathusius' pipistrelle	1	6	-	-	-	1	-	-	1.0	
Noctule / Leisler's bat	1	-	1	1	2	-	-	3	1.0	
Brown long eared bat	1	-	-	-	2	-	2	-	0.6	
Leisler's bat	-	-	-	1	1	1	-	-	0.4	
Serotine	-	-	-	1	-	-	-	-	0.1	
Total	371	245	175	386	83	197	121	55	108.4	

- 5.44 The most commonly noted species over the course of the surveys were common pipistrelle (average of 108.4 bat passes per transect) and soprano pipistrelle (average of 41.5 passes per transect). Three species (serotine, brown long-eared bat, and Leisler’s bat) had the lowest average pass rate recorded (<1 pass per transect).
- 5.45 Early passes by noctule and pipistrelles (common and soprano) were recorded at the Site, indicating that roosting sites for these species are present in the local area.
- 5.46 A total of 26 passes by *Myotis* species, which could not be identified to species level, were recorded with a relatively even spread across the entire survey season. Eight Nathusius’ pipistrelle passes were recorded, with six of these coming in a single month (May). Five brown long-eared bat passes were recorded, with records spread between April, August (dawn survey), and September. Three Leisler’s bat passes were recorded, one in each of July, August (dawn survey) and August (dusk survey). The single Leisler’s bat for which GPS data is available was at the eastern boundary of the Site, adjacent to the corner where Sandy Lane intersects with Green Lane. The single serotine pass was recorded in this survey (in July).
- 5.47 Figures 6d and 6e show the spatial distribution of bat passes at the site, as recorded by surveyors during the bat activity transect survey. This distribution is similar to that recorded in the 2018 surveys: bat activity was particularly abundant adjacent to woodland along the Rowel Brook in the north of the Site and along Yarnton Lane (which has a double hedgerow with numerous mature trees). Some bat passes were recorded from almost all hedgerows that were included in the transects, and also from the small area of plantation woodland around the barns at Parker’s Farm.

Automated detector survey

- 5.48 A summary of the data obtained from the automated bat detector survey is provided in Tables 14 to 18. A total of 9,499 bat passes were recorded over the entire monitoring period. At least nine species of bat were recorded within the Site. These included all eight species that were recorded in the transect survey, plus barbastelle. Common pipistrelle was the species most frequently recorded, with this species accounting for 4,668 passes (i.e., almost half of the total number). Noctule and soprano pipistrelle were the species next most frequently recorded.
- 5.49 Nathusius’ and serotine bats had the lowest pass rate, equating to a total of four and ten passes, respectively, over the whole survey period.
- 5.50 A total of 79 barbastelle passes were recorded. This species was recorded from all three automated detector locations, with the majority being recorded at L1 (46 passes).

- 5.51 The results from automated detector Location 3 indicate that bats make use of Sandy Lane. All of the species recorded at the wider Site were recorded at this location. This rural lane with hedgerows on both sides provides linking habitat between Kidlington and the Oxford Canal to the east of the Site with habitat within the Site (e.g., the double hedgerows associated with Yarnton Lane and potential roosting sites in the semi-detached houses on Sandy Lane itself) and with potential roosting sites associated with the trees and buildings of Yarnton to the west.
- 5.52 The highest level of bat activity was recorded between 41–60 minutes after sunset, which is when most foraging activity tends to take place. Four bat species were recorded within the 0–40 minute period after sunset: common pipistrelle, noctule, soprano pipistrelle, and Leisler's bat, which all typically emerge from their roosts shortly after dusk. This indicates that roosting sites for these species are present in the local area. Noctule activity continued from 20 minutes before sunrise until sunrise, which is further indication that this species is roosting on or in proximity to the Site.
- 5.53 Taken together, the results of the above bat surveys suggest that the Site provides roosting, foraging, and commuting habitat for a range of bat species, including foraging and commuting habitat for barbastelle which are relatively rare in central England.
- 5.54 These results are broadly similar to those obtained in the 2018 survey work, except that lesser horseshoe bat was not detected in the 2022 survey, whereas two passes of this species were recorded on Sandy Lane in 2018.

Table 14: Summary of automated bat detector survey data showing average pass rate for each month.

Species	April	May	Aug	June	July	Sept	Oct	Total
Common pipistrelle	200	496	771	534	2,257	349	61	4,668
Soprano pipistrelle	35	124	514	155	884	220	64	1,996
Noctule	26	228	266	446	712	203	18	1,899
Leisler's bat	20	102	2	89	185	1	-	399
<i>Myotis</i> species	7	11	47	23	158	81	22	349
Barbastelle bat	4	13	13	7	11	27	4	79
Long eared bat species		7	18	9	5	25	12	76
Noctule / Leisler's bat	-	-	4	3	-	9	-	16
Serotine	5	3	1	-	-	1	-	10
Nathusius' pipistrelle		-	-	2		2	-	4
Common / Soprano pipistrelle	-	-	-	-	-	-	3	3
Total	297	984	1,636	1,268	4,212	918	184	9,499

Table 15: Summary of automated bat detector survey data showing average pass rates for each detector location.

Species	L1	L2a	L2b	L3	Total
Common pipistrelle	917	1,029	1,378	1,344	4,668
Soprano pipistrelle	173	723	602	498	1,996
Noctule	871	286	368	374	1,899
Leisler's bat	121	17	96	165	399
<i>Myotis</i> sp.	90	179	34	46	349
Barbastelle bat	46	15	11	7	79
Brown long eared bat	38	14	13	11	76
Noctule / Leisler's bat	2	7	2	5	16
Serotine	-	4	1	5	10
Nathusius' pipistrelle	-	1	1	2	4
Common / Soprano pipistrelle	-	3	-	-	3
Total	2,258	2,278	2,506	2,457	9,499

Table 17: Dusk bat passes from automated bat detector surveys in relation to typical species emergence times (shown in orange). Dusk passes account for 7,803 of the total of 9,499 passes recorded.

Species	Time Period (minutes after sunset)								Total
	Sunset	0-20	21-40	41-60	61-80	81-100	101-120	Night period	
Common pipistrelle	1	29	597	769	433	347	296	1,416	3,888
Soprano pipistrelle		1	207	405	232	110	83	773	1,811
Noctule	50	152	386	292	144	48	45	239	1,356
<i>Myotis</i> species	-	-	-	2	13	8	9	289	321
Leisler's bat	-	3	51	52	51	30	5	57	249
Barbastelle bat	-	-	-		10	4	2	61	77
Long eared bat species	-	-	-	1	1	4	2	62	70
Noctule / Leisler's bat	-	-	3	3	2	1	1	6	16
Serotine	-		1	-	4	2	-	3	10
Common / Soprano pipistrelle	-	-	3	-	-	-	-	3	3
Nathusius' pipistrelle	-	-	1	-	-	-	-	1	2
Total	51	185	1,249	1,524	890	554	443	2,907	7,803

Table 18: Dawn bat passes from automated detector surveys. Dawn passes account for 1696 of the total of 9,499 passes that were recorded.

Species	Time Period (minutes before sunrise)						Total
	120-101	100-81	80-61	60-41	40-21	20-0	
Common pipistrelle	113	157	174	265	71	-	780
Noctule	5	6	18	172	324	18	543
Soprano pipistrelle	35	37	46	58	9	-	185
Leisler's bat	3	3	9	84	51	-	150
<i>Myotis</i> species	14	6	5	3	-	-	28
Long eared bat sp.	4	1	-	-	1	-	6
Barbastelle bat	2	-	-	-	-	-	2
Nathusius' pipistrelle	-	1	-	1	-	-	2
Total	176	211	252	583	456	18	1,696

Dormouse

- 5.55 No records of dormouse were obtained in the desk study within the last 10 years. Dormouse is a European Protected Species and a SPI.
- 5.56 Dormouse is thought to be under-recorded in Oxfordshire, and BSG has anecdotal evidence that this species is present close to Woodstock. Habitats suitable for this species, including woodland and hedgerows are present at the Site.
- 5.57 No evidence of dormouse was found during the 2022 survey, indicating that this species is likely to be absent from the areas of the Site proposed for development.
- 5.58 These results are similar to those obtained in the 2018 survey work, when a similar level of survey effort also found no evidence of this species at the Site.
- 5.59 Therefore, dormouse is considered likely to be absent from the Site.

Water Vole

- 5.60 The desk study yielded 15 records of water vole from the search area within the last 10 years. All of these were from the Oxford Canal. There were no records from within the Site, but three were from locations on the canal that are directly adjacent to the east of the Site.
- 5.61 There were no records of the invasive species American mink *Neovison vison*, which is a significant predator of water vole.
- 5.62 The Berkshire, Buckinghamshire and Oxfordshire Water Vole Recovery Project has conducted surveys for water vole on the Oxford Canal since 2003. Recent surveys have revealed sporadic presence of this species, but the 2021 survey showed no evidence of water voles at Kidlington. American mink are noted to continue to be present along the Oxford Canal. (BBOWT 2021).
- 5.63 This species and its burrows are protected under the Wildlife and Countryside Act 1981 (as amended), and it is a SPI.
- 5.64 The Oxford Canal clearly provides important habitat for this species. The Rowel brook is considered to provide sub-optimal habitat for water vole due to its relatively fast flow and generally shaded conditions and scarcity of suitable marginal food plants. Ditches at the Site also provide possible habitat for this species, but due to their seasonal nature and the lack of food plants, these are also considered to be sub-optimal.
- 5.65 The water vole surveys carried in 2022 out at the Site found no signs of this species.
- 5.66 Suitable habitats at the Site have good connectivity to the Oxford Canal, and water vole is likely to be present in the wider surrounding area.
- 5.67 These results differ to those obtained in the 2018 survey work, which reported signs of this species on the Rowel Brook. These included a latrine site with fresh droppings (present on both survey visits) at Pond P1, which is situated adjacent to Rowel Brook in the north of the Site. Water vole burrows were also found in the banks of Rowel Brook just west of pond P1.
- 5.68 The survey results indicate that this species is likely to be absent from the Site, but is could be present in the Oxford Canal adjacent to the east of the Site, and therefore has potential to recolonise the Rowel Brook within the Site.

□ □ □ □ r □

- 5.69 There were 98 records of otter (a European Protected Species and a SPI) from the desk study search area within the last 10 years. Almost all of the records are from the Oxford Canal (including many from the section directly adjacent to the Site). None of the records are from within the Site itself.
- 5.70 The Environment Agency (2010) otter survey has abundant records for this species from across the Thames catchment, including records from the River Cherwell (in whose catchment the Site lies). It describes this species as present throughout the Cherwell valley.
- 5.71 No otter signs were found within the Site during the surveys carried out in 2022. However, Rowel Brook (and its tributary) could support otters, as this species is clearly well established on the Oxford Canal, adjacent to the Site. It is possible that otters occasionally use Rowel Brook or ditches at the site, for example to disperse between the Oxford Canal and areas of suitable habitat to the west, such as lakes at Cassington Quarry (ca. 1.5 km to the south) or the River Glyme (ca. 2.5 km to the north-west).
- 5.72 These results are broadly similar to those obtained in the 2018 survey work.

□ □ □ □ r N □ □ □ □ □ □ M □ □ □ □ □ □ □

- 5.73 Records were obtained for two other notable mammal species in the desk study: hedgehog *Erinaceus europaeus*, and brown hare *Lepus europaeus*. These are both SPIs.
- 5.74 There were 289 records of hedgehog within the last 10 years. Most of these records were from Kidlington and Yarnton. There were two records from within the Site, on Sandy Lane. The hedgerows, woodland and scrub at the Site provide suitable shelter and habitat for this species, and areas of grassland provide suitable foraging habitat. Therefore, this species is assumed to be present within areas of suitable habitat at the Site, although the arable fields which dominate the west of the Site represent relatively poor habitat for hedgehog due to a lack of suitable cover.
- 5.75 There were 90 records of brown hare, from the last 10 years. None are from the Site itself. The majority were from Bladon Heath to the west of the Site. The open fields at the Site provide suitable habitat for this species, and several individuals were noted onsite during the 2022 breeding bird surveys.

□ □ rd □ □

- 5.76 The desk study returned 946 records of birds from the last ten years, including 19 species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Of these, the following have the potential to breed on or near the Site: red kite *Milvus milvus*, hobby *Falco Subbuteo*, peregrine *Falco peregrinus*, barn owl *Tyto alba*, kingfisher *Alcedo atthis*, and firecrest *Regulus ignicapilla*.
- 5.77 There were records of 19 SPIs, of which the following have potential to breed on or near the Site: bullfinch *Pyrrhula pyrrhula*, cuckoo *Cuculus canorus*, dunnoek *Prunus modularis*, grasshopper warbler *Locustella naevia*, grey partridge *Perdix perdix*, herring gull *Larus argentatus*, house sparrow *Passer domesticus*, lapwing *Vanellus vanellus*, linnnet *Carduelis cannabina*, skylark *Alauda arvensis*, song thrush *Turdus philomelos*, starling *Sturnus vulgaris*, yellow wagtail *Motacilla flava* and yellowhammer *Emberiza citrinella*.
- 5.78 There were records of a further eight species that are red-listed, of these greenfinch *Chloris chloris*, house martin *Delichon urbicum*, mistle thrush *Turdus viscivorus*, swift *Apus apus*, have potential to breed on or near the Site.

Wintering bird survey results

- 5.79 The grassland and arable areas of the Site were considered to have some potential to support wintering bird species, but only very limited use of the Site was noted during the wintering bird survey carried out in winter 2021/22 (i.e., fieldfare within grassland and gulls on arable land). The arable land at the Site is intensively farmed and sown to winter crops (so winter stubble is not present) and

is set within a wider area of mainly intensive arable land and developed land. It is not close to any important sites for wintering birds. Whilst there is some wetland habitat at Stratfield Brake, Kidlington, just east of the Oxford Canal (40 m east of the Site, and 0.8 km from parts of the Site proposed for development), the nearest significant wetlands are at Yarnton / Cassington Gravel Pits, ca. 1.6 km to the southwest, and adjacent damp grassland at Oxford Meadows SAC. The desk study included many records of wetland bird species at these two locations, but not from within or close to the Site itself.

5.80 The Phase 1 habitat survey and the assessment of buildings and trees for their bat potential indicated that there are no buildings or trees within the Site that have potential to support roosting or breeding barn owl. The open farmland at the Site provides suitable foraging habitat for this species, but its presence was not noted during the extensive suite of ecology surveys (including numerous visits at dusk and dawn) that were carried out in 2018 and 2022.

Breeding bird survey results

5.81 The Site itself supports a range of arable, grassland, woodland/scrub, and hedgerow habitats that provide suitable breeding habitat for various bird species. Results of the breeding bird characterisation survey are shown on Figures 9a-d. Territory numbers are listed in Table 19.

Table 19: Summarised breeding bird survey data from April-June 2022 survey visits.

Common Name	Latin Name	Category	Count
Blackbird	<i>Turdus merula</i>	Green	33
Blackcap	<i>Sylvia atricapilla</i>	Green	31
Blue Tit	<i>Cyanistes caeruleus</i>	Green	34
Carrion Crow	<i>Corvus corone</i>	Green	1
Chiffchaff	<i>Phylloscopus collybita</i>	Green	24
Collared Dove	<i>Streptopelia decaocto</i>	Green	3
Chaffinch	<i>Fringilla coelebs</i>	Green	6
Dunnock	<i>Prunella modularis</i>	Amber	40
Green Woodpecker	<i>Picus viridis</i>	Green	3
Goldcrest	<i>Regulus regulus</i>	Green	1
Goldfinch	<i>Carduelis carduelis</i>	Green	13
Greenfinch	<i>Chloris chloris</i>	Red	8
Great Spotted Woodpecker	<i>Dendrocopos major</i>	Green	2
Great Tit	<i>Parus major</i>	Green	22
House Sparrow	<i>Passer domesticus</i>	Red	6
Red Kite	<i>Milvus milvus</i>	Green	1
Linnet	<i>Linaria cannabina</i>	Red	1
Long-tailed Tit	<i>Aegithalos caudatus</i>	Green	8
Lesser Whitethroat	<i>Curruca curruca</i>	Green	2
Mistle Thrush	<i>Turdus viscivorus</i>	Red	1
Magpie	<i>Pica pica</i>	Green	2
Grey Partridge	<i>Perdix perdix</i>	Red	1
Robin	<i>Erithacus rubecula</i>	Green	64
Skylark	<i>Alauda arvensis</i>	Red	21
Barn Swallow	<i>Hirundo rustica</i>	Green	1
Song Thrush	<i>Turdus philomelos</i>	Amber	18
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	Amber	1
Treecreeper	<i>Certhia familiaris</i>	Green	1

5.92 eDNA Survey

In 2021, a total of six ponds were subject to eDNA survey. Pond P4 located at Begbroke Science Park was not surveyed as GCN had been recorded from this pond in 2018 and it was assumed to still be present there. All of the eDNA survey results from 2021 were negative (indicating the absence of GCN). Results are listed in Table 20. Pond locations are shown on Figure

Table 20: Results of 2021 eDNA survey for GCN.

Pond ID	eDNA Results
1	Negative
2	Negative
3	Negative
4	Not surveyed, previously positive
5	Negative
6	Negative
7	Not surveyed, pond no longer present
8	Negative
9	Not surveyed, poor habitat connectivity to site
10	Not surveyed, poor habitat connectivity to site
11	Not surveyed, no access
12	Not surveyed, no access
13	Not surveyed due to poor habitat connectivity to development areas within Site

5.93 Overnight Surveys

In 2022, overnight surveys for GCN were carried out of pond 4. The results of these surveys are provided in Table 21.

Table 21: Results of overnight GCN survey

Pond ID	Males						Total	GCN Present	Notes
	0	1	2	3	4	5			
4	0	0	1	1	3	0	3	Yes	30 smooth newt, 5 common toads. Abundant goldfish. 1 large carp. Large external filter (with UV unit) in operation.

In the overnight surveys, GCN was recorded from the single pond (P4) that was surveyed. The peak count was three adult GCN. Eggs of this species were found.

The peak count for pond 4 was three. This equates to a small population size class for this pond. Since this pond was the only pond that was found to contain GCN, the peak count (and population size class) for the Site as a whole is the same.

Terrestrial survey for GCN

A terrestrial survey for GCN was carried out in a part of the Site in proximity to ponds 11 and 12, because of the lack of access to survey these offsite ponds. This survey found no GCN, although common toad was recorded, indicating that the survey conditions and artificial refuges employed was suitable for detecting amphibians.

Overview of GCN Results

5.97 The results of the various GCN survey work carried out in 2021 and 2022 is consistent with the 2018 survey results, indicating that a small population of this species is present in the ornamental pond at Begbroke Science Park (pond 4), but that it is likely absent from other ponds at the Site. It is likely to be present in suitable terrestrial habitat in the vicinity of pond 4 but is likely absent from other parts of the Site.

Other amphibians

5.98 The desk study returned 26 records of smooth newt *Lissotriton vulgaris*, six records of palmate newt *Lissotriton helveticus*, 12 records of common frog *Rana temporaria*, and seven records of common toad *Bufo bufo* within the last 10 years. Of these, common toad is a SPI.

5.99 Common toad was found at the Site during the terrestrial survey for GCN and the reptile survey. The peak count of common toad at the Site was three. This species was also noted at Begbroke Science Park (in proximity to pond 4) during the bat emergence surveys carried out in 2022 (with a peak count of two individuals). Key areas of the Site for this species are the plantation woodland around Parker’s Farm, Field A in the north-east of the Site, Field E in the south of the Site (the locations of these fields are indicated in Figure 4) and Begbroke Science Park. Smooth newt and common toad were found in pond P4 during overnight surveys for GCN.

R

5.100 The desk study returned records of 21 reptiles from the last ten years, of the following species: slow-worm *Aguis fragilis*, grass snake *Natrix natrix*, and common lizard *Zootoca vivipara*. These species are protected under the Wildlife and countryside Act 1981 (as amended) and are SPIs. None of these records were from within the Site.

5.101 The large arable fields which dominate the Site provide poor habitat for reptiles. Hedgerows, scrub, woodland, riparian habitats, verges, and grassland provide more suitable habitat.

5.102 Results of the 2022 reptile survey are provided in Table 22 and shown on Figure 11. Three species of reptile were found to be present at the Site (slow-worm, grass snake, and common lizard).

Table 22: Results of reptile survey.

N	r			r
	r	r	rd	
1	-	-	-	-
2	2	-	1	2 x field vole, 2 x toad
3	17	1	1	-
4	7	-	-	4 x field vole
5	17	-	-	2 x toad, 1 x small mammal
6	9	-	-	-
7		--		Several field voles

5.103 Key areas of the Site for reptiles are the grassland Fields in the north-east of the Site, Parkers Farm to the east of the Science Park, and a triangular area of grassland and scrub in the south of the Site.

F

5.104 The desk study returned 15 records of three species of fish from the last ten years, all from the River Cherwell, located ca. 1.7 km east of the Site). Of these brown trout *Salmo trutta* is a SPI, bullhead

Cottus gobio is listed on Annex II of the European Habitats Directive, and barbel *Barbus barbus* receives some protection under the Habitats Regulations 2017. Rowel Brook has suitability to support bullhead, and a small specimen of this species was recorded there during the macroinvertebrate survey, but the stream is considered too shallow to support the other species.

5.105 Other widespread stream fish could be present, although stream is susceptible to summer drying (it was completely dry in September 2022).

Crayfish

5.106 There are no desk study records of that native white-clawed crayfish *Austropotamobius pallipes* from the search area within the last 10 years.

5.107 The crayfish survey carried out at the Site in 2017 found no evidence of white-clawed crayfish. One adult individual of the non-native invasive American signal crayfish *Pacifastacus leniusculus* was found during the torchlight survey (location indicated in Figure 8).

5.108 The absence of white-clawed crayfish in the 2017 survey, and the presence of signal crayfish means that the former is unlikely to be present at the Site. Since there was considered to be no realistic possibility for this situation to have changed since 2017, further survey for this species after 2017 was not considered necessary.

Stream Habitat

5.109 Stream habitat details and water chemistry measurements at each of the three sampling locations are provided in Tables 23 and 24, respectively. A total of 25 unique aquatic macroinvertebrate families were recorded from the sampling locations in 2022. The samples were generally dominated by freshwater shrimps (Gammaridae), caddisflies (Limnephilidae), hoglice (Asellidae) and true fly larvae (Diptera). A complete list of all the macroinvertebrate taxa recorded at each of the stream locations can be found in Appendix 9.

Table 23: Stream habitat details at sampling locations 1 to 3. For locations see Figure 8.

Location	1	2	3
Altitude (m)	1	1.5	1
Area (m ²)	0.04	0.08	NA
Area (m ²)	0.05	0.125	0.3
Area (m ²)	0.3	1.2	0.8
Area (m ²)	0.3	1.2	0.8
Adjacent land use	Arable	Scrub	Arable
Adjacent land use	Arable	Arable	Arable
Macroinvertebrates (Asellidae)	90	0	NA
Macroinvertebrates (Asellidae)	0	0	0
Flow	Run	Run	Run
Diversity	Extensive	Extensive	Extensive
Depth	Soft	Stable	Unstable
Flow	Moderate	Slight	NA
Flow	Slight	Clear	Moderate
Flow	Moderate	Moderate	Heavy
Fish	None	Low	None

Table 24: Stream water chemistry measurements at sampling locations 1 to 3.

Dissolved Solids (mg/L)	Major Ions (mg/L)	Total Dissolved Solids (mg/L)			Average (mg/L)
		Ca	Mg	Other	
688	775	688	775	NA	731.5
8.07	8.13	8.07	8.13	NA	8.1
347	389	347	389	NA	368
NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA

TDS: total dissolved solids; DO: dissolved oxygen.

WHPT scores

5.110 Whalley Hawkes, Paisley and Trigg (WHPT) metric scores (Whalley and Hawkes 1996, 1997) for Autumn 2022 and Summer 2022 were calculated from the family-level macroinvertebrate data and are summarised in Table 25.

Table 25: WHPT scores for summer and autumn 2022 at sampling locations 1 to 3.

Sampling Location	Metric	WHPT Score			Average
		Autumn	Summer	Other	
Location 1	N	11	13	NA	12
	A	4.809	4.846	NA	4.83
Location 2	N	16	15	10	13.67
	A	5.325	5.2	4.26	4.93

WHPT: Whalley, Hawkes, Paisley and Trigg metric score.
ASPT: Average (number of) species per taxon.

5.111 WHPT scores are highest in the samples taken from Sampling Locations 1 and 2, scoring over 4.8 in both autumn and summer. This indicates at these points in the Rowel Brook the water quality is good. Sampling location 3 had the lowest WHPT score, indicating water quality is fair in this location. In addition, the water chemistry measurements for locations 1 and 2 indicate the Rowel Brook and its tributary have moderate water quality.



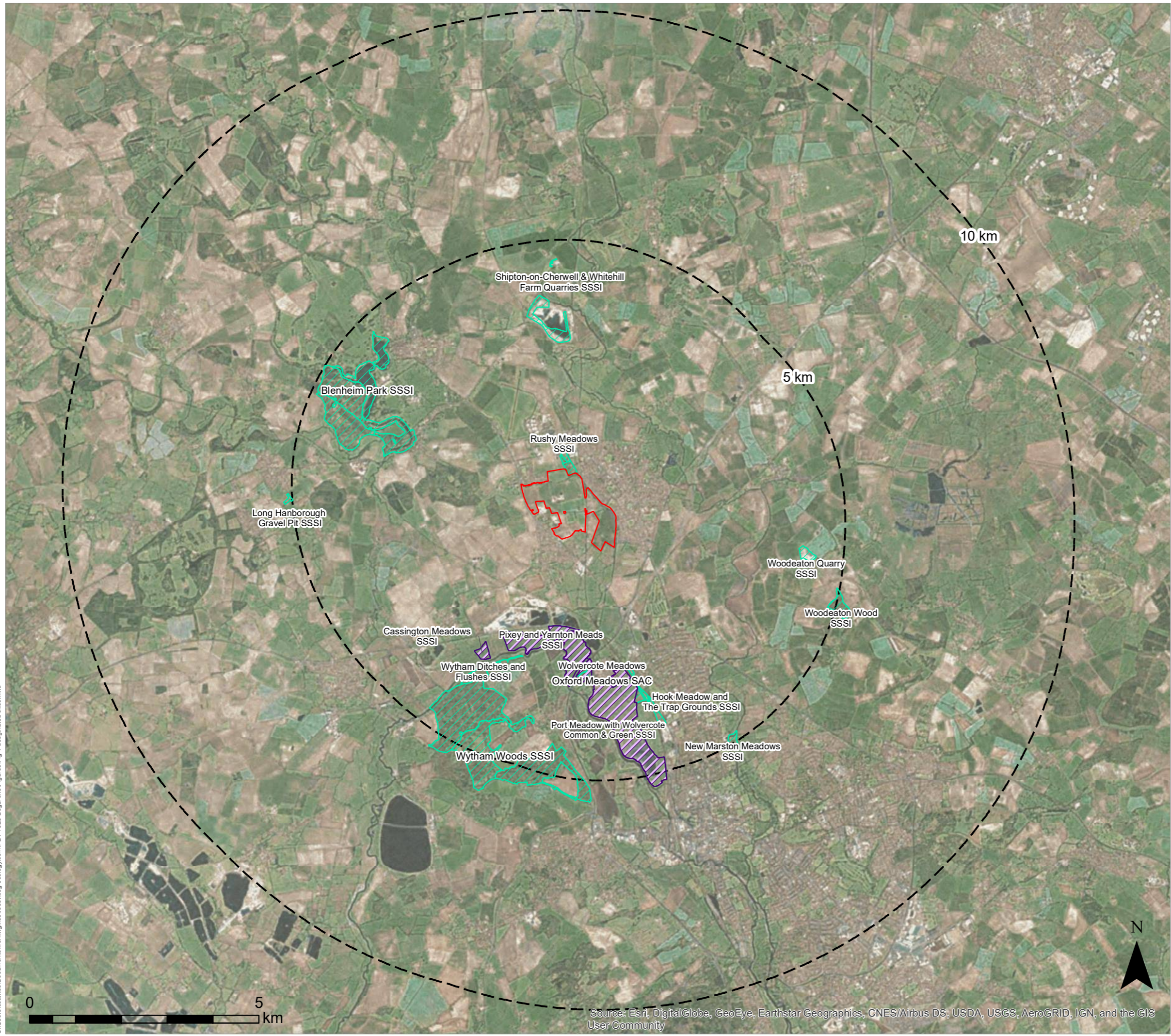
R

- Altringham, J. (2003). *British Bats*. Harper Collins Publishers. Applied Ecology Ltd (2010) *Ecological Assessment Survey, Begbroke Science Park Access Road, Oxfordshire*. Report to University of Oxford.
- ARG UK (2010). *ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index*. Amphibian and Reptile Groups of the United Kingdom.
- Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., Griffiths, RA., Foster, J., Wilkinson, J., Arnett, A., Williams, P., and Dunn, F. (2014). *Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA*. Freshwater Habitats Trust, Oxford.
- Bright, P.W, Morris, P.A. and Mitchell-Jones, T. (2006). *The Dormouse Conservation Handbook* Second Edition. English Nature, Peterborough.
- Dean M., Strachan R., Gow D., Andrews R. M., Mathews F., Chanin, P. R. F. (2016) *Water Vole Mitigation Handbook*. The Mammal Society, London.
- Defra (2007) *Hedgerow Survey Handbook*. Defra.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69285/pb11951-hedgerow-survey-handbook-070314.pdf [accessed 14/04/23].
- BBOWT (2021) *Oxford Canal Water Vole Project Update 2021*. BBOWT. [accessed 14/04/23].
- BRIG (2011) *UK Biodiversity Action Plan Priority Habitat Descriptions*. JNCC.
- BSG Ecology (2015) *Land around Begbroke Science Park: Biodiversity Survey*. Report to University of Oxford.
- BSG Ecology (2018a) *Begbroke Science Park Outline Planning Application: Ecology Report*. Report to Oxford University. Report to University of Oxford.
- BSG Ecology (2018b) *Begbroke Science Park Outline Planning Application: Great Crested Newt and Reptile Report*. Report to University of Oxford.
- Cherwell District Council (2020) *The Cherwell Local Plan 2011 – 2031 (Part 1) Partial review – Oxford’s Unmet Housing Need*. CDC.
<https://www.cherwell.gov.uk/download/downloads/id/9710/adopted-cherwell-local-plan-2011-2031-part-1-partial-review-web-reduced.pdf> [accessed 20/03/23].
- Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)*. The Bat Conservation Trust, London.
- Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. 2021. The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. *British Birds* 114: 723-747.
- Environment Agency (2010) *Fifth otter survey of England 2009–2010*. Environment Agency.
- Erskine S. EE., Killick J. J., Lambrick C. R., Lee E. M. (2018) *Oxfordshire’s Threatened Plants*. Pisces Publications.
- Falk S. J. (1991) *A Review of the Scarce and threatened Files of Great Britain*. Research & survey in nature conservation, No. 39. JNCC.





- Froglife (1999). Reptile Survey. *An introduction to planning, conducting and interpreting surveys for snake and lizard conservation*. Froglife Advice Sheet 10. Froglife, Halesworth.
- Harris, S., Cresswell, P. and Jeffries, D. (1989). *Surveying Badgers*. Occasional publication of Mammal Society, Number 9. Mammal Society.
- Harris, S., Jefferies, D., Cheeseman, C. and Booty, C. (1994). *Problems with badgers*. Royal Society for the Prevention of Cruelty to Animals, Horsham, West Sussex.
- JNCC (2016) *Phase 1 habitat survey: A technique for environmental audit*. JNCC.
- Kirby, P. (1992) A review of scarce and threatened Hemiptera of Great Britain. UK Nature Conservation, No. 2. JNCC.
- Natural England (2010) *Higher Level Stewardship: Farm Environment Plan (FEP) Manual*. Third Edition March 2010. Natural England.
- Natural England (2015a) *Hazel or common dormice: surveys and mitigation for development projects*. Natural England, Worcester. <https://www.gov.uk/guidance/hazel-or-common-dormice-surveys-and-mitigation-for-development-projects>
- Natural England (2015b) *Great crested newts: Surveys and mitigation for development projects*. Natural England. <https://www.gov.uk/guidance/great-crested-newts-surveys-and-mitigation-for-development-projects> [accessed 03/12/2018].
- Natural England (2015c) *Reptiles: survey and mitigation for development projects*. Natural England. <https://www.gov.uk/guidance/reptiles-protection-surveys-and-licences> [accessed 29/11/2018].
- Natural England (2022) Biodiversity Metric 3.1 – Habitat Condition Assessment Sheets with Instructions. Natural England. <http://publications.naturalengland.org.uk/file/5631620555210752> [accessed 20/03/23].
- Neal, E., and Cheeseman, C.L. (1996). *Badgers*. T & AD Poyser Natural History Ltd, London.
- Oldham, R.S., Keeble, J., Swan, M.J.S. and Jeffcote, M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). *Herpetological Journal* 10 (4): 143-155.
- Oxfordshire Flora Group (2015). *Oxfordshire Rare Plant Register*. ANHSO.
- Rodwell, J.S. et al. (1992). *British Plant Communities Volume 3: Grasslands and montane communities*. Joint Nature Conservation Committee, Peterborough.
- Stewart A., Pearman D. A., Preston C. D. (1994) *Scarce Plants in Britain*. JNCC.
- Stroh P. A., Leach S. J., August T. A., Walker K. J., Pearman D. A., Rumsey F. J., Harrower C. A., Fay M. F., Martin J. P., Pankhurst, C. D., Preston C. D., Taylor, I. (2014) *A Vascular Plant Red List for England*. BSBI.
- Stroh P.A., Walker K. J., Humphry T. A., Prescott O. L., Burkmar R. J. (2020) *Plant Atlas 2020*. Princeton.
- TVERC & BMERC (2009) *Criteria for the Selection of Local Wildlife Sites in Berkshire, Buckinghamshire and Oxfordshire*. TVERC.
- Walley, W.J. & H.A. Hawkes (1996) A computer-based reappraisal of the Biological Monitoring Working Party scores using data from the 1990 river quality survey of England and Wales. *Water Research* 30 (9): 2086-2094.
- Walley, W.J. & H.A. Hawkes (1997) A computer-based reappraisal of the Biological Monitoring Working Party score system incorporating abundance rating, site type and indicator value. *Water Research* 31 (2): 201-210.

WFD UKTAG (2014) *UKTAG River Assessment Method for Benthic Invertebrate Fauna: Invertebrates (General Degradation) Whalley, Hawkes, Paisley and Trigg (WHPT) Metric in River Invertebrate Classification Tool (RICT)*. WFD UKTAG, Stirling.

□□ **F**□□□r□□□□



LEGEND

-  Site boundary
-  5/10 km buffer around site
-  Sites of Special Scientific Interest (SSSI) within 5 km
-  Special Areas of Conservation (SAC) within 10 km

BSG | ecology

OFFICE: Oxford
T: 01865 883833
JOB REF: P21-1029

PROJECT TITLE
BEBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 1: Site Location and Statutory Designated Sites

DATE: 09.11.2022 CHECKED: KH SCALE: 1:80,000
DRAWN: CS APPROVED: TF VERSION: 1.0

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing. All dimensions are to be checked on site. Area measurements for indicative purposes only.

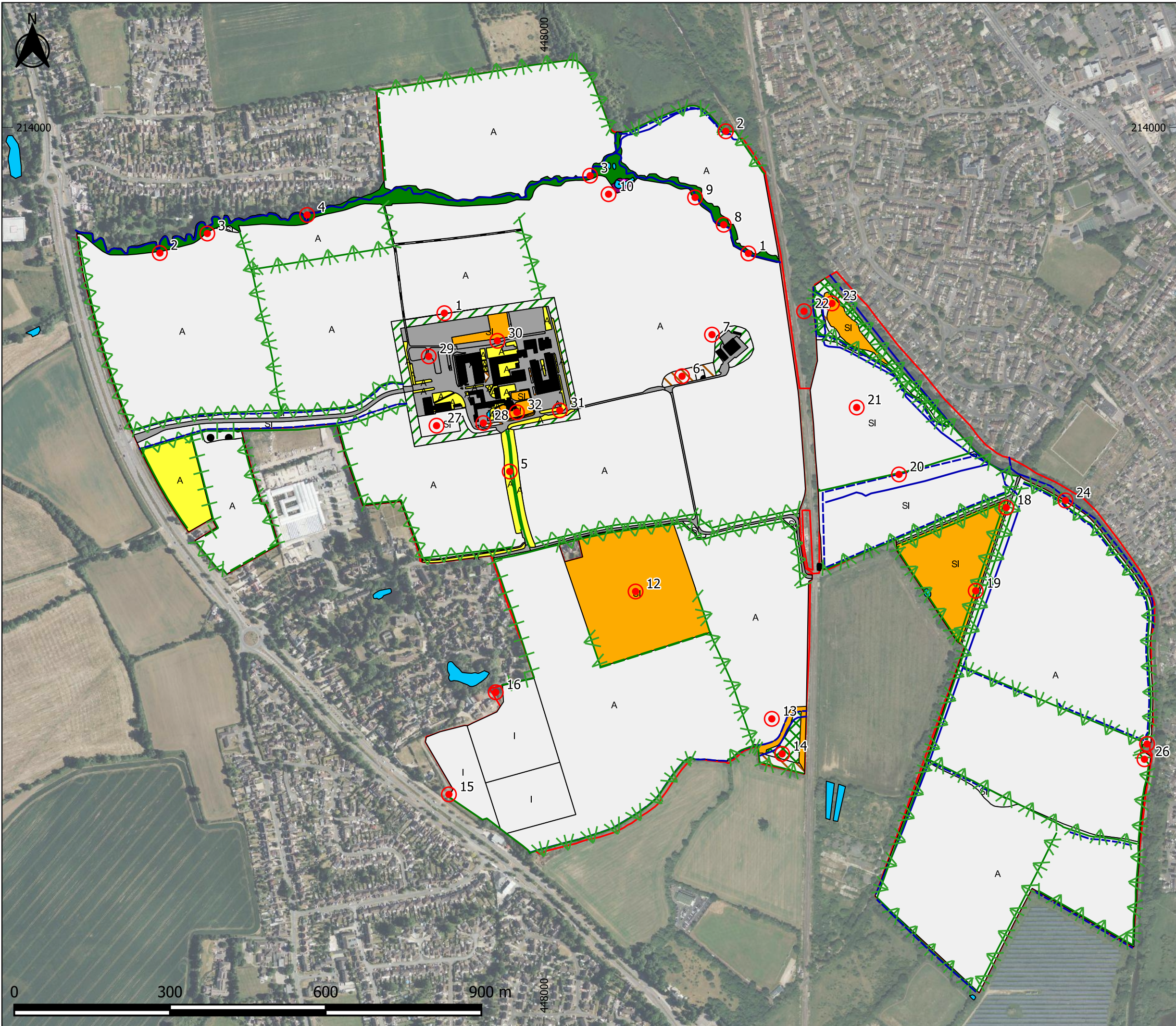
This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri

Sources: BSG Ecology survey data
© Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right 2018.

C:\Users\casantos\Documents\workingfiles\roost\bag-ecology.com\P21-1029 Begbroke\Figures\Fig 1 designated sites.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



- Legend
- Target note
 - ▲ Intact hedge - native species-rich
 - Intact hedge - species-poor
 - - - Defunct hedge - species-poor
 - ▲ Hedge with trees - native species-rich
 - Hedge with trees - species-poor
 - - - Dry ditch
 - Running water
 - Broadleaved woodland - semi-natural
 - ▨ Broadleaved woodland - plantation
 - ▩ Scrub - dense/continuous
 - Neutral grassland - semi-improved
 - Improved grassland
 - Poor semi-improved grassland
 - ▨ Other tall herb and fern - ruderal
 - Fen
 - Standing water
 - Cultivated/disturbed land - arable
 - Cultivated/disturbed land - amenity grassland
 - ▨ Introduced shrub
 - Built up areas inc. hardstanding
 - Buildings
 - Bare ground
 - Site boundary

BSG | ecology

OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
BEBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
Figure 2: Phase 1 Habitat Survey

DATE: 23/06/2023 CHECKED: TF SCALE: 1:7,000
 DRAWN: CS APPROVED: JMG VERSION: 1.2

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of His Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data

Graphics Ref. No.: 03497



- Legend
- Line of Trees (Ecologically Valuable) - with Bank or Ditch (w1g6NE1), Important
 - Native Hedgerow (h2NE5), Not important
 - Native Hedgerow - Associated with bank or ditch (h2NE9), Not important
 - Native Hedgerow with trees (h2NE4), Not important
 - Native Species Rich Hedgerow (h2NE2), Important
 - Native Species Rich Hedgerow - Associated with bank or ditch (h2NE7), Important
 - Native Species Rich Hedgerow with trees (h2NE1), Important
 - Native Species Rich Hedgerow with trees - Associated with bank or ditch (h2NE6), Important
 - Site boundary

Condition:
 P - Poor
 M - Moderate
 G - Good



OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
 BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
 Figure 3: Hedgerow survey

DATE: 12/05/2023 CHECKED: KH SCALE: 1:7,111
 DRAWN: MSG APPROVED: TF VERSION: 1.1

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data

Graphics Ref. No.: 03501



- Legend
- Site Boundary
 - Site boundary
 - Field subject to botanical survey
 - Habitat detail
 - Mixed scrub
 - Modified grassland
 - Other neutral grassland
 - Ruderal/Ephemeral
 - Location of red list arable weeds
 - Corn marigold
 - Common Cudweed
 - Moderate
 - Poor

BSG | ecology

OFFICE: OXFORD
T: 01865 883833
JOB REF: P21-1029

PROJECT TITLE
BEBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
Figure 4: Botanical survey

DATE: 11/01/2023 CHECKED: KH SCALE: 1:10,500
DRAWN: EW APPROVED: TF VERSION: 1.0

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

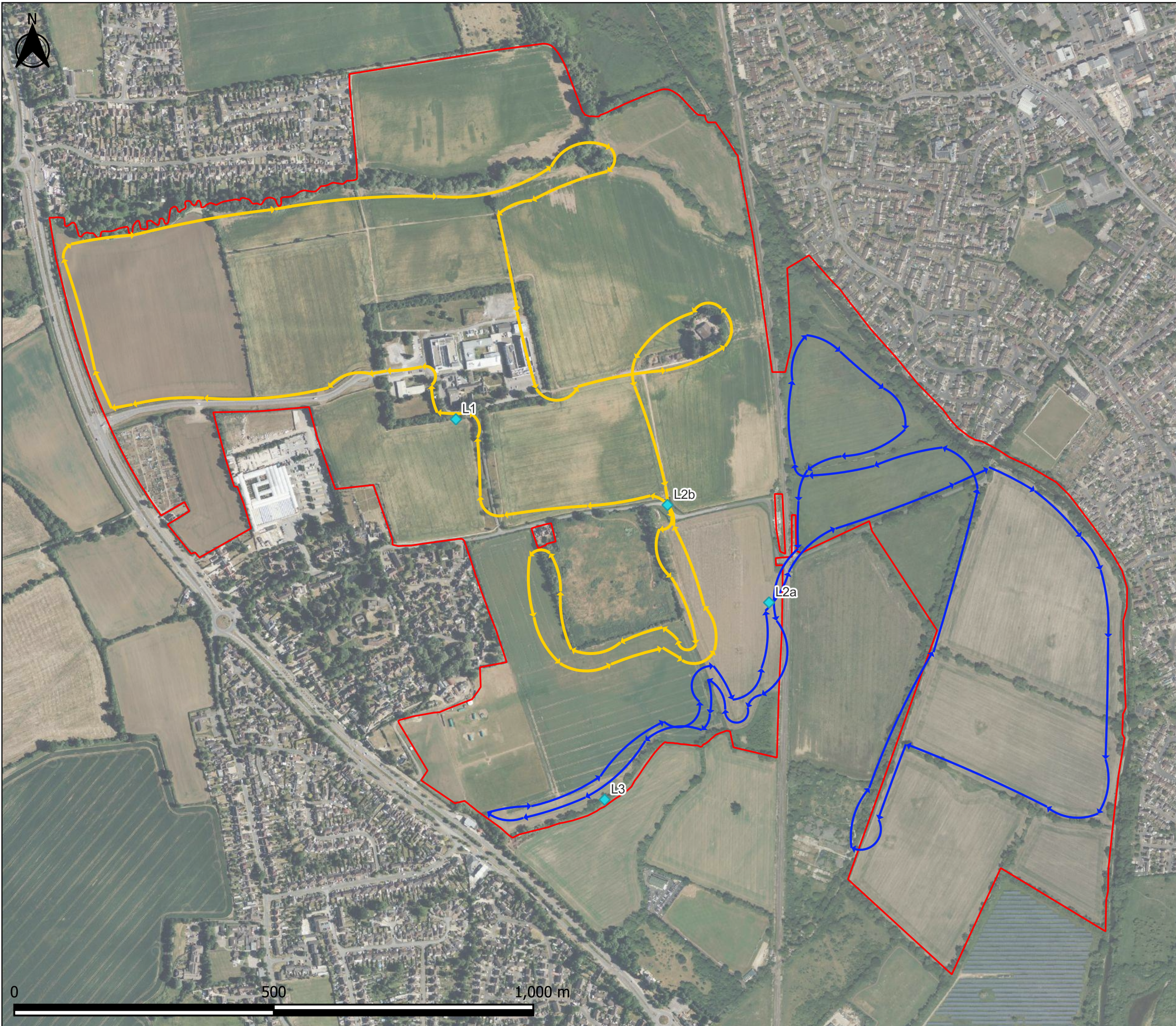
This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing, Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data

Graphics Ref. No.: 02-451



- Legend
- Site boundary
 - ◆ Static Detector
 - Transect route walked
 - Transect 1
 - Transect 2

BSG | ecology

OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
 BEGBROKE PR8, ECOLOGY SURVEY AND

DRAWING TITLE
 Figure 6a: Bat Activity Survey Methods

DATE: 16/02/2023 CHECKED: KH SCALE: 1:7,000
 DRAWN: CS APPROVED: TF VERSION: 1.2

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing, Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data



Graphics Ref. No.: 02777



Legend

Site boundary

Suitability of tree to support roosting bats

● High

● Medium

● Low



OFFICE: OXFORD
T: 01865 883833

JOB REF: P21-1029

PROJECT TITLE
BEBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
Figure 6b: Tree Assessment for Bats

DATE: 23/06/2023 CHECKED: TF SCALE: 1:7,000
DRAWN: CS APPROVED: JMG VERSION: 1.3

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data



- Legend
- Site boundary
 - Building
 - Suitability of building to support roosting bats
 - Moderate
 - Negligible
 - Surveyor position

Inset i: Zone A



OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
 BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
 Figure 6ci: Building Assessment for Bats

DATE: 12/05/2023 CHECKED: KH SCALE: 1:6,800
 DRAWN: MSG APPROVED: TF VERSION: 1.2

Copyright © BSG Ecology

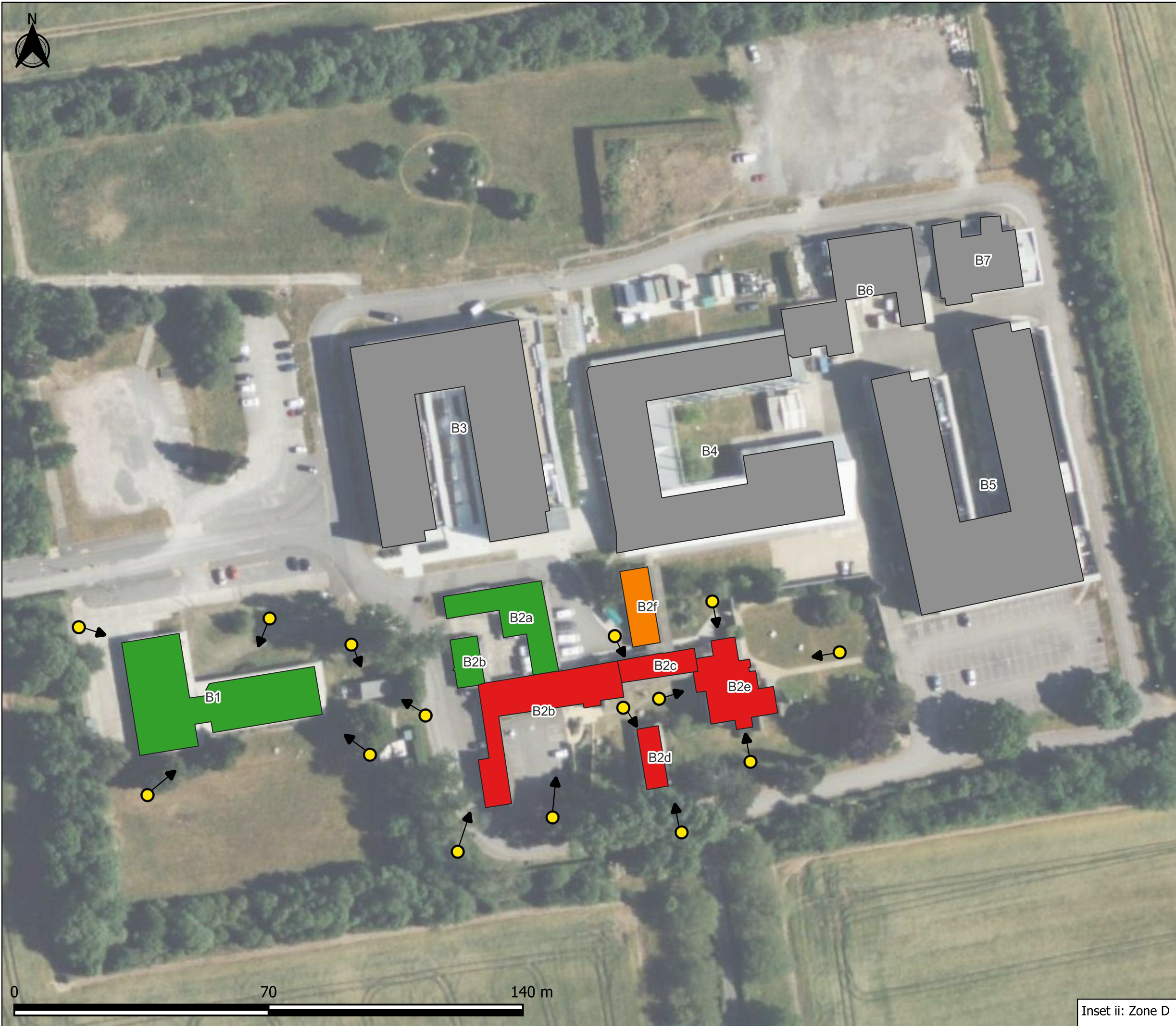
No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data



Legend

- Site boundary
- Suitability of building to support roosting bats
- High
- Moderate
- Low
- Negligible
- Surveyor location and direction of view



OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
 BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
 Figure 6cii: Building Assessment for Bats (Begbroke Science Park)

DATE: 23/06/2023 CHECKED: TF SCALE: 1:1,000
 DRAWN: CS APPROVED: JMG VERSION: 1.3

Copyright © BSG Ecology

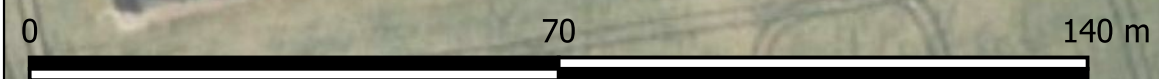
No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

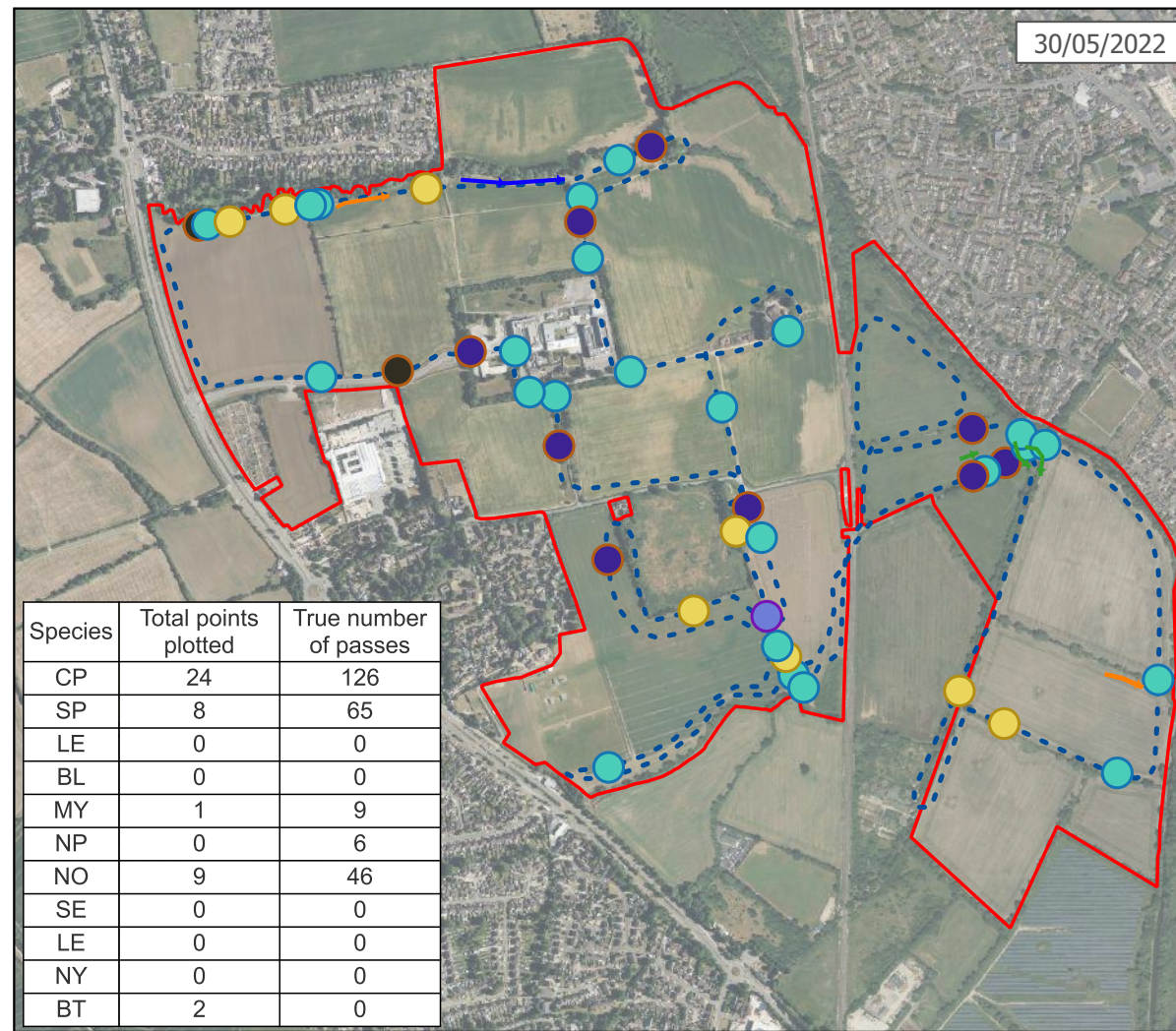
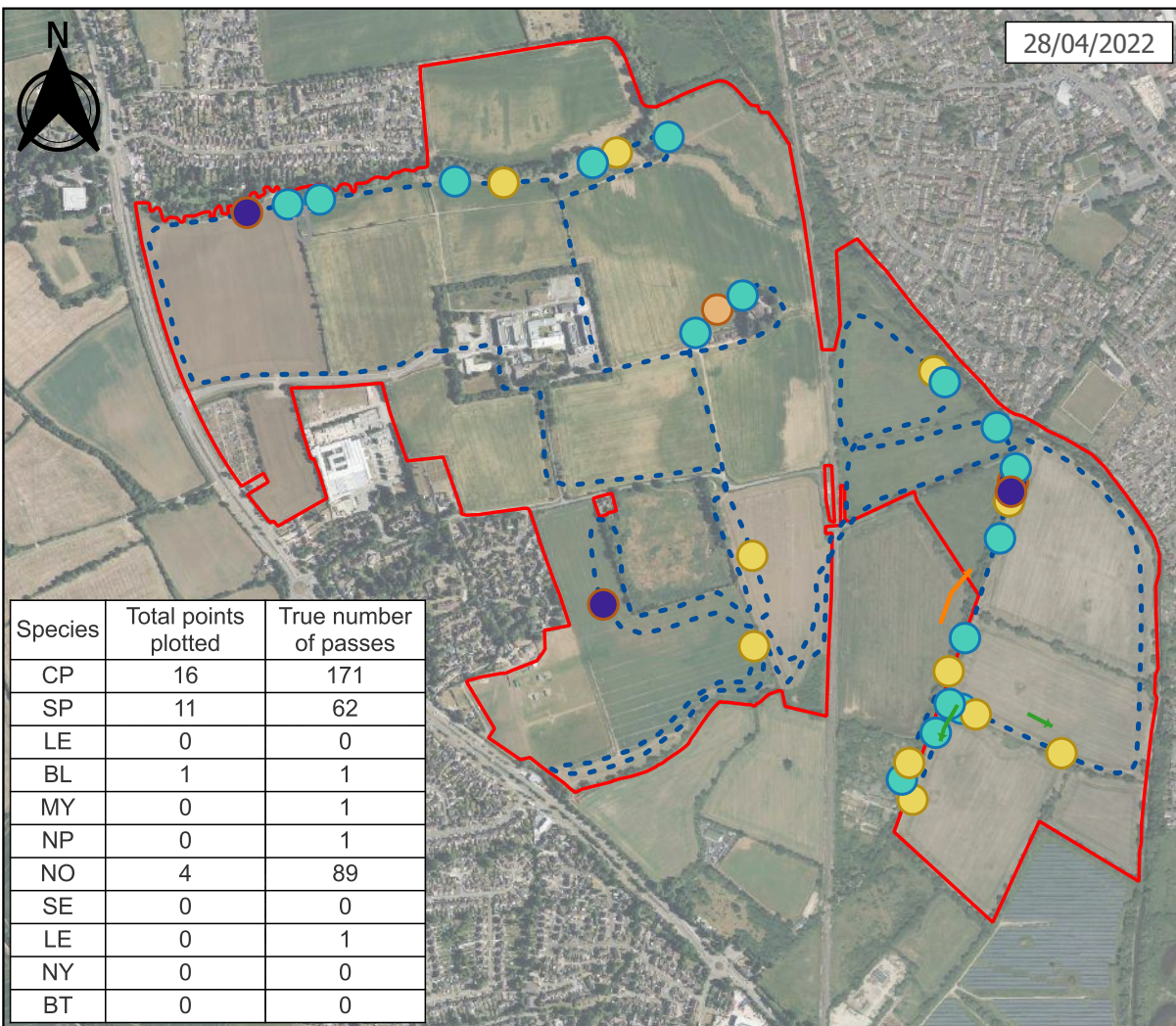
Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data



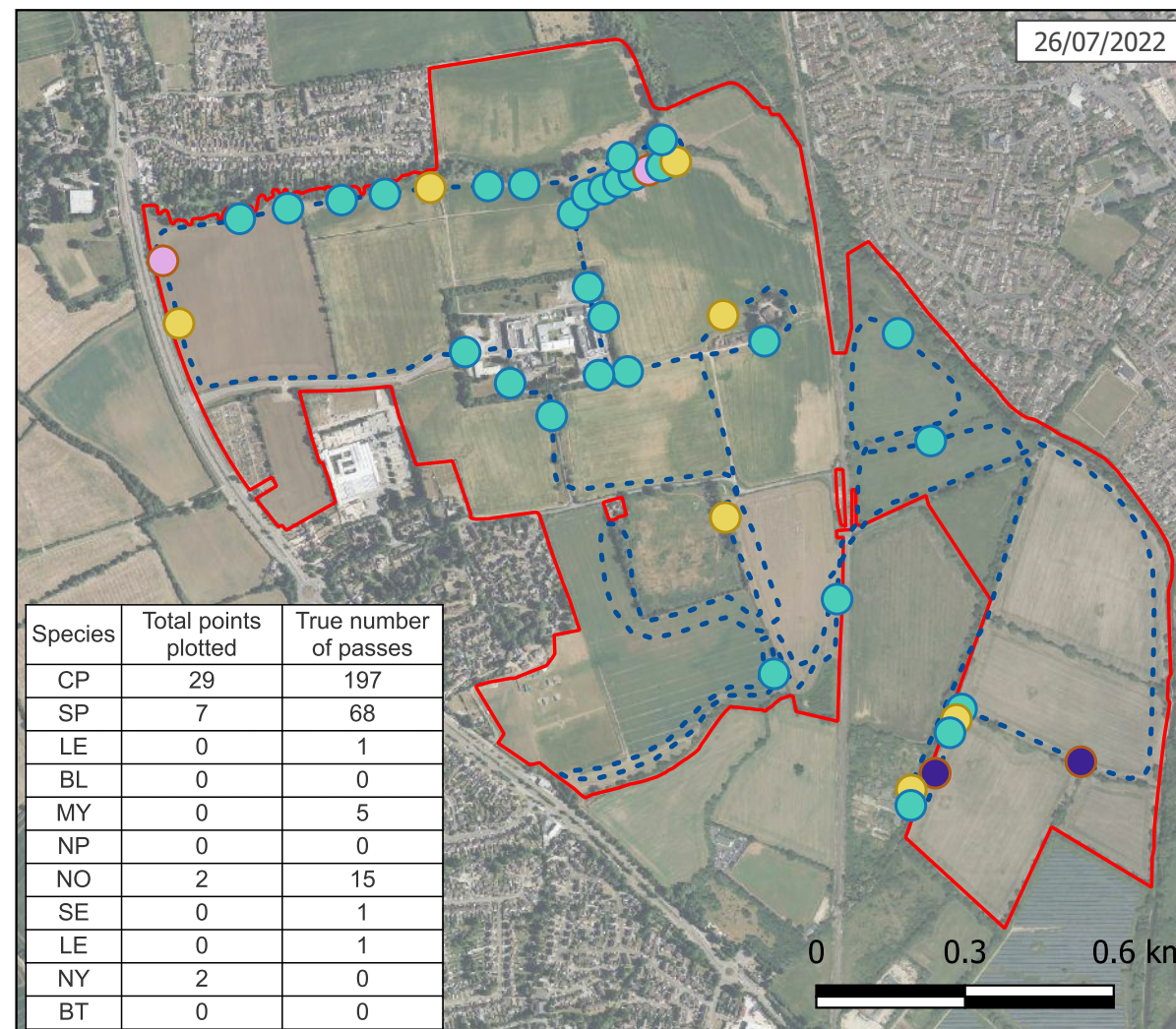
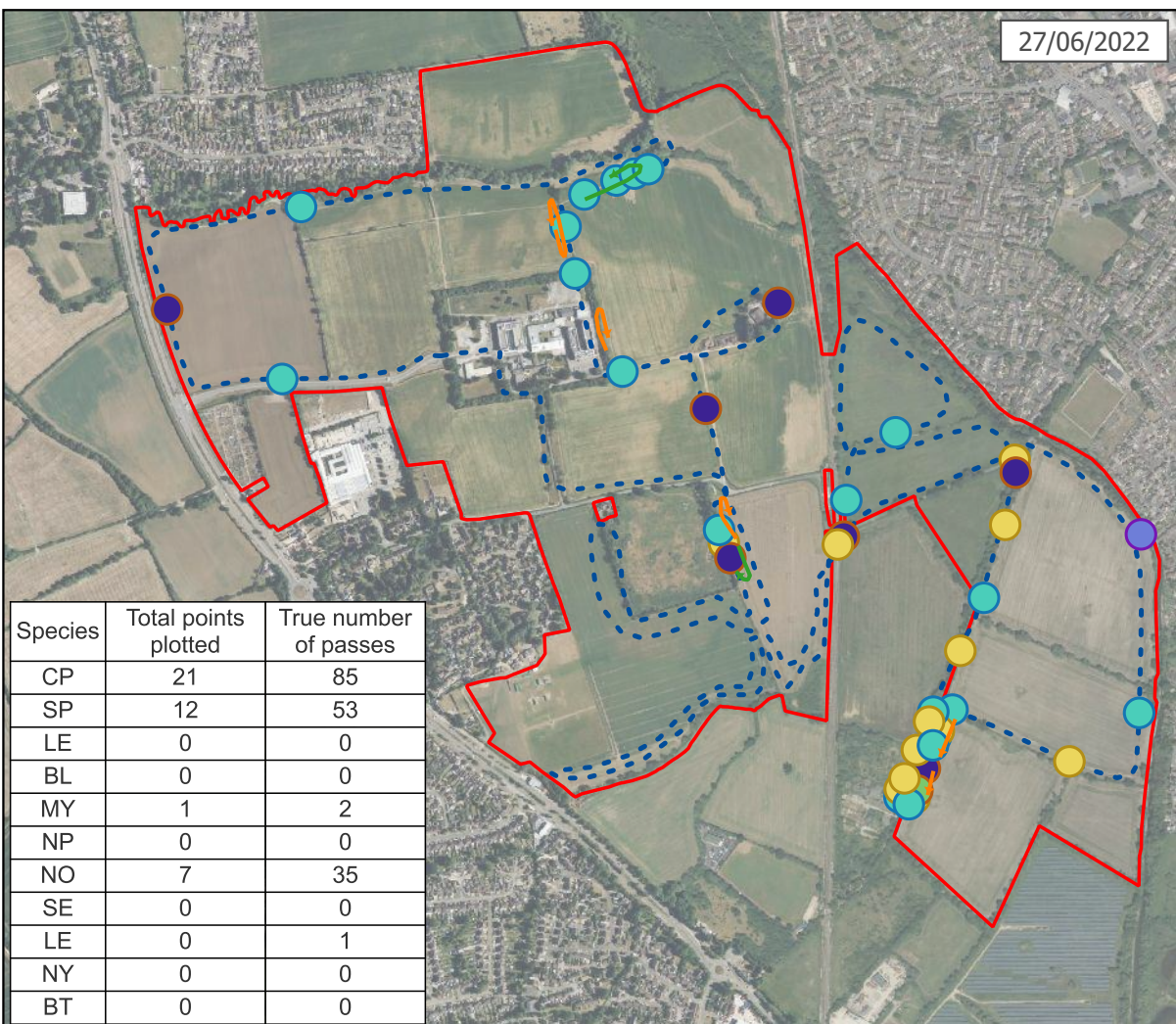
Inset ii: Zone D

Graphics Ref. No.: 03500



- Legend
- Site boundary
 - Survey transect
 - Brown long-eared bat
 - Common pipistrelle bat
 - Myotis Bat
 - Noctule bat
 - Nyctalus bat
 - Common or Soprano pipistrelle
 - Soprano pipistrelle bat
 - Unidentified Bat
 - Flight
 - Foraging flight
 - Commuting flight
 - Unknown

Code	Species
CP	Common pipistrelle
SP	Soprano pipistrelle
LE	Leisler's bat
BL	Brown long eared bat
MY	Myotis sp.
NP	Nathusius' pipistrelle
NO	Noctule
SE	Serotine
LE	Noctule / Leisler's bat
NY	Nyctalus
BT	Unidentified



BSG | ecology

OFFICE: OXFORD
T: 01865 883833

JOB REF: P21-1029

PROJECT TITLE
BEBBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
Figure 6d: Bat Survey Transect 2022: April - July (Map 1 of 2)

DATE: 15/02/2023 CHECKED: KH SCALE: 1:
DRAWN: CS APPROVED: TF VERSION:1.2

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

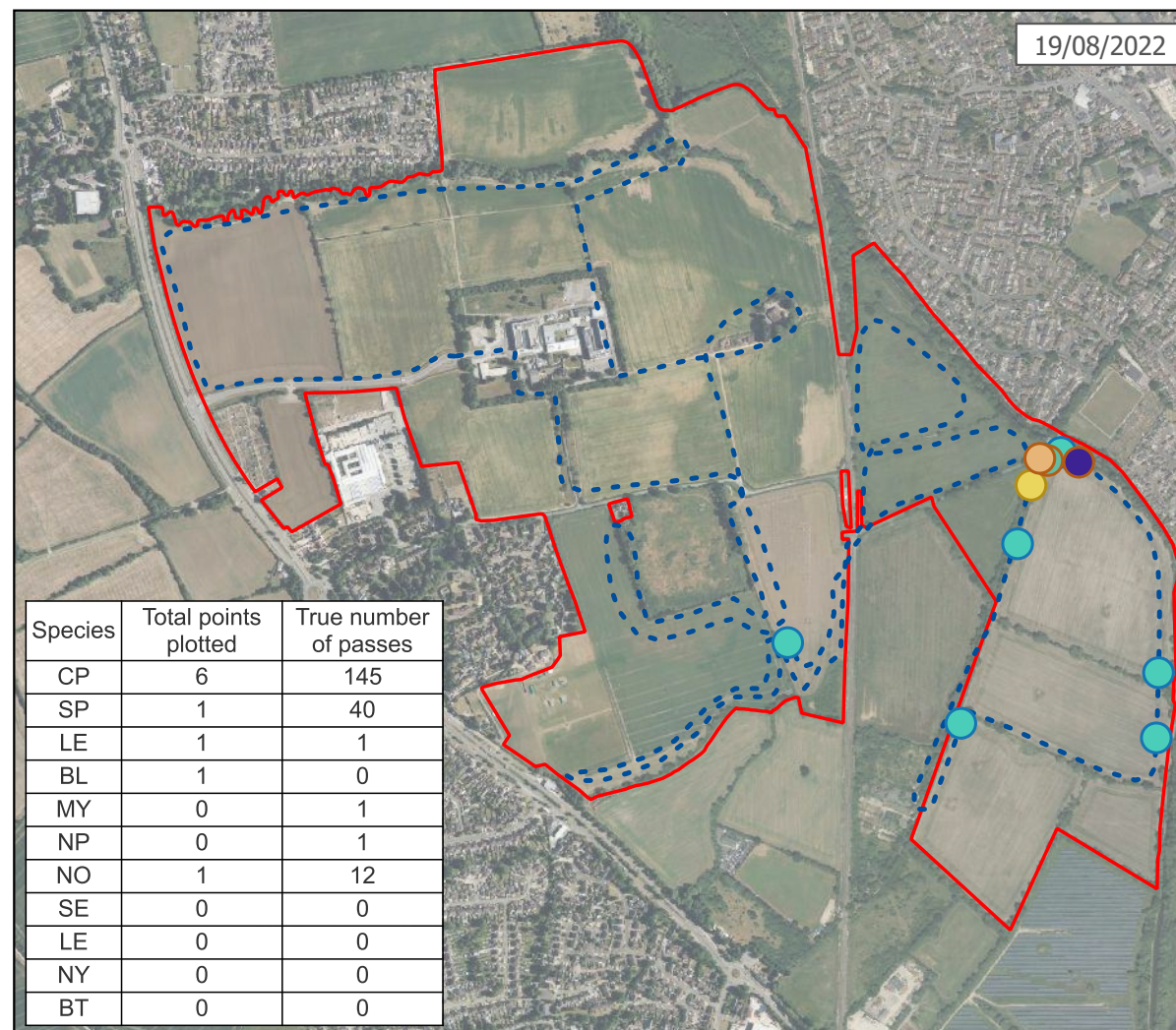
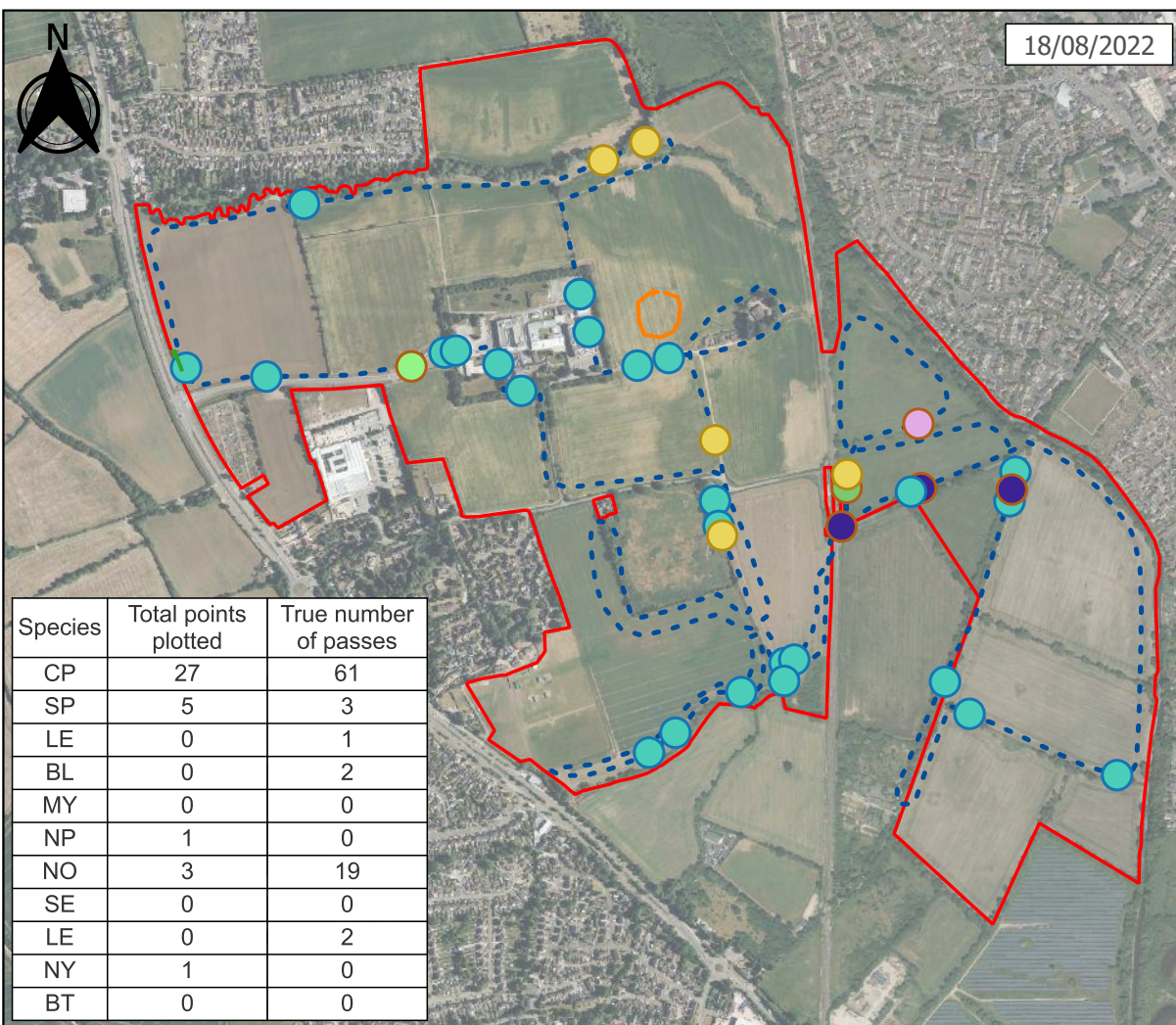
This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing, Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data

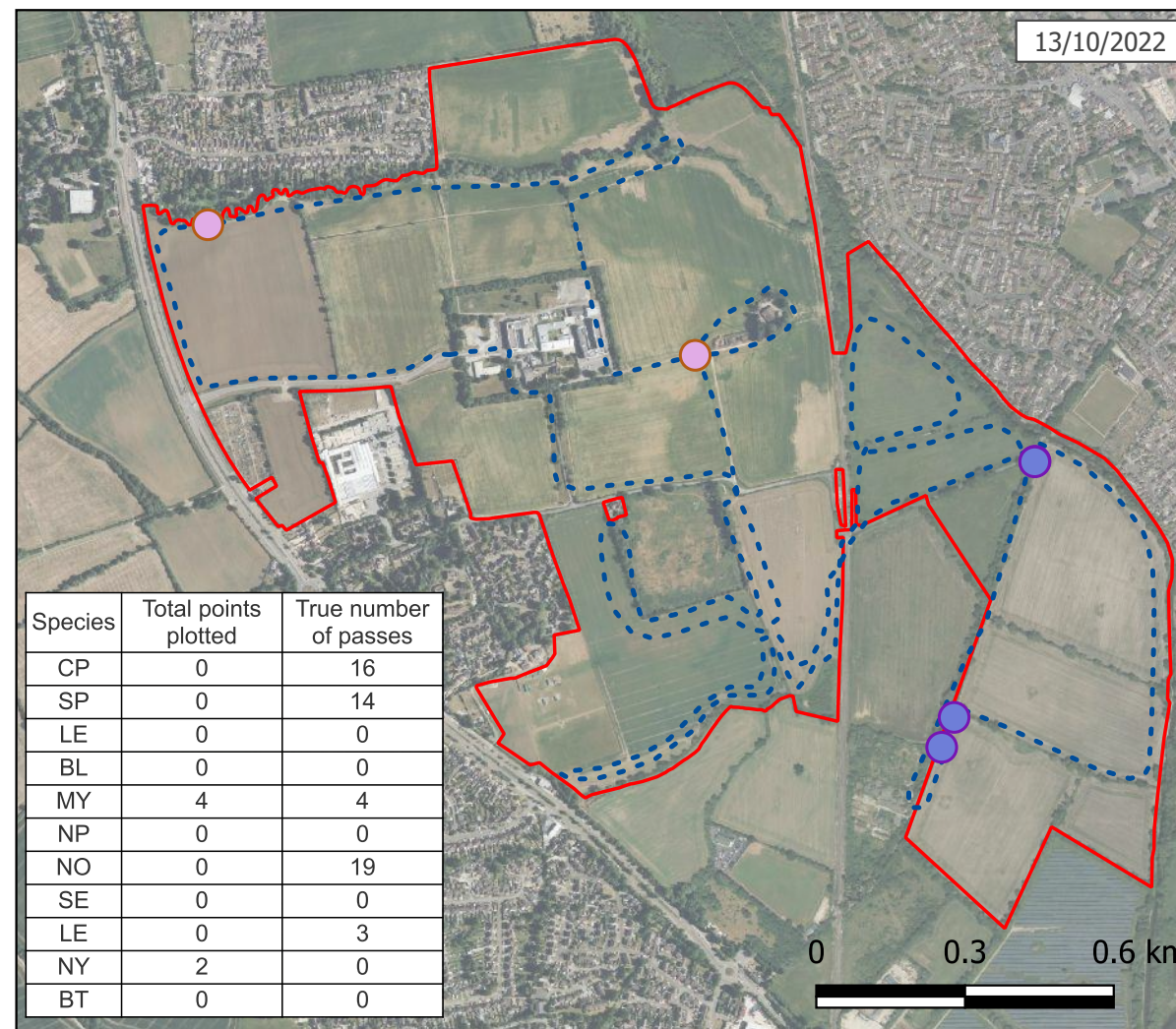
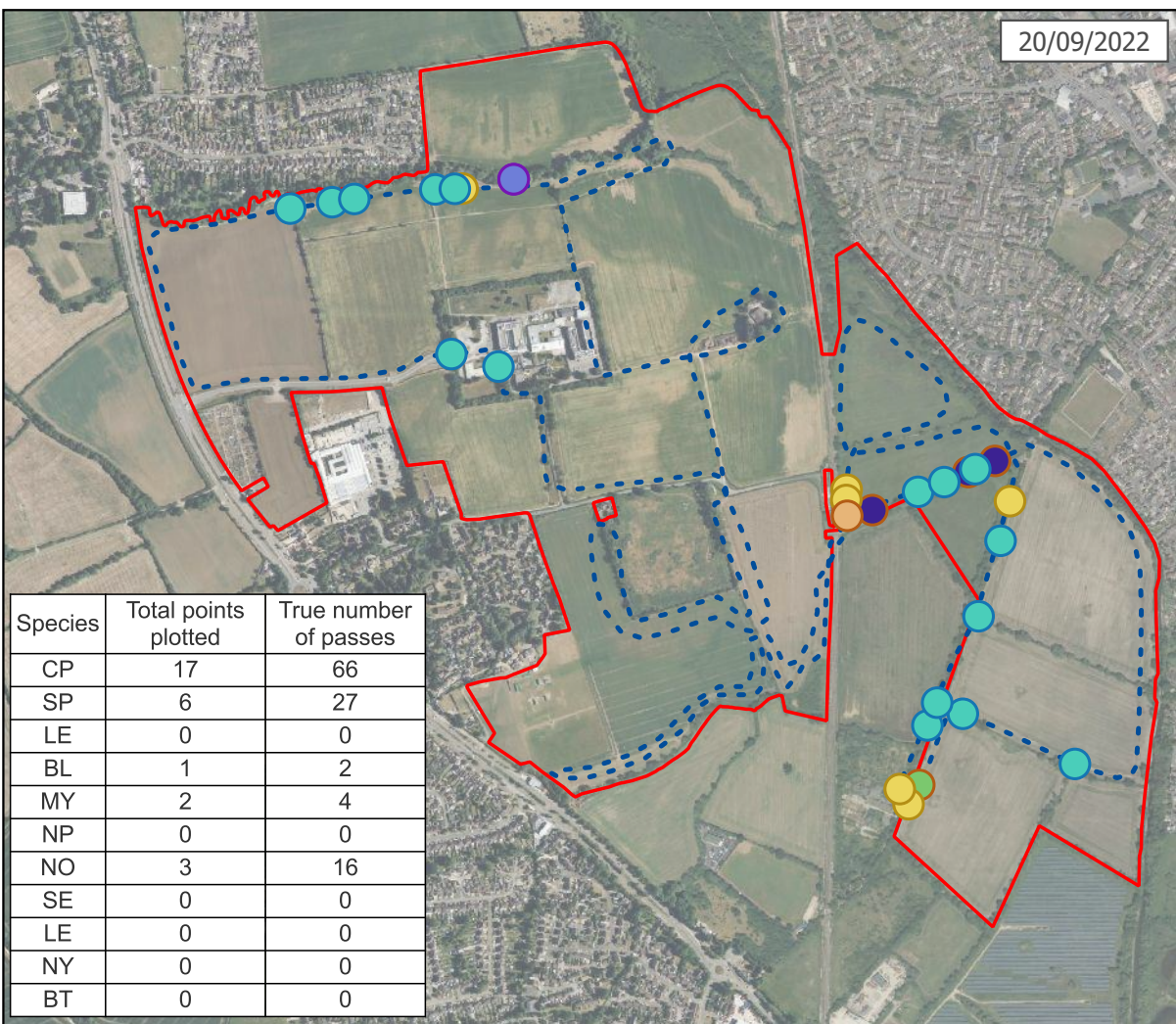
Graphics Ref. No.: 02767



Legend

- Site boundary
- Survey transect
- Brown long-eared bat
- Common pipistrelle bat
- Leisler's bat
- Myotis Bat
- Noctule bat
- Nathusius' pipistrelle bat
- Nyctalus bat
- Common or Soprano pipistrelle
- Soprano pipistrelle bat
- Foraging flight
- Commuting flight

Code	Species
CP	Common pipistrelle
SP	Soprano pipistrelle
LE	Leisler's bat
BL	Brown long eared bat
MY	Myotis sp.
NP	Nathusius' pipistrelle
NO	Noctule
SE	Serotine
LE	Noctule / Leisler's bat
NY	Nyctalus
BT	Unidentified



BSG | ecology

OFFICE: OXFORD
T: 01865 883833

JOB REF: P21-1029

PROJECT TITLE
BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
Figure 6e: Bat Survey Transect 2022: August - October (Map 2 of 2)

DATE: 15/02/2023 CHECKED: KH SCALE: 1:
DRAWN: CS APPROVED: TF VERSION: 1.2

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing, Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data

Graphics Ref. No.: 02768



- Legend
- Site boundary
 - Line of Dormouse nest tubes
 - Area of Dormouse nest tubes
 - 5 Number of tubes in survey line/area

BSG | ecology

OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
 BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
 Figure 7: Dormouse survey

DATE: 11/01/2023 CHECKED: KH SCALE: 1:7,000
 DRAWN: EW APPROVED: TF VERSION: 1.0

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing, Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data

Graphics Ref. No.: 02-452



- Legend
- Aquatic invertebrate sample locations
 - - - Watercourses surveyed for otter and water vole
 - Site boundary



OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

BEBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
 Figure 8: Watercourse survey

DATE: 12/05/2023 CHECKED: KH SCALE: 1:7,000
 DRAWN: MSG APPROVED: TF VERSION: 1.2

Copyright © BSG Ecology

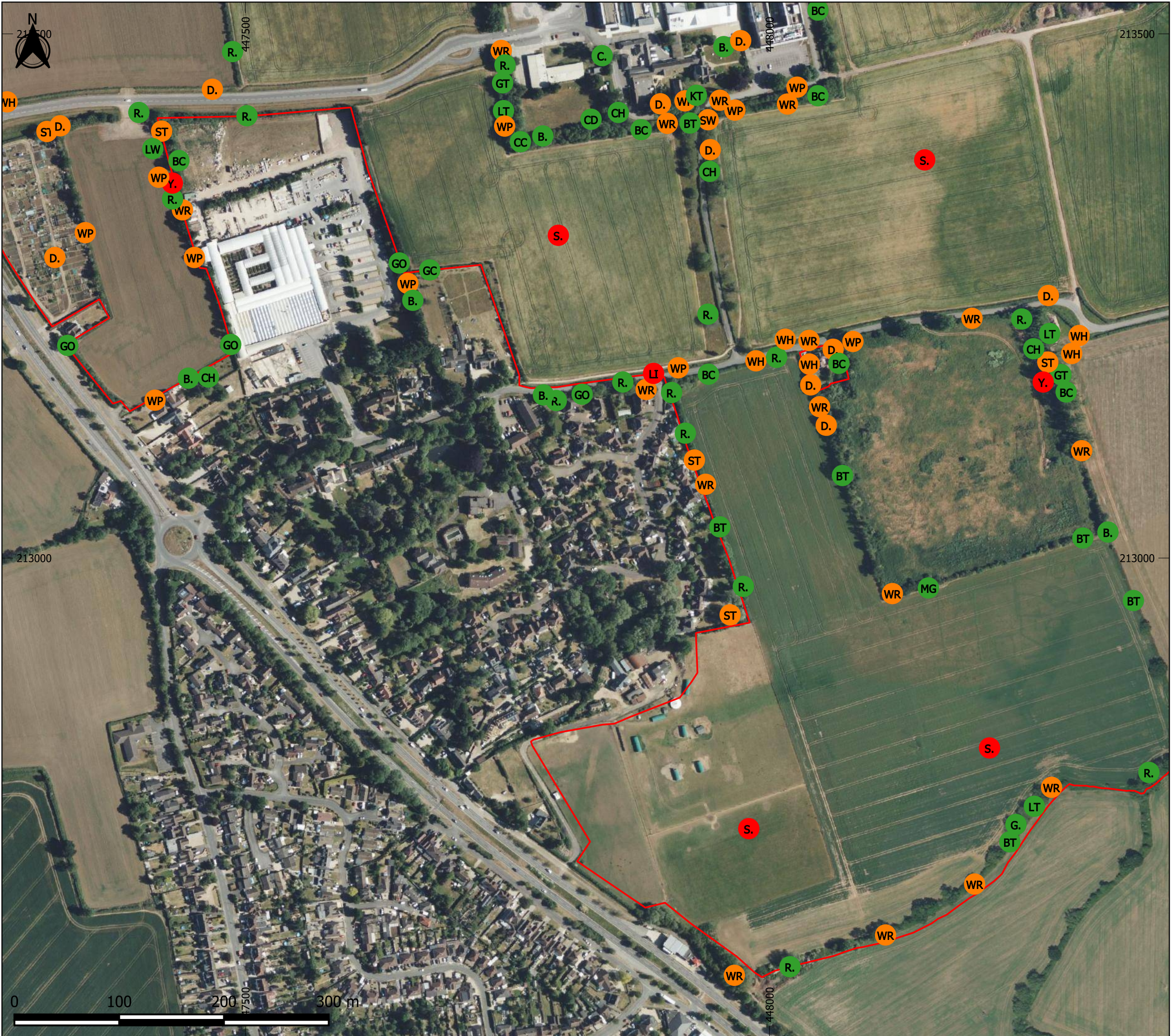
No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data



Legend

BoCC status

- Red
- Amber
- Green
- Site boundary

BTO Code	Species
B.	Blackbird
BC	Blackcap
BH	Black-headed Gull
BT	Blue Tit
BZ	Buzzard
C.	Carrion Crow
CD	Collared Dove
CH	Chaffinch
D.	Dunnock
G.	Green Woodpecker
GC	Goldcrest
GS	Great Spotted Woodpecker
GT	Great Tit
HM	House Martin
HS	House Sparrow
JD	Jackdaw
KT	Red Kite
LT	Long-tailed Tit
MA	Mallard
MG	Magpie
R.	Robin
S.	Skylark
ST	Song Thrush
SW	Sedge Warbler
WH	Whitethroat
WP	Woodpigeon
WR	Wren
WT	Willow Tit
Y.	Yellowhammer



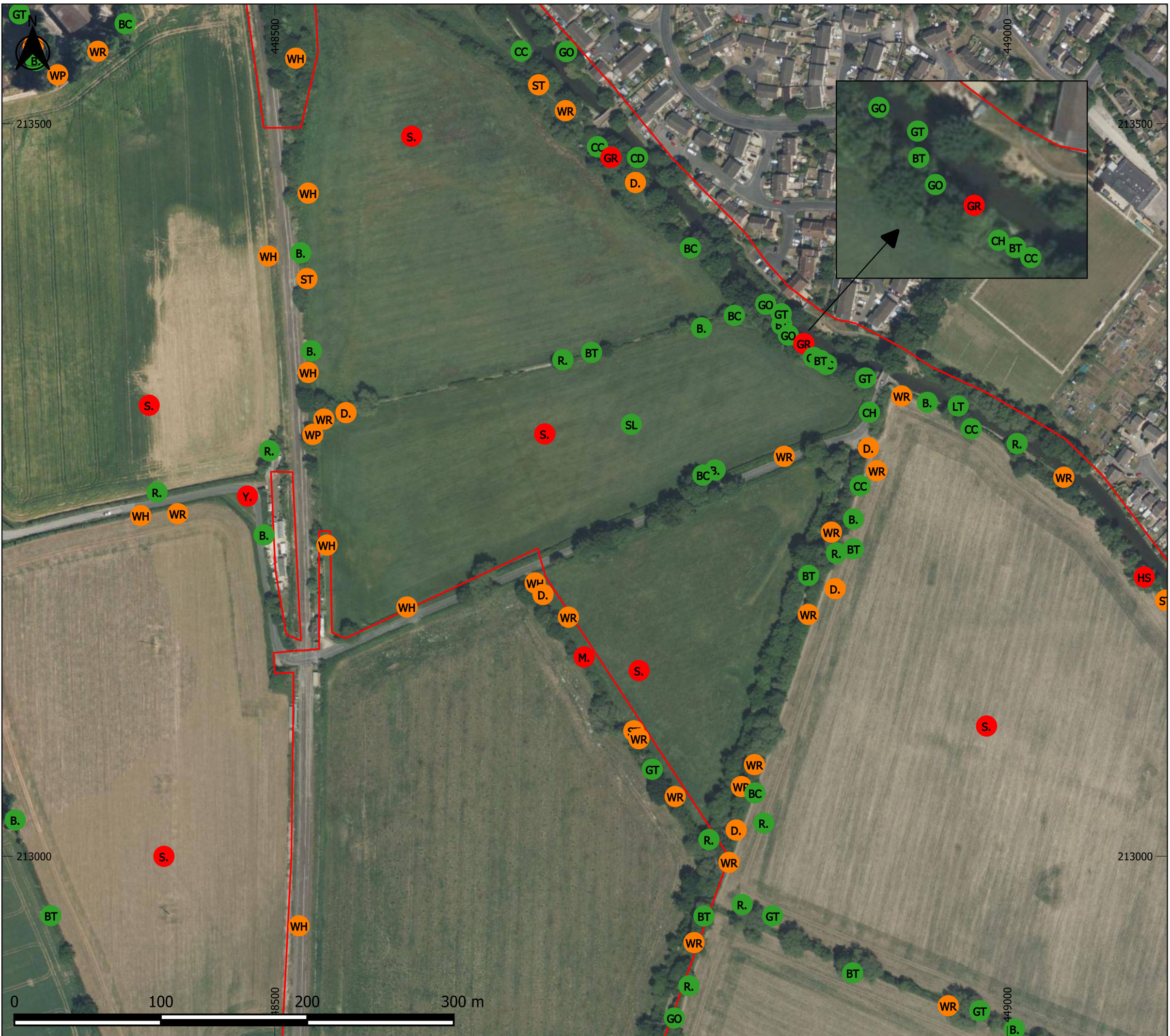
OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
 BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
 Figure 9c: Breeding bird characterisation survey (South west of site)

DATE: 15/05/2023 CHECKED: KH SCALE: 1:3,500
 DRAWN: EW/MG APPROVED: TF VERSION: 1.1

Copyright © BSG Ecology
 No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.
 This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980
 Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.
 Projection: OSGB 1936/British National Grid - EPSG 27700
 Sources: BSG Ecology survey data



Legend

BoCC status

- Red
- Amber
- Green

Site boundary

BTO Code	Species
B.	Blackbird
BC	Blackcap
BH	Black-headed Gull
BT	Blue Tit
BZ	Buzzard
C.	Carriion Crow
CC	Chiffchaff
CD	Collared Dove
CH	Chaffinch
D.	Dunnock
G.	Green Woodpecker
GF	Golden Pheasant
GO	Goldfinch
GR	Greenfinch
GT	Great Tit
HS	House Sparrow
KT	Red Kite
LI	Linnet
LT	Long-tailed Tit
M.	Mistle Thrush
MG	Magpie
R.	Robin
S.	Skylark
SG	Starling
SL	Barn Swallow
ST	Song Thrush
SW	Sedge Warbler
WH	Whitethroat
WP	Woodpigeon
WR	Wren
Y.	Yellowhammer



OFFICE: OXFORD
T: 01865 883833

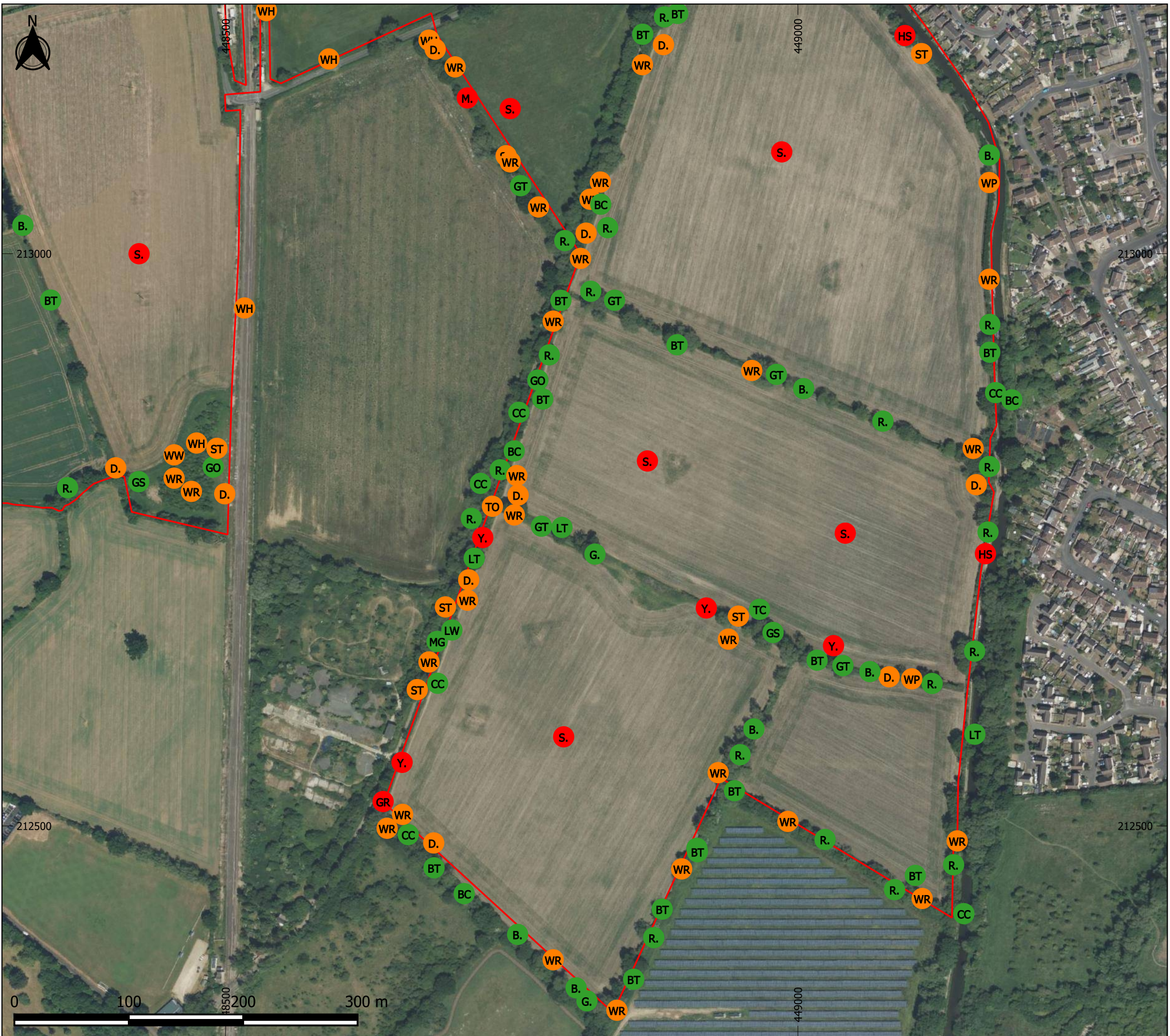
JOB REF: P21-1029

PROJECT TITLE
BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
Figure 9d: Breeding bird characterisation survey (Mid-east of site)

DATE: 15/05/2023 CHECKED: KH SCALE: 1:2,500
DRAWN: EW/MG APPROVED: TF VERSION: 1.1

Copyright © BSG Ecology
No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.
This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980
Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.
Projection: OSGB 1936/British National Grid - EPSG 27700
Sources: BSG Ecology survey data



Legend

- BoCC status
- Red
 - Amber
 - Green
 - Site boundary

BTO Code	Species
B.	Blackbird
BC	Blackcap
BH	Black-headed Gull
BT	Blue Tit
BZ	Buzzard
C.	Carrion Crow
CC	Chiffchaff
CK	Cuckoo
CW	Cetti's Warbler
D.	Dunnock
G.	Green Woodpecker
GO	Goldfinch
GR	Greenfinch
GS	Great Spotted Woodpecker
GT	Great Tit
HS	House Sparrow
J.	Jay
JD	Jackdaw
K.	Kestrel
KT	Red Kite
LI	Linnet
LT	Long-tailed Tit
LW	Lesser Whitethroat
M.	Mistle Thrush
MG	Magpie
MT	Marsh Tit
OC	Oystercatcher
PW	Pied Wagtail
R.	Robin
RL	Red-legged Partridge
S.	Skylark
ST	Song Thrush
SW	Sedge Warbler
TC	Treecreeper
TO	Tawny Owl
WH	Whitethroat
WP	Woodpigeon
WR	Wren
WW	Willow Warbler
Y.	Yellowhammer



OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
 BEGBROKE PR8, ECOLOGY SURVEY AND ASSESSMENT 2022

DRAWING TITLE
 Figure 9e: Breeding bird characterisation survey (South east of site)

DATE: 15/05/2023 CHECKED: KH SCALE: 1:3,200
 DRAWN: EW/MG APPROVED: TF VERSION: 1.1

Copyright © BSG Ecology
 No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.
 This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980
 Aerial Photography © Bing. Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.
 Projection: OSGB 1936/British National Grid - EPSG 27700
 Sources: BSG Ecology survey data



- Legend
- Pond
 - Site boundary
- eDNA Survey Results and Pond Number
- Negative
 - Positive
 - Not Surveyed
 - Pond no longer present

Positive eDNA Pond Results

Species	Peak Count
Great Crested Newt	7
Smooth Newt	4
Common Toad	1
Unidentified Newt	1



OFFICE: OXFORD
 T: 01865 883833
 JOB REF: P21-1029

PROJECT TITLE
BEBROKE PR8, ECOLOGY SURVEY AND ASSESMENT 2022

DRAWING TITLE
Figure 10: Pond Surveys

DATE: 09/01/2023 CHECKED: TF SCALE: 1:7,500
 DRAWN: EW APPROVED: TF VERSION:1.0

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing and are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office © Crown Copyright 2023. All rights reserved. Reference number: 100048980

Aerial Photography © Bing, Microsoft Bing Maps screen shot reprinted with permission from Microsoft Corporation.

Projection: OSGB 1936/British National Grid - EPSG 27700

Sources: BSG Ecology survey data

Graphics Ref. No.: 02215

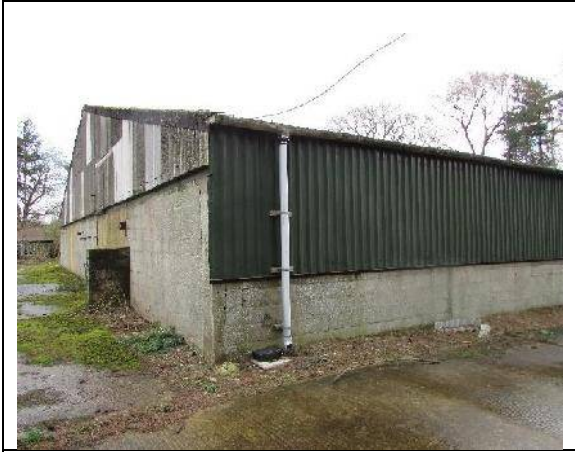
□□ □□□□□r□□□□□□

Photographs from site visits carried out at various times in 2021 and 2022.

	
<p>1. Arable field and hedgerow in north of Site.</p>	<p>2. Allotments in west of Site.</p>
	
<p>3. Field A in NW of the Site, semi-improved neutral grassland, abundant false oat-grass, with scrub and ruderal plants.</p>	<p>4. Field D, with semi-improved neutral grassland supporting range of grasses and forbs.</p>
	
<p>5. Field E with semi-improved neutral grassland, comomo nettle and scrub.</p>	<p>6. Field F, former landfill area at centre of the Site.</p>

	
<p>7. Begbroke Hill Farmhouse at Begbroke Science Park.</p>	<p>8. Field B in NE of Site. Poor semi-improved grassland with abundant Yorkshire fog.</p>
	
<p>9. Field C in NE of Site. Poor semi-improved grassland dominated by tall fescue.</p>	<p>10. Rowel Brook within woodland on the northern boundary of the Site, with residential properties directly adjacent.</p>
	
<p>11. Rowel brook in north of Site, dry in September 2022. Adjacent woodland with abundant sycamores</p>	<p>12. Hedgerows 10. Low barn at Parker's Farm, with plantation woodland visible.</p>

	
<p>13. Native species-rich hedgerow with trees in the south of the site.</p>	<p>14. Native species rich hedgerow in the west of the site, north of Sandy Lane.</p>
	
<p>15. Pond 4. Formal pond with ornamental fish and external water filtration system.</p>	<p>16. Hybrid poplar trees on west boundary of the former landfill site.</p>
	
<p>17. Building in SW corner of Begbroke Science Park.</p>	<p>18. Modern buildings at Begbroke Science Park.</p>



19. Modern barns at Parker's Farm.

Begbroke PR8 Policy Area
Ecology Baseline Report

BLANK PAGE

Issuing office

Worton Park | Worton | Oxfordshire | OX29 4SX
 T: 01865 883833 | W: www.bsg-ecology.com | E: info@bsg-ecology.com

Client	The Tripartite
Project	Begbroke PR8 Policy Area, Ecology Baseline Report
Version	FINAL
Project number	P17-255 Begbroke PR8 Ecology Baseline Report

	Name	Position	Date
Originated	Tom Flynn	Senior Ecologist	15 October 2018
Reviewed	Peter Newbold	Principal Ecologist	22 November 2018
Approved for issue to client	Peter Newbold	Principal Ecologist	22 November 2018
Issued to client	Tom Flynn	Senior Ecologist	06 December 2018

Disclaimer

This report is issued to the client for their sole use and for the intended purpose as stated in the agreement between the client and BSG Ecology under which this work was completed, or else as set out within this report. This report may not be relied upon by any other party without the express written agreement of BSG Ecology. The use of this report by unauthorised third parties is at their own risk and BSG Ecology accepts no duty of care to any such third party.

BSG Ecology has exercised due care in preparing this report. It has not, unless specifically stated, independently verified information provided by others. No other warranty, express or implied, is made in relation to the content of this report and BSG Ecology assumes no liability for any loss resulting from errors, omissions or misrepresentation made by others.

Any recommendation, opinion or finding stated in this report is based on circumstances and facts as they existed at the time that BSG Ecology performed the work. The content of this report has been provided in accordance with the provisions of the CIEEM Code of Professional Conduct. BSG Ecology works where appropriate to the scope of our brief, to the principles and requirements of British Standard BS42020.

Nothing in this report constitutes legal opinion. If legal opinion is required the advice of a qualified legal professional should be secured. Observations relating to the state of built structures or trees have been made from an ecological point of view and, unless stated otherwise, do not constitute structural or arboricultural advice.

Contents

1	Summary	2
2	Introduction	3
3	Previous ecology survey work	5
4	Consultation	6
5	Methods	7
6	Results and Interpretation	24
7	References	53
8	Figures	55
9	Photographs	56
10	Appendix List	60
11	Appendix 1: Draft PR8 Policy Plan	61
12	Appendix 2: Invertebrate Data	62
13	Appendix 3: Summaries of Relevant Policy, Legislation and Other Instruments	65
14	Appendix 4: Target Notes	73
15	Appendix 5: Botanical Data	76
16	Appendix 6: Hedgerow Data	81

1 Summary

- 1.1 BSG Ecology was commissioned by the Tripartite in October 2017. This was to undertake ecological surveys to provide baseline ecological information in support of potential development on land east of the A44 at Begbroke, Oxfordshire.
- 1.2 This 'Site', which is approximately 177 ha in extent, is shown in Figure 1. It includes all areas of the draft PR8 site that are owned by the Tripartite. It also includes the draft PR3b site, which is a single field in the south of the Site, adjacent to the railway line.
- 1.3 The Site forms the major part of a draft allocation under Cherwell Local Plan Draft Policy PR8 Land East of the A44¹, for a new urban neighbourhood comprising up to 1950 new homes, the expansion of Begbroke Science park, a secondary school, two primary schools, and associated infrastructure.
- 1.4 This report presents the results of an ecology desk study and a comprehensive set of ecology baseline surveys carried out at the Site in 2017 and 2018. The overall purpose of this work is to provide the ecology baseline information necessary to support an Ecological Impact Assessment of proposed development at the Site.
- 1.5 The scope of this work has been agreed with Cherwell District Council and includes: a desk study, Phase 1 habitat survey update, hedgerow survey, botanical survey, otter and water vole survey, freshwater invertebrate survey, white-clawed crayfish survey, preliminary bat roost appraisal of buildings and trees, bat roost inspection and emergence/re-entry survey, bat activity survey, dormouse survey, breeding bird characterisation survey, badger survey, reptile survey, and great crested newt survey.
- 1.6 Previous ecology-related work at the Site includes a 2015 Biodiversity Survey and Badger Survey, a 2016 statement of key constraints and opportunities, a 2017 soil survey and a 2018 hydrological study.
- 1.7 The main habitats present at the Site are arable land, poor semi-improved grassland, woodland, hedgerows, streams and ditches. Six ponds are present within the Site, as are numerous mature trees, and there are small areas of good semi-improved grassland, scrub, tall ruderal vegetation, amenity grassland, plantation woodland and hardstanding. Buildings are present at Begbroke Science Park in the centre-north of the Site, but outside of areas proposed for development under PR8, and at Parker's Farm within the north-east of the Site. Of these habitats, the woodland and hedgerows, and one of the ponds are Habitats of Principal Importance in England. Of the 53 hedgerows present at the Site, 37 hedgerows are species-rich and 30 are *Important* under the Hedgerow Regulations 1997.
- 1.8 The results of surveys indicate that the Site supports the following protected species: badger (including setts), roosting, foraging and commuting bats, ground and scrub/tree nesting birds, great crested newt, water vole, and reptiles (slow-worm, common lizard and grass snake). Common toad (which is a 'Species of Principal Importance' is also present. Based on surveys, dormouse and white-clawed crayfish are unlikely to be present. Freshwater invertebrate surveys indicate that the stream at the Site, the Rowel Brook, has moderate to good water quality.
- 1.9 A separate report by BSG Ecology, *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities*, provides advice on potential ecological impacts and opportunities of the PR8 development, based on the baseline information provided in the current report.

¹ In *Cherwell Local Plan 2011-2031 (Part 1): Partial Review – Oxford's Unmet Housing Need*. Pages 120–126). <https://www.cherwell.gov.uk/downloads/download/1228/pr73-cherwell-local-plan-2011-%E2%80%93-2031-part-1> [accessed 29/11/18].

2 Introduction

Background to commission

- 2.1 BSG Ecology was commissioned by the Tripartite in October 2017. This was to undertake and report ecological surveys to provide baseline ecological information in support of potential development on land east of the A44 at Begbroke, Oxfordshire.

Site description

- 2.2 This 'Site', which is approximately 177 ha in extent, is shown in Figure 1. It includes all areas of the draft PR8 site that are owned by the Tripartite. It also includes the draft PR3b site, which is a single field in the south of the Site, adjacent to the rail line.
- 2.3 It is located south and east of the Village of Begbroke, and extends south to the village of Yarnton and east to the Village of Kidlington. It includes Begbroke Science Park in its northern part (though no new development is proposed there under PR8), and surrounds a former landfill site towards its centre. The A44 Woodstock road forms part of the western boundary, and the Oxford Canal forms part of the eastern boundary. The Site is crossed east-west by the minor road Sandy Lane, and north-south by the Oxford to Banbury railway line.
- 2.4 The Site is predominantly arable farmland with hedgerows and some grassland. The only buildings within the Site boundary are at Begbroke Science Park and two large modern barns and a smaller stone shed at Parker's Farm in the north-east corner of the Site.

Description of project

- 2.1 The Tripartite is promoting the Site for development.
- 2.2 The Site forms the major part of a draft allocation under Cherwell Local Plan Draft Policy PR8 Land East of the A44², for a new urban neighbourhood comprising up to 1950 new homes, the expansion of Begbroke Science Park, a secondary school, two primary schools, and other supporting uses.
- 2.3 The Draft Policy PR8 policies Map proposes that the majority of the centre and south of the Site will be allocated to residential use and schools), an arc around the north of Begbroke Science Park will be allocated to employment use (i.e. expansion of the Science Park), and the north and east of the Site will be allocated to a variety of greenspace uses.

Scope of this report

- 2.4 This report presents the results of a comprehensive set of baseline ecology survey work relating to the Site that was undertaken between October 2017 and October 2018, including desk study work and consultation (regarding the scope of this work) with statutory agencies, including Cherwell District Council, Natural England and the Environment Agency.
- 2.5 The overall purpose of the baseline surveys is to provide the ecology baseline information necessary to support an Ecological Impact Assessment of a proposed development at the Site.
- 2.6 The specific aims of the ecology baseline surveys work are as follows:
- To establish whether any designated wildlife sites are present within or close to the Site, and to provide a summary of their wildlife interest.

² In *Cherwell Local Plan 2011-2031 (Part 1): Partial Review – Oxford's Unmet Housing Need*. Pages 120–126). <https://www.cherwell.gov.uk/downloads/download/1228/pr73-cherwell-local-plan-2011-%E2%80%932031-part-1> [accessed 29/11/18].

- To map and describe the habitats present within the Site, and to collect botanical information to a level of detail sufficient to allow them to be evaluated against local and national criteria.
- To determine the potential of the Site to support any species that are legally protected or any species or species groups that are otherwise of conservation interest.
- To determine whether any such species or species groups are present at the Site and to provide information on their distribution within and their use of the Site.

2.7 A separate report *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities* (BSG Ecology, 2018) provides advice on potential ecological impacts and opportunities of the PR8 development, based on the baseline information provided in the current report and based on consultation with statutory agencies.

3 Previous ecology survey work

- 3.1 Previous relevant survey or desk study work containing baseline ecological information is summarised below.
- 3.2 Previous work focusing on ecological constraints and opportunities or on potential ecological impacts is not included here but is summarised in the accompanying report: *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities* (BSG Ecology, 2018).

2010 ecological assessment for Begbroke Science Park

- 3.3 An ecological survey and assessment was carried out in support of the planning application for a new access road from the A44 Woodstock Road to Begbroke Science Park (Applied Ecology Ltd., 2010). This assessment covered a narrow corridor of land in the north-west of the Site, west of the Science Park and was based on a habitat survey, a badger survey, and a ground-based assessment of buildings and trees to determine their potential to support roosting bats.
- 3.4 The assessment noted potential for great crested newt in ponds in the vicinity of the area surveyed, potential for bats to roost in two buildings, and the presence of a main badger sett and an outlier sett nearby. It specified appropriate ecology mitigation, including the installation of a badger tunnel under the new access road.

2015 biodiversity survey

- 3.5 BSG Ecology carried out a biodiversity survey of the PR8 site in January 2015 (BSG Ecology 2015a, 2015b) comprising a desk study, extended Phase 1 habitat survey and a badger survey, and an assessment of the likely ecological impacts and mitigation options for development.
- 3.6 The updated desk study is reported in Section 6 of this report and is therefore not summarised here.
- 3.7 Habitats identified at the Site included arable land, semi-improved neutral grassland, species-poor semi-improved grassland, improved grassland, broad-leaved semi-natural woodland, plantation woodland, hedgerow, scrub, tall ruderal vegetation, swamp, running water (the Rowel Brook and an inflowing stream), ditches, ponds, mature and semi-mature trees, buildings and hard standing.
- 3.8 Evidence of badger *Meles meles* (including badger setts) was found in several location on and adjacent to the Site.
- 3.9 The Site was considered to have the potential to support the following protected or notable species: roosting, foraging and commuting bats, otter *Lutra lutra*, water vole *Arvicola amphibia*, dormouse *Muscardinus avellanarius*, breeding birds (including kingfisher *Alcedo atthis*, barn owl *Tyto alba* and farmland birds), reptiles and great crested newt *Triturus cristatus*. Surveys were recommended for these species. Surveys were also recommended to determine the nature conservation value of hedgerows and semi-improved grassland at the Site.

2018 ecology reports for Begbroke Science Park

- 3.10 BSG Ecology carried out biodiversity surveys over the period January to June 2018 in support of a planning application for building works at Begbroke Science Park. These included a desk study, Phase 1 habitat survey, reptile survey and great crested newt survey (BSG Ecology, 2018a and 2018b). The great crested newt survey recorded a maximum count of two animals in the formal ponds at Begbroke Science Park, and found no evidence of reptiles there. Since these surveys were carried out in concert with the surveys detailed within this report, these results are subsumed into Section 6.

4 Consultation

Cherwell District Council

- 4.1 Charlotte Watkins, Ecology officer at Cherwell District Council was consulted by email on 22 January 2018 by Tom Flynn of BSG Ecology, regarding the proposed scope of baseline ecology surveys for the Site. The 2015 Biodiversity Survey report (BSG Ecology, 2015) was also provided.
- 4.2 Charlotte responded on 5 February 2018, including the following:
- “The scope of the surveys proposed looks generally fine at this stage. My main comments would be that there is no justification for not including invertebrate surveys and some of the habitat (from a desk top study) looks potentially important in this regard? and that the need for winter bird surveys should be based on the updated Phase 1.”*
- 4.3 The term “*no justification*” is interpreted to mean that no justification was provided in the information submitted.
- 4.4 Tom Flynn responded on 12 February, providing the required justification, and explaining that terrestrial invertebrate surveys and winter bird surveys were not considered proportionate or necessary at the Site and providing the context and justification for this view. It was also noted that the Phase 1 habitat survey had not yet been updated, but walkover surveys of the Site (for the purposes of the badger survey) conducted in January and February 2018 had revealed no significant changes in land use at the Site.
- 4.5 There were no further comments from the Cherwell District Council Ecology Officer.

Natural England and Environment Agency

- 4.6 Consultation with these two government agencies was carried out with regard to potential ecological impacts of development at the Site. This is therefore discussed in the accompanying report *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities* (BSG Ecology, 2018).

5 Methods

Desk study

- 5.1 In order to obtain information on designated wildlife sites in the vicinity of the Site, together with historical records of protected species (or species that are otherwise of conservation interest) a data search was requested from the Thames Valley Environmental Records Centre (TVERC) on 06 December 2017. Data was received from TVERC on 20 December 2017 and included the following:
- Information on non-statutory wildlife sites within 2 km of any part of the Site centre.
 - Records of protected, notable³ and invasive species from within 2 km of any part of the Site.
- 5.2 A search for statutory designated wildlife sites was carried out on 05 December 2017 (and repeated on 12 October 2018) by searching the UK Government MAGIC⁴ website for the following:
- Information on International/European wildlife sites within 10 km of any part of the Site.
 - Information on statutory wildlife sites within 5 km of any part of the Site centre.
 - Information on ancient woodland within 3 km of any part of the Site centre.
- 5.3 Great crested newts can use terrestrial habitat up to 500 m from breeding ponds (English Nature, 2001) and therefore searches were carried out in January 2018 for ponds within 500 m of the Site using Ordnance Survey (OS) mapping available from the Multi-Agency Geographical Information for the Countryside (MAGIC) website.
- 5.4 Aerial imagery and OS mapping of the Site and surrounding area available at Bing⁵ and Google Maps⁶ were accessed over the period 2017 to 2018 to aid in the various ecology surveys that were carried out at this time.
- 5.5 The reports of previous surveys relating to the Site noted in Section 3 *Previous ecology survey work* were also reviewed as part of the ecology desk study.

Extended Phase 1 habitat survey

- 5.6 A Phase 1 habitat survey of the Site, based on standard industry guidance (JNCC, 2010), was carried out on 16 and 17 April and on 23 and 31 May by Dr Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology. This survey updated a previous Phase 1 habitat survey of the Site carried out by the same surveyor on 8–12 January 2015 (and reported in BSG Ecology, 2015).
- 5.7 The extent of the Phase 1 habitat survey is indicated in Figure 2.
- 5.8 Habitats present at the Site were identified and mapped onto an Ordnance Survey base map, with any features of particular ecological interest target noted.
- 5.9 Lists of dominant plant species were collected for all habitats of potential conservation significance in a series of target notes to accompany the Phase 1 habitat plan.
- 5.10 It should be noted that species lists derived from the target notes are not necessarily an exhaustive inventory of all species occurring at a Site. They are intended to illustrate the character of habitats present, general species richness of a particular area, and draw attention to any species that may

³ “Notable” species in this context are those listed as notable in the TVERC database, indicating that they are included on any of various lists of species of conservation concern or priority at the local, regional or national level (e.g. the red data lists, Oxfordshire rare plants register, etc).

⁴ Multi-agency Geographical Information for the Countryside: www.magic.gov.uk.

⁵ www.bing.com/maps

⁶ www.google.uk/maps

be considered uncommon or unusual. The habitat surveys were conducted on days when the weather conditions were calm and dry and the weather did not constrain this work. The survey visits were carried out within the optimal time-of-year for Phase 1 habitat surveys (JNCC, 2010).

- 5.11 The Phase 1 habitat survey was 'extended' to give consideration to the potential of the habitats present at the Site to support protected species or species otherwise of conservation interest. This included a preliminary appraisal of the potential value of the Site for bats.

Hedgerow survey and assessment

- 5.12 In order to evaluate the conservation significance of hedgerows present at the Site, hedgerow surveys and assessment were carried out at the Site on 31 May 2018 by Kate Rooney GradCIEEM, Ecologist at BSG Ecology and on 02 and 03 October 2018 by Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology. These surveyors have previous experience of hedgerow surveys. The surveys were undertaken a suitable time of year for hedgerow surveys (Defra, 2007).
- 5.13 All hedgerows present were mapped on to Ordnance Survey base maps of the Site (for hedgerow locations see Figure 3). The average numbers of woody and woodland species (as defined in the Hedgerow Regulations 1997) were recorded for each hedgerow. Hedgerows were placed into the categories 'species-rich' or 'species-poor' by the surveyor, based on whether the average number of woody species present in a 30 m length was five or more ('species rich') or fewer than five ('species poor') (see Defra, 2007). Hedgerows were also subject to the collection of further information, including the presence of: a bank or wall, less than 10% gaps, trees, woodland species, adjacent ditches, parallel hedgerow (within 15 m) and connections to other ecological features such as woodlands, ponds and other hedgerows.
- 5.14 Freely available aerial imagery from Bing Maps (www.bing.com/maps) was used to aid in the locating and mapping of hedgerows by indicating their lengths and the presence of significant gaps.
- 5.15 The above information was used to identify hedgerows at the Site meeting the criteria for determining 'Important' hedgerows under *Wildlife and Landscape* in Schedule 1 of the Hedgerow Regulations 1997.

Botanical survey

- 5.16 In order to obtain more detailed information on the conservation value of grassland at the Site, a botanical survey was undertaken on 31 May 2018 by Dr Tom Flynn MCIEEM, Senior Ecologists at BSG Ecology, who has experience of botanical survey and evaluation.
- 5.17 The area subject to detailed botanical survey (which includes four pasture fields at the east of the Site and an area of grass and scrub adjacent to the west of the rail line), is indicated in Figure 4.
- 5.18 Woodland at the Site was not subject to detailed botanical survey because its status as a valuable habitat, to be retained in the proposed development was clear from the results of the Phase 1 habitat survey. The areas of grassland at the Site required more detailed information for their conservation value to be determined.
- 5.19 The grassland survey involved the surveyor marking out five quadrats (each 2 m x 2 m in size, marked out using tape measures) in typical stands of vegetation in each of the four survey fields to the east of the railway line. For the small area of grassland just east of the railway line, two quadrats were taken in grassland and two in tall ruderal vegetation. The small size of these areas meant that further quadrats were considered unnecessary to characterise this vegetation. The area of scrub dominating the centre of this latter field was not subject to quadrat survey because the density of this scrub prevented access. A species list for this scrub was produced based on observations from the exterior, including estimation of relative abundance using the DAFOR⁷ scale.

⁷ DAFOR is a scale of relative abundance that is frequently used in habitat and botanical surveys, with the following categories: D: dominant; A: abundant; F: frequent; O: occasional; R: rare.

- 5.20 For each quadrat, the surveyor identified all vascular plant species present and estimated their percentage cover classes using the Domin scale (Rodwell *et al*, 1992). Where noted, bryophytes (mosses and liverworts) were also recorded, though a detailed search/survey for these species was not carried out.
- 5.21 Quadrat data were tabulated using Microsoft Excel and sorted into a floristic table (as used in Rodwell *et al*, 1992). Data analysis involved the following methods:
- The vegetation community identification keys in Rodwell *et al* (1992) were used to identify plant communities, based on the data in the floristic table.
 - The floristic tables were compared (by inspection) with those of Rodwell *et al* (1992).
- 5.22 A written summary of each of the grassland in each of the surveyed fields was also produced.
- 5.23 The conservation value of the grassland in the survey area was evaluated with reference to the following:
- BRIG (2011) *UK Biodiversity Action Plan Priority Habitat Descriptions*. JNCC. This was used to identify Habitats of Principal Importance in England (HPIs), designated under Section 41 of the NERC Act, 2006.
 - Stroh *et al* (2014) *A Vascular Plant Red List for England*. BSBI.
 - TVERC & BMERC (2009) *Criteria for the Selection of Local Wildlife Sites in Berkshire, Buckinghamshire and Oxfordshire*. TVERC.
 - Oxfordshire Flora Group (2015). *Oxfordshire Rare Plant Register*. ANHSO.

Badger Survey

- 5.24 In order to obtain information on the presence and use of the Site by badgers, and on the location of any badger setts, the Site was subject to a badger survey by Dr Tom Flynn and Helen Simmons on 23 January 2018 and by Dr Tom Flynn on the 23 February 2018. This was updated with incidental observation made during ecology surveys carried out across the Site by various ecologists employed by BSG Ecology between April and October 2018, including during the Phase 1 habitat survey of the Site. The badger survey covered all areas within the Site. Where evidence of badger in adjacent areas was seen from the Site, this was also recorded.
- 5.25 The badger survey involved searching for and mapping (using a hand-held GPS receiver) any field sign of badger, such as latrines, obvious pathways used by badger and locations of setts. Several categories of badger setts have been identified as described below (adapted from Neal and Cheeseman, 1996; Harris *et al.*, 1994):
- Main sett - Normally where cubs are raised and in continuous and regular use throughout the year. Typified by large spoil heaps and well-trodden paths. There can be many entrances to the sett (often with some of these disused), although a main sett can sometimes only have a single entrance.
 - Annexe setts - Intermediate-sized and may be used by breeding badgers. Normally close to a main sett and connected to it by obvious paths. They may not be in use all the time, even if the main sett is very active.
 - Subsidiary sett - Similar to annexe setts but are likely to be further away (at least 50 m from the main sett) and not as well connected to the main sett as annexe setts. May only be used intermittently.
 - Outlier setts - Small setts with one or two entrance holes which are used sporadically by badgers as a temporary refuge (Neal & Cheeseman, 1996). Spoil heaps are likely to be small and there may not be obvious paths connecting to other setts. Use may be sporadic. There may be several outlier setts within one badger social group's territory (Neal & Cheeseman, 1996).

5.26 For all badger sett entrance holes that were found, an indication of the level of activity was also recorded according to Harris et al. (1989), as follows:

- Active - active sett entrances contain no debris or vegetation, are obviously regularly used and often show signs of having been recently excavated.
- Partially used - partially used entrances are those not in regular use, and which may have debris (leaf litter, twigs, moss, etc.) around the entrance. However, they could potentially be used regularly in the future with minimal clearance necessary.
- Disused - disused sett entrances show signs of not having been used for a considerable period of time and would not be used again without extensive clearance by a badger.

Bat Survey

Assessment of Buildings

5.27 A preliminary ground level roost assessment was carried out on 23 January 2018 by Dr Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology and Helen Simmons, ACIEEM (who holds Natural England bat licences (numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS). This survey was carried out to determine the potential of buildings that could be affected by the proposed development to support roosting bats. The survey was based on industry standard guidance (Chapters 4 and 6 of Collins, 2016). Buildings were allocated to the following categories of suitability for bats, based on the above guidance: Negligible, Low, Moderate or High. Notes of building structure and any potential bat roost features that were visible were also made during the survey.

Emergence/re-entry survey of Buildings

5.28 Emergence/re-entry surveys were carried out at the stone shed at Parker's Farm (building A3 on Figure 6c), which is the only building with potential to support roosting bats within the Site, in order to determine whether it is being used by roosting bats. In line with the guidance in Chapter 7 of Collins (2016) and the moderate bat potential assigned to this building, the survey involved one dusk emergence survey (on 09 August 2018) and one dawn re-entry survey (on 28 September 2018).

5.29 Emergence/re-entry surveys were also carried out at the Begbroke Hill Farmhouse building complex at Begbroke Science Park (buildings 2a to 2e on Figure 6d), which was assessed as having high potential to support roosting bats. This building is outside of the area proposed for new development under PR8, and no direct effects on this building from PR8 are therefore anticipated. However, given the potential for this building to support a roost of high conservation significance, and the fact that the Science Park (and hence this building) will be surrounded by new development under PR8, it was considered appropriate to obtain more information on the any use of the building by bats. Internal surveys were not considered safe due to the lack of asbestos survey information for the building, and for this reason emergence/re-entry surveys were carried out instead. In line with the guidance in Chapter 7 of Collins (2016) and the high bat potential assigned to this building, the survey involved two dusk emergence surveys (on 01 and 22 August 2018 at the main farmhouse and on 31 July and 23 August 2018 on a building to the south-west of this) and one dawn re-entry survey (on 5 September 2018 on the main farmhouse and on 6 September 2018 for the building to the south-west of this). Buildings at Begbroke Science Park with negligible or low suitability to support roosting bats were not subject to emergence/re-entry surveys.

5.30 The emergence and re-entry surveys were carried out in accordance with industry standard guidance (Chapter 7, Collins, 2016). Numbers and positions of surveyors for each survey visit were determined by Helen Simmons ACIEEM, Ecologist at BSG Ecology, who holds Natural England bat licences (numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS). Numbers of surveyors viewing each building on each survey visit and dates of survey visits are provided in Table 1. Where buildings were adjacent and within a surveyor's field of view, multiple buildings were

surveyed by one surveyor. Buildings at the Site that were assessed as having negligible value for roosting bats were not subject to these, or any further, surveys.

Table 1: Dates of emergence surveys and numbers of surveyors employed.

Location	Building Number	Number of Surveyors	Bat Potential	Survey Visit		
				1	2	3
Stone Barn at Parkers Farm	A3	2	Moderate	09/08/18 Dusk	28/09/18 Dawn	N/A
Begbroke Hill Farmhouse and adjacent buildings	B2c & B2e	4	High	01/08/18 Dusk	22/08/18 Dusk	05/09/18 Dawn
Building south – west of Begbroke Hill Farmhouse	B2d	2	High	31/07/18 Dusk	23/08/18 Dusk	06/09/18 Dawn

- 5.31 The numbers of emergence/re-entry survey visits met the number required under the standard guidance (Chapter 7 of Collins, 2016).

Assessment of Trees

- 5.32 In order to assess trees with the potential to be affected by the proposed development for their potential to support roosting bats, a preliminary ground level roost assessment was carried out on 2 and 3 October 2018 by Dr Tom Flynn. The survey was based on industry standard guidance (Chapters 4 and 6 of Collins, 2016).
- 5.33 All trees present within or on the boundary of areas of the draft Policy PR8 plan (see Appendix 1) proposed for built development were surveyed. Trees were allocated to the following categories of potential suitability for bats, based on Table 4.1 in Collins (2016): Negligible, Low, Moderate, or High as per the above guidance. Locations of trees with Low, Moderate and High suitability were mapped using a handheld GPS receiver. Trees with Negligible suitability for roosting bats were not mapped. This survey was also extended to the draft policy PR3b area.
- 5.34 Trees within parts of the PR8 area not proposed for built development (e.g. the proposed Local Nature Reserve, Nature Area, Parkland, and Retained Agricultural Land) were not subject to survey because trees in these areas are not likely to be affected by the proposed development.

Inspection of Trees

- 5.35 Trees at the Site assessed as having moderate or high suitability to support bats (in the bat potential assessment), or for which roosting potential could not be confidently determined from the ground, were subject to ground level or climbed roost inspections (as appropriate). Ground level inspections with an endoscope were carried out on 19 October 2018 by Helen Simmons ACIEEM (who holds Natural England bat licences (numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS), covering trees T5, T6 and T10. A climbing inspection was carried out by Karl Lofthouse, an independent licensed bat worker and trained tree climber, and an assistant, on 26 October 2018, covering tree T9. Tree T3 was considered to have moderate bat potential, but was considered unsafe to climb, due to fungal rot being present.

Transect Surveys

- 5.36 In order to provide information on the level of bat activity at the Site, walked dusk transect surveys based on standard industry guidance (Chapter 8 in Collins, 2016) were carried out in October 2017 and approximately monthly over the period April-September 2017. Survey dates are shown in Table 2.

Table 2: Dates and weather conditions of monthly bat activity transect surveys.

Visit	Date	Surveyors	Temperature (start–end °C)	Wind (start–end, Beaufort)	Cloud (start–end, Oktas)	Rain
1	10.10.17	Sarah Joscelyne , Ashley Sendell-Price, Tom Flynn, Elly Pattullo	17-14	3-1	3-6	None
2	26.04.18	Thomas Flynn, Melanie Sanders, David Kent, Mia Milsom	11-6	2-1	4-2	None
3	23.05.18	Thomas Flynn, Mark Norriss, Sarah Joscelyne, Joe Bishop	16-13	4-2	8-7	None
4	26.06.18	Thomas Flynn, Sarah Joscelyne, Joe Bishop, Kate Rooney	20-17	1-1	0-0	None
5	17.07.18	Sarah Joscelyne, Elly Pattullo, Thomas Flynn, Kate Rooney	18-15	3-2	6-5	None
6	15.08.18	Joe Bishop, Ashley Sendell-Price, Sarah Joscelyne, Elly Pattullo	20-17	4-3	8-6	None
7	10.09.18	Mark Norriss, Elly Pattullo, Sarah Joscelyne, Ashley Sendell-Price	18-19	4-1	8-6	None

- 5.37 The main aim of the transect surveys was to aid the characterisation of the bat assemblage, and patterns of bat activity and to determine the location of any areas with higher levels of bat activity, such as potential foraging areas and/or commuting routes. Accordingly, the selected transect route was designed to sample areas of the Site which support habitat suitable for use by bats (based on the guidance in Chapter 4 of Collins, 2016). Survey effort was based on the assessment of the Site having moderate value for bats (based on the results of the previous Phase 1 habitat survey (BSG Ecology, 2015) and on the guidance in Table 4.1 of Collins (2016).
- 5.38 Two transect routes were mapped out with each transect survey involving two surveyors walking predetermined routes through the Site (see Figure 6a) whilst recording bats. Bat activity was recorded using Anabat express or Anabat SD1 hand-held electronic bat detectors. These models of detector automatically record all bat passes, allowing species identification to be confirmed by analysis of call characteristics. Where bats were seen, surveyors recorded the observed behaviour and numbers of bats onto a field survey form. Field notes included a record of the time of each bat encounter, thus allowing results to be cross-referenced with the calls recorded using the bat detectors.
- 5.39 The two transects cover the majority of the field boundaries at the Site. Transect 1 passes around the fields surrounding Begbroke Science Park, past Begbroke Hill Farmhouse within the Science Park, around agricultural buildings at Parker's Farm, runs adjacent to and crosses Sandy Lane and runs along much of the perimeter of the old landfill site which is located in the centre of the Site (though outside the Site boundary due to separate ownership). This transect does not pass through two fields in the north of the Site which are proposed as a Local Wildlife Site in the draft PR8 plan, because impacts from the proposed development in this location are unlikely.
- 5.40 Transect 2 follows field boundaries in the east of the Site (which are dominated by hedgerows with trees), this includes a section adjacent to the Oxford Canal at the east of the Site, a section of Yarnton Lane byway (which is unsuitable for motor vehicles and bordered on both sides by deep

diches and hedgerows with abundant mature trees), and a section along the southern boundary of the Site which is adjacent to a hedgerow dominated by mature trees located adjacent to the south of the boundary.

- 5.41 Transect surveys were carried out in suitable weather conditions. Weather conditions are shown in Table 2. Transects commenced at or before sunset and finished 2 to 2.5 hours after sunset. The timing of the surveys covered the bat emergence period and the period of most intense foraging activity when invertebrate prey is most abundant (Altringham, 2003). The direction and start point of each transect route was altered for each survey to ensure that different parts of the Site were surveyed at different times of the night.
- 5.42 Surveyors participating in activity survey transects are listed in Table 3. Each transect was led by a surveyor with experience in undertaking bat activity transects.

Table 3: Surveyors participating in transect surveys.

Surveyor	Job title	CIEEM status
Thomas Flynn	Senior Ecologist, BSG Ecology	MCIEEM
Mark Norris	Ecologist, BSG Ecology	GradCIEEM
Sarah Joscelyne	Ecologist, BSG Ecology	
Kate Rooney	Ecologist, BSG Ecology	GradCIEEM
Ashley Sendell-Price	Ecologist, BSG Ecology	
Elly Pattullo	Ecologist, BSG Ecology	
Mia Milsom	Ecologist, BSG Ecology	
David Kent	Ecologist, self-employed	ACIEEM
Joe Bishop	Ecologist, BSG Ecology	

Automated Surveys

- 5.43 Automated detector surveys were conducted at the Site, based on standard industry guidance (Chapter 8 of Collins, 2016). These surveys employed Wildlife Acoustics Song Meter 4 (SM4) bat detectors. These are full spectrum detectors that trigger automatically to record bat echolocation calls, and can be deployed and left to remotely record bat activity for a period of several nights. Detector locations are shown in Figure 6a.
- 5.44 These detectors were deployed for at least five nights at three pre-defined locations within the Site in October 2017 and monthly over the period April–September 2018. One of these locations (2a) was changed (to 2b) after the first two months of survey. The rationale for choosing the locations (shown in Figure 6a), and changing Location 2 is provided in Table 4. The survey periods were: 4–10 October 2017, 24–30 April, 23–31 May, 26 June–2 July, 17–23 July, 16–21 August and 19–25 September 2018.

Table 4: Static bat detectors locations.

Location	Location and Features	Reason for inclusion in survey
1	Southern edge of shelterbelt of trees along southern boundary of Begbroke Science Park.	To determine the extent of bat activity associated with the trees around Begbroke Science Park and with the old entrance road to the Science Park (and its associated trees and hedgerows). This location is also the part of the Site that is closest to Begbroke Hill Farmhouse which was considered likely to (and subsequently was found to) support roosting bats, and there is potential for the shelterbelt of trees here to be affected by the Proposed Development.

2a	Site boundary adjacent to western side of railway line in south of Site. Microphone pointing	To determine use of the railway corridor as a route through the Site by bats. This location was used only for the October 2017 and April 2018 deployments. Thereafter it was decided that a location on Sandy Lane would be more useful (see 2b below), since this road and its associated hedgerows are likely to be of more value to bats, and will be bordered (and potentially affected) by development to the north and south under the PR8 development, whereas the railway corridor will be bordered by large areas of greenspace to the east.
2b	Northern side of hedgerow on Southern side of Sandy Lane, towards the centre of the site.	To determine the extent to which Sandy Lane is used by bats. This road and its associated hedgerows appear to provide useful east-west habitat connectivity across the centre of the Site. It could also provide a commuting route between any bat roosts in the two semi-detached houses the centre of the Site (building C on Figure 6c) and suitable foraging habitat to the east (e.g. the Oxford Canal) or west (e.g. gardens at Yarnton). Given that these buildings are outside the Site boundary due to separate ownership, and were not accessible for detailed surveys, the use of this static detector will also provide valuable information on the potential of this building to support significant bat roosts.
3	Close to southern boundary of site, adjacent to boundary ditch and hedgerow with mature trees.	To determine the extent to which this hedgerow is used by bats. It appears to provide useful east-west habitat connectivity in the south of the Site. This hedgerow would be bordered and potentially affected by development to the north under PR8.

5.45 The detectors were programmed to begin recording at half an hour before sunset and to stop half an hour after sunrise, allowing continuous monitoring to take place during the period when bats are active (i.e. sunset to sunrise). There were no detector failures during the survey.

Call identification

5.46 Bat audio data collected during transect and static surveys were analysed using Kaleidoscope Pro software to identify bat species and to assess activity levels at different times during the night period. Each bat call identified was manually checked by an ecologist experienced in sound analysis. Bat calls associated with emerging or re-entering bats (confirmed visually) during emergence/re-entry surveys were also subject to analysis.

5.47 Wherever possible the calls were identified to species level. However, due to the similarity of call characteristics which can prevent reliable species identification, species of the genus *Myotis* were grouped together and recorded as *Myotis* sp. Pipistrelle bat (*Pipistrellus* sp.) calls have been separated out into individual species where possible on the following basis:

- Common pipistrelle *Pipistrellus pipistrellus*: peak frequency ≥ 42 to < 49 kHz
- Soprano pipistrelle *Pipistrellus pygmaeus*: peak frequency 51 kHz or above
- Nathusius' pipistrelle *Pipistrellus nathusii*: peak frequency < 39 kHz

5.48 However, pipistrelle calls with intermediate characteristics cannot always be reliably separated. These calls were classified as follows, based on measurements of peak frequency:

- For calls with intermediate characteristics the following categories were used:
- "Pipistrelle 50 kHz" (calls within the ≥ 49 and < 51 kHz range): These are indeterminate calls which could originate from either common or soprano pipistrelle bats.
- "Pipistrelle 40 kHz" (calls within the ≥ 39 and < 42 kHz range): These are indeterminate calls which could originate from either common pipistrelle or Nathusius' pipistrelle bats.

- 5.49 Some of the calls produced by noctule bats *Nyctalus noctula* and Leisler's bats *Nyctalus leisleri* have overlapping characteristics, which can prevent reliable separation if the call recording quality is poor. Such calls were therefore identified simply as *Nyctalus* sp.
- 5.50 Similarly, some calls produced by brown long-eared bats *Plecotus auritus*, *Myotis* bats, and serotine bats *Eptesicus serotinus* can have overlapping characteristics, particularly when a call is poorly or partially recorded. Where such calls have been recorded they have been identified during the analysis as "indeterminate calls".
- 5.51 The data provided by automated bat detectors was entered into and analysed using a Microsoft Excel spreadsheet in order to determine the total number of bat passes recorded and also the pass rate (i.e. the average number of bat passes recorded per hour of night). It is difficult to assess actual bat numbers from the information collected by static bat detectors. Where multiple bat calls are recorded these could, for example, either have been produced by a single bat repeatedly flying back and forth past the detector or by multiple bats, each flying past on a single occasion. The data obtained therefore provides a relative measure of bat activity at different locations and at different times, rather than a measure of population size.

Table 5: Dates and conditions for reptile surveys.

Visit no.	Date	Surveyors	Temperature (°C)	Cloud (Otkas)	Weather Notes
Setup	14.03.2018	MN	N/A	N/A	N/A
1	13.10.2018	JP	10-11	8	Occasional sun Light wind
2	19.04.2018	PN + JB	11-19	0	Very light breeze, strong sun
3	25.04.2018	JB	10-13	5-7	Light wind, occasional sun, Rain at end of survey
4	01.05.2018	JB	10-13	0-4	Strong sun, light wind
5	08.05.2018	JB	16-19	0	Strong sun, light wind
6	14.05.2018	JB	15-18	0	Strong sun, light wind
7	25.05.2018	JB	14-17	8	Rain all morning prior to survey, light wind

Dormouse Survey

- 5.52 In order to determine whether dormouse *Muscardinus avellanarius* is present at the Site a dormouse survey was carried out in 2018. The survey targeted hedgerows at the Site that provide suitable habitat for this species and are likely to be affected by the Proposed Development. Hedgerows in areas proposed for greenspace under PR8 were not surveyed because adverse effects there are unlikely. Two hedgerows that run south of Begbroke Science Park (along the old access road) are heavily managed by trimming. They are heavily dominated by ivy and are species-poor. They are considered to provide poor habitat for dormouse and were therefore not surveyed.
- 5.53 The survey method and effort was based on industry standard guidance (Bright et al., 2006). A total of 170 dormouse survey nest tubes (of standard industry specification) were set out at approximately 20 m intervals in areas of suitable habitat on 28 March by John Baker MCIEEM, Senior Ecologist at BSG Ecology (Natural England dormouse survey licence; 2016-22591-CLS-CLS) and Joe Bishop, Ecologist at BSG Ecology. Locations of tubes are shown in Figure 7. Survey visits to examine the nest tubes to look for signs of dormouse (e.g. characteristic nests or hairs, or the animals themselves) were carried out approximately monthly between July 2018 and end-September 2018 by John Baker.
- 5.54 Survey tubes were checked for signs of dormouse on 1 June, 29 June, 31 July, 4 September, 1 October and 1 November 2018. Using the points-based system to assess survey effort of Bright et al. (2006), this survey achieved a score of 22 points. Taking into account the fact that 230 (rather than the minimum number of 50) nest tubes were deployed, the score was doubled, in line with

standard industry guidance (Natural England, 2015a). The score, of 44 points is therefore well above the minimum of 20 points recommended for determining absence of dormouse (Bright et al., 2006).

Water Vole Survey

- 5.55 In order to determine whether water vole is present at the Site, surveys for this species were carried out over the period 2017–2018, based on standard industry guidance (Dean et al., 2016). The survey covered all suitable habitat for this species that is present at the Site, which comprises the Rowel Brook in the north of the Site and a tributary which flows into this from the east. Several ditches in the south-east of the Site were also surveyed (primarily because of historical records of the species from this location that were obtained in the desk study (see Results section), although these were considered to offer relatively poor habitat for water vole currently, due to the lack of water and/or riparian vegetation there.
- 5.56 A survey visit undertaken on 19 October 2017 by Peter Newbold MCIEEM, Principal Ecologist at BSG Ecology, and Elly Pattullo, Ecologist at BSG Ecology, covered all of the above areas. A survey visit on 24 April 2018 by Sarah Joscelyne, Ecologist at BSG Ecology, and Connor Butler, Ecologist at BSG Ecology, covered the eastern part of the Rowel Brook (and its tributary). A survey on 02 Oct by Tom Flynn MCIEEM, Ecologist at BSG Ecology and Peter Newbold MCIEEM, Principal Ecologist at BSG Ecology covered the remaining areas that were not surveyed in April 2018. All surveys were led by staff with experience in carrying out surveys for water vole.
- 5.57 On each survey visit, all accessible stretches of the stream or ditch within or on the boundary of the Site were surveyed. The survey involved systematically searching for evidence of water vole, including: latrines (communal areas of droppings), feeding stations, grazed lawns, burrows, runs and footprints. The habitats present were also assessed for their suitability to support the species (based on characteristics of the banks, channel depth and vegetation cover). Survey timing and effort took into account the recommendations of industry standard guidance (Dean et al., 2016).
- 5.58 Small parts (estimated at less than 5% of the total length) of the Rowel Brook were inaccessible during the survey due to the presence of dense scrub. Given that water vole was found to be present at the Rowel Brook during the survey, so long as it is assumed that it could be present anywhere along this watercourse within the Site (though some parts are more suitable than others), this limitation will not adversely affect the assessment of the ecological impacts of the proposed development.
- 5.59 Ditches forming the southern boundary of the Site east of the railway line are outside the Site boundary and were not surveyed.

Otter Survey

- 5.60 In order to determine whether otter is present at the Site, an otter survey was conducted by searching for signs of this species during the water vole survey detailed above. The survey covered the same sections of watercourse as the water vole survey (see Figure 8). The otter survey was based on the survey method of the Environment Agency (2010). This involved searching for evidence of otter and other riparian mammal species (such as American mink *Neovison vison*) along the stream and ditch banks and around any bridges. Such evidence can include spraints (droppings), footprints, runs (paths worn through vegetation adjacent to the water) slides (areas of steep bank showing signs of regular use by otters to access the water), and holts (burrows).
- 5.61 Particular attention was paid to prominent bankside or in-stream features such as tree trunks, branches, rocks, areas of bare ground, culverts and inflowing ditches or pipes, since these types of structures are often used as sprainting sites (otter spraints are used to indicate territories). Areas of mud were inspected for the presence of footprints.
- 5.62 Numerous potential sprainting sites were examined during the survey (and no signs of otter were seen), and the Rowel Brook is unlikely to provide important foraging habitat for otter (given its small size and likely very limited fish population). Therefore the small proportion of the watercourse that

was inaccessible (as detailed under water vole survey above) will not adversely affect the assessment of the ecological impacts of the proposed development.

Breeding Bird Characterisation Survey

- 5.63 In order to provide information on the use of the Site by breeding birds, a breeding bird characterisation survey was carried out over the period April–June 2018. This involved monthly visits to the Site during which all habitats at the Site were walked over, with attention being paid especially to linear features and woodland areas. Adjacent to and within areas of woodland, frequent stops were made to listen and scan for singing and calling birds. Large open areas were covered either from the edges, through direct observation, or were crossed by the surveyors. Birds observed beyond the boundary of the Site were also noted in order to provide further contextual information. Bird locations were mapped and behaviour recorded using standard British Trust for Ornithology (BTO) codes and symbols on field maps during each survey. The maps obtained as a result of the three visits were then collated to produce a single territory map. Breeding was assumed for all species which displayed breeding behaviour (such as carrying nesting material or food) and for species displaying territorial behaviour in suitable habitat.
- 5.64 The survey visits were carried out on 5 April 2018, 04 May 2018 and 12 June 2018 by John Baker, Gareth Clay and Peter Newbold, all MCIEEM and Senior or Principal Ecologists at BSG Ecology, and experienced field ornithologists. During all visits, the weather conditions were suitable for breeding bird surveys (there was no rain, or winds exceeding 5 on the Beaufort Scale).

Great Crested Newt Survey

- 5.65 Great crested newt breeds in waterbodies and can be found within terrestrial habitat up to 500 m from (though typically within 250 m of) such aquatic habitat. All ponds within the Site and within 500 m of the Site were therefore identified using Ordnance Survey maps (see Figure 10).
- 5.66 The six ponds within the Site (Ponds P1 to P6 on Figure 10) were subject to Habitat Suitability Index (HSI) assessment for this species and to surveys to determine whether this species is likely to be present. The HSI assessment (and, where access permission was available, surveys) were extended to include ponds on adjacent land within 500 m of proposed development at the Site ('proposed development' excludes areas proposed as nature reserve, parkland or retained agricultural land). Seven ponds outside the Site were subject to HSI, of which three (P7, 8 and 9) were accessed (allowing further survey), three (P10, 11 and 12) were assessed using aerial photography and Ordnance survey mapping only, and one (P13) was not accessed directly but was viewed from within the Site.
- 5.67 Methods used at each of the ponds are listed in Table 6, and are described below in more detail.

Table 6: Summary of great crested newt surveys. Ponds within the PR8 Site are highlighted in grey.

Pond ID	Approximate distance from development (excluding greenspace)	Habitat Suitability Index Assessment (2016)	Environmental DNA Survey (2018)	Overnight Surveys	Terrestrial survey in vicinity
1	80 m	Yes	Yes	No	No
2	80 m	Yes	Yes	No	No
3	60 m	Yes	Yes	No	No
4	20 m	Yes	Yes	Yes	No
5	220 m	Yes	Yes	No	No
6	320 m	Yes	Yes	No	No
7	80 m	Yes	Yes	No	No
8	40 m	Yes	Yes	No	No
9	80 m	Yes	Yes	No	No
10	260 m	Yes	No access	No access	No

11	40 m	Yes	No access	No access	Yes
12	60 m	Yes	No access	No access	Yes
13	530 m	Yes	No access	No access	No

- 5.68 Two of the ponds outside the Site but within 500 m of proposed development (P11 and 12) were not subject to any on-site surveys due to a lack of access permission. The landowner was contacted twice in writing in April 2017 and did not respond. These ponds were identified from Ordnance Survey maps, and are situated directly adjacent to one another, approximately 40 m and 60 m south-east of the PR3b site and 120 m and 140 m south-east of the PR8 site respectively. From Ordnance Survey maps, these ponds appear to be former settlement ponds (or similar) at a disused sewage or water treatment works. Aerial photography indicates that they now support willow scrub / wet woodland rather than open water, and their potential to provide breeding habitat for GCN is therefore likely to be limited. However, because the use of these ponds by GCN cannot be ruled out, and this species could therefore use terrestrial areas of the Site in proximity to these ponds, a terrestrial survey for this species was carried out at the Site, in the area of suitable terrestrial habitat closest to these ponds (see *Terrestrial survey* below).
- 5.69 Pond P10 is within 500 m of proposed development, but is located beyond 250 m from proposed development. Aerial photography indicates that this pond has suitable terrestrial habitat in its vicinity and it has poor connectivity to the Site because it lies beyond the A44 Woodstock Road which is a dual carriageway. For these reasons it is considered that any great crested newt populations associated with this pond is unlikely to utilise terrestrial habitat within areas of the Site proposed for development, and further surveys were therefore not carried out at this pond.
- 5.70 Pond 13 is located just outside the south-eastern boundary of the Site, close to parts of the Site that, under PR8, will be retained as agricultural land. Because of this retained agricultural land, and because much of the east of the Site is proposed as greenspace, P13 is 530 m from proposed development at the Site. It is considered that any great crested newt populations associated with this pond is unlikely to utilise terrestrial habitat within areas of the Site proposed for development, and further surveys were therefore not carried out at this pond.
- 5.71 The following paragraphs provide further detail on the four types of survey that were carried out for GCN.

Habitat Suitability Index Assessment

- 5.72 In order to provide a robust assessment of the potential for the presence of GCN at the Site, a Habitat Suitability Index (HSI) Assessment was undertaken for ponds within and close to the Site. This assessment was carried out by Dr Tom Flynn, MCIEEM, Senior Ecologist at BSG Ecology, on 16 and 17 April 2018. Tom Flynn has a Natural England great crested newt survey licence (number 2015-17735-CLS-CLS) and has carried out surveys for this species since 2005.
- 5.73 The HSI assessment covered all ponds within the Site, and all ponds within 250 m of the Site. For ponds P10, P11 and P12 (for which no access permission was obtained), the assessment was based on aerial photographs and Ordnance Survey mapping (with a precautionary approach taken for variables for which there was no information). Pond 13 was viewed from the Site but was not accessed directly.
- 5.74 HSI was developed for GCN by Oldham (2000). The revised method for determining HSI values, developed by ARG UK (2010) was used to implement the assessment. The method involves allocating scores to features associated with a pond such as size, quality of surrounding habitat and presence of fish. These scores are then combined to calculate the overall HSI for each pond as a number between 0 and 1, with 0 being the least suitable and 1 being the most suitable. The HSI score allows each pond to be placed in one of five pre-defined categories defining its suitability for GCN as follows: <0.5: poor; 0.5–0.59: below average; 0.6–0.69: average; 0.7 – 0.79: good; >0.80: excellent.

Environmental DNA survey

- 5.75 In order to determine presence or absence of GCN at the site, environmental DNA (eDNA) surveys were undertaken for ponds within and close to the Site. This assessment was carried out by Dr Tom Flynn, MCIEEM, Senior Ecologist at BSG Ecology and Ashley Sendell-Price, Ecologist at BSG Ecology, on 16 and 17 April 2018.
- 5.76 The eDNA survey covered all ponds within the Site, and all ponds within 250 m of proposed development at the Site, except for ponds P11 and P12, for which no access permission was obtained.
- 5.77 Water samples were collected as per the standard guidance (Biggs *et al.*, 2014) and sent by courier to ADAS Ltd for laboratory analysis for GCN DNA (order number 1040008-79534). ADAS also tested each sample for signs of inhibition or degradation (the presence of which could invalidate the analysis) and no such inhibition or degradation was found. Results were provided by ADAS on 24 April 2018.
- 5.78 There were no constraints or limitations on the effectiveness of the survey.

Overnight surveys

- 5.79 In order to provide data for the estimation of population size class, overnight surveys for great crested newt were carried out on one pond (Pond P4 in Figure 10). This pond was surveyed because the results of the eDNA survey indicate that this species is present there (but absent from all other ponds surveyed).
- 5.80 The overnight surveys were based on industry standard guidance (English Nature, 2001; Natural England, 2015b). This recommends that to estimate population size class, six appropriately-timed overnight survey visits should be undertaken. The overnight surveys should utilise a minimum of three methods: preferably torch survey (mid-March to mid-June), bottle-trapping (March to May) and egg search (April to June) and at least three of the overnight visits should be carried out between mid-April and mid-May.
- 5.81 Torch surveys involved searching for GCN after sunset using two Clulite 1 million candle power torches. All accessible parts of a pond's margins were slowly walked and searched.
- 5.82 Bottle trapping was carried out where water depth and bank side access allowed. Bottle traps (constructed from 2 L plastic drinks bottles) were set in suitable parts of a pond at dusk and left in place overnight. Bottle traps were checked for amphibians the following morning within 12 hours of setting, and any animals caught were released at the point of capture. Because the pond is lined with concrete, it was not possible to support traps on bamboo canes inserted into the pond base. Traps were therefore modified by adding weights to the funnel end, allowing them to float vertically below the surface, supported by an air bubble at the top. Traps were tethered to the bank to avoid loss.
- 5.83 Egg searches were conducted in order to determine whether GCN were breeding. This involved searching marginal and aquatic vegetation for the distinctive leaf folding pattern and egg size and colour produced by GCN. Results from egg searches are only useful for indicating presence/likely absence, and not population size. The presence of GCN eggs also provides clear evidence of attempted breeding at a pond.
- 5.84 Overnight surveys were carried out on the dates and under the weather conditions indicated in Table 7, and by the surveyors listed in Table 8. The surveys were led by Dr Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology who holds a Natural England GCN survey licence (number 2015-17735-CLS-CLS), and has carried out surveys for this species since 2005. A surveyor holding a Natural England survey licence for GCN was present on each survey visit.

Table 7: Survey conditions during overnight surveys for great crested newt.

Visit	Date	Surveyors (see Table 8)	Temperature (after torch survey)	Wind Speed (Beaufort)	Rain (during survey)	Turbidity score (/5)	Vegetation score (/5)
1	26.04.2018	TF + MS	6	2	none	0	1
2	02.05.2018	TF + JP	7	2	none	0	2
3	10.05.2018	TF + JB	6	2	none	2	2
4	17.05.2018	TF + RM	6	2	none	2	2
5	23.05.2018	TF + KR	12	3	none	2	2
6	30.05.2018	TF + RM	14	1	none	2	2

Table 8: Surveyors participating in overnight surveys for great crested newt.

Surveyor	Initials	Job title and employer (at time of survey)	CIEEM Status	Natural England Great Crested Newt Licence number
Dr Tom Flynn	TF	Senior Ecologist, BSG Ecology	MCIEEM	2015-17735-CLS
Rachel McDonald	RM	Ecologist, BSG Ecology		
Jamie Peacock	JP	Ecologist, BSG Ecology		2016-20471-CLS-CLS
Kate Rooney	KR	Ecologist, BSG Ecology	GradCIEEM	2015-17459-CLS-CLS
Melanie Sanders	MS	Ecologist, BSG Ecology		
Joe Bishop	JB	Ecologist, BSG Ecology		

- 5.85 The above guidance recommends that to determine population size class, the peak count obtained from six survey visits should be used, with at least three of these visits carried out between mid-April and mid-May. GCN populations (which can include multiple ponds, depending upon the distance and habitats between them) can then be classed as 'small' for maximum counts of up to 10 adults, 'medium' for maximum counts between 11 and 100, and 'large' for maximum counts exceeding 100 adults.
- 5.86 Weather conditions during the survey visits (including temperature) were suitable for the surveys (see summary data in Table 7 above). Turbidity and vegetation cover were within acceptable limits for torchlight surveys on all six survey visits (the ranges were 0–2 and 2–2 respectively). There were no constraints or limitations on the effectiveness of the survey.

Terrestrial survey

- 5.87 Because surveys were not carried out at the off-site ponds P11 and P12, and these are within 250 m of proposed residential or other, potentially high impact, development at the Site, it was considered appropriate to carry out a terrestrial survey for GCNs. The purpose of this survey was to determine whether GCNs are present in suitable terrestrial habitats within parts of the Site close to ponds P11 and P12.
- 5.88 The closest terrestrial habitat suitable for GCN within the Site is a triangular shaped area of scrub and rough grassland that forms the PR3b Site. This area is between 40 and 150 m from Ponds 11 and 12. In order to survey this area for terrestrial GCN, a total of 20 artificial refuges consisting of carpet tiles measuring 50 cm by 50 cm were placed out around the perimeter of the area (the centre is inaccessible due to the presence of dense scrub). These tiles were in addition to 20 artificial reptile shelters placed in this area for the reptile survey (see *Reptile Survey* below), which also provided suitable sheltering sites for GCN. The 40 artificial refuges were checked by surveyors on six occasions during daytime between 13 April 2018 and 04 June 2018, and on a further four occasions between 10 September 2018 and 01 October 2018. Survey visits were carried out by the following staff who hold Natural England GCN survey licences: Mark Norriss, Ecologist at BSG Ecology (Natural England GCN licence number 2016-22023-CLS-CLS), Tom Flynn, John

Baker MCIEEM, Senior Ecologist at BSG Ecology (Natural England GCN licence number 2016-22258-CLS-CLS) and Peter Newbold MCIEEM, Principal Ecologist at BSG Ecology (Natural England GCN licence number 2015-18530-CLS-CLS). Joe Bishop, Ecologist at BSG Ecology assisted with some of the survey visits.

- 5.89 The use of artificial refuges without the use of the dug-in drift fencing that is specified in industry standard guidance for terrestrial GCN survey (English Nature, 2001) was considered a proportionate level of survey effort, given the limited potential for ponds 11 and 12 to be breeding ponds and (from aerial photographs) the abundance of suitable terrestrial habitat in their vicinity outside the Site.
- 5.90 Weather conditions during the survey (i.e. in April, May and September 2018) were suitable. The weather in April was bright and showery. May had above average temperatures but rainfall was close to normal across central and southern England. September had unsettled weather for most of the month⁸.

Reptile Survey

- 5.91 From the results of the Phase 1 habitat survey, suitable reptile habitat was identified at the Site. This is predominantly on the margins of fields adjacent to hedgerows or scrub, or in rough grassland. In order to determine whether reptiles are present (and if so, which species), a presence/absence survey for reptiles following the industry standard guidance of Froglife (1999) was carried out in 2018.
- 5.92 A total of 100 artificial refuges (each comprising a piece of roofing felt 100 x 50 cm (i.e. 0.5 m²) were placed within the suitable habitats at the Site on 15 March 2018 (see Figure 8 for locations). Because of the nature of the Site (predominantly arable fields) it is difficult to accurately map the area of potentially suitable reptile habitat and hence to calculate refuge density that was required and deployed in suitable habitat. However, based on the recommendations of Froglife (1999), which refer to a refuge density of 5–10 refuges per hectare, the 100 refuges used were sufficient to cover 10–20 ha of suitable habitat (i.e. 5–11 % of the 177 ha Site). Based on the Phase 1 habitat survey (see Figure 2), this is considered to be significantly more than the area of suitable reptile habitat at the Site.
- 5.93 The artificial refuges were checked for reptiles on seven occasions between 13 April and 25 May 2018. Survey visits were carried out on the dates and under the weather conditions indicated in Table 9. The timing and weather conditions were suitable for reptile surveys (Froglife, 1999; Natural England, 2015c). The surveyors were as listed for terrestrial GCN survey above. All have previous experience and/or formal training in reptile survey

Table 9: Dates and weather conditions of reptile survey visits.

Visit no.	Date	Surveyors*	Temperature (°C)	Cloud (Otkas)	Weather Notes
Setup	14.03.2018	MN	N/A	N/A	N/A
1	13.04.2018	JP	10-11	8	Occasional sun Light wind
2	19.04.2018	PN + JB	11-19	0	Very light breeze, strong sun
3	25.04.2018	JB	10-13	5-7	Light wind, occasional sun, Rain at end of survey
4	01.05.2018	JB	10-13	0-4	Strong sun, light wind
5	08.05.2018	JB	16-19	0	Strong sun, light wind
6	14.05.2018	JB	15-18	0	Strong sun, light wind
7	25.05.2018	JB	14-17	8	Rain all morning prior to survey, light wind

⁸ Source: <https://www.metoffice.gov.uk/climate/uk/summaries/2018> [accessed 29/11/2018].

* Surveyors: MN: Mark Norriss, Ecologist at BSG Ecology; JP: Joe Pollard, Ecologist at BSG Ecology; JB: John Baker, Senior Ecologist at BSG Ecology.

Invertebrate Surveys

Crayfish survey

- 5.94 A manual and night torchlight survey for white clawed crayfish *Austropotamobius pallipes* was undertaken on 04 October 2017. The survey was carried out by Julie Bywater of Bywater Ecology who has extensive experience of crayfish surveys and holds a white-clawed crayfish Natural England survey licence, assisted by Sarah Joscelyne, Ecologist at BSG Ecology.
- 5.95 The night survey was preceded by a daytime inspection to target suitable areas for night survey and a manual survey involving searching for crayfish by stone turning and hand netting. The torchlight survey involved searching the Rowel Brook within the Site by torchlight (using two Clulite 1 million candle power torches).

Targeted stream aquatic macroinvertebrate survey

- 5.1 Aquatic macroinvertebrates were collected at a total of five sampling points on 04 October 2017 and 24 April 2018 along Rowel Brook. Sample 1 was taken from a tributary to the east of the Rowell Brook. Samples 2-5 were taken from Rowel Brook itself, which flows from west to east. Sampling locations are shown in Figure 8 and Photographs A2-1 to A2-6 in Appendix 2.
- 5.2 Macroinvertebrates were collected using standard three-minute kick sample methodology (BS EN 27828:1994) using a 1 mm mesh hand net. Three minutes of net sampling was carried out with the time divided equally between all of the mesohabitats present. Stony or sandy substrates were lightly kick-sampled to disturb and capture macroinvertebrate inhabiting the stream bed. Care was taken to avoid deep accumulations of soft sediment since this makes later sorting extremely difficult. Similarly, the netting of large volumes of plant material was avoided. One minute of hand searching (of rocks, logs, leaf packs and other submerged debris) was then carried out for invertebrates (e.g. limpets, caddis larvae, pond skaters, riffle and whirligig beetles) that might otherwise have been missed during the net sampling.
- 5.1 Coarse debris was checked for clinging invertebrates before being removed from the net. Samples were preserved immediately in 70% industrial methylated spirit for subsequent laboratory analysis.
- 5.2 At each sampling point, habitat details such as channel characteristics, adjacent land use and macrophyte cover and composition were recorded on a standard form. In addition, water chemistry was measured using a multi-parameter meter. Recordings of conductivity, pH, total dissolved solids and dissolved oxygen were taken.

Macroinvertebrate identification

- 5.3 In the laboratory, aquatic macroinvertebrates were separated from material collected incidentally as a by-catch of the kick-sampling process. All macroinvertebrate individuals present in the sample were identified to family-level under a stereoscopic microscope (x70) using the most up-to-date identification keys available.
- 5.4 Macroinvertebrate samples were identified by Dr Jessica Kent of BSG Ecology. The brook and its tributary were at a normal flow level during both surveys.

Weather conditions

- 5.5 The weather on 04 October 2017 was overcast and cool (maximum temperature 14°C), with a moderate breeze.
- 5.6 On 24 April 2018 the weather was overcast and cool (maximum temperature 14°C), with a moderate breeze and occasional rain.

Data analysis – WHPT

- 5.7 A calculation was made of the Whalley, Hawkes, Paisley and Trigg (WHPT) metric from the macroinvertebrate family list. WHPT supersedes the Biological Monitoring Working Party (BMWP) index (WFD UKTAG, 2014).
- 5.8 Macroinvertebrate families which are more susceptible to pollution, including Philopotamidae (caddis fly), Siphonuridae (mayfly) and Taeniopterygidae (stonefly) score highly. Conversely, pollution-tolerant groups (such as Oligochaeta (worms) and Chironomidae (non-biting midge larvae)) score the least points. Accordingly, high-scoring watercourses have highest water quality, whilst polluted watercourses score the lowest. WHPT scores are weighted by the abundance of individual families.
- 5.9 The WHPT metric can be expressed as the Number of Taxa (NTAXA), which is the total number of scoring taxa, and the Average Score Per Taxon (ASPT), which is obtained by dividing the WHPT score by the number of scoring taxa. The higher the ASPT, the cleaner the watercourse is; in general, ASPT scores over 5 are indicative of good biological quality, and scores below 4 are indicative of poor biological quality.

Baseline Survey Limitations

- 5.10 All relevant survey limitations have been noted within the above text.

6 Results and Interpretation

6.1 A summary of relevant legislation and planning policy is provided in Appendix 3.

Statutory Designated sites

6.2 There are no statutory wildlife sites within the Site. Statutory wildlife sites within the desk study search area are indicated in Figure 1 and listed in Table 10.

Table 10: Statutory designated wildlife sites within 5 km of the Site centre.

Site Name	Designation	Overview	Area (ha)	Approximate distance and
Rushy Meadow	SSSI ¹	Damp meadow.	8.7	10 m NE
Oxford Meadows	SAC ²	Floodplain grassland, including grazed pasture and hay meadows.	267.4	1.8 km S
Cassington Meadows	SSSI	Hay meadows and fen.	7.0	2.8 km SW
Pixey and Yarnton Meads	SSSI	Floodplain hay meadows.	85.6	1.8 km S
Wolvercote Meadows	SSSI	Floodplain hay meadows.	9.2	2.4 km S
Blenheim Park	SSSI	Oak-dominated pasture woodland and lakes.	225.2	2.5 km NW
Portmeadow with Wolvercote Common and Green	SSSI	Grazed floodplain grassland.	166.7	2.5 km S
Shipton on Cherwell and Whitehill Farm Quarries	SSSI	Notified for its geological interest: white limestone containing abundant and important fossils.	27.7	2.7 km N
Wytham Ditches and Flushes	SSSI	Ditches supporting species-rich eutrophic aquatic and fen flora.	5.7	2.7 km SW
Hook Meadows and the trap Grounds	SSSI	A series of poorly-drained unimproved neutral meadows.	11.3	3.6 km S
Wytham Woods	SSSI	A complex of ancient woodland, wood pasture, common land and old limestone grassland.	426.5	3.6 km SW
Woodeaton Quarry	SSSI	Notified for its geological interest: a Bathonian section and white limestone formation.	6.4	4.0 km E
Shipton-on-Cherwell and Whitehill Farm Quarries SSSI	SSSI	Notified for its geological interest: a section from near the base of the White Limestone up to the Lower Cornbrash (with important fossil reptiles) at Shipton Quarry; and the highly fossiliferous Shipton Member of the White Limestone at Whitehill Quarry.	4	4.4 km N
Woodeaton Wood	SSSI	Woodland forming an intact relic of the ancient Shotover Forest.	14.1	4.8 km E
New Marston Meadows	SSSI	A series of agriculturally unimproved neutral meadows on the flood plain of the River Cherwell.	44.4	4.9 km SE
Long Hanborough Gravel Pit	SSSI	Notified for its geological interest: This site provides exposures in the gravel of the Pleistocene Hanborough Terrace of the Evenlode Valley.	4.3	5.0 km W
¹ Site of Special Scientific Interest ² Special Area of Conservation				

- 6.3 Of these, one statutory wildlife site is within 1 km of the Site: Rushy Meadows Site of Special Scientific Interest (SSSI). This site lies close to the north-east of the Site, separated by track, public footpath and double hedgerow. The citation for this site⁹ notes that Rushy Meadows SSSI consists of a series of unimproved alluvial grasslands alongside the Oxford Canal, and that the low-intensity, traditional management of this site has produced rich meadow and fen communities containing several uncommon plant species such as pepper saxifrage *Silvaum silaus*, devil's bit scabious *Succisa pratensis*, heath grass *Danthonia decumbens*, marsh valerian *Valeriana dioica*, betony *Stachys officinalis*, early marsh orchid *Dactylorhiza incarnata*, distant sedge *Carex distans* and water avens *Geum rivale*. It also notes that meadow habitats of this type are now both rare and under threat in Britain, particularly, in this district due to the pressures of agricultural improvement and urban development.
- 6.4 The next closest statutory wildlife site is Oxford Meadows Special Area of Conservation (SAC), ca. 1.8 km to the south of the site, beyond the A44 Woodstock Road, a railway line and the A40 road. This site supports unimproved lowland hay meadow and pasture, and is designated for the EU Annex I habitat Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) and the EU Annex II plant species creeping marshwort *Apium repens*. The SAC is made up of all or part of four SSSIs (specifically, Cassington Meadows SSSI, Pixey and Yarnton Meads SSSI, Wolvercote Meadows SSSI, and the majority of Portmeadow with Wolvercote Common and Green SSSI).
- 6.5 The Site is within the SSSI Impact Risk Zones for Rushy Meadow SSSI and Oxford Meadows SAC.

Ancient Woodland

- 6.6 The Site contains no sites listed on Natural England's Ancient Woodland Inventory (which includes ancient replanted woodland sites). There are six such sites within 3 km of the Site, listed in Table 11.

Table 11: Ancient Woodland within 5 km of the Site centre.

Site Name	Approximate distance and direction
Begbroke Wood	0.66 km W
Bladon Heath	0.90 km W
Worton Heath	1.1 km W
Burleigh Wood	2.4 km W
Busby's Spinny	2.9 km N
Wytham Wood (including various sub-compartments)	3.6 km SW

Non-statutory designated sites

- 6.7 Non-statutory designated sites within 2 km of the Site are listed in Table 12. The Site contains one non-statutory designated site: Lower Cherwell Valley Conservation Target Area (CTA), part of which occupies an arable field and a pasture field in the north-east of the Site (within areas of proposed greenspace). This CTA also extends along the Oxford Canal adjacent to the eastern boundary of the Site. There are six Local Wildlife Sites (LWS) within 2 km of the Site, one Potential Local Wildlife Site (PLWS), one Conservation Target Area (CTA) and one Woodland Trust Reserve. Of these, the Woodland Trust reserve at Stratfield Brake is the nearest to the Site, being located 80 m east beyond the Oxford Canal.

Table 12: Non-statutory wildlife sites within 2 km of the Site.

Designation	Site Name and ID	Description	Approx. Distance & Direction from Site
CTA	Lower Cherwell Valley	The Cherwell Valley from Lower Heyford to Kidlington and south of Kidlington along the Oxford Canal. Dominated by lowland meadows	Overlaps with north-eastern part of Site.

⁹ <https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1001685.pdf>

		but with other habitats including wetlands and quarry workings.	
Woodland Trust Reserve	Stratfield Brake	A small area of mature woodland and larger areas of young planted woodland. Includes an extension area to the north.	80 m E
LWS	Meadows west of Oxford Canal 41V18	Two fields adjacent to Oxford Canal containing lowland meadow and fen.	0.35 km S
LWS	Begbroke Wood 41 R03	Oak woodland with abundant bluebells, silver-washed fritillary butterfly, damp areas and an area of calcareous grassland.	0.47 km E
LWS	Langford Meadows 41S02	An area of tall herb fen, lowland meadow and rough grassland, supporting a range of plant species, and a locally important site for birds including reed bunting and snipe.	0.85 km N
LWS	Bladon Heath 41L02	A former heath that has been planted with conifers but retains some of its distinctive plant and invertebrate species, and has areas of semi-natural woodland, and fragments of slightly acid open ground along its rides.	0.90 km E
CTA	Oxford Meadows and Farmoor	A large area of lowland meadows, Farmoor Reservoir and gravel workings north and west of Oxford. It includes part of the Oxford Meadows SAC. It includes wetland habitat.	1.3 km S
LWS	Loop Farm Flood Meadows 41V02	Two wet species-rich floodplain fields with species-rich hedgerows and a small area of reedbed between the railway line and Oxford canal and adjacent to Duke's Cut Pond.	1.3 km S
LWS	Wet Wood and Swamp Near Yarnton 41V08	Two small borrow pits either side of the railway line, supporting wet woodland, tall wetland vegetation and sedges. Also some drier ash woodland.	1.3 km S
LWS	Wet Woodland and Swamp south west of Yarnton 41V08	Two small borrow pits containing tall wetland vegetation, wet willow woodland, and a bank of ash woodland.	1.4 km S
LWS	Cassington to Yarnton Gravel Pits 41Q11	A series of river terrace gravel pits, with areas of silt bed, developing reed beds, and young plantation woodland. It has considerable bird interest, particularly for wintering waterfowl.	1.4 km S
LWS	Cassington to Yarnton Pits East Extension	Meadows adjacent to the east of the existing LWS. Supports elements of lowland meadow habitat.	1.4 km S
PLWS	Kidlington Meadows 41X02	A large site on the floodplain of the River Cherwell, containing former pasture on which scrub and young plantation woodland is developing. The site also has some local bird interest.	1.5 km NE
PLWS	Branson's Lake and Scrub	Lake with reedbed and adjacent woodland and scrub along the river Cherwell. Attracts wildfowl.	1.5 km NE
LWS	Duke's Lock Pond 41V13	A pond providing a substantial area of reedbed north of Duke's Lock on the Oxford Canal. Abundant sedge and reed warbler present, and reed bunting.	1.5 km S
BBOWT Reserve	Oxey Mead	A field forming part of Pixey and Yarnton Meads SSSI. Supports invertebrates, wet meadow plants, skylark and wading birds.	1.8 km S
Oxford City SLINC	Linkside Lake	Lake on the site of an old clay pit.	1.9 km SE
LWS	Canalside Meadow (Oxford Canal Marsh)	Wet meadow grading into sedge-dominated fen alongside the Oxford Canal. Important for birds.	2.0 km S

Habitats

- 6.8 The Site is dominated by arable fields with an extensive network of hedgerows. A stream, Rowel Brook, passes across the north of the site. There is an associated corridor of woodland, and an inflowing stream. There is a small block of mixed plantation woodland around several barns (Parker's Farm), east of the Science Park. Areas of species-poor semi-improved grassland and amenity grassland are present at the Science Park, and there are small areas of damp semi-improved neutral grassland in the north-east of the Site, east of the railway line. Ditches are mainly present east of the railway line. A number of buildings are present, including large modern buildings and an old stone farmhouse and associated buildings at Begbroke Science Park.
- 6.9 A Phase 1 habitat plan of the Site is provided in Figure 2. Habitats present at the Site are listed in Table 13. Related target notes are included in Appendix 4. The full botanical survey data is provided in Appendix 5.

Table 13: Phase 1 habitats at the Site.

Habitat	Description
Arable land	The Site is dominated by large arable fields (Photographs 1 and 2). During the visits carried out in 2015 and in 2018, these were observed to support crops of winter wheat, barley and oilseed rape. Field boundaries are formed by hedgerows (see below). There is also an area of public allotments in current use in the north-west of the Site adjacent to the A44 Woodstock Road. Widespread arable weeds noted include field pansy <i>Viola arvensis</i> , field poppy <i>Papaver rhoeas</i> , hedge mustard <i>Sisymbrium officinale</i> , spear thistle <i>Cirsium vulgare</i> , prickly sow-thistle <i>Sonchus asper</i> , and mugwort <i>Artemisia vulgaris</i> . Two arable weeds with more restricted national distributions (corn marigold <i>Glebionis segetum</i> and common cudweed <i>Filago vulgaris</i>) were also recorded during the botanical survey, being present on arable field margins in the north-west and centre-south of the Site, respectively. For more details on these two species at the Site, see the section <i>Plants</i> below. This habitat is not a HPI since it does not conform to the description of the Habitat of Principal Importance <i>Arable Field Margins</i> in BRIG (2011).
Good semi-improved neutral grassland	<p><u>Field A</u> in the north-east of the Site (Photograph 3) is dominated by the coarse grass false oat-grass <i>Arrhenatherum elatius</i>, and much of the margins are dominated by ruderals (e.g. common nettle <i>Urtica dioica</i>) and bramble <i>Rubus fruticosus</i> agg. scrub. These characteristics indicate a lack of recent management, and there was no evidence of mowing or other management on visits throughout 2018. The sward contains a number of other grass and forb species, including species such as tufted hair-grass <i>Deschampsia cespitosa</i>, meadowsweet <i>Filipendula ulmaria</i> and wild angelica <i>Angelica sylvestris</i>, that are indicative of damp conditions.</p> <p><u>Field D</u> in the east of the Site (Photograph 4) is dominated by a mix of false oat-grass and Yorkshire fog <i>Holcus lanatus</i>. Various other grasses are present including red fescue <i>Festuca rubra</i>, meadow foxtail <i>Alopecurus pratensis</i> and smooth meadow-grass <i>Poa pratensis</i>. A range of forbs is present, including hogweed <i>Heracleum sphondylium</i>, germander speedwell <i>Veronica chamaedrys</i>, common sorrel <i>Rumex acetosa</i>, creeping buttercup <i>Ranunculus repens</i>, lesser stitchwort <i>Stellaria graminea</i> and greater burnet <i>Sanguisorba officinalis</i>. Several of these species are indicative of damp conditions. However, most of these forbs are present at relatively low abundance, and much of the sward is grass-dominated and not species-rich. This field was mown between July and August 2018.</p> <p>Fields A and D were subject to detailed botanical survey in May 2018. The results are provided in Appendix 5. Based on the description in JNCC (2010) these fields support good semi-improved neutral grassland. Based on the Natural England (2010) <i>Farm Environment Plan</i> grassland keys, fields A and D support good quality semi-improved grassland in some areas and species-poor semi-improved grassland in others. Due to the dominance of false oat-grass, the grassland in these two fields is considered most closely-related to the MG1 <i>Arrhenatherum elatius</i> community. Based on the description in BRIG (2011), Fields A and D do not support the Habitat of Principal Importance (HPI) <i>Lowland Meadows</i>, or any other HPI. The <i>Lowland Meadows</i> HPI includes only unimproved grassland of the MG4, MG5 of MG8 communities. However, the grassland here may have been derived from more species-rich communities in the recent past (such as MG4 <i>Alopecurus pratensis</i>-<i>Sanguisorba officinalis</i> grassland, damp MG5 <i>Cynosurus cristatus</i>-<i>Centaurea nigra</i> grassland, or MG6 <i>Cynosurus cristatus</i> grassland). These two fields have some potential for ecological restoration through</p>

	<p>appropriate management.</p> <p><u>Begbroke Science Park</u> has a small area of semi-improved neutral grassland in the north. This grassland was subject to detailed botanical survey in July 2015 (BSG, 2015), the results of which are provided in Appendix 5. Since this area will not be directly affected by the PR8 development, this area was not subject to detailed botanical survey in 2018.</p> <p>This grassland has an open sward with areas of bare ground visible, indicating that it is of relatively recent origin. It is present on a flat area with a sandy soil. Online aerial imagery shows that a row of two to three residential buildings (and associated gardens) were present in this area until at least 2004. A list of plant species present in this area was collected by BSG Ecology surveyors during grassland monitoring surveys carried out in 2014 and 2015. This list is provided in Appendix 5. Based on the description in JNCC (2010) this grassland has been classified as good semi-improved grassland, though due to its recent origin, it also has some similarity with ephemeral/short perennial habitat. Based on the Natural England (2010) <i>Farm Environment Plan</i> grassland keys, this grassland is good quality semi-improved grassland. From the species present and the recent origin of this grassland, it does not have affinity to National Vegetation Classification communities MG4, MG5 or MG8. This area does not support the Habitat of Principal Importance Lowland Meadows, or any other HPI, based on the descriptions in BRIG (2011).</p> <p><u>Lawn at Begbroke Hill Farmhouse.</u> Although closely-mown, this is relatively species-rich, containing a number of grass, forb and bryophyte species (e.g. common bent <i>Agrostis capillaris</i>, red fescue <i>Festuca rubra</i>, yarrow <i>Achillea millefolium</i> daisy <i>Bellis perennis</i>, common cat's-ear <i>Hypochoeris radicata</i> and springy turf-moss <i>Rhytidiadelphus squarrosus</i>). Since this area will not be directly affected by the PR8 development, this area as not subject to detailed botanical survey. This area does not support the Habitat of Principal Importance Lowland Meadows, or any other HPI, based on the descriptions in BRIG (2011).</p>
Poor semi-improved neutral grassland	<p>Two fields in the north-east of the Site (fields B and D on Figure 4) and a small area of a third field that is dominated by scrub (field E on Figure 4) support relatively species-poor grassland, though the species composition of these differs:</p> <p><u>Field B</u> (Photograph 5) is dominated by Italian ryegrass <i>Lolium multiflorum</i> in most areas, with some areas dominated by Yorkshire fog (Photograph 4). A few other grass species are present but forbs are rare. This field was observed to be in a ploughed state during a visit by BSG Ecology in 2015 (BSG Ecology, 2015), and it is assumed that it was sown to Italian ryegrass at or shortly after this time, and that this species has persisted through self-seeding. This field was mown between July and August 2018.</p> <p>This field was subject to detailed botanical survey in May 2018. The results are provided in Appendix 5. Based on the description in JNCC (2010) this field support poor semi-improved neutral grassland. Based on the Natural England (2010) <i>Farm Environment Plan</i> grassland keys, field B supports species-poor improved grassland. This grassland does not resemble any recognised NVC communities and is clearly not a HPI, based on the descriptions in BRIG (2011).</p> <p><u>Field C</u> (Photograph 6), adjacent to the South of Field B, has a sward consisting almost exclusively of tall fescue <i>Schedonorus arundinaceus</i>. Some Yorkshire fog is also present, as are a few other grasses and forbs including creeping cinqfoil <i>Potentilla reptans</i>, creeping buttercup <i>Ranunculus repens</i> and a little wild angelica. This field was noted to be very wet during site visits in early 2018. This grassland was mown between July and August 2018. The dominance of tall fescue is likely to have resulted from seeding (this species is occasionally grown as a hay crop in damp situations). Ploughing is likely to have occurred following January 2015, since this field was observed (on a visit by BSG Ecology) to support a rough mixed grass sward at that time (BSG Ecology 2015).</p> <p>This field was subject to detailed botanical survey in May 2018. The results are provided in Appendix 5. Based on the description in JNCC (2010) this field support poor semi-improved neutral grassland. Based on the Natural England (2010) <i>Farm Environment Plan</i> grassland keys, field A and D supports species-poor improved grassland. This grassland does not resemble any recognised NVC communities and is clearly not a HPI, based on the descriptions in BRIG (2011).</p> <p><u>Field E</u> in the south of the Site (Photograph 7) is dominated by dense hawthorn <i>Crataegus monogyna</i> scrub, but the periphery appears to be mown annually (mowing occurred between July and August in 2018), resulting an outer strip of common nettle and coarse grassland</p>

	<p>dominated by false oat-grass and cock's-foot (Photograph 6). Several forb species are occasionally present, including hogweed <i>Heracleum sphondylium</i>, perforate St. John's-wort <i>Hypericum perforatum</i>, hairy tare <i>Vicia hirsuta</i>, curled dock <i>Rumex crispus</i> and tufted vetch <i>Vicia cracca</i>. The dominance of grasses and relatively low abundance and diversity of forb species makes this grassland poor rather than good semi-improved neutral grassland. Because of the dominance of false oat-grass, this grassland shows similarity to MG1 <i>Arrhenatherum elatius</i> grassland.</p> <p>This field was subject to detailed botanical survey in May 2018. The results are provided in Appendix 5. Based on the description in JNCC (2010) grassy area of this field support poor semi-improved neutral grassland. Based on the Natural England (2010) <i>Farm Environment Plan</i> grassland keys, grassy areas of this field support species-poor semi-improved grassland. This grassland is not a HPI, based on the descriptions in BRIG (2011).</p> <p>Several further small areas of species-poor semi-improved grassland are present at the site, including areas at the Science Park (for which data from 2015 is provided in Appendix 5) and on road verges on Sandy Lane. These areas are grass-dominated, with relatively few forb species. This grassland in these areas is not a HPI, based on the descriptions in BRIG (2011).</p>
Improved grassland	An area of improved grassland dominated by perennial rye-grass <i>Lolium perenne</i> with some creeping buttercup <i>Ranunculus repens</i> is present in the south-west of the site. This grassland has a short sward and is used for deer farming. This habitat does not represent the Habitat of Principal Importance Lowland Meadows, based on the description in BRIG (2011).
Amenity grassland	Various areas of amenity grassland (lawn) are present around the Science Park and on associated road verges (Target Notes 29, 32). These are closely mown, and species-poor, being dominated by perennial rye-grass, or in some areas, by red fescue <i>Festuca rubra</i> . This habitat does not represent the Habitat of Principal Importance Lowland Meadows, based on the description in BRIG (2011).
Broad-leaved semi-natural woodland	A corridor of semi-natural woodland follows the Rowel Brook in the north of the Site (Target Note 3; Photograph 10), and also follows a smaller stream which flows into this at the northeast of the Site (Target Note 9). This woodland is dominated by pedunculate oak <i>Quercus robur</i> (but also contains ash <i>Fraxinus excelsior</i> , sycamore <i>Acer pseudoplatanus</i> , alder <i>Alnus glutinosa</i> and crack willow <i>Salix fragilis</i>). Where present, the shrub layer is dominated by hazel <i>Corylus avellana</i> , and the field layer by bramble and ivy <i>Hedera helix</i> . This woodland is natural in character and has distinct shrub and field layers of native species. This habitat is considered to conform to the description of Lowland Mixed Deciduous Woodland in BRIG (2011) and therefore is a HPI. The non-native invasive plant species variegated yellow archangel <i>Lamiastrum galeobdolon</i> ssp. <i>argentatum</i> is present in the western part of this woodland, presumably having escaped from a garden at Begbroke (Target note 4).
Plantation woodland	A small area of planted woodland containing mixed mature trees including Italian alder <i>Alnus cordata</i> and Scots pine <i>Pinus sylvestris</i> is present around modern and old barns at Parker's Farm, east of the Science Park (Target Note 7, Photograph 2). There is also a belt of young deciduous planted woodland surrounding the Science Park (Target Note 1); this contains a range of native broad-leaved species such as hazel, silver birch <i>Betula pendula</i> and osier willow <i>Salix viminalis</i> . Due to its young age and lack of mature canopy or woodland ground flora, this habitat is not considered to conform to the description of Lowland Mixed Deciduous Woodland in BRIG (2011) and therefore is not a HPI.
Hedgerow	There is a network of agricultural hedgerows across the site (e.g. Photographs 1 and 8), mostly dominated by hawthorn but containing a range of native shrub species (including blackthorn <i>Prunus spinosa</i> , spindle <i>Euonymus europaeus</i> , buckthorn <i>Rhamnus cathartica</i> , dogwood <i>Cornus sanguinea</i> , hazel, elder <i>Sambucus nigra</i> , English elm <i>Ulmus procera</i> , crab apple <i>Malus sylvestris</i> , and dog rose <i>Rosa canina</i>), and in some cases, trees (such as ash, crack willow <i>Salix fragilis</i> , pedunculate oak and (on the northern boundary of the Site) turkey oak <i>Quercus cerris</i>). The majority of the hedgerows are species-rich, containing five or more woody species. Some are defunct (i.e., not stock-proof). Because they are all composed of 80% or more of native species, all of the hedgerows at the Site represent the HPI Hedgerows. For further details of hedgerows at the Site, see the section <i>Hedgerows</i> below.
Scrub	Several areas of the Site support areas of dense scrub, either dominated by hawthorn (with other woody species) or by bramble <i>Rubus fruticosus</i> agg. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI.
Introduced Shrub	Small areas of introduced ornamental shrubs are present within the Science Park. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is

	therefore not a HPI.
Tall Ruderal vegetation	Tall ruderal vegetation is present as stands of common nettle in the north-east of the Site, and of hemlock <i>Conium maculatum</i> and other species on bunds just east of Parker's Farm. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI.
Swamp	A small area of swamp dominated by common reed <i>Phragmites australis</i> and lesser pond sedge <i>Carex acutiformis</i> surrounds part of pond P1 in the North of the Site (Photograph 11). A further area of swamp dominated by reed sweet-grass <i>Glyceria maxima</i> is present on the eastern edge of the Site (Target Note 26; Photograph 10); adjacent to an artificial stream associated with a canal lock). This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI.
Running water	A small stream, the Rowel Brook, flows west to east across the north of the Site (Target Note 2; Photograph 9 and see also photographs in Appendix 4). The channel has a depth of ca. 0.5 to 1.2 m with relatively steep soil banks. The water depth was observed to vary between approximately 0.1 and 0.5 m during 2018. The river flows into the Oxford Canal on the north-eastern boundary of the site. A smaller stream flows north-west and enters the Rowel Brook towards the north-east of the Site (Target Note 8). A short artificial stream is present at the east of the Site flowing around a lock on the Oxford Canal (Target Note 25). This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI.
Ditches	Ditches are present adjacent to many of the hedgerows at the Site, particularly in the east of the Site. Many of these ditches held water during survey visits early in 2018, but all were dry by June 2018. Aquatic plants were present in some ditches, including fool's water-cress <i>Apium nodiflorum</i> (e.g. Target Note 20, Target Note 24; Photographs 7 and 10). This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI.
Ponds	Six ponds are present within the Site (labelled P1 to P6 on Figure 10). Further details of these are provided in the section <i>Ponds</i> below. See Photographs 11, 13, 14, 15, 16, 17 and 18). The presence of great crested newt makes pond P4 at Begbroke Science Park a HPI. The other ponds within the Site do not conform to any of the habitat descriptions in BRIG (2011) and are therefore not HPis.
Trees	In addition to the woodland described above, there are various mature and semi-mature trees at the Site. The Science Park itself has some mature trees (e.g. Scots pine <i>Pinus sylvestris</i> , Austrian pine <i>Pinus nigra</i> , and grey poplar <i>Populus x canescens</i>). There are also abundant semi-mature trees, including an avenue of walnut <i>Juglans regia</i> along the former access road south of the Science Park (Target Note 5). In the remainder of the Site, mature trees are only present in woodland or hedgerows (e.g. Tree T9 in Figure 6b; Photograph 19) except for a mature poplar in the south-west of the Site (Tree T10 on Figure 6b). The potential of trees at the Site to support roosting bats is described in the section <i>Bats</i> below. Individual trees do not conform to any of the habitat descriptions in BRIG (2011) and are therefore not a HPI. However, in most cases, trees at the Site form part of woodland or hedgerow habitat which are HPis.
Buildings and hard standing	A range of buildings is present at Begbroke Science Park; these include a stone farmhouse and associated buildings (Photograph 20) and various modern buildings (Photograph 21). The only buildings at the Site outside the Science Park are two large modern agricultural barns (Photograph 22) and a low stone barn or animal shelter (Photograph 23), all at Parker's Farm. Further details of buildings at the site, including an assessment of their potential to support roosting bats, is provided in the section <i>Bats</i> below. This also covers several other buildings that are outside the Site, but close or directly adjacent to it. This habitat does not conform to any of the habitat descriptions in BRIG (2011) and is therefore not a HPI.

Hedgerows

- 6.10 Hedgerows (some with accompanying ditches) separate the majority of the fields at the Site and are present adjacent to various roads and footpaths. These hedgerows comprise almost entirely

native species and have varying species-richness. Many hedgerows are somewhat overgrown, with sections that are defunct (i.e. no longer stock-proof). The locations of the hedgerows at the Site are shown on Figure 3.

- 6.11 A total of 53 hedgerows were identified within the Site. Of these, 37 (i.e. 67%) are species-rich and the remainder are species-poor. A total of 30 may be classified as 'Important' under the criteria listed under 'Wildlife and Landscape' in Schedule 1 of the Hedgerow Regulations 1997. This is summarised in Table 14.

Table 14: Summary of hedgerow survey results.

Hedgerow categories	Important	Not Important	Total
Species-rich	28	9	37
Species-poor	2	14	16
Total	30	23	53

- 6.12 The total number of woody species in each hedgerow varies between one (i.e. hawthorn only in Hedgerow H17) and 14 (in Hedgerow H46). The average number of woody species per hedgerow (based on one or more 30 m sample lengths) varies between 1 (for hedgerow H17) and 10 (for hedgerow H49). Hedgerows in the east of the Site, east of the railway line were particularly rich in woody species and trees. Hedgerow H39, which forms part of the southern boundary of the Site, also contains abundant trees. The dominant hedgerow shrub across the Site is hawthorn, and the dominant hedgerow tree is pedunculate oak. Other woody species present include ash, English elm, spindle, elder, honeysuckle *Lonicera periclymenum*, hazel, dog rose, crack willow, goat willow *Salix caprea*, wild privet *Ligustrum vulgare*, crab apple, blackthorn, guelder rose, dogwood, buckthorn, and holly *Ilex aquifolium*.
- 6.13 Woodland ground flora species noted growing in hedgerow bases, particularly towards the east of the Site include dog's mercury *Mercurialis perennis*, lords-and-ladies *Arum maculatum*, and herb Robert *Geranium robertianum*.
- 6.14 A summary of the criteria under 'Wildlife and Landscape' in Schedule 1 of the Hedgerow Regulations which are met by Important hedgerows at the Application is provided in Table 15.

Table 15: Summary of Important hedgerows.

Criteria for Important hedgerows	Qualifying hedgerows
Average of seven woody species.	H1, H4, H9, H16, H25, H31, H34, H35, H36, H42, H44, H45, H46, H47, H48, H49, H50, H51
Average of six woody species plus three additional features (as defined in Section 6 of Schedule 1 of the Hedgerow Regulations).	H33, H37, H39, H40, H41, H43
Average of five woody species plus four or more additional features.	H8, H52
Present adjacent to a public road or other right of way and with an average of four woody species plus two or more additional features.	H5, H10 H23, H24

- 6.15 Further details of all of the hedgerows at the Site are included in Appendix 6.

Ponds

- 6.16 Six ponds are present within the Site, these are indicated as Ponds P1–P6 on Figure 10. Descriptions of these ponds are provided in Table 16, along with all other ponds within 250 m of the Site. Ponds P10, P11, P12 and P13 were not accessed: the information presented for these was obtained from Ordnance Survey mapping and aerial photographs.

Table 16: Description of Ponds. Details for ponds within the Site are highlighted in grey.

Pond ID	Description	Approximate Distance and Direction from Site	Approximate distance from development (excluding greenspace)
P1	Shaded pond with some lesser duckweed <i>Lemna minor</i> , and abundant leaf litter and some dead wood. Margins support areas of swamp dominated by common reed and lesser pond sedge. Concrete dam and weir fitted, with metal outlet pipe. Size ca. 9 m x 6 m, with channel extending north-east. Depth to ca. 35 cm. The facilities manager mentioned that this pond was created as a water source for irrigation at the Weeds Research Organization which formerly occupied the Science Park. Almost dry in July 2018, and western part heavily dominated by common reed.	Within Site	80 m
P2	Series of four artificial rectangular ponds separated by narrow earth dams. Total size ca. 10 m x 4 m. Shaded by trees with abundant leaf litter. No vegetation. Maximum water depth noted. 25 cm. Dry by late May 2018.	Within Site	80 m
P3	Series of three artificial rectangular ponds separated by narrow earth dams. Total size ca. 10 m x 4 m. Shaded by trees with abundant leaf- litter. No marginal or aquatic plants visible. Maximum water depth noted ca. 25 cm. Dry by late May 2018.	Within Site	60 m
P4	Formal pond within Science Park. Paved margins. Abundant marginal plants at southern end, including reedmace <i>Typha latifolia</i> , unbranched bur-reed <i>Sparganium erectum</i> , bogbean <i>Menyanthes trifoliata</i> , water horsetail <i>Equisetum fluviatile</i> , lesser duckweed <i>Lemna minor</i> , and water mint <i>Mentha aquatica</i> . Abundant aquatic plants, including hornwort <i>Ceratophyllum demersum</i> and Canadian pondweed <i>Elodea canadensis</i> . Large external filter. Ornamental fish present (many goldfish <i>Carassius auratus</i> and one large carp <i>Cyprinus carpio</i>), filtration system. Size ca. 5 m x 15 m.	Within Site	20 m
P5	Pond under large multi-stemmed crack willow. Leaf litter present. Minimal wetland vegetation present. Shaded. Depth to ca. 25 cm. Size ca. 11 x 6 m. Dry by late May 2018.	Within Site	220 m
P6	Pond forming part of ditch network, adjacent to canal towpath. Bramble scrub adjacent. Minimal wetland vegetation noted. Shaded. Size ca. 12 x 4 m. Dry by mid-June 2018.	Within Site	320 m
P7	Large pond within grounds of the Ley Community residential centre in Yarnton. Turbid water and no aquatic plants noted. Banks steep/engineered in places. Population of large koi carp present. Ca. 35 x 15 m.	80 m W	80 m
P8	Large naturalistic landscape pond surrounded by mature crack willows within a modern housing development. Various marginal vegetation present, including water mint. Ca. 80 m x 18 m.	10 m W	40 m
P9	Farm field pond surrounded by mature crack willows. Ca. 22 x 10 m.	50 m W	80 m
P10	Large pond in school grounds. Ca 85 x 20 m. Rowel Book flows through this pond. Not accessed.	260 m N	260 m
P11	Presumed to be a defunct settlement pond or similar, located at a defunct water treatment works. Now supports willow woodland. Ca 70 m x 10 m. Not accessed.	40 m E	40 m
P12	Presumed to be a defunct settlement pond or similar, located at a defunct water treatment works. Now supports willow woodland. Ca 70 m x 10 m. Not accessed.	60 m E	60 m
P13	Small farm field pond associated with field ditch network. Visible from, but located outside the Site. Ca. 10 m x 8 m.	10 m S	530 m

Plants

- 6.17 The desk study returned records of 38 species of higher plants from the search area. None of the records are from within the Site itself, the closest being from Rushy Meadows SSSI to the north-east.

- 6.18 The records include four Species of Principal Importance in England (SPI): Marsh stitchwort (in addition to records from Rushy Meadows SSSI, this is recorded from two locations south of the Site the closest being around 0.4 km distant; records were from 1986–2010); tubular water-dropwort *Oenanthe fistulosa* (two records, 2007 and 2010 from ca. 1.4 km from Site); white helleborine *Cephalanthera damasonium* was recorded (in 2015) along a bridleway from Yarnton to Oxey Mead, ca. 1.5 km from Site; and there was an old (1990) record of corn buttercup *Ranunculus arvensis* from 1.6 km south of the Site. The latter species is listed as *Endangered* (and the above species as *Vulnerable*) in the England red list for vascular plants (Stroh et al., 2014).
- 6.19 There were records of a further six species listed as *Vulnerable* in the England red list, including round-fruited rush *Juncus compressus*, bladder sedge *Carex vesicaria*, lesser spearwort *Ranunculus flammula*, strawberry clover *Trifolium fragiferum*, water violet *Hottonia palustris* and corn marigold *Glebionis segetum*.
- 6.20 There were records of a further four species listed as *Nationally Rare* or *Nationally Scarce* (in Stewart et al. 1994) including wood barley *Hordelymus europaeus*, stinking hellebore *Helleborus foetidus*, Jacob's-ladder *Polemonium caeruleum* and large-leaved lime *Tilia platyphyllos*.
- 6.21 Remaining native species for which records were obtained in the desk study are all listed as *Near Threatened*.
- 6.22 There were desk study records (from 1987 to 2016) for seven non-native invasive plant species (none of which were from within the Site): Canadian waterweed *Elodea canadensis*, Nuttall's waterweed *Elodea nuttallii*, New Zealand pygmyweed *Crassula helmsii*, buddleia *Buddleija davidii*, orange balsam *Impatiens capensis*, Himalayan balsam *Impatiens balsamifera* and rhododendron *Rhododendron ponticum*. Of these, Canadian waterweed was recorded from pond P8, ca. 40 m from the Site, New Zealand pygmy weed was recorded from within 300 m of the site (at Stratfield Brake nature reserve, beyond the Oxford Canal), and orange balsam was recorded from fields 500 m south of the Site.
- 6.23 During the botanical and hedgerow survey, carried out in May and October 2018, corn marigold and common cudweed were recorded in the margins of arable fields at the Site. Their locations are shown in Figure 4. Corn marigold is listed as *Vulnerable* in the England Red List. It is listed as “*not scarce in Oxfordshire*” and is described as “*still widely found in Oxfordshire on non-calcareous soils*” in *Oxfordshire's Threatened Plants* (Erskine et al, 2018). Common cudweed is listed as *Near Threatened* in the England Red List. In *Oxfordshire's Threatened Plants* it is listed as “*not scarce in Oxfordshire*” but “*scarce in vice county 23*” (vice county 23 covers Northern and Eastern Oxfordshire and includes the Site), the description reads “*In vice county 23 there is not much suitable habitat and it has declined here steadily*”.

Badgers

- 6.24 A total of 15 records of badger were obtained in the desk study (from 1981 to 2013), with the closest from around 0.5 km north-west of the Site and the majority from further north or south of the site. There were no records from with the Site.
- 6.25 The Site provides suitable habitat for badger, and the desk study clearly indicates that this species is present in the local area.
- 6.26 In the 2018 badger survey, three active main setts were found within or close to the boundary of the Site. Their locations are indicated on Figure 5. They are all located west of the railway line. There are also three outlier setts and one subsidiary setts on this side off the Site. The part of the Site to the east of the railway line is lower lying and subject to wetter conditions in winter, making it much of it less suitable for main setts. Two outlier setts are present here, within a hedgerow.

Main Sett 1 (4 holes)

- 6.27 This is located in an area of scrub just outside the Site boundary and close to the Begbroke Science Park access road, on mounded soil and waste material. The sett has four visible active holes, and potential for further holes in bramble scrub on land outside the site. A well-trodden area

around the holes was noted, along with bedding material and a heavily scratched trunk of a small elder tree in amongst the holes. This Sett was also reported as active in the 2010 and 2015 badger surveys. Active annexe or subsidiary setts are present to the north (two holes), south-west (one hole), and east of this sett.

Main Sett 2 (3 holes)

- 6.28 This is located on the railway embankment, outside, but close to, the Site boundary. There are three visible active holes.

Main Sett 3 (8+ holes)

- 6.29 This extensive sett or group of setts occupies an area of scrub adjacent to the Site and part of an arable field within the Site, south of Sandy Lane. The exact number of holes could not be determined because the sett straddles the Site boundary, but there are 8 active holes within the Site. These extend into the ploughed areas of the arable field by around 5 m. Another active sett is present ca. 200 m to the west, just outside the Site. This is assumed to be a subsidiary sett due to its proximity and smaller number of holes.

Outlier Setts in east of Site

- 6.30 There are three active holes that had limited signs of activity in January 2018. It may be that this sett is only used during drier periods (the east of the Site has relatively wet ground compared with the east).
- 6.31 No other badger setts were found during the survey.

Other observations

- 6.32 A badger fence is present in the vicinity of Main Sett 1 along both sides of the access road between the A44 Woodstock Road and the Science Park. This was installed during construction of the access road in order to reduce the risk of badgers being killed on this road. It was specified as mitigation in the 2010 ecology survey, due to the proximity of the sett to the proposed road, and due to the presence of a well-used path leading north from the sett (across the route of the proposed road). A concrete badger tunnel was also installed under the access road at the location of this track and is still present. The fence is a three rail wooden post and rail fence, with coated chain-link wire. The tunnel appears to be in use by badgers: well-used paths lead from the badger sett through the tunnel and along the hedgerow to the north of the road. A hole has been made (presumably by badgers) at the base of the fence close to the northern tunnel entrance, allowing access to the road.
- 6.33 Relatively few badger dung pits or foraging diggings / snuffle holes were noted at the Site. These are indicated on Figure 5. Dung pits are located between the main setts, as would be expected (dung pits are often used to mark territory boundaries).
- 6.34 Rabbit burrows were abundant in some parts of the Site, including adjacent to the allotments in the west around Parker's Farm and in some areas south of Sandy Lane.

Bats

- 6.35 The desk study returned 97 records of bats (from 1980 to 2015) from the search area. Of these, 73 are from 2008 or later. Three records are from within the Site boundary: these were records of an injured pipistrelle *Pipistrellus* sp. (species not specified) from towards the centre of the Site, a Leisler's *Nyctalus leisleri* bat from the north of the Site and an injured soprano pipistrelle *Pipistrellus pygmaeus* from the east of the Site. There were no records of bat roosts within the Site.
- 6.36 Most of the other records were from around Kidlington and Yarnton; they included records of *Myotis* species, Natterer's bat *Myotis nattereri*, noctule *Nyctalus noctula*, common pipistrelle *Pipistrellus pipistrellus*, brown long-eared bat *Plecotus auritus* and soprano pipistrelle. Roosts

mentioned in the data include roosts of common pipistrelle and Leisler's bat on the north-east side of Kidlington and of pipistrelle in North Oxford.

- 6.37 The above records indicate that a number species of bats are present in the local area of the Site. BSG Ecology has also confirmed the presence of at least 11 species of bats from the Woodstock area during surveys at other sites, including roosts of pipistrelle, soprano pipistrelle, Nathusius' pipistrelle *Pipistrellus nathusii*, barbastelle bat *Barbastella barbastellus*, Natterer's bat, Daubenton's bat *Myotis daubentonii*, noctule, brown long-eared bat and lesser horseshoe *Rhinolophus hipposideros*.
- 6.38 All bat species in the UK are European Protected Species. Seven species (barbastelle, Bechstein's bat, noctule, soprano pipistrelle, brown long-eared bat, and greater and lesser horseshoe) are also Species of Principal Importance (SPIs).
- 6.39 The Site is located adjacent to the Oxford Canal, which is likely to provide important local foraging and commuting habitat for bats. Wet grassland at Rushy Meadows SSSI, to the north of the Site may also provide valuable foraging habitat, and woodland at Bladon Heath and Begbroke Wood to the west, and Blenheim Park to the north is likely to provide valuable foraging and roosting habitat. Buildings at Yarnton, Begbroke and Kidlington may provide roosting sites.
- 6.40 The Site provides habitat suitable for foraging bats, particularly the woodland along the Rowel brook in the north of the Site and areas of damp grassland in the east of the Site. The network of hedgerows provide potential commuting routes across the Site, between the above foraging areas and may link roosting sites within and around the Site with foraging areas within and near the Site. The Site is currently not subject to a high level of lighting, except around Begbroke Science Park which has a number of floodlights.

Roost Potential of Buildings

- 6.41 The Site contains six buildings or clusters of buildings. Two of these (Begbroke Science Park and Parkers Farm) are within the PR8 Site. The buildings were divided into 26 separate buildings for the purposes of the roost potential survey, listed in Table 17 and indicated on Figures 6c and 6d. The condition of buildings ranges from good to poor. A number of the buildings have potential egress and access points, and may be expected to support bat roosts, possibly including maternity roosts.

Table 17: Potential of buildings to support roosting bats.

Location	Building Number	Description	Bat Suitability
Parkers Farm (on-Site)	A1	Large agricultural barn. Concrete block lower walls and corrugated metal upper walls and roof.	Negligible
	A2	Large agricultural barn. Concrete block lower walls and corrugated asbestos upper walls and roof.	Negligible
	A3	Low stone barn/animal shelter with corrugated metal roof. Open side to south.	Moderate
Begbroke Science Park (surrounded by the Site)	B1	Single-storey office building. 20 th Century. Block walls and corrugated metal pitched roof. Some gaps under fascia on northern elevation.	Low
	B2a	Single storey brick and stone farm outbuildings, refurbished to offices. Pitched roof with slate tiles. Small gaps present under ridge tiles.	Low
	B2b	Single-storey stone farm outbuildings, refurbished to offices. Pitched roof with slate tiles.	Low
	B2c	Two storey stone farm outbuildings, refurbished to offices/reception. Pitched roof with uneven limestone slate tiles. Multiple potential bat access points. Also gaps under fascia and under soffit box.	High
	B2d	Small single-storey stone and brick building. Date plaque indicates 17 th century. Pitched roof with stone tiles. Gaps behind fascia on both gable ends. Moss on roof limits access under tiles.	High

Location	Building Number	Description	Bat Suitability
	B2e	Begbroke Hill Farmhouse. Large three-storey 17th century farmhouse. Gaps under fascia on west elevation. Some gaps under tiles.	High
	B2f	Single-storey stone building with slanted and pitched roof. With concrete tiles. Gaps behind fascia and soffit box into roof space on North-west elevation.	Moderate
	B3	Large modern two storey office building. 21 st century. Clad with wood and metal.	Negligible
	B4	Hirsch Building. Late 20 th century office building of brick, metal, glass and stone. Metal roof.	Negligible
	B5	Institute of Advanced Technology. 21 st century. Metal and wood cladding.	Negligible
	B6	Store building. Late 20 th century. Stone walls and asbestos and metal roof.	Negligible
	B7	Store building. 21 st century later. Metal walls and roof.	Negligible
Two semi-detached houses on Sandy Lane (off-Site)	C1	Two two-storey semi-detached houses south of Sandy Lane. Rendered wall, pitched tile roofs with some missing tiles. Gaps under ridge tiles. Loft space may be present. Property and grounds not accessed, viewed from within the PR8 Site.	High
Buildings at College Farm Barns (off-Site)	D1	North cottage. Two-storey brick and stone cottage. Small block extension. Wood-clad porch. Pitched tile roof. Gaps under tiles on all elevations. Gaps under fascia on south and south-west. Gaps under soffit.	High
	D2a	Recently refurbished/modernised farmhouse. Stone wall, wood cladding and pitched tile roof. One or two gaps at gable ends on west and south elevations.	Low
	D2b	Open sided brick shed with corrugated metal roof.	Low
	D3	Complex of three open-sided wood-clad sheds built on steel frame.	Low
	D4	Corrugated metal shed. Open sided to north.	Negligible
	D5	Corrugated metal shed.	Negligible
	D6	Barn/shed of block construction with pitched corrugated metal roof. And some wood cladding in poor condition.	Low
Houses near level crossing (off-Site)	E1	Stone two-storey cottage east of level crossing. Pitched slate roof. Loft space. Property and grounds not accessed, viewed from within the PR8 Site/Sandy Lane.	Moderate
	E2	Two modern mobile homes. Property and grounds not accessed, viewed from within the PR8 Site/Sandy Lane.	Negligible
House on Woodstock Road (off-Site)	F	Blenheim Edge Guest House. Modern two-storey brick house. Tiled roof with some missing tiles and gaps under ridge. Plastic soffit boards. Appears to have loft space, but no obvious access points for bats. Property and grounds not accessed, viewed from within the PR8 Site.	Moderate

- 6.42 The building assessment found five buildings to have high, four to have moderate, seven to have low and 10 to have negligible suitability to support roosting bats.

Emergence/re-entry survey of Buildings

- 6.43 Results of emergence and re-entry surveys of buildings are provided in Table 18. These indicate that day roosts of small numbers of common bat species are present in buildings at Begbroke Science Park.

Table 18: Results of emergence surveys of buildings. Results refer to bats seen emerging or re-entering buildings).

Location	Building Number	Bat Suitability	Survey Visit 1	Survey Visit 2	Survey Visit 3	Roost Type*
Stone Barn at Parkers	A3	Moderate	None	None	N/A	N/A

Location	Building Number	Bat Suitability	Survey Visit 1	Survey Visit 2	Survey Visit 3	Roost Type*
Farm						
Begbroke Hill Farmhouse and adjacent buildings	B2d & B2e	High	1 common pipistrelle emerged from eastern end of taller roof ridge above reception building, northern side.	1 bat (echolocation not heard and so species not identified) emerged from hole in stonework on east-facing gable end of farmhouse (B2e) close to roofline. 2 common pipistrelles entered near apex of gable end of a small stone extension on east face. 2 common pipistrelles emerged from south-west corner of protruding wing on southern face of building. Possible emergence of 1 soprano pipistrelle from southern aspect of lowest roof of building B2d.	None	Day roost.
Building south-west of Begbroke Hill Farmhouse	B2e	High	None	1 common pipistrelle emerged from hole below bargeboard (ca. half way along board) on northern gable end.	None	Day roost.
* Based on Table 3.1 in Collins (2016).						

Roost Potential of Trees

6.44 There is some potential for bats to roost within trees at the Site. Results of the preliminary ground level roost assessment are provided in Table 19, and indicated on Figure 6b, which also incorporates the results of follow-up endoscope and climbing inspections (these inspections were carried out on Trees 5, 6 and 10, and on tree 9, respectively).

Table 19: Bat roost potential of trees on or adjacent to the Site.

Tree ID	Species	Age	Notes	Bat Suitability
Trees within Site boundary				
T1	Walnut	Semi-mature	Small knot hole on SE side, 3.5 m from ground.	Low
T2	Walnut	Semi-mature	Dead tree. Peeling bark on south side, ground level to 1.5 m.	Low
T3	Crack willow	Semi-mature	Four stems. Several small and 1 medium woodpecker hole on north side of north stem. Dead wood and bracket fungus above.	Moderate
T4	Italian alder	Mature	Bark damage on east side, ca 3 m in length. Some woodpecker damage near top of this. Could develop into roosting feature in future.	Negligible
T5	Crab apple	Mature	Openings at base right near ground, no upward holes. Stump section 3 to 4 m tall. Follow up inspection with endoscope confirmed low potential.	Low
T6	Crab apple	Mature	Openings at base of stump. Follow up inspection with endoscope confirmed low potential.	Low
T7	Oak	Mature	No visible features. No clear view of all of the crown due to branches. Poor roosting habitat.	Low

Tree ID	Species	Age	Notes	Bat Suitability
T8	Oak	Semi-mature	Some dead wood and broken branches. Small areas of flaky bark. Poor roosting habitat.	Low
T9	Ash	Semi-mature	Split along 3 m of SE side of trunk. Limited value to bats.	High
T10	Hybrid black	Mature	Medium hole at 2 m on east side of trunk. Follow-up endoscope inspection confirmed high potential.	High
Trees outside Site boundary				
T11	Hybrid black poplar	Semi-mature	Several woodpecker holes on east side.	Moderate
T12	Hybrid black poplar	Semi-mature	Woodpecker hole half way up stem on east side.	Low
T13	Ash	Mature	Heavy ivy growth, making parts of stem/main branches not visible.	Low
T14	Oak	Mature	Small woodpecker hole present on north side.	Low
T15	Ash	Semi-mature	Parts of crown obscured by ivy. Low potential on a precautionary basis.	Low
T16	Crack willows & ash	Semi-mature	Line of trees with some ivy. No visible features. Negligible to Low on a precautionary basis.	Negligible–Low
T17	Ash	Ash	Two small woodpecker holes facing downwards on branch on north side. One blocked knot hole on east	Low
T18	Crack willow	Mature	Pollarded crack willow. Large mature stump with some holes/cracks present but likely too congested with young growth to allow access by bats.	Low
T19	Ash	Semi-mature	Two small woodpecker holes on north side.	Low
T20	Ash	Mature	Main trunk is broken open. Likely to open for bats and open above.	Low
T21	Oak	Mature	Dead limbs. Woodpecker hole facing downwards in dead limb pointing east.	Moderate
T22	Oak	Mature	Pollarded. Many holes on north-east side. Bark contorted into potential roost feature towards stop of main stem.	High
T23	Crack willow	Mature	Pollarded. Trunk split open to east, crack extending much of trunk. Potential roost feature.	High
T24	Crack willow	Mature	Pollarded. Potential roost feature (small crack at 2 m height) on north-east side.	Low
T25	Crack willow	Mature	Pollarded. Cavity on north-west side. Potential roost feature. Low potential because cluttered by brambles.	Low

- 6.45 A total of nine trees within development areas of the Site have potential to support roosting bats. Of these, two have high, one has moderate and six have low suitability to support roosting bats. All other threes within development areas of the Site have negligible suitability.
- 6.46 A further 14 trees located directly adjacent to development areas within the Site, but themselves outside the Site boundary also have potential to support roosting bats. Of these, two have high, two have moderate and, ten have low suitability to support roosting bats. Also, a short row of multi-stemmed crack willows that were difficult separate out was assessed collectively to have negligible to low bat suitability.
- 6.47 All other trees at the Site were considered to have negligible suitability to support roosting bats, or were present within proposed greenspace and are unlikely to be affected by the proposed development.

Bat activity transect surveys

- 6.48 A summary of the bat transect survey data is provided in Table 20 (and where bat locations were noted in the field, on Figures 6e, 6f and 6g). This indicates that at least eight species of bat were recorded during the walked transect surveys, including common pipistrelle (439 passes in total), soprano pipistrelle (19 passes), Nathusius' pipistrelle (1 pass), *Myotis* species (9 passes), serotine (1 pass), and barbastelle (1 pass). The highest number of passes was recorded during the October transect (120 passes) and the lowest activity was in April (37 passes) (conditions were suitable on the latter date, with a temperature of 6–11°C and wind of Beaufort scale 1–2, see Table 2 above).

Table 20: Summary of bat transect survey data showing bat passes per transect and total numbers of passes.

Species	Bat passes per transect								Total passes
	April	May	June	July	Aug	Sept	Oct	Mean	
Common pipistrelle	15.0	31.0	11.5	22.5	16.0	33.0	98.5	33.8	439
Noctule		23.5	26.0	5.5	13.0	21.5	3.0	13.2	172
Soprano pipistrelle	3.0	11.5	7.0	6.0	9.0	6.0	12.5	7.8	19
Myotis species		0.5	0.5			0.5	3.0	0.7	9
Nyctalus species	0.5	3.0						0.5	7
Brown long-eared bat		0.5					2.0	0.4	5
Common / Soprano pipistrelle		8.0	0.5	0.5			0.0	1.5	2
Nathusius' pipistrelle							0.5	0.1	1
Serotine		0.5						0.1	1
Barbastelle bat							0.5	0.1	1
Total	18.5	78.5	45.5	34.5	38.0	61.5	120.0	58.1	755

- 6.49 The most commonly noted species over the course of the surveys were common pipistrelle (average of 33.8 bat passes per transect) and noctule (average of 13.2 passes per transect). Three species (Nathusius' pipistrelle, brown long-eared bat and barbastelle) had the lowest average pass rate recorded (0.1 passes per transect). Greatest bat activity was recorded during the month of October, with high levels of activity also recorded in May and September.
- 6.50 Figures 6e, 6f, and 6g show the spatial distribution of bat passes at the Site. The highest level of activity was recorded adjacent to woodland along the Rowel Brook in the north of the Site, along Yarnton Lane (which has a double hedgerow with numerous mature trees), on the hedgerow between Yarnton Lane and the Oxford Canal towards the south-east of the Site, and along the hedgerow forming part of the southern boundary of the Site. Bat passes were recorded from almost all hedgerows that were included in the transects, and also from the small plantation around the barns at Parker's Farm.
- 6.51 The single barbastelle pass was recorded in October, adjacent to the woodland that runs along the Rowel Brook in the north of the Site.
- 6.52 The single Nathusius' pipistrelle was recorded in October, adjacent to the woodland that runs along the Rowel Brook in the north of the Site.
- 6.53 Early passes by noctule and pipistrelles (common and soprano) were recorded in the south-east and the north of the Site indicating that roosting sites for these species are present in the local area.

Automated detector survey

- 6.54 A summary of the data obtained from the automated bat detector survey is provided in Tables 21, 22 and 23. A total of 7,188 bat passes were recorded over the entire monitoring period. At least ten species of bat were recorded within the Site. These included the eight species recorded in the

transect survey plus Leisler's bat and lesser horseshoe bat. In agreement with the findings of the transect data, the static data showed that common pipistrelle was the species most frequently recorded, with an average pass rate of 4.81 bats/hr (equating to a total of 5,421 passes over the whole survey period). Noctule and soprano pipistrelle were the species next most frequently recorded.

- 6.55 Lesser horseshoe and serotine had the lowest average pass rate (of <0.01 bats/hr), equating to a total of two and three actual passes (respectively) over the whole survey period. Lesser horseshoe was recorded from static detector location 2 (on Sandy Lane) in September and serotine from location 1 (on the southern edge of the Science Park) in May and June.
- 6.56 The results from static detector Location 3 indicate that bats (including lesser horseshoe) do make use of Sandy Lane. This rural lane with hedgerows on both sides provides linking habitat between Kidlington and the Oxford Canal to the east of the Site with habitat within the Site (e.g. the double hedgerows associated with Yarnton Lane and potential roosting sites in the semi-detached houses on Sandy Lane itself) and with Yarnton to the west.
- 6.57 A total of 31 barbastelle passes were recorded, in April, May September and October. This species was recorded from all three static detector locations.
- 6.58 Greatest bat activity was recorded between 41–60 minutes after sunset which is when most foraging activity tends to take place. Six bat species were recorded within the 1–40 minute period after sunset: common pipistrelle, noctule, soprano pipistrelle, brown long-eared bat, Leisler's bat and lesser horseshoe. Of these species, noctule, Leisler's bat, pipistrelle species, lesser horseshoe typically emerge early. This indicates that roosting sites for these species are present in the local area. Common pipistrelle bat and noctule activity continued from 20 minutes before sunrise until sunrise, which is further indication that these two species are roosting on or in proximity to the Site.
- 6.59 Taken together, the results of the above bat surveys suggest that the Site does provide important roosting, foraging and commuting habitat for a range of bat species, including foraging and commuting habitat for barbastelle and lesser horseshoe which are relatively rare in central England.

Table 21: Summary of static bat detector survey data showing average pass rate (bat passes per hour) for each month.

Species	Month							
	April	May	June	July	August	September	October	Total
Common pipistrelle	0.27	3.16	12.55	6.91	11.98	1.45	0.50	4.81
Noctule	0.02	1.74	1.65	0.50	0.45	0.21	0.03	0.66
Soprano pipistrelle	0.04	0.30	0.42	1.51	1.33	0.65	0.09	0.60
<i>Myotis</i> species	0.03	0.06	0.28	0.18	0.14	0.11	0.16	0.13
Brown long-eared bat		0.03	0.01	0.10	0.05	0.04	0.02	0.04
Leisler's bat		0.20	0.02	0.01	0.04			0.04
Common pipistrelle / soprano pipistrelle			0.05	0.06	0.06	0.01	0.02	0.03
Nathusius' pipistrelle		0.15	0.01			0.01		0.03
Barbastelle		0.10	0.04			<0.01	0.03	0.03
<i>Nyctalus</i> sp.			0.06	0.01	0.01		0.01	0.01
Serotine		0.01		0.01			0.01	<0.01
Lesser horseshoe bat						0.01		<0.01
Total	0.35	5.74	15.10	9.29	14.05	2.50	0.85	6.38

Table 22: Summary of static bat detector survey data showing average pass rates (bat passes per hour) for each static detector location.

Species	Location			
	1	2	3	Total
Common pipistrelle	9.08	3.06	2.29	4.81
Noctule	0.98	0.43	0.55	0.66
Soprano pipistrelle	0.22	0.73	0.86	0.60
<i>Myotis</i> species	0.17	0.07	0.16	0.13
Brown long-eared bat	0.07	0.02	0.01	0.04
Leisler's bat	0.05	0.03	0.05	0.04
Common pipistrelle / soprano pipistrelle	0.01	0.05	0.02	0.03
Nathusius' pipistrelle	0.03	0.04	0.02	0.03
Barbastelle	0.06	0.01	0.01	0.03
<i>Nyctalus</i> sp.	0.01	0.01	0.01	0.01
Serotine	0.01			<0.01
Lesser horseshoe bat			0.01	<0.01
Total	10.69	4.46	3.98	6.38

Table 23: Summary of static bat detector survey data showing average pass rate (bat passes per hour) for each time period.

Species	Time Period													Total
	Sunset-20 mins	21-40 mins	41-60 mins	61-80 mins	81-100 mins	101-120 mins	Middle of night	120-101 mins	100-81 mins	80-61 mins	60-41 mins	40-21 mins	Sunrise-20 mins	
Common pipistrelle	0.78	19.73	27.00	14.73	10.43	8.45	2.43	1.38	1.88	2.48	3.35	5.03	0.95	4.81
Noctule	1.53	2.88	2.10	1.80	1.70	0.65	0.16	0.03	0.03	0.25	1.35	0.73	1.05	0.66
Soprano pipistrelle		0.60	1.68	1.45	1.00	1.13	0.60	0.13	0.25	0.83	0.28			0.60
<i>Myotis</i> species			0.05	0.15	0.25	0.28	0.17	0.18	0.05	0.03	0.03			0.13
Brown long-eared bat	0.03		0.03	0.03	<0.01		0.05	0.05	0.00	0.03	<0.01			0.04
Leisler's bat	0.03	0.13	0.30	0.18	0.10	0.10	0.01			0.05	0.03			0.04
Common pipistrelle / soprano pipistrelle		0.05	0.03	0.05	0.08	0.08	0.02		0.05		0.03			0.03
Nathusius' pipistrelle			0.05	0.10	0.10	0.08	0.03		0.03					0.03
Barbastelle				0.03	0.03	0.15	0.04							0.03
<i>Nyctalus</i> species		0.03			0.05	0.10	<0.01		0.03					0.01
Serotine				0.03	<0.01		<0.01							<0.01
Lesser horseshoe bat	<0.01												<0.01	<0.01
Total	2.35	23.40	31.23	18.53	13.73	11.00	3.53	1.75	2.30	3.65	5.05	5.75	2.00	6.38

Dormouse

- 6.60 Three records of hazel dormouse were obtained in the desk study, all of which were from woodland at Bladon Heath, which is 0.9 km west of the Site, beyond the A44 Woodstock Road. The closest record was 1.3 km from the Site, and all three records were relatively recent (2007–2010).
- 6.61 Dormouse is a European Protected Species and a SPI.
- 6.62 Dormouse is thought to be under-recorded in Oxfordshire, and BSG has anecdotal evidence that this species is present close to Woodstock. Habitats suitable for this species, including woodland and hedgerows are present at the Site.
- 6.63 No evidence of dormouse was found during the 2018 survey, indicating that this species is likely to be absent from the areas of the Site proposed for development.

Water vole

- 6.64 The desk study yielded 61 records of water vole from the search area. Of these, 15 were from 2008 or later. The majority of records were from the Oxford Canal, including from the section adjacent to the eastern boundary of the Site. There were also three records from within the Site. These were from the Rowel Brook (and its tributary), from the late 1990s and early 2000s. There was also a record (from 1997) from a ditch adjacent to the southern boundary of the Site east of the railway line; this ditch is outside the Site boundary.
- 6.65 There were two records of the invasive species American mink *Neovison vison* (from 2003–2005) from the search area (both from around 1.5 km south of the Site), one of which was from the Oxford Canal). This species is a significant predator of water vole.
- 6.66 The Berkshire, Buckinghamshire and Oxfordshire Water Vole Recovery Project has conducted surveys for water vole on the Oxford Canal since 2003. Recent surveys have revealed a stable but relatively low population of water voles in many areas. Mink continue to be present and are subject to a control programme (BBOWT, 2017).
- 6.67 This species and its burrows are protected under the Wildlife and Countryside Act 1981 (as amended) and it is a SPI.
- 6.68 The Oxford Canal clearly provides important habitat for this species. The Rowel brook is considered to provide sub-optimal habitat for water vole due to its relatively fast flow and generally shaded conditions and scarcity of suitable marginal food plants. Ditches at the Site also provide possible habitat for this species, but due to their seasonal nature and also the lack of food plants, these are also considered to be sub-optimal.
- 6.69 The water vole surveys carried out at the Site found clear signs of the species in 2017 and 2018. These included a latrine site with fresh droppings (present on both survey visits) at Pond P1, which is situated adjacent to the Rowel Brook in the north of the Site. Water vole burrows were also found in the banks of the Rowel Brook just west of this pond. No other signs of this species were found within the Site, such as in ditches in the south of the Site. These results suggest that this species is present at the Site in low numbers. The suitable habitats at the Site have good connectivity to the Oxford Canal, and any water vole at the Site are likely to be from part of the much larger Oxford Canal Population.

Otter

- 6.70 There were 137 records of otter (which is a European Protected Species and a SPI) from the desk study search area. All of these are from 2007 or later. Almost all of the records are from the Oxford Canal (including many from the section directly adjacent to the Site), with several from the River Cherwell to the east of Killington. None of the records are from within the Site.

- 6.71 The Environment Agency (2010) otter survey has abundant records for this species from across the Thames catchment, including records from the River Cherwell (in whose catchment the Site lies). It describes this species as present throughout the Cherwell valley.
- 6.72 No signs of otter were found within the Site during the surveys carried out in 2017 and 2018, suggesting that the Rowel Brook (and its tributary) and ditches elsewhere at the Site do not support resident otters, although this species is clearly well established on the Oxford Canal, adjacent to the Site. However it is possible that otters occasionally use the Rowel Brook or ditches at the site, for example to disperse between the Oxford Canal and areas of suitable habitat to the west, such as lakes at Cassington Quarry (ca. 1.5 km to the south) or even to the River Glyme (ca. 2.5 km to the north-west).

Other Notable Mammals

- 6.73 Records were obtained for three other notable mammal species in the desk study: hedgehog *Erinaceus europaeus*, polecat *Mustela putorius* and brown hare *Lepus europaeus*. These are all SPIs.
- 6.74 There were 79 records of hedgehog, from 1981 to 2015 (with 45 from 2008 or later). Most of these records were from Kidlington and Yarnton. There were three records from Sandy Lane, within the Site. The hedgerows, woodland and scrub at the Site provide suitable shelter and habitat for this species, and areas of grassland provides suitable foraging habitat. Therefore this species should be assumed present. The arable fields represent relatively poor habitat for hedgehog.
- 6.75 There were nine records of brown hare, from 1987–2015 (with four from 2008 or later). None are from the Site itself. The majority were from Bladon Heath to the west of the Site, and the closest was from an arable field ca. 0.7 km north-west of the Site. The open fields at the Site provide potentially suitable habitat for this species, but the lack of sightings during the extensive ecology surveys carried out there in 2017-2017 suggest that this species is unlikely to be present at anything other than very low numbers.
- 6.76 There were 5 record of polecat, from 2000 to 2012. Of these, one record (from 2006) is from Sandy Lane within the Site. Polecat is not strongly associated with any particular habitat types, but the Site is likely to be suitable for this species.

Birds

- 6.77 The desk study returned 3,181 records of birds, including 33 species listed in Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). Of those, the following have the potential to breed on or near the Site: red kite *Milvus milvus*, hobby *Falco Subbuteo*, peregrine *Falco peregrinus*, barn owl kingfisher and firecrest *Regulus ignicapilla*.
- 6.78 There were records of 31 SPIs, of which the following have potential to breed on or near the Site: bullfinch *Pyrrhula pyrrhula*, corn bunting *Emberiza calandra*, cuckoo *Cuculus canorus*, duncock *Prunus modularis*, grasshopper warbler *Locustella naevia*, grey partridge *Perdix perdix*, herring gull *Larus argentatus*, house sparrow *Passer domesticus*, lapwing *Vanellus vanellus*, lesser spotted woodpecker *Dendrocopos minor*, linnets *Carduelis cannabina*, skylark *Alauda arvensis*, song thrush *Turdus philomelos*, starling *Sturnus vulgaris*, tree sparrow *Passer montanus*, turtle dove *Streptopelia turtur*, willow tit *Poecile montanus*, yellow wagtail *Motacilla flava* and yellowhammer *Emberiza citrinella*.
- 6.79 There were records of a further six species that are red-listed: (dunlin *Calidris alpina*, fieldfare *Turdus pilaris*, redwing *Turdus iliacus*, ruff *Philomachus pugnax*, Temminck's stint *Calidris temminckii*, and whimbrel *Numenius phaeopus*), none of which have potential to breed on or near the Site.
- 6.80 There were also records of amber-listed species from within the Site, of which green woodpecker *Picus viridis*, grey wagtail *Motacilla cinerea*, kestrel *Falco tinnunculus*, mistle thrush *Turdus viscivorus*, and willow warbler *Phylloscopus trochilus* have potential to breed on or near the Site.

- 6.81 The Site itself supports a range of arable, grassland, woodland/scrub and hedgerow habitats that provide suitable breeding habitat for various bird species. The arable areas have some potential to support wintering bird species, but only limited use of the site was noted during habitat survey visits in winter 2015 (BSG Ecology, 2015) and winter 2018 (i.e. fieldfare within grassland and gulls on arable land). The arable and almost all of the grassland at the Site is intensively farmed and sown to winter crops (rather than stubble) and is set within a wider area of mainly intensive arable land and developed land. It is not close to any important sites for wintering birds. Whilst there is some wetland habitat at Stratfield Brake, Kidlington, just east of the Oxford Canal (40 m east of the Site, and 0.8 km from areas of the Site proposed for development), the nearest significant wetlands are at Yarnton/Cassington Gravel Pits, ca. 1.6 km to the southwest, which have extensive adjacent damp grassland at Oxford Meadows SAC. The desk study included many records of wetland bird species at these two locations, but not from within or close to the Site itself. Therefore, wintering bird surveys were not considered necessary or proportionate at the Site.
- 6.82 The Phase 1 habitat survey and the assessment of buildings and trees for their bat potential indicated that there are no buildings or trees within the Site that have potential to support roosting or breeding barn owl. The open farmland at the site provides suitable foraging habitat for this species, but its presence was not noted during the extensive suite of ecology surveys (including numerous visits at dusk and dawn) that were carried out in 2018.
- 6.83 Results of the breeding bird characterisation survey are shown on Figure 9. These indicate that the breeding bird community there is typical of the habitats present. This consisted mainly of common and widespread species, but also included several SPIs as well as species listed in the Birds of Conservation Concern (Eaton et al., 2015) Red or Amber lists. The majority of the species of higher conservation status are those associated with farmland habitats. This included small numbers of skylark *Alauda arvensis* (21 territories present on the Site) which utilise the arable land on the Site and yellow wagtail *Motacilla flava* (2 territories present on the Site), both of which are SPIs.
- 6.84 Several other SPIs were also recorded as breeding which are more associated with the woodlands and hedgerow or scrub areas, including dunnock *Prunella modularis* (an Amber listed species; 42 territories present on the Site) and song thrush *Turdus philomelos* (a Red-listed species; 8 territories present on the Site).
- 6.85 Other species of conservation concern were noted in the vicinity of the Site, such as house sparrow *Passer domesticus* (a SPI and Red-listed species) and swift *Apus apus* (an Amber-listed species) but these were not breeding within the Site.

Great crested newt

- 6.86 The desk study returned 45 records of great crested newt from the search area (from 2007-2015). The closest of these to the Site are from a pond in north-east Kidlington ca. 1 km north-east of the Site, beyond the Oxford Canal. The majority of the other records are from over 1.5 km from the Site (e.g. from North Oxford Golf Club, and Water Eaton).
- 6.87 Great crested newt is a European Protected Species and a SPI. Ponds within and close to the Site provide potentially suitable breeding habitat. Hedgerows, woodland, scrub, verges and grassland provide suitable terrestrial habitat, although the arable land which occupies the majority of the proposed development areas within the Site provides poor habitat for this species.

Habitat Suitability Index

- 6.88 The suitability of waterbodies within 500 m of the Site for great crested newts was determined using the HSI approach. The component scores and HSI scores resulting from this assessment are shown in Table 24.
- 6.89 Four ponds (P1, P8, P9 and P10 on Figure 10) have excellent suitability, three ponds (P11, P12 and P13) have good suitability, two ponds (P4 and P6) have average suitability, one pond (P7) has below average and three ponds (P2, P3 and P5) have poor suitability for great crested newts.

- 6.90 Of the six ponds within the Site, pond P1 has excellent suitability, Ponds P4 and P6 have average suitability, and ponds P2, P3 and P5 have poor suitability.
- 6.91 Because ponds 10, 11 and 12 could not be accessed, a precautionary approach was used in the assessment, with component scores set high for factors such as pond drying and shade which could not be determined from Ordnance survey maps or aerial photography. As a consequence, the HSI scores for these ponds may have been overestimated.

Table 24: Results of great crested newt habitat suitability assessment.

Pond ID	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
1. Location	1	1	1	1	1	1	1	1	1	1	1	1	1
2. Pond area	0.4	0.05	0.05	0.2	0.05	0.2	1	0.8	0.6	0.9	0.1	0.1	0.2
3. Pond drying	0.9	0.1	0.1	0.9	0.1	0.5	0.9	0.9	1	1	1	1	1
4. Water quality	1	0.33	0.33	0.67	0.67	0.67	0.33	1	1	1	0.67	0.67	1
5. Shade	1	0.2	0.2	1	1	0.6	1	1	1	1	1	1	1
6. Fowl	1	1	1	1	1	1	1	1	1	1	1	1	1
7. Fish	1	1	1	0.33	1	1	0.01	0.67	1	1	1	1	1
8. Ponds	0.92	0.92	0.92	0.92	0.82	0.82	0.92	0.92	0.95	0.92	0.82	0.82	0.7
9. Terrestrial	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	1	1	0.67
10. Macrophytes	0.8	0.4	0.4	0.6	0.4	0.4							
HSI Score	0.84	0.39	0.39	0.66	0.49	0.62	0.53	0.89	0.91	0.94	0.75	0.75	0.79
Suitability class¹	E	P	P	A	P	A	BA	E	E	E	G	G	G
¹ Suitability classes: E: excellent; G: good; A: average; BA: below average; P: poor.													

Environmental DNA survey

6.92 In 2018, a total of nine ponds were subject to eDNA survey. Positive results (indicating the presence of great crested newt) were obtained for one pond: P4 located at Begbroke Science Park. Results are listed in Table 25.

Table 25: Results of 2015 eDNA survey for great crested newt. Grey highlighting indicates ponds within the Site. The single positive result is shown in bold.

Pond ID	eDNA survey results
P1	Negative
P2	Negative
P3	Negative
P4	Positive
P5	Negative
P6	Negative
P7	Negative
P8	Negative
P9	Negative
P10	Not surveyed
P11	Not surveyed
P12	Not surveyed
P13	Not surveyed

Overnight surveys

6.93 In 2016, overnight surveys for great created newts were carried out at Pond 4. The results of these surveys for the ponds are provided in Table 26.

Table 26: Results of overnight great crested newt survey.

Pond ID	Maximum adult GCN count per survey visit						Peak count	GCN eggs present	Notes, including peak counts of other amphibians or fish.
	1	2	3	4	5	6			
4	1	0	2	0	0	0	2	No	Four smooth newt, one common toad. Large numbers of young goldfish and one large common carp.

6.94 In the overnight surveys, great crested newt was recorded from the single pond (P4) that was surveyed. The peak count was two adults. No eggs of this species were found.

Population class estimate

6.95 The peak count for pond P4 was two. This equates to a small population size class for this pond. Since this pond was the only pond that was found to contain great crested newt, the peak count (and population size class) for the Site as a whole is the same.

Terrestrial Survey

6.96 No great crested newts were found on any of the 10 terrestrial survey visits that were carried out. Common toad was found within the survey area on various occasions, including during the reptile survey and during bat activity transects.

Other amphibians

- 6.97 There were 38 records of smooth newt *Lissotriton vulgaris* (from 1985–2015), six records of palmate newt *Lissotriton helveticus* (from 2009), 22 records of common frog *Rana temporaria* (1995–2015) and two records of common toad *Bufo bufo* (from 1986–2003).
- 6.98 Of these, common toad is a SPI. Records for this species were from ca. 1.3 km to the east and ca. 1.0 km to the south.
- 6.99 Common toad was found at the Site during the terrestrial survey for great crested newt and the reptile survey. The peak count of common toad at the Site was seven. Key areas of the Site for this species are: the plantation woodland around Parker's Farm, Field A in the north-east of the Site and Field E in the south of the Site (the locations of these fields are indicated in Figure 4).
- 6.100 Smooth newt and common toad were found in pond P4 during overnight surveys for great crested newt. There is no industry standard approach to estimating population size class for these species.

Reptiles

- 6.101 The desk study returned records of four reptile species: slow-worm *Aguis fragilis*, grass snake *Natrix natrix*, common lizard *Zootoca vivipara*, and adder *Vipera berus*. These species are protected under the Wildlife and countryside Act 1981 (as amended) and are SPIs.
- 6.102 There were fourteen records of grass snake (from 1980 to 2015), the closest being from ca. 150 m north of the Site, from with Rushy Meadows SSSI. There were five records of slow-worm (from 1980 to 2009), from east Kidlington (ca. 0.8 km east of the Site) and from ca. 1.7 km west of the Site, at Bladon Heath. There were three records of common lizard (from 1983 to 2001), the closest being from ca. 0.8 km north of the Site. There was one record of adder (from 1987) from ca. 1.9 km south of the Site.
- 6.103 The large arable fields which dominate the Site provide poor habitat for reptiles. Hedgerows, scrub, woodland, riparian habitats, verges and grassland provide more suitable habitat.
- 6.104 Results of the reptile survey are provided in Table 27. Three species of reptile were found to be present at the Site (slow-worm, grass snake and common lizard). Common toad was also recorded during this survey.

Table 27: Results of reptile survey.

Visit Number	Peak counts			Other species
	Slow-worm	Grass snake	Common lizard	
1			6	3 common toad
2			1	3 common toad
3	4	1	3	6 common toad
4	5	1	1	6 common toad
5	2	1		7 common toad
6			1	7 common toad
7	9	3	6	2 common toad
Peak count	9	3	6	7 common toad
Key locations	Field A in north-east of Site.	Compost heaps west of Parker's Farm. Field E in south of Site.	Field A in north-east of Site.	Field A in north of Site, Field E in south of Site.

- 6.105 Key areas of the Site for reptiles are Field A in the north-east of the Site, Field E in the south of the Site and the compost heaps and surrounding earth banks) between Parker's Farm and Begbroke Science Park (see Figure 11 for these locations).

Fish

- 6.106 The desk study returned records of four species of fish, all from the River Cherwell, located ca. 1.7 km east of the Site), from 2002 to 2014. Of these brown trout *Salmo trutta* is a SPI, bullhead *Cottus gobio* is listed on Annex II of the European Habitats and barbel *Barbus barbus* receives some protection under the Habitats Regulations 2017. The Rowel Brook has some suitability to support bullhead, but is too shallow to support the other species.

Crayfish

- 6.107 There is one desk study record of white-clawed crayfish *Austropotamobius pallipes* from the search area (from 2004), from 1.4 km north of the Site (i.e. the River Cherwell). There are ten records of the non-native invasive American signal crayfish *Pacifastacus leniusculus* (from 2015) from the search area, indicating that it is present in the River Cherwell and in the Oxford Canal in the vicinity of the Site.
- 6.108 The crayfish survey carried out at the Site found no evidence of white-clawed crayfish, and therefore this species is likely to be absent from the Site. One adult individual of the non-native invasive American signal crayfish *Pacifastacus leniusculus* was found during the torchlight survey (location indicated in Figure 8).

Other Invertebrates

- 6.109 The desk study returned records of 20 species of beetle (from 1982 to 2010) from the 2 km search area, all of which are *Nationally Notable* or *Scarce*. None of these records are from the Site itself. Two species (*Longitarsus dorsalis* and *Chrysolina oricalcia*, both of which have a conservation status of *Nationally Notable*) were recorded from Rushy Meadow and a field to the west of this, both of which are adjacent to the north of the Site.
- 6.110 There are records of six butterfly species (from 1981 to 2015): wall *Lasiommata megera*, small heath *Coenonympha pamphilus*, white admiral *Limenitis camilla*, Duke of Burgundy *Hamearis Lucina*, white-letter hairstreak *Satyrion w-album* and black hairstreak *Satyrion pruni*. None of the records are from within the Site, with the closest being from within Rushy Meadows SSSI, adjacent to the north of the Site. The majority of records were from Bladon Heath (ca.1 km or more to the west of the Site). Black hairstreak is protected under the Wildlife and Countryside Act 1981 (as amended), Duke of Burgundy and white-letter hairstreak are protected under this act and are also SPIs, and the other three species are also SPIs.
- 6.111 There are records of 45 moth species (from 1982 to 2012), none of which were from the Site itself. Most of these records were from Rushy Meadows (adjacent to the Site) or from Bladon heath, Yarnton, or Oxey Mead BBOWT Reserve. Two of these species are *Nationally Notable* and the remainder are SPIs.
- 6.112 There are nine records of one dragonfly species, common club-tail *Gomphus vulgatissimus* (from 1983 to 1993), which is listed as *Near Threatened* on the UK red list (Daguet et al, 2008). One record was from near Pond P1 within the north of the Site (from 1983). The other records were from outside the Site.
- 6.113 There are records of five species of true flies (all from 1999), from either Bladon Heath or Oxey Mead. One of these (*Dicranomyia chorea*) is listed as *Rare* and the others as *Notable* in the UK red list (Falk, 1991).
- 6.114 There are three records of true bugs (from 1992 to 2009). Of these, two are nationally notable and one (*Lygus pratensis*) is listed as *Rare* on the UK red list (Kirby, 1992).
- 6.115 There are also desk study records of three further invertebrate species (from 1998 to 2016), all of which are listed by TVERC as non-native invasive species: two crustaceans (demon shrimp *Dikerogammarus haemobaphes* from the river Cherwell) and the amphipod shrimp *Crangonyx pseudogracilis* from ponds around Kidlington and North Oxford) and a segmented worm *Hypania invalida* from Cassington Gravel Pits.

Targeted stream aquatic macroinvertebrate survey

- 6.116 Stream habitat details and water chemistry measurements at each of the five sampling locations were recorded (see Table 28 and Table 29 respectively). A total of 37 unique aquatic macroinvertebrate families were recorded from the sampling locations. The samples were generally dominated by freshwater shrimps (Gammaridae), true fly larvae (Diptera), hoglice (Asellidae) and caddisfly (Limnephilidae). A complete list of all the macroinvertebrate taxa recorded at each of the stream locations can be found in Appendix 2.

Table 28: Stream habitat details at sampling locations 1 to 5. For locations see Figure 8.

Sampling Location	1	2	3	4	5
Average width (m)	1	1.5	1	1	1.3
Average depth (m) Autumn 2017	0.035	0.075	0.06	0.125	0.1
Average depth (m) Spring 2018	0.05	0.125	0.3	0.3	0.3
Average height, left bank (m)	0.3	1.2	0.8	1.5	0.6
Average height, right bank (m)	0.3	1.2	0.8	0.8	1.3
Adjacent land use, left bank	Arable	Path	Arable	Arable	Arable/ Suburban
Adjacent land use, right bank	Arable	Arable	Arable	Arable	Arable
Macrophyte cover (%) Autumn 2017	20	0	0	0	0
Macrophyte cover (%) Spring 2018	20	0	0	0	5
Habitat	Slack	Run	Run	Run	Run
Detritus present?	Widespread	Local	Widespread	Widespread	Widespread
Bed stability	Unstable/soft	Stable	Unstable	Unstable	Unstable
Turbidity Autumn 2017	Clear	Clear	Clear	Clear	Clear
Turbidity Spring 2018	Slight	Clear	Slight	Moderate	Moderate
Shade	Heavy	Heavy	Heavy	Heavy	Moderate
Flow	Normal	Normal	Normal	Normal	Normal

Table 29: Stream water chemistry measurements at sampling locations 1 to 5.

Sampling Period	Measurement	Sampling Location					Average
		1	2	3	4	5	
Autumn 2017	Conductivity (uS/cm)	638	626	649	664	664	648.20
	pH	7.34	7.66	7.37	8.1	8.21	7.74
	TDS (ppm)	319	313	324	332	332	324.00
	DO (mg/L)	0.98	6.9	2.99	5.72	6.76	4.67
	DO (%)	8.8	63.6	27.5	52.6	62.4	42.98
Spring 2018	Conductivity (uS/cm)	467	539	520	513	508	509.40
	pH	7.8	7.35	7.69	7.8	7.74	7.68
	TDS (ppm)	233	269	261	258	254	255.00
	DO (mg/L)	1.39	0.52	1.51	1.52	1.6	1.31
	DO (%)	12.8	4.7	13.7	13.8	14.6	11.92

TDS: total dissolved solids; DO: dissolved oxygen.

Data analysis - WHPT

6.117 Whalley Hawkes, Paisley and Trigg (WHPT) metric scores (Whalley and Hawkes 1996, 1997) for Autumn 2017 and Spring 2018 were calculated from the family-level macroinvertebrate data and are summarised in Table 30.

Table 30: WHPT scores for autumn 2017 at sampling locations 1 to 5.

Sampling period	Score type	Sampling Location					Average
		1	2	3	4	5	
Autumn 2017	WHPT No. Taxa	15	21	14	10	8	13.60
	WHPT ASPT	5.41	5.07	4.03	4.02	3.78	4.46
Spring 2018	WHPT No. Taxa	17	16	10	16	16	15.00
	WHPT ASPT	5.05	5.75	4.07	4.59	4.61	4.81

WHPT: Whalley, Hawkes, Paisley and Trigg metric score.
ASPT: Average (number of) species per taxon.

6.118 WHPT scores are highest in the samples taken from sample Sampling Locations 1 and 2, scoring over 5 in both autumn and spring. This indicates at these points in the Rowel Brook the water quality is good. The samples taken from sample points 3–5 have broadly similar scores for WHPT, generally between 4 and 5, indicating water quality is moderate in these locations. In addition, the water chemistry measurements for all five samples indicate the Rowel Brook and its tributary have moderate water quality.

7 References

- Altringham, J. (2003). *British Bats*. Harper Collins Publishers. Applied Ecology Ltd (2010) *Ecological Assessment Survey, Begbroke Science Park Access Road, Oxfordshire*. Report to University of Oxford.
- ARG UK (2010). *ARG UK Advice Note 5: Great Crested Newt Habitat Suitability Index*. Amphibian and Reptile Groups of the United Kingdom.
- Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., Griffiths, RA., Foster, J., Wilkinson, J., Arnett, A., Williams, P., and Dunn, F. (2014). *Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA*. Freshwater Habitats Trust, Oxford.
- Bright, P.W, Morris, P.A. and Mitchell-Jones, T. (2006). *The Dormouse Conservation Handbook* Second Edition. English Nature, Peterborough.
- Dean M., Strachan R., Gow D., Andrews R. M., Mathews F., Chanin, P. R. F. (2016) *Water Vole Mitigation Handbook*. The Mammal Society, London.
- Defra (2007) *Hedgerow Survey Handbook*. Defra.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69285/pb11951-hedgerow-survey-handbook-070314.pdf
- BBOWT (2017) Water Vole Recovery Project. BBOWT. <https://www.bbowt.org.uk/wildlife/wildlife-conservation/water-vole-recovery-project>
- BRIG (2011) *UK Biodiversity Action Plan Priority Habitat Descriptions*. JNCC.
- BSG Ecology (2015) *Land around Begbroke Science Park: Biodiversity Survey*. Report to University of Oxford.
- BSG Ecology (2018a) *Begbroke Science Park Outline Planning Application: Ecology Report*. Report to Oxford University. Report to University of Oxford.
- BSG Ecology (2018b) *Begbroke Science Park Outline Planning Application: Great Crested Newt and Reptile Report*. Report to University of Oxford.
- Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)*. The Bat Conservation Trust, London.
- Daguet C., French G, Taylor P (2008) *The Odonata Red Data List for Great Britain*. JNCC.
- Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R.D., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D.A. and Gregory, R.D. (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108: 708–746.
- Environment Agency (2010) *Fifth otter survey of England 2009–2010*. Environment Agency.
- Erskine S. EE., Killick J. J., Lambrick C. R., Lee E. M. (2018) *Oxfordshire's Threatened Plants*. Pisces Publications.
- Falk S. J. (1991) *A Review of the Scarce and threatened Files of Great Britain*. Research & survey in nature conservation, No. 39. JNCC.

- Froglife (1999). Reptile Survey. *An introduction to planning, conducting and interpreting surveys for snake and lizard conservation*. Froglife Advice Sheet 10. Froglife, Halesworth.
- Harris, S., Cresswell, P. and Jeffries, D. (1989). *Surveying Badgers*. Occasional publication of Mammal Society, Number 9. Mammal Society.
- Harris, S., Jefferies, D., Cheeseman, C. and Booty, C. (1994). *Problems with badgers*. Royal Society for the Prevention of Cruelty to Animals, Horsham, West Sussex.
- JNCC (2010) *Phase 1 habitat survey: A technique for environmental audit*. JNCC.
- Kirby, P. (1992) A review of scarce and threatened Hemiptera of Great Britain. UK Nature Conservation, No. 2. JNCC.
- Natural England (2010) *Higher Level Stewardship: Farm Environment Plan (FEP) Manual*. Third Edition March 2010. Natural England.
- Natural England (2015a) *Hazel or common dormice: surveys and mitigation for development projects*. Natural England, Worcester. <https://www.gov.uk/guidance/hazel-or-common-dormice-surveys-and-mitigation-for-development-projects>
- Natural England (2015b) *Great crested newts: Surveys and mitigation for development projects*. Natural England. <https://www.gov.uk/guidance/great-crested-newts-surveys-and-mitigation-for-development-projects> [accessed 03/12/2018].
- Natural England (2015c) *Reptiles: survey and mitigation for development projects*. Natural England. <https://www.gov.uk/guidance/reptiles-protection-surveys-and-licences> [accessed 29/11/2018].
- Neal, E., and Cheeseman, C.L. (1996). *Badgers*. T & AD Poyser Natural History Ltd, London.
- Oldham, R.S., Keeble, J., Swan, M.J.S. and Jeffcote, M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). *Herpetological Journal* 10 (4): 143-155.
- Oxfordshire Flora Group (2015). *Oxfordshire Rare Plant Register*. ANHSO.
- Rodwell, J.S. et al. (1992). *British Plant Communities Volume 3: Grasslands and montane communities*. Joint Nature Conservation Committee, Peterborough.
- Stewart A., Pearman D. A., Preston C. D. (1994) *Scarce Plants in Britain*. JNCC.
- Stroh P. A., Leach S. J., August T. A., Walker K. J., Pearman D. A., Rumsey F. J., Harrower C. A., Fay M. F., Martin J. P., Pankhurst, C. D., Preston C. D., Taylor, I. (2014) *A Vascular Plant Red List for England*. BSBI.
- TVERC & BMERC (2009) *Criteria for the Selection of Local Wildlife Sites in Berkshire, Buckinghamshire and Oxfordshire*. TVERC.
- Walley, W.J. & H.A. Hawkes (1996) A computer-based reappraisal of the Biological Monitoring Working Party scores using data from the 1990 river quality survey of England and Wales. *Water Research* 30 (9): 2086-2094.
- Walley, W.J. & H.A. Hawkes (1997) A computer-based reappraisal of the Biological Monitoring Working Party score system incorporating abundance rating, site type and indicator value. *Water Research* 31 (2): 201-210.
- WFD UKTAG (2014) *UKTAG River Assessment Method for Benthic Invertebrate Fauna: Invertebrates (General Degradation) Whalley, Hawkes, Paisley and Trigg (WHPT) Metric in River Invertebrate Classification Tool (RICT)*. WFD UKTAG, Stirling.

8 Figures

Figure 1: Site Location and Statutory Designated Sites

Figure 2: Phase 1 Habitat Plan

Figure 3: Hedgerow Survey

Figure 4: Botanical Survey

Figure 5: Badger Survey (Confidential)

Figure 6a: Bat Survey Methods

Figure 6b: Tree Assessment for Bats

Figure 6c: Building Assessment for Bats

Figure 6d: Building Assessment for Bats (Begbroke Science Park)

Figure 6e: Bat Activity Transect Survey Results (Spring)

Figure 6f: Bat Activity Transect Survey Results (Summer)

Figure 6g: Bat Activity Transect Survey Results (Autumn)

Figure 7: Dormouse Survey

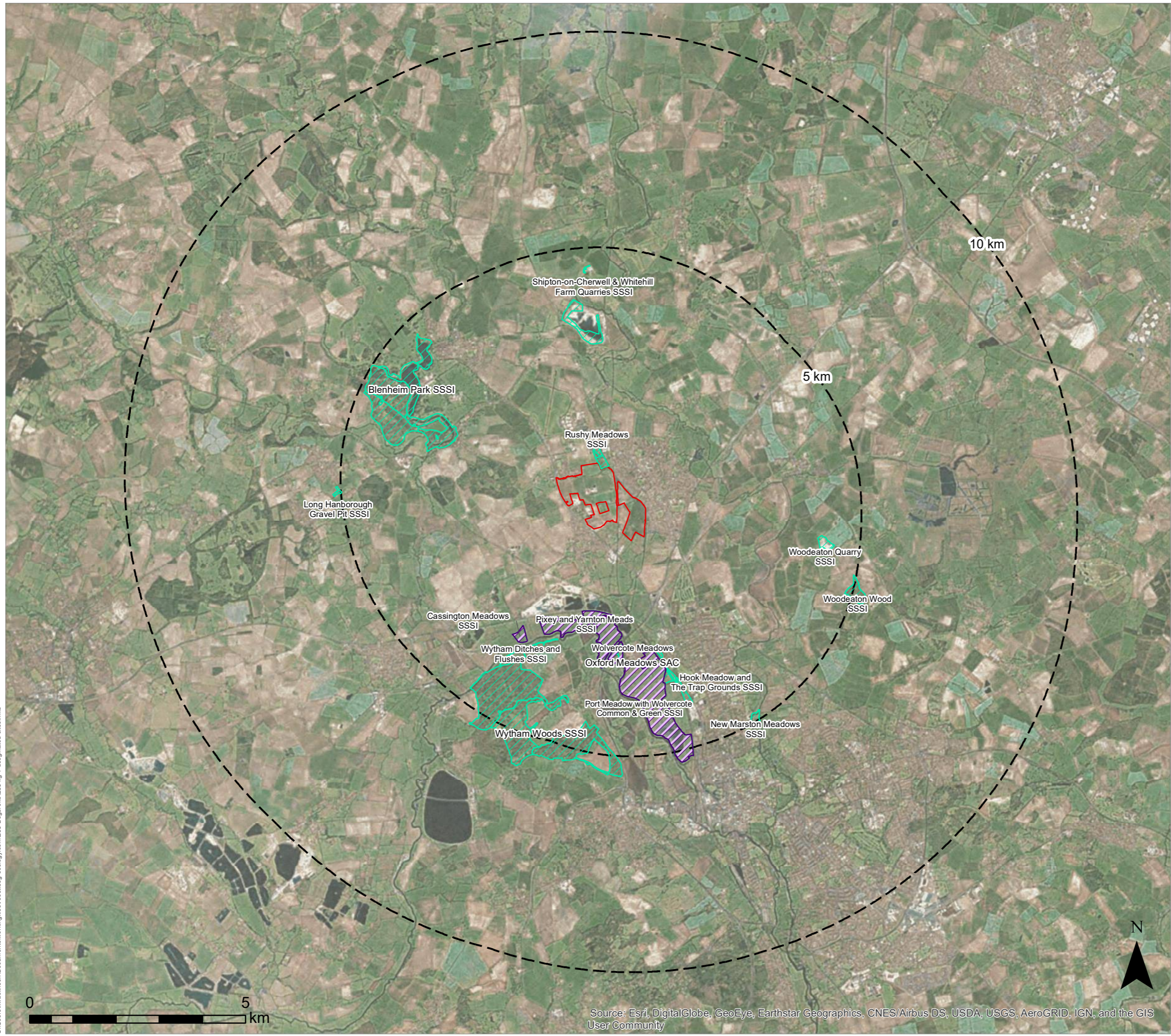
Figure 8: Watercourse Survey Results

Figure 9a: Breeding Bird Characterisation Survey (north of Site)

Figure 9a: Breeding Bird Characterisation Survey (south of Site)

Figure 10: Pond Surveys

Figure 11: Reptile Survey



LEGEND

- Site boundary
- 5/10 km buffer around site
- Sites of Special Scientific Interest (SSSI) within 5 km
- Special Areas of Conservation (SAC) within 10 km

BSG | ecology

OFFICE: Oxford
 T: 01865 883833
 JOB REF: P17-255

PROJECT TITLE
 BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
 Figure 1: Site Location and Statutory Designated Sites

DATE: 04.12.2018 CHECKED: TF SCALE: 1:85,000
 DRAWN: KW APPROVED: PN VERSION: 1.2

Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
 All dimensions are to be checked on site.
 Area measurements for indicative purposes only.

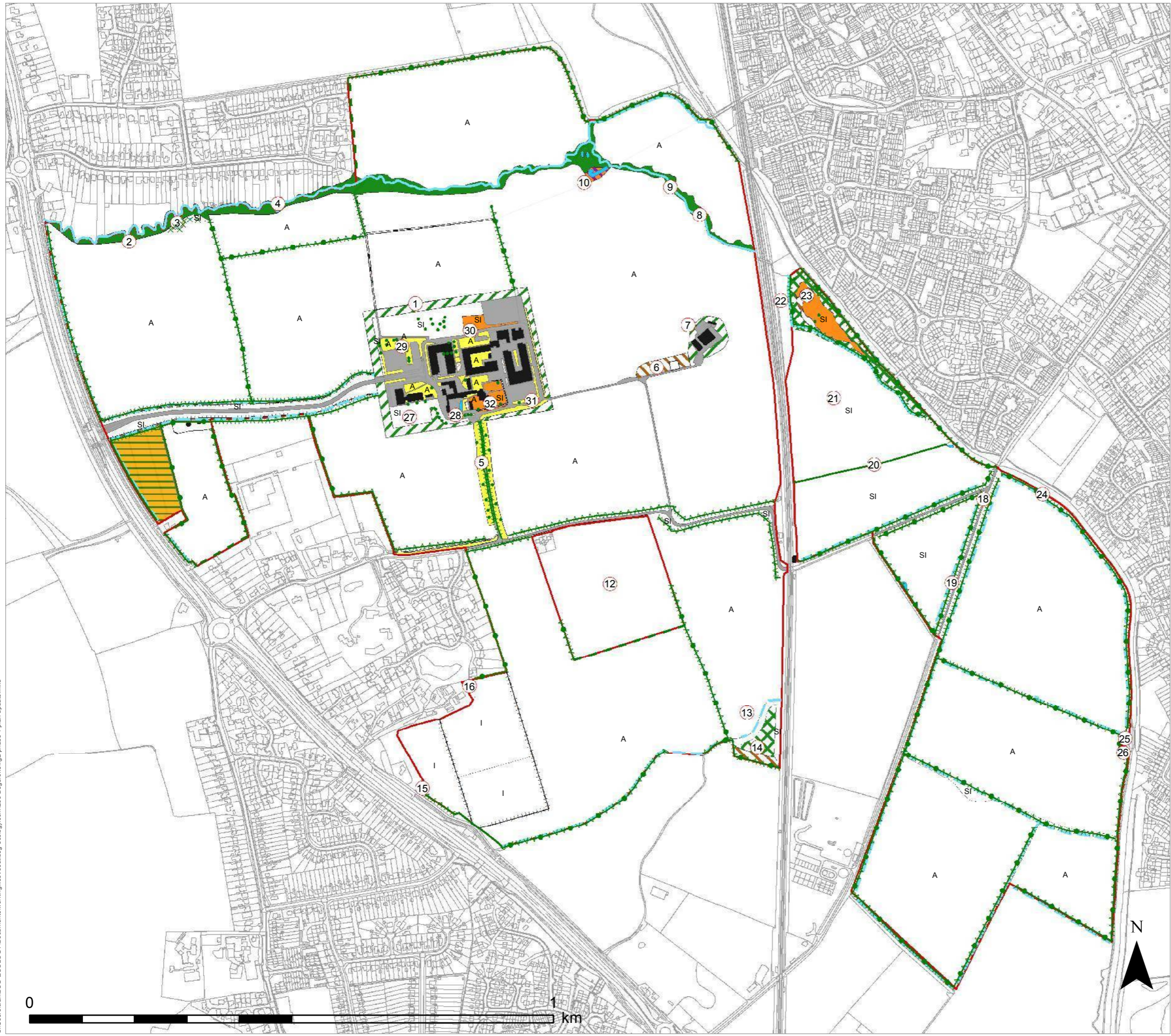
This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri

Sources: BSG Ecology survey data
 © Natural England copyright. Contains Ordnance Survey data © Crown copyright and database right 2018.

C:\Users\kwalkinson\Documents\working\files\root\bsg-ecology.com\255 Begbroke\255 fig 1 designated sites.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



LEGEND

	Site boundary		Species-rich hedgerow
	Allotments		Species-rich hedgerow with trees
	Hardstanding		Species-poor hedgerow
	Broadleaved semi-natural woodland		Species-poor hedgerow with trees
	Broadleaved plantation woodland		Species-poor defunct hedgerow
	Dense scrub		Stream
	Semi-improved neutral grassland		Fence
	Improved grassland		Ditch
	Swamp		Scattered scrub
	Poor semi-improved grassland		Broadleaved tree
	Tall ruderal vegetation		Target note
	Pond		
	Arable		
	Amenity grassland		
	Introduced shrub		
	Building		
	Bare ground		

BSG | ecology

OFFICE: Oxford
T: 01865 883833
JOB REF: P17-255

PROJECT TITLE
BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 2: Phase 1 Habitat Survey

DATE: 06.12.2018
DRAWN: COH
CHECKED: TF
APPROVED: PN
SCALE: 1:7,000
VERSION: 1.2

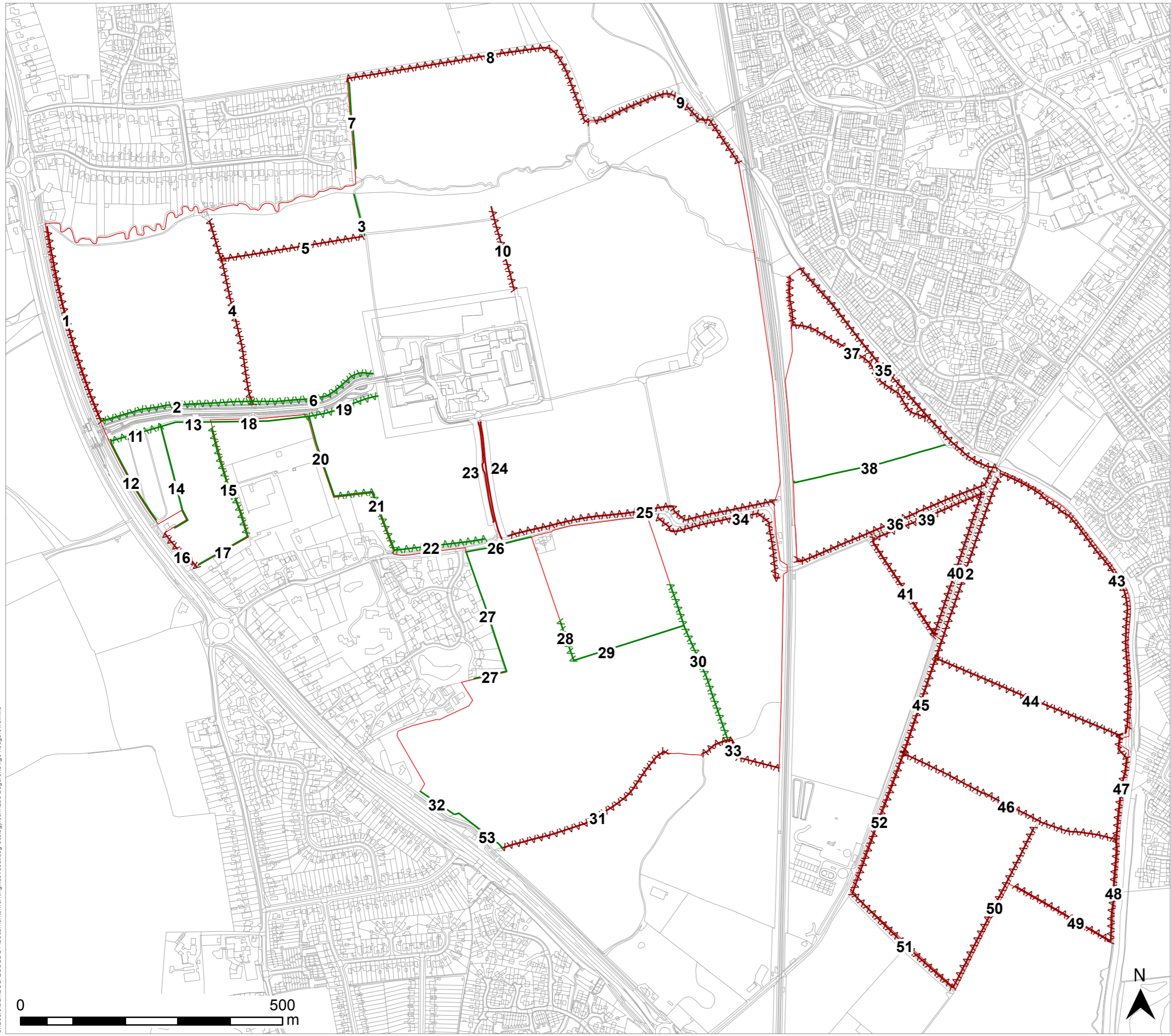
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing. All dimensions are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data, basemap derived from drawing TDN033/12/01 produced by University of Oxford Estate Services

C:\Users\cam.BSG-ECOLOGY\Documents\workingfiles\roost_bsg-ecology.com\256 Begbroke\fig2 phase 1 plan update.mxd



LEGEND

- Site boundary
- Hedgerow status**
- Not important, species-poor
- Not important, species-rich
- Important, species-poor
- Important, species-rich



OFFICE: Oxford
 T: 01865 883833
 JOB REF: P17-255

PROJECT TITLE
 BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
 Figure 3: Hedgerow survey

DATE: 06.12.2018 CHECKED: TF SCALE: 1:7,000
 DRAWN: COH APPROVED: PN VERSION: 1.3

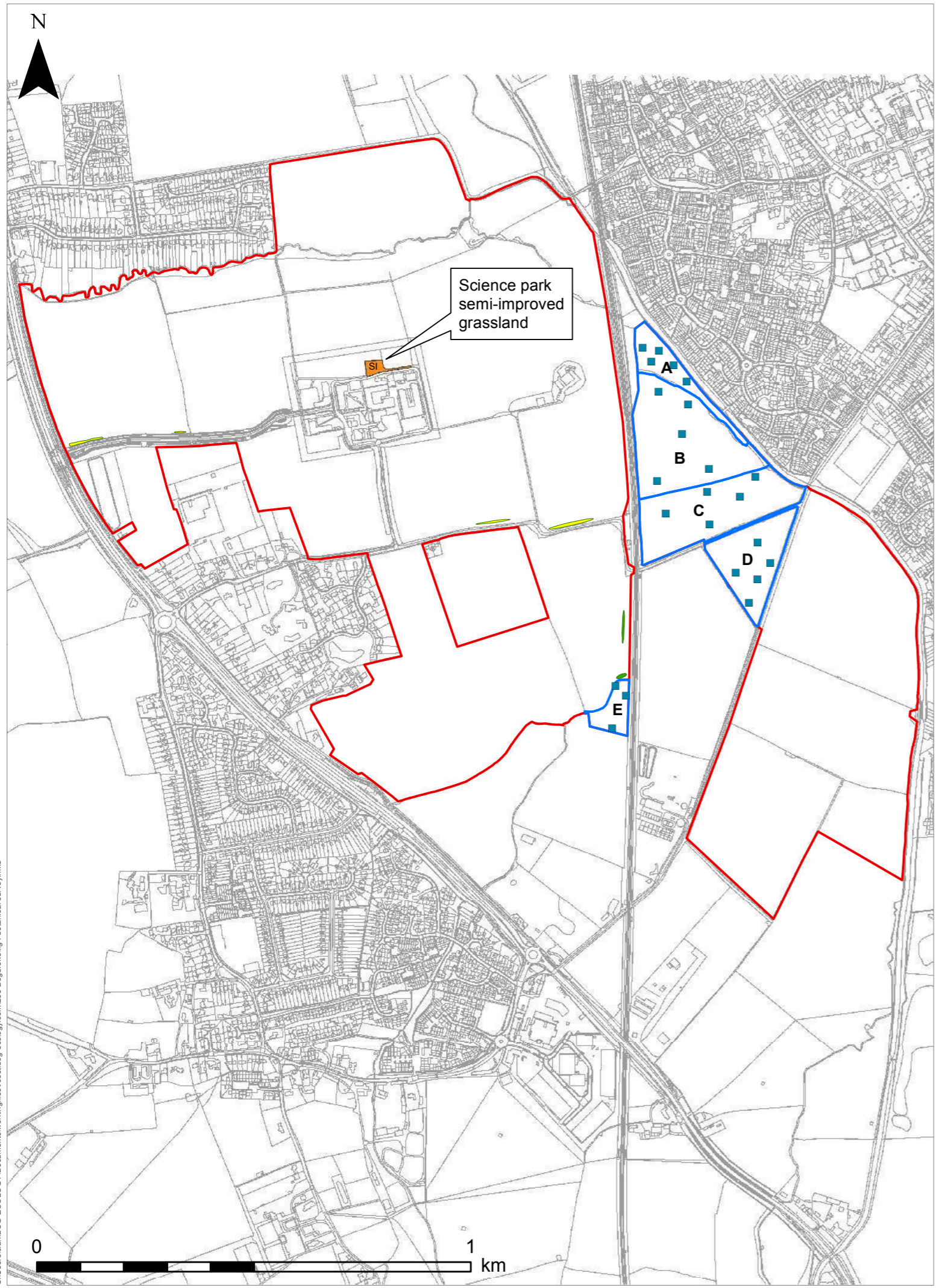
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
 All dimensions are to be checked on site.
 Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
 Sources: BSG Ecology survey data, basemap derived from drawing TDN033/12/01 produced by University of Oxford Estate Services

C:\Users\clan.BSG-ECOLGY\Documents\workingfiles\roost_bsg-ecology.com\255 Begbroke\fig3 hedgerows.mxd



- LEGEND**
- Site boundary
 - Field subject to botanical survey
 - Location of botanical quadrats (2m x 2m)
- Location of red list arable weeds**
- Common cudweed (*Filago vulgaris*)
 - Corn marigold (*Glebionis segetum*)
- Habitat detail**
- Dense scrub
 - SI Semi-improved neutral grassland
 - SI Poor semi-improved grassland
 - Tall ruderal vegetation

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 4: Botanical survey

DATE: 04.12.2018 CHECKED: TF SCALE: 1:10,500
DRAWN: COH APPROVED: PN VERSION: 1.1

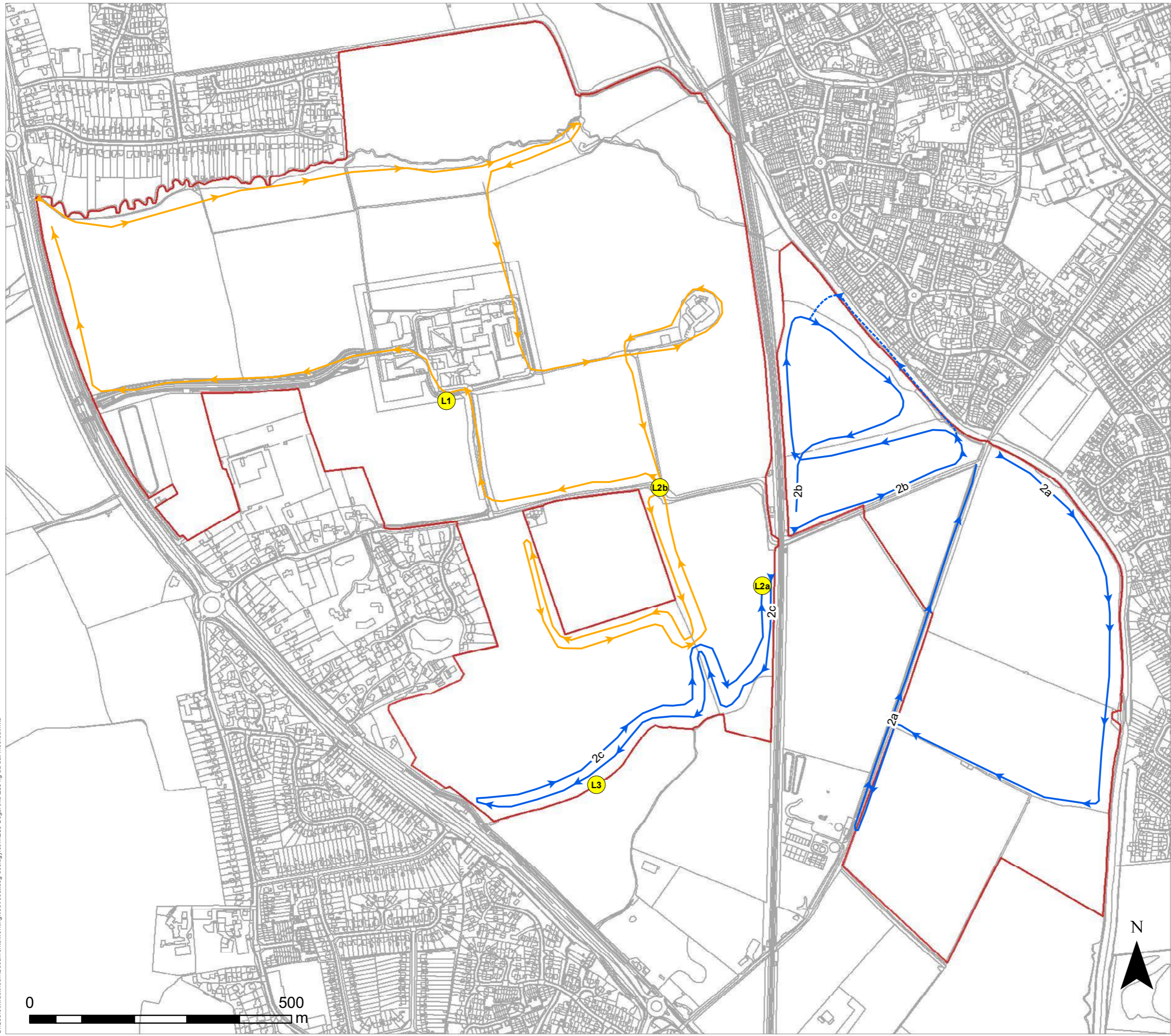
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data, basemap derived from drawing TDN/033/12/01 produced by University of Oxford Estate Services

C:\Users\clan.BSG-ECOLOGY\Documents\workingfiles\roost_bsg-ecology.com\256_Begbroke\fig4_botanical_survey.mxd



- LEGEND**
- Site boundary
 - L1 Static detector
 - Transect route walked**
 - Transect 1
 - Transect 2
 - Transect 2b diversion in June and July 2018

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 6a: Bat survey methods

DATE: 04.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.1

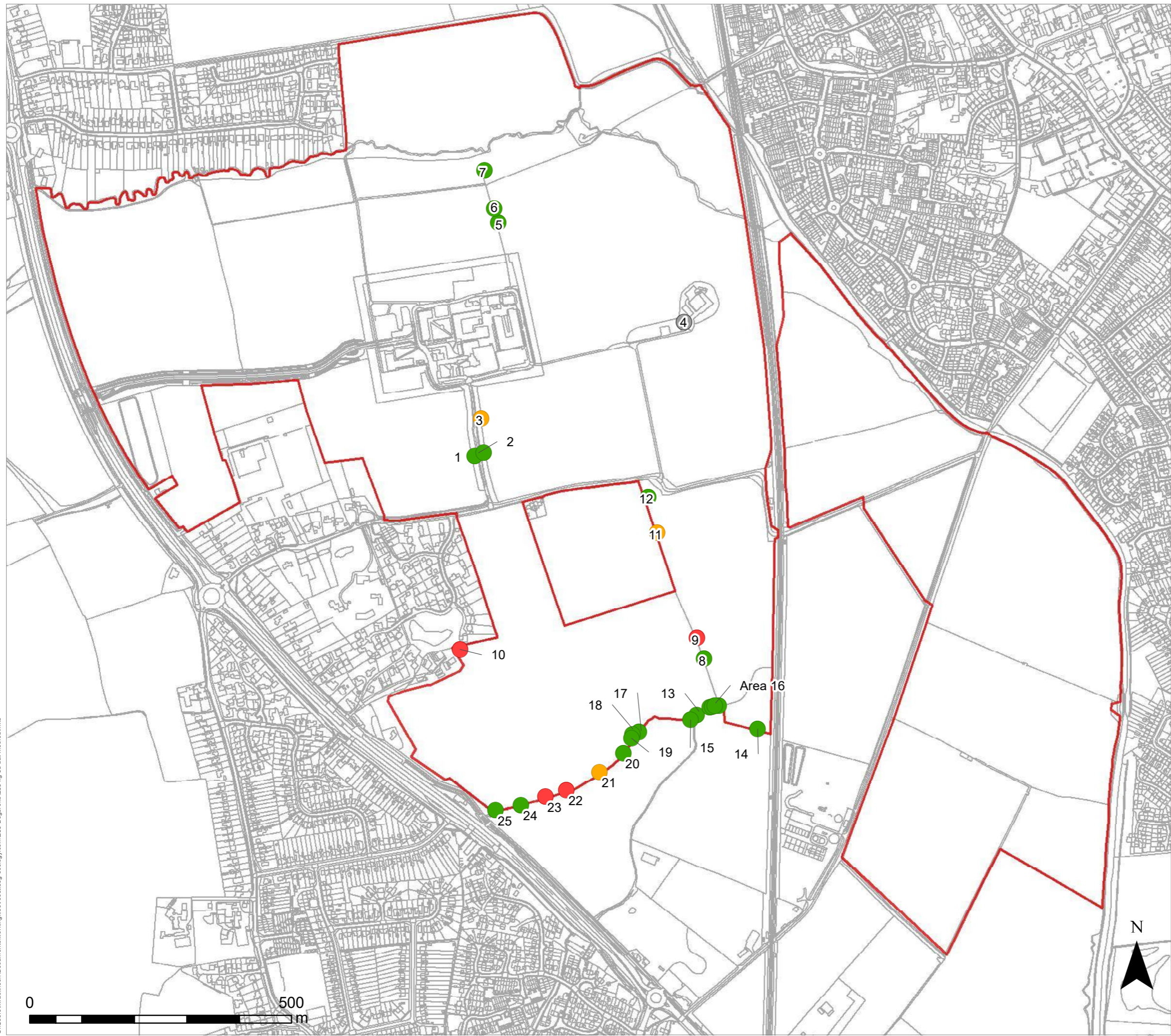
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwalkinson\Documents\working\files\roast.bsg-ecology.com\255 Begbroke\255 fig 6a bat method.mxd



LEGEND

Site boundary

Suitability of tree to support roosting bats

- High
- Medium
- Low
- Negligible
- Tree number

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 6b: Tree Assessment for Bats

DATE: 04.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.2

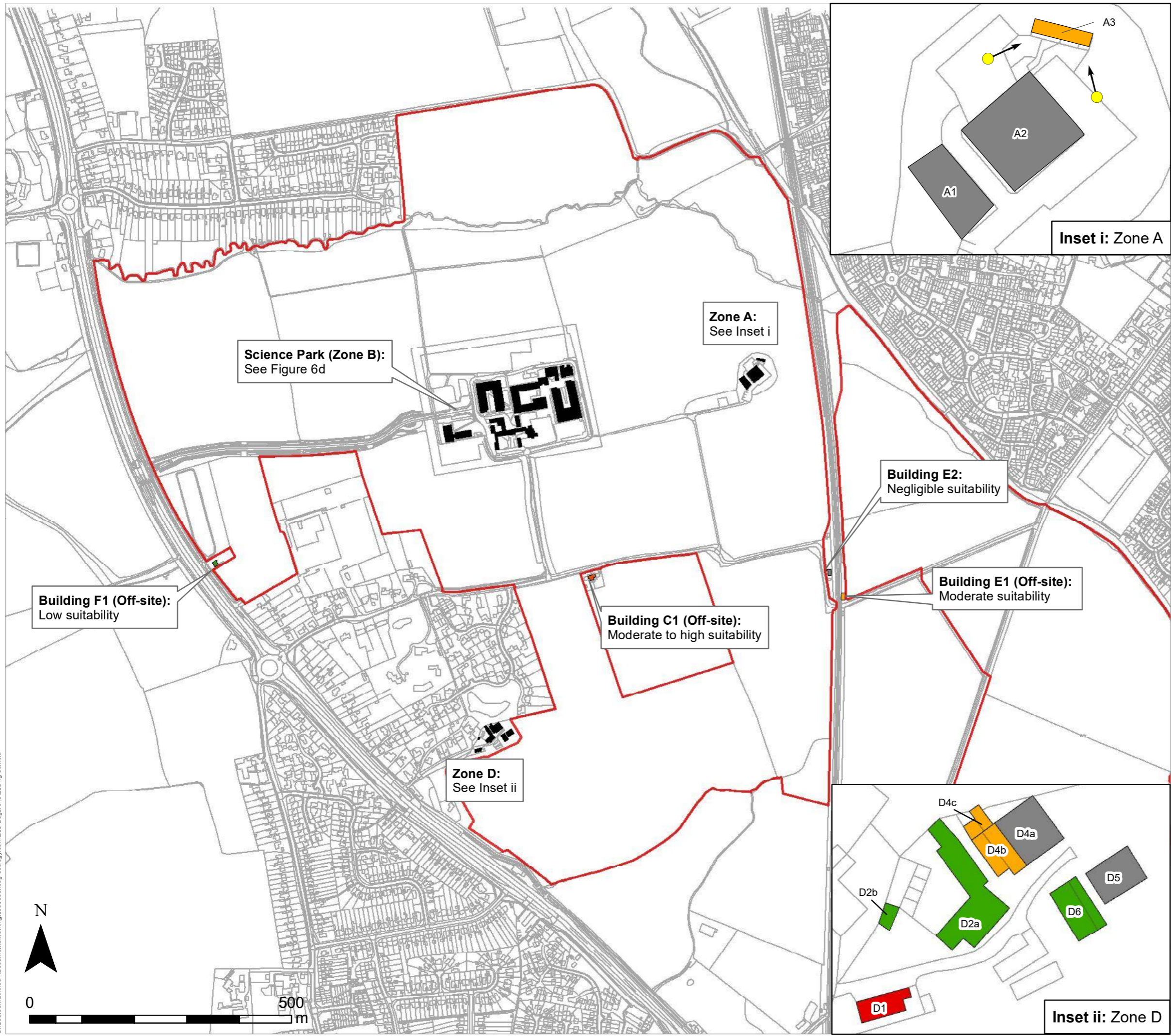
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved.
Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwalkinson\Documents\working\files\roost.bsg-ecology.com\255 Begbroke\255 fig 6b bat method.mxd



LEGEND

- Site boundary
- Building
- Surveyor Position

Suitability of building to support roosting bats

- High
- Low
- Moderate
- Negligible

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 6c: Building Assessment for Bats

DATE: 04.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.2

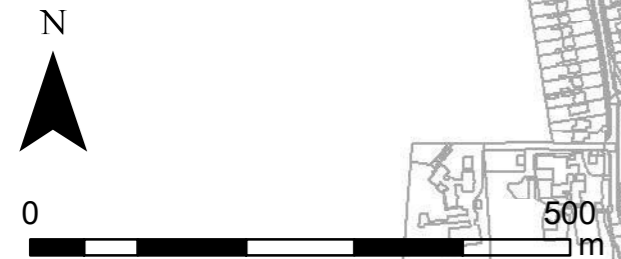
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved.
Reference number: 10048980


OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwalkinson\Documents\working\files\roost.bsg-ecology.com\255_Begbroke\255_fig_6c.mxd







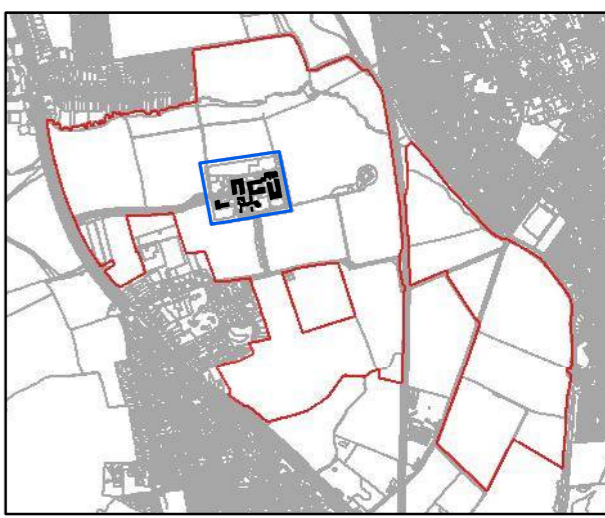


LEGEND

-  Surveyor Position

Suitability of building to support roosting bats

-  High
-  Low
-  Moderate
-  Negligible



BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 6d: Building Assessment for Bats
(Begbroke Science Park)

DATE: 04.12.2018 CHECKED: TF SCALE: 1:1,000
DRAWN: KW APPROVED: PN VERSION: 1.2

Copyright © BSG Ecology

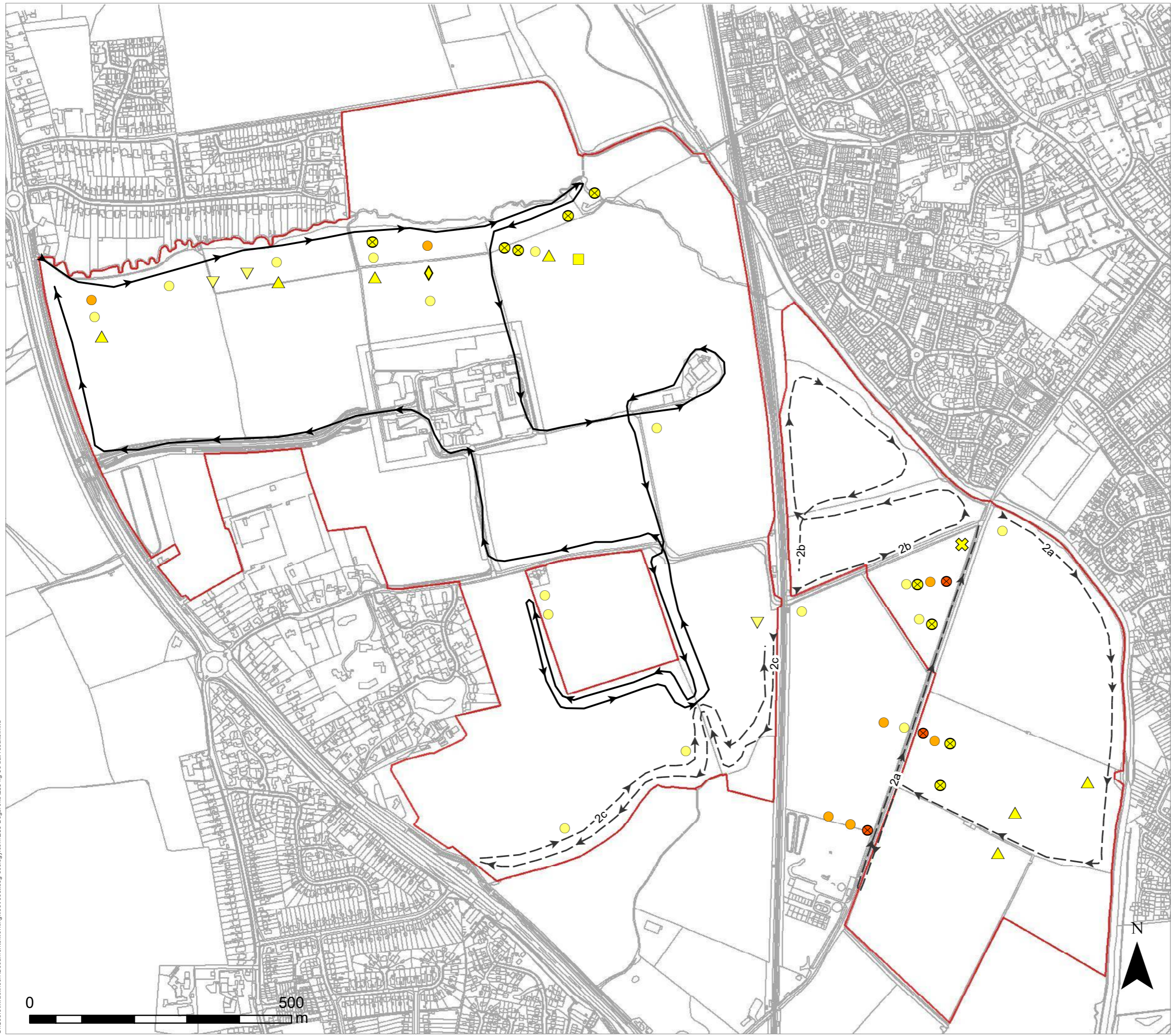
No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri

Sources: BSG Ecology survey data

C:\Users\kwalkinson\Documents\working\files\roost.bsg-ecology.com\255 Begbroke\255 fig 6d science park.mxd



LEGEND

- Site boundary
- Common pipistrelle
- Soprano pipistrelle
- Noctule
- Nyctalus* species
- Barbastrelle
- Brown long-eared bat
- Myotis* species

Month species observed

- April
- May

Transect route walked

- Transect 1
- 2a- Transect 2

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 6e: Bat Activity Transect Survey Results: **Spring**

DATE: 04.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.2

Copyright © BSG Ecology

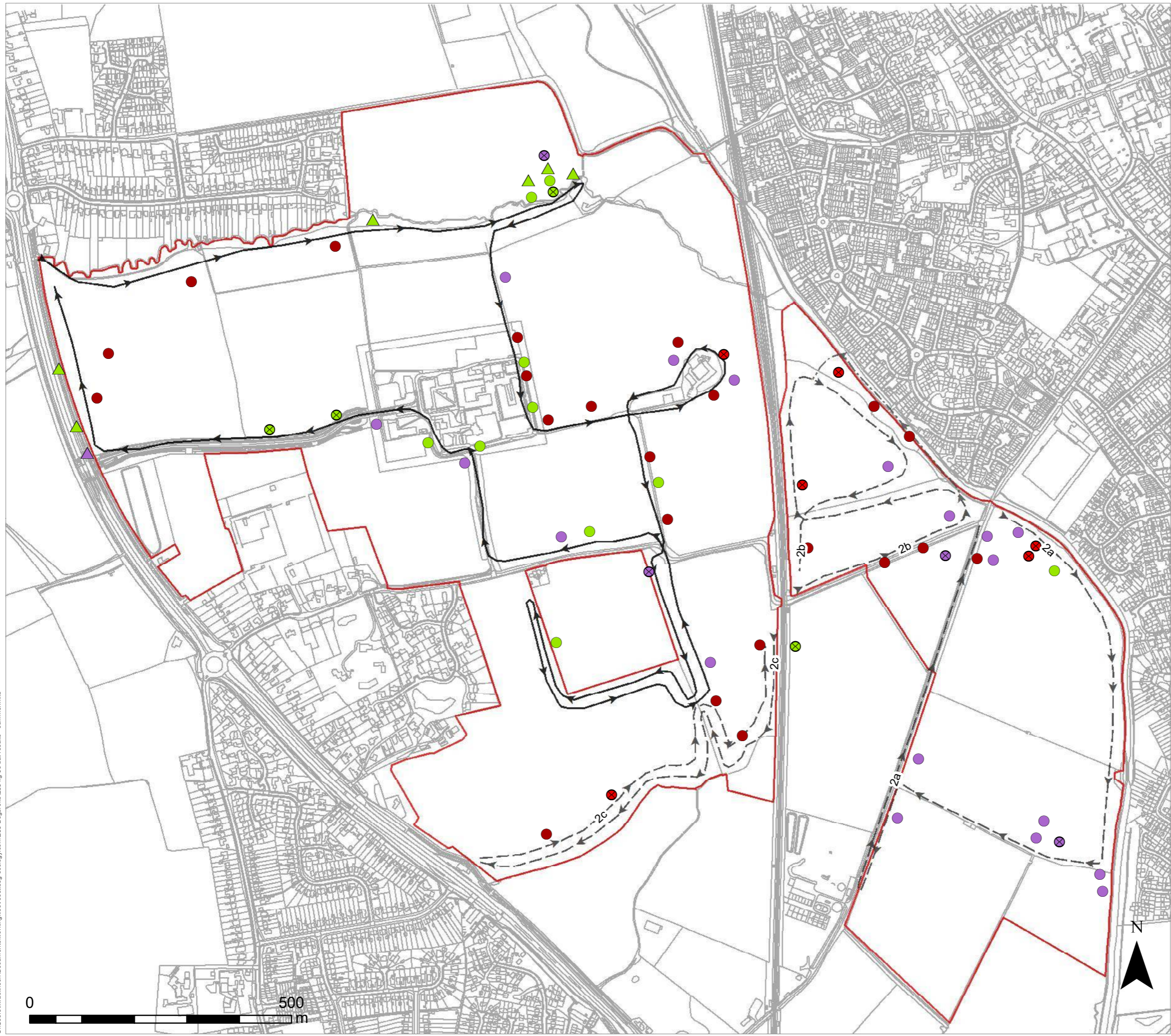
No dimensions are to be scaled from this drawing. All dimensions are to be checked on site. Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri

Sources: BSG Ecology survey data

C:\Users\kwinson\Documents\working\files\roost.bsg-ecology.com\255 Begbroke\255 fig 6e bat results.mxd



LEGEND

- Site boundary
- Common pipistrelle
- Soprano pipistrelle
- Noctule

Month species observed

- June
- July
- August

Transect route walked

- Transect 1
- Transect 2
- Transect 2b diversion in June and July 2018

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 6f: Bat Activity Transect Survey Results: **Summer**

DATE: 04.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.2

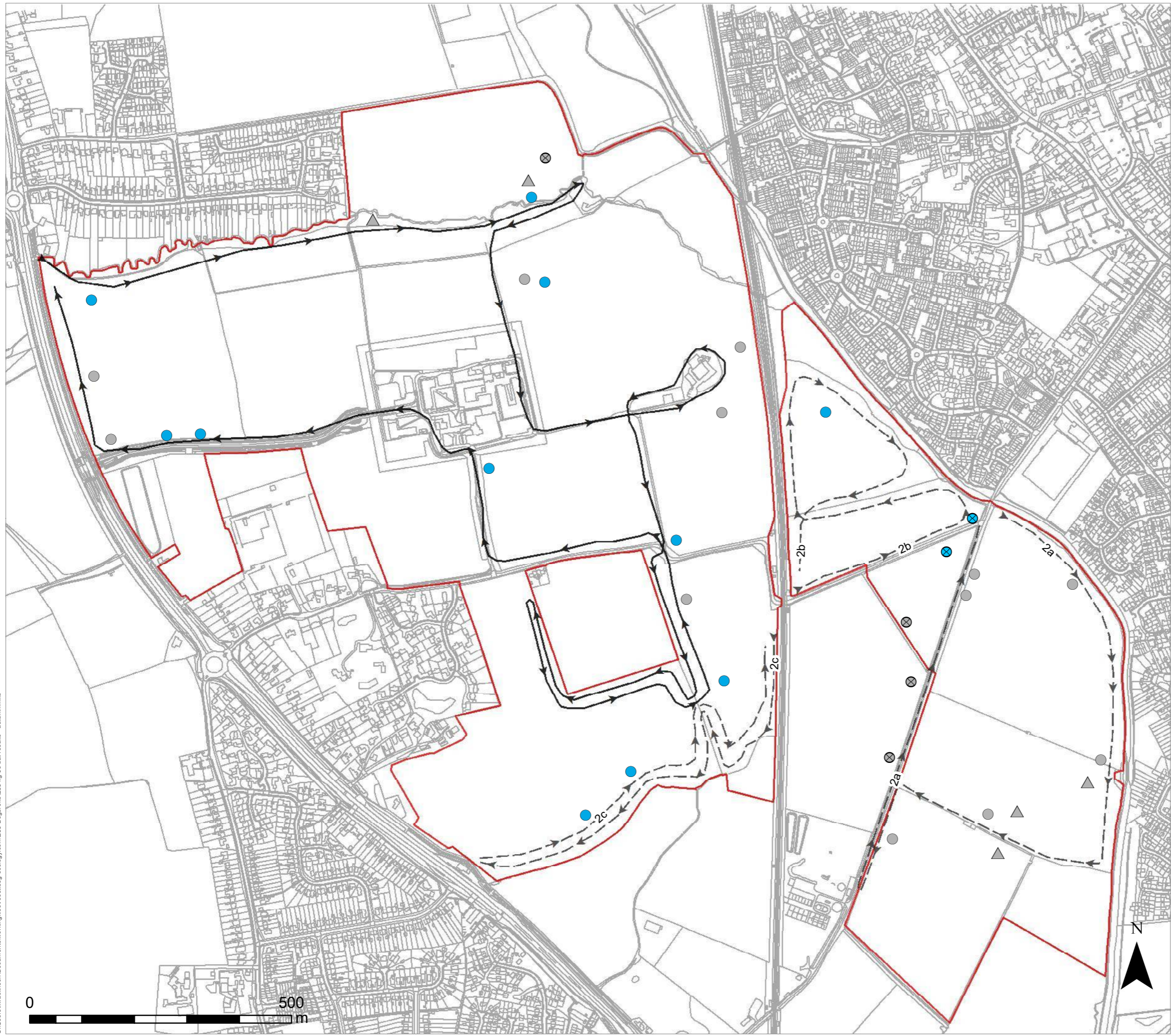
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwinson\Documents\working\files\roost.bsg-ecology.com\255 Begbroke\255 fig 6e bat results - summer.mxd



LEGEND

- Site boundary
- Common pipistrelle
- Soprano pipistrelle
- Noctule

Month species observed

- September
- October

Transect route walked

- Transect 1
- 2a- Transect 2

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 6g: Bat Activity Transect Survey Results: **Autumn**

DATE: 04.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.2

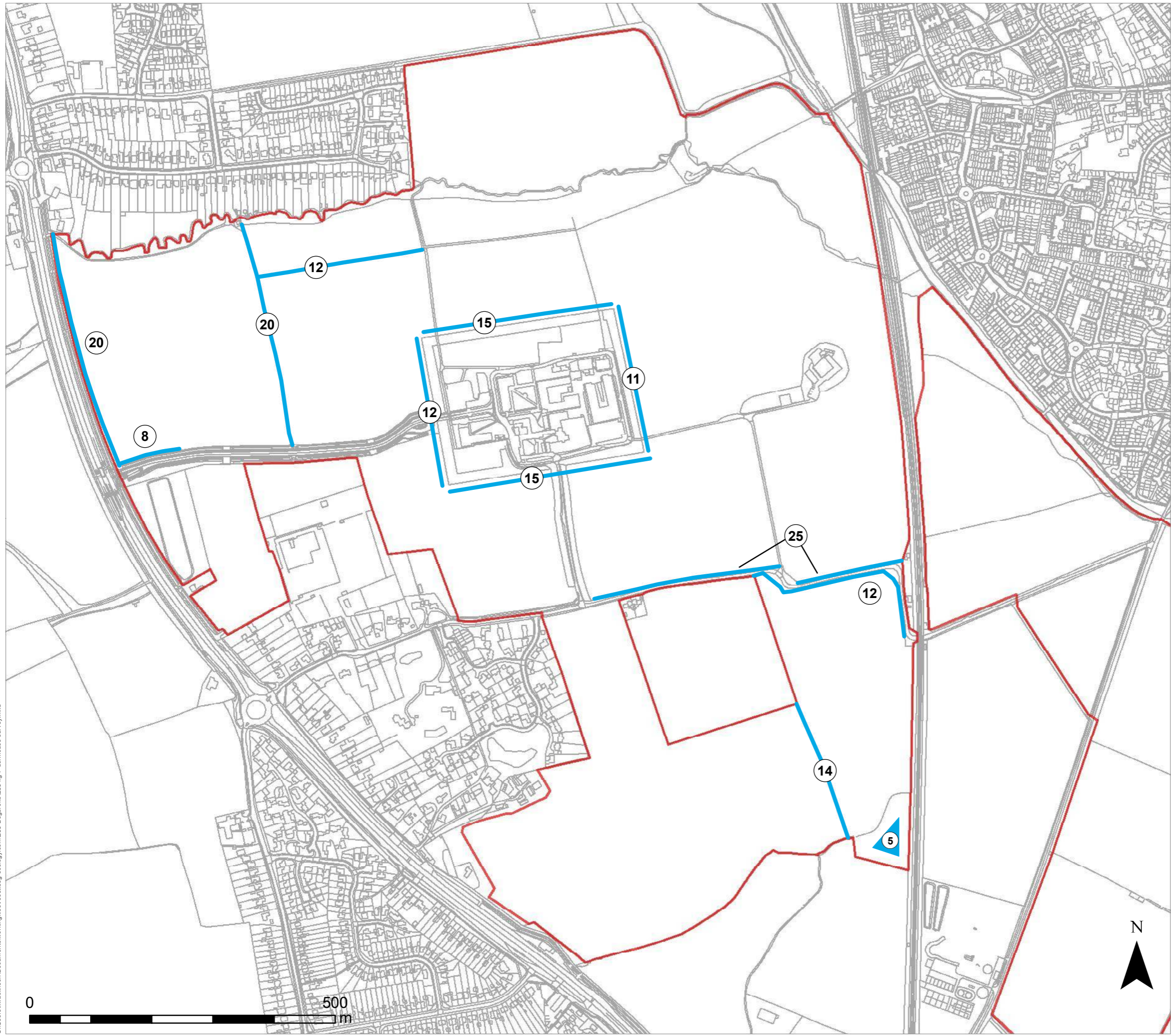
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved.
Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwinson\Documents\working\files\roost.bsg-ecology.com\255 Begbroke\255 fig 6e bat results - autumn.mxd



- LEGEND**
- Site boundary
 - Line of Dormouse nest tubes
 - Area of Dormouse nest tubes
 - 12 Number of tubes in survey line/area

C:\Users\kwalkinson\Documents\working\files\roost.bsg-ecology.com\255 Begbroke\255 fig 7 dormouse survey.mxd

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 7: Dormouse Survey

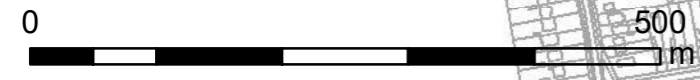
DATE: 04.12.2018 CHECKED: TF SCALE: 1:6,000
DRAWN: KW APPROVED: PN VERSION: 1.2

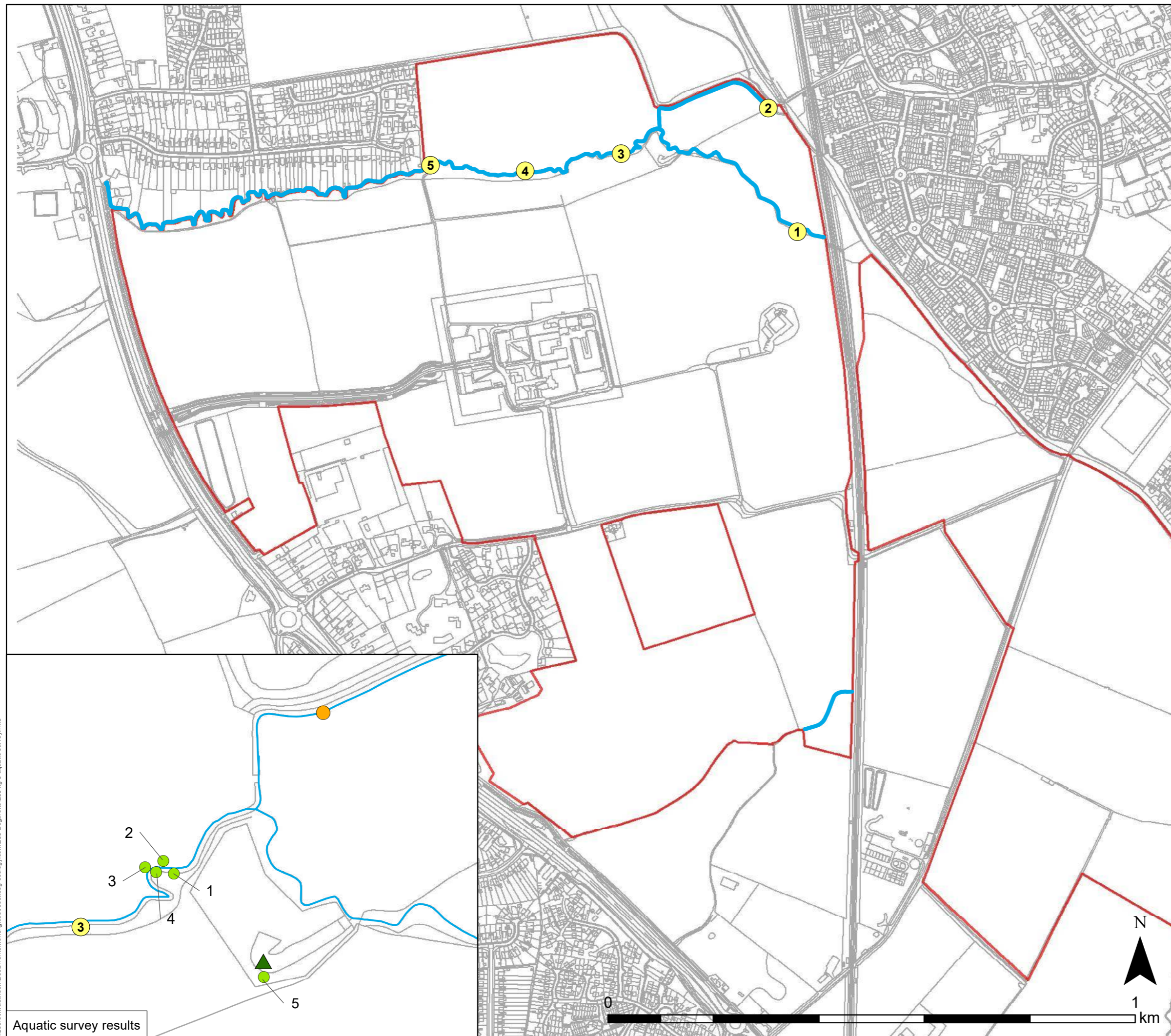
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data





LEGEND

- Site boundary
- Otter, Water Vole and Crayfish survey area
- 1 Aquatic invertebrate sampling location
- Signal Crayfish location (invasive non-native species)

Water Vole Survey Results

- 1 Burrow
- Latrine



OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 8: Watercourse Survey Results

DATE: 06.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.4

Copyright © BSG Ecology

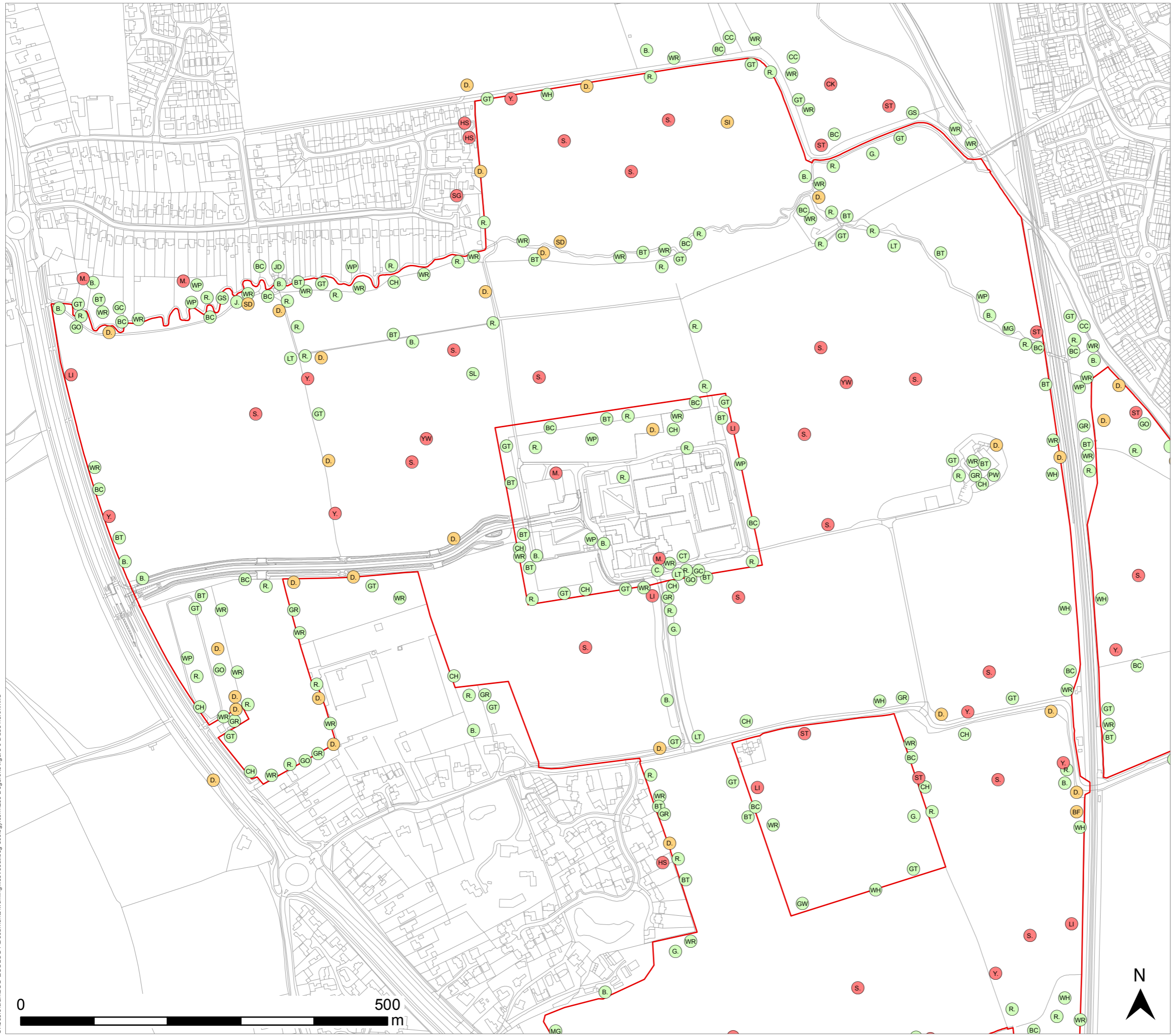
No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwalkinson\Documents\workingfiles\root\bsg-ecology.com\255 Begbroke\255 fig 8 aquatic survey.mxd

Aquatic survey results



LEGEND

Site boundary

BoCC status

- Red list
- Amber list
- Green list

BTO code	Species	Scientific name
B.	Blackbird	<i>Turdus merula</i>
BC	Blackcap	<i>Sylvia atricapilla</i>
BF	Bullfinch	<i>Pyrrhula pyrrhula</i>
BT	Blue Tit	<i>Cyanistes caeruleus</i>
C.	Carrion Crow	<i>Corvus corone</i>
CC	Chiffchaff	<i>Phylloscopus collybita</i>
CD	Collared Dove	<i>Streptopelia decaocto</i>
CH	Chaffinch	<i>Fringilla coelebs</i>
CK	Cuckoo	<i>Cuculus canorus</i>
CT	Coal Tit	<i>Periparus ater</i>
D.	Dunnock	<i>Prunella modularis</i>
G.	Green	<i>Picus viridis</i>
GC	Goldcrest	<i>Regulus regulus</i>
GO	Goldfinch	<i>Carduelis carduelis</i>
GR	Greenfinch	<i>Chloris chloris</i>
GS	Great Spotted Woodpecker	<i>Dendrocopos major</i>
GT	Great Tit	<i>Parus major</i>
GW	Garden Warbler	<i>Sylvia borin</i>
HS	House Sparrow	<i>Passer domesticus</i>
J.	Jay	<i>Garrulus glandarius</i>
JD	Jackdaw	<i>Corvus monedula</i>
KT	Red Kite	<i>Milvus milvus</i>
LI	Linnet	<i>Carduelis cannabina</i>
LT	Long-tailed Tit	<i>Aegithalos caudatus</i>
M.	Mistle Thrush	<i>Turdus viscivorus</i>
MG	Maggpie	<i>Pica pica</i>
PW	Pied Wagtail	<i>Motacilla alba</i>
R.	Robin	<i>Erithacus rubecula</i>
S.	Skylark	<i>Alauda arvensis</i>
SD	Stock Dove	<i>Columba oenas</i>
SG	Starling	<i>Sturnus vulgaris</i>
SI	Swift	<i>Apus apus</i>
SL	Swallow	<i>Hirundo rustica</i>
ST	Song Thrush	<i>Turdus philomelos</i>
WG	White-fronted Goose	<i>Anser albifrons</i>
WH	Whitethroat	<i>Sylvia communis</i>
WP	Woodpigeon	<i>Columba palumbus</i>
WR	Wren	<i>Troglodytes troglodytes</i>
Y.	Yellowhammer	<i>Emberiza citrinella</i>
YW	Yellow Wagtail	<i>Motacilla flava</i>



OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

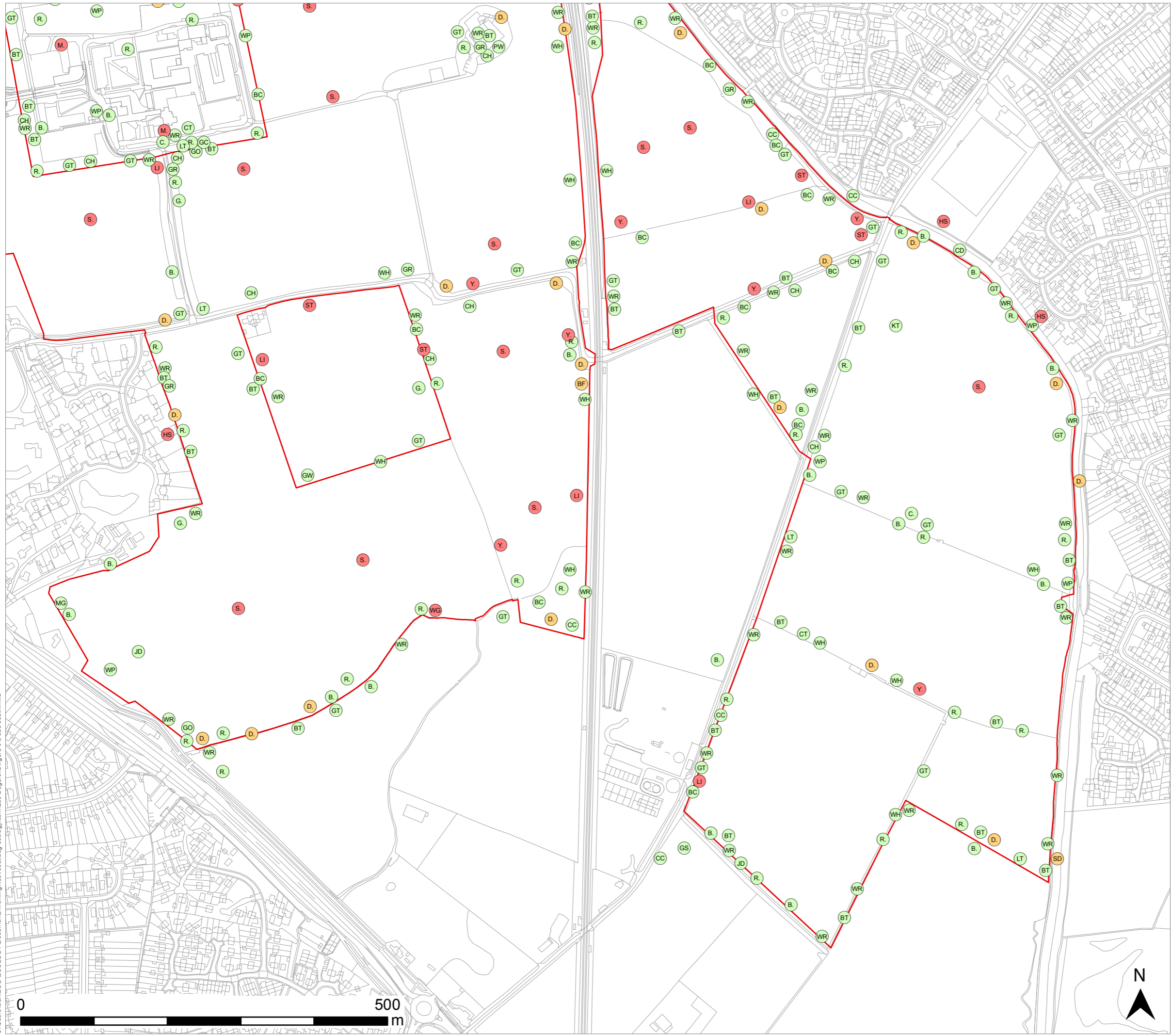
PROJECT TITLE
**LAND AROUND BEGBROKE SCIENCE PARK,
UNIVERSITY OF OXFORD**

DRAWING TITLE
**Figure 9 (a): Breeding bird characterisation survey
(north of site)**

DATE: 30.11.2018 CHECKED: TF SCALE: 1:5,000
DRAWN: COH APPROVED: PN VERSION: 1.0

Copyright © BSG Ecology
No dimensions are to be scaled from this drawing. All dimensions are to be checked on site. Area measurements for indicative purposes only.
This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980
OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data, basemap derived from drawing TDN/033/12/01 produced by University of Oxford Estate Services

C:\Users\ian.BSG-ECOLOG\Documents\workingfiles\roost.bsg-ecology.com\255 Begbroke figure 9 a tbs north.mxd



LEGEND

Site boundary

BoCC status

- Red list
- Amber list
- Green list

BTO code	Species	Scientific name
B.	Blackbird	<i>Turdus merula</i>
BC	Blackcap	<i>Sylvia atricapilla</i>
BF	Bullfinch	<i>Pyrrhula pyrrhula</i>
BT	Blue Tit	<i>Cyanistes caeruleus</i>
C.	Carrion Crow	<i>Corvus corone</i>
CC	Chiffchaff	<i>Phylloscopus collybita</i>
CD	Collared Dove	<i>Streptopelia decaocto</i>
CH	Chaffinch	<i>Fringilla coelebs</i>
CK	Cuckoo	<i>Cuculus canorus</i>
CT	Coal Tit	<i>Periparus ater</i>
D.	Dunnock	<i>Prunella modularis</i>
G.	Green Woodpecker	<i>Picus viridis</i>
GC	Goldcrest	<i>Regulus regulus</i>
GO	Goldfinch	<i>Carduelis carduelis</i>
GR	Greenfinch	<i>Chloris chloris</i>
GS	Great Spotted Woodpecker	<i>Dendrocopos major</i>
GT	Great Tit	<i>Parus major</i>
GW	Garden Warbler	<i>Sylvia borin</i>
HS	House Sparrow	<i>Passer domesticus</i>
J.	Jay	<i>Garrulus glandarius</i>
JD	Jackdaw	<i>Corvus monedula</i>
KT	Red Kite	<i>Milvus milvus</i>
LI	Linnet	<i>Carduelis cannabina</i>
LT	Long-tailed Tit	<i>Aegithalos caudatus</i>
M.	Mistle Thrush	<i>Turdus viscivorus</i>
MG	Magpie	<i>Pica pica</i>
PW	Pied Wagtail	<i>Motacilla alba</i>
R.	Robin	<i>Erithacus rubecula</i>
S.	Skylark	<i>Alauda arvensis</i>
SD	Stock Dove	<i>Columba oenas</i>
SG	Starling	<i>Sturnus vulgaris</i>
SI	Swift	<i>Apus apus</i>
SL	Swallow	<i>Hirundo rustica</i>
ST	Song Thrush	<i>Turdus philomelos</i>
WG	White-fronted Goose	<i>Anser albifrons</i>
WH	Whitethroat	<i>Sylvia communis</i>
WP	Woodpigeon	<i>Columba palumbus</i>
WR	Wren	<i>Troglodytes troglodytes</i>
Y.	Yellowhammer	<i>Emberiza citrinella</i>
YW	Yellow Wagtail	<i>Motacilla flava</i>



OFFICE: Oxford
 T: 01865 883833
 JOB REF: P17-255

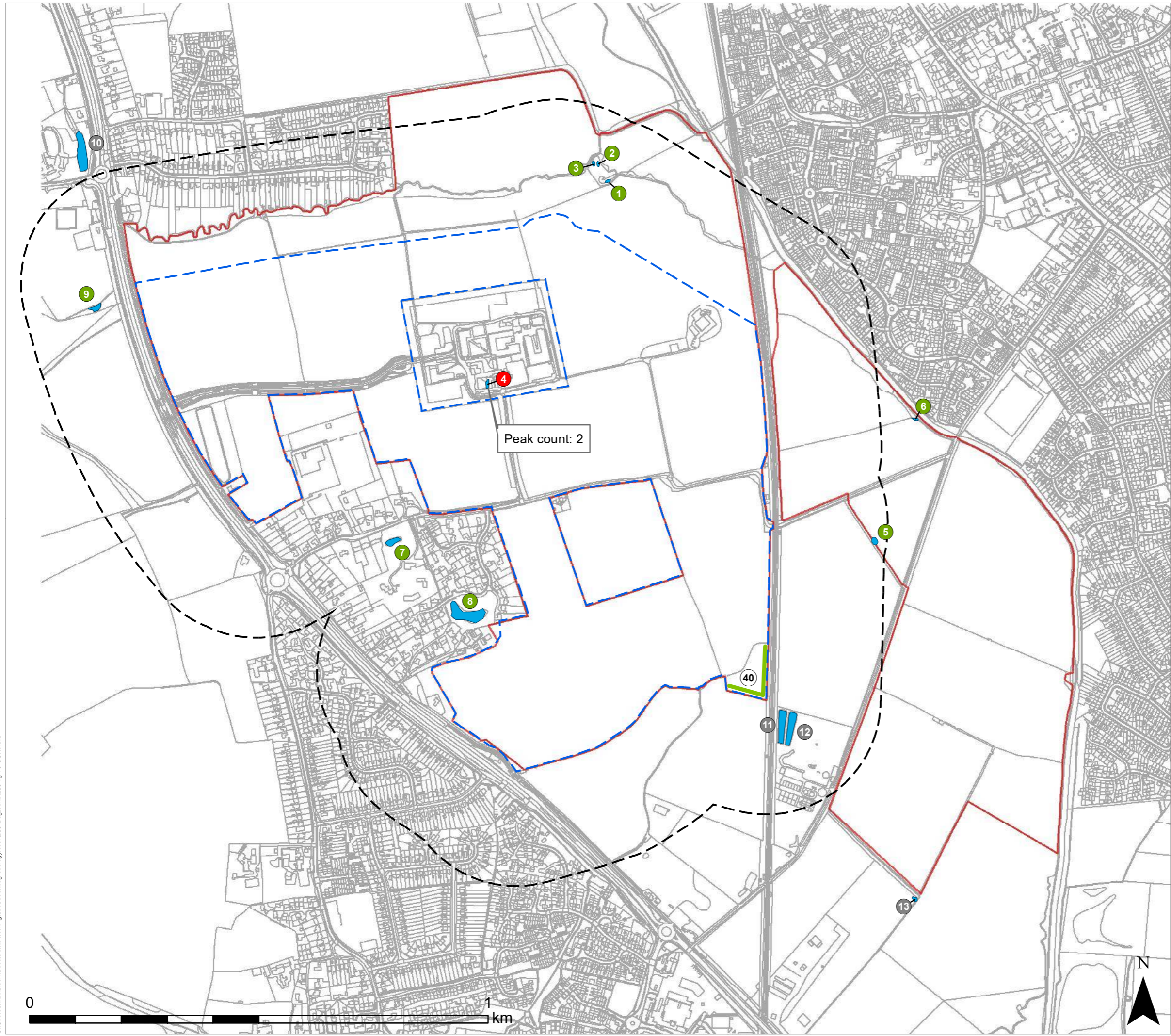
PROJECT TITLE
 LAND AROUND BEGBROKE SCIENCE PARK,
 UNIVERSITY OF OXFORD

DRAWING TITLE
 Figure 9 (b): Breeding bird characterisation survey
 (south of site)

DATE: 30.11.2018
 CHECKED: TF
 SCALE: 1:5,000
 DRAWN: COH
 APPROVED: PN
 VERSION: 1.0

Copyright © BSG Ecology
 No dimensions are to be scaled from this drawing. All dimensions are to be checked on site. Area measurements for indicative purposes only.
 This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980
 OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
 Sources: BSG Ecology survey data, basemap derived from drawing TDN/033/12/01 produced by University of Oxford Estate Services

C:\Users\ian.BSG-ECOLOG\Documents\workingfiles\roost.bsg-ecology.com\255 Begbroke figure 9 b bbs south.mxd



LEGEND

- Site boundary
- Development area
- 250 m buffer around development area
- Line of carpet mats and artificial GCN refuges
- 40 Number of mats and artificial refuges along line (20 each)
- Pond

eDNA survey result (including pond reference number)

- 4 Positive
- 4 Negative
- 4 Not surveyed

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEGBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 10: Pond Surveys

DATE: 06.12.2018 CHECKED: TF SCALE: 1:8,000
DRAWN: KW APPROVED: PN VERSION: 1.4

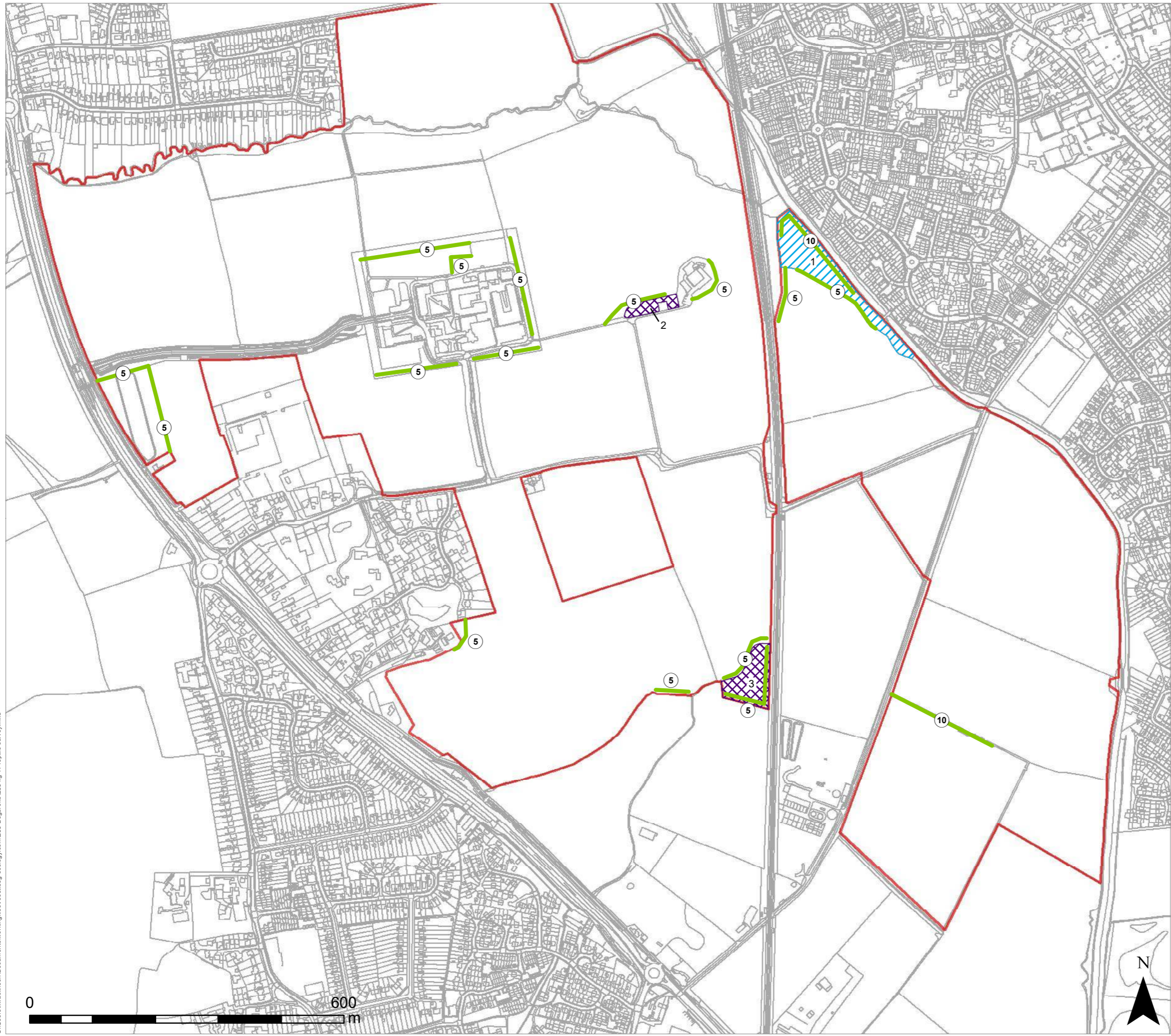
Copyright © BSG Ecology

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwalkinson\Documents\working\files\roast_bsg-ecology.com\255 Begbroke\255 fig 10 GCN.mxd



LEGEND

- Site boundary
- Line of artificial refuges
- 12 Number of artificial refuges along survey line

Key reptile areas

- 1 Common lizard
- 2 Grass snake

BSG | ecology

OFFICE: Oxford
T: 01865 883833

JOB REF: P17-255

PROJECT TITLE
BEBROKE ECOLOGY SURVEYS

DRAWING TITLE
Figure 11: Reptile Survey

DATE: 06.12.2018 CHECKED: TF SCALE: 1:7,000
DRAWN: KW APPROVED: PN VERSION: 1.3

Copyright © BSG Ecology







No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

This drawing may contain: Ordnance Survey material by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown Copyright 2018. All rights reserved. Reference number: 10048980

OS Open data © Crown copyright and database right 2018 | Aerial Photography © Esri
Sources: BSG Ecology survey data

C:\Users\kwalkinson\Documents\working\files\roost.bsg-ecology.com\255 Begbroke\255 fig 11 reptile survey.mxd

9 Photographs

	
<p>1. Arable field and hedgerow in north of Site.</p>	<p>2. View towards barns at Parker's Farm from SE.</p>
	
<p>3. Field A in NE of Site. Good semi-improved neutral grassland with meadowsweet.</p>	<p>4. Field D in E of Site. Good semi-improved neutral grassland.</p>
	
<p>5. Field B in NE of Site. Poor semi-improved grassland dominated by Italian ryegrass.</p>	<p>6. Field C in NE of Site. Poor semi-improved grassland dominated by tall fescue.</p>

	
<p>7. Field E in S of Site and adjacent ditch with dense hawthorn scrub.</p>	<p>8. Hedgerows along Yarnton Lane in E of site.</p>
	
<p>9. Rowel Brook in N of Site.</p>	<p>10. Ditch adjacent to field E.</p>
	
<p>11. Pond 1 in N of Site with swamp in margins.</p>	<p>12. Swamp in E of Site, near Oxford Canal.</p>



13. Pond 1 (eastern end) in N of Site.



14. Pond 2 (series of rectangular ponds) in N of Site.



15. Pond 3 (series of rectangular ponds) in N of Site.





16. Pond 4 in Begbroke Science Park.



17. Pond 5 in hedgerow in E of Site.



18. Pond 6 on eastern boundary of Site.

	
<p>19. Ash tree (T9) in south of Site with high potential to support roosting bats.</p>	<p>20. Begbroke Hill Farmhouse and associated buildings at Begbroke Science Park.</p>
	
<p>21. Modern office buildings at Begbroke Science Park.</p>	<p>22. Modern barns at Parker's Farm in NE of Site.</p>
	
<p>23. Old stone barn/animal shelter at Parker's Farm in NE of Site.</p>	

10 Appendix List

Appendix 1: Draft PR8 Policy Plan

Appendix 2: Invertebrate Data

Appendix 3: Summaries of Relevant Policy, Legislation and Other Instruments

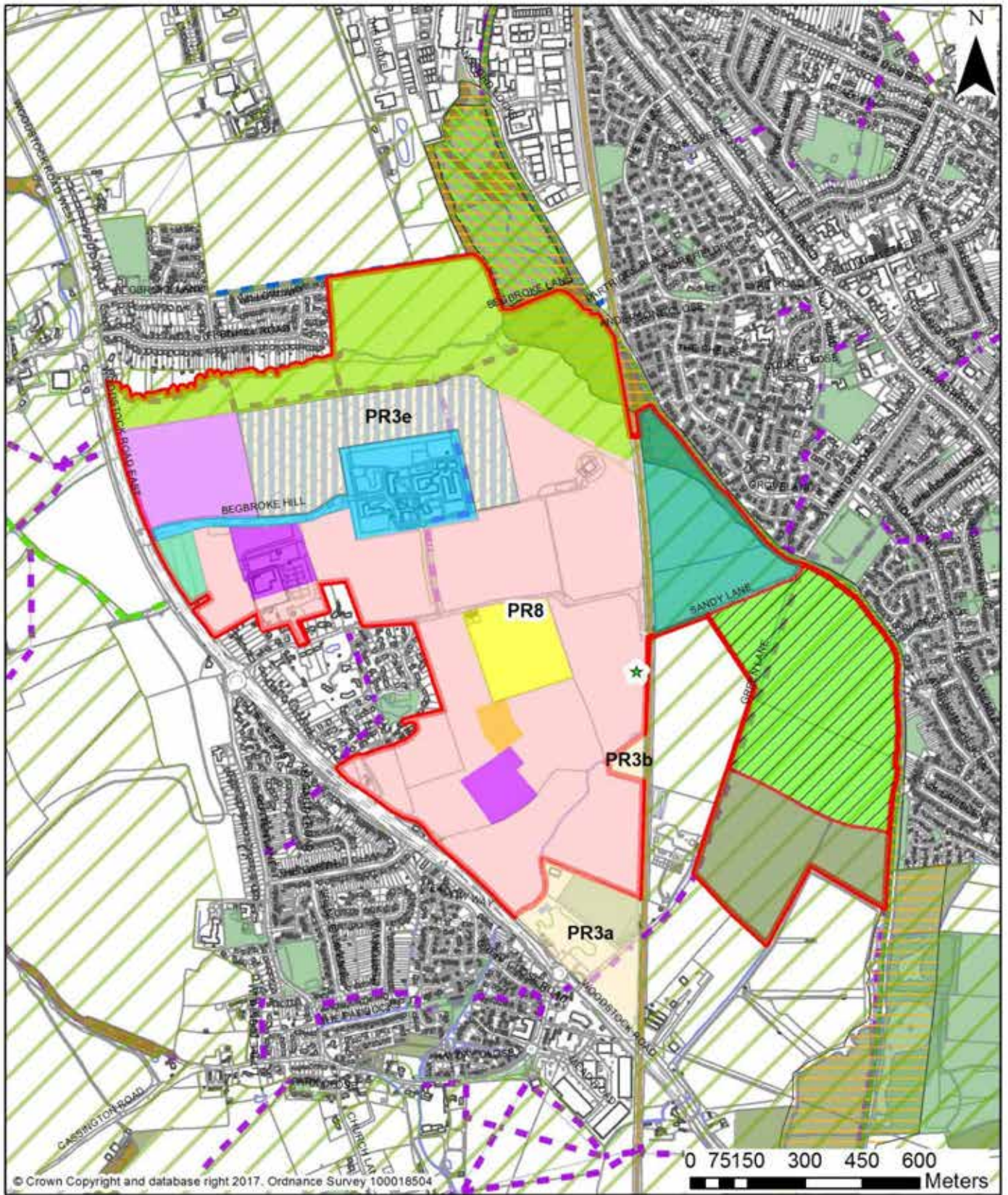
Appendix 4: Target Notes

Appendix 5: Botanical Data

Appendix 6: Hedgerow Data

11 Appendix 1: Draft PR8 Policy Plan

Policy PR8 – Policies Map – Land East of the A44



Key			
	Land East of the A44		Former Landfill Site
	Residential		Green Space
	Land Reserved for Employment		Local Nature Reserve
	Primary School Use		Nature Conservation Area
	Secondary School Use		Parkland
	Local Centre		Retained agricultural land
	Existing Begbroke Science Park		Conservation Target Areas
	Reserved Land for Railway Station/Halt		Sites of Special Scientific Interest
			Oxford Canal Trail
			Existing Green Space
			Ancient Woodland
			Policy PR3
			Revised Green Belt
			Conservation Target Areas
			Sites of Special Scientific Interest
			Oxford Canal Trail
			Existing Green Space
			Ancient Woodland
			BAP Habitat
			Public Footpath
			Public Bridleway
			Restricted Byways
			Byway Open to all Traffic
			Cherwell District

12 Appendix 2: Invertebrate Data

Photographs



A2-1. Sample location 1



A2-2. Sample location 1



A2-3. Sample location 2



A2-4. Sample location 3



A2-5. Sample location 4



A2-6. Sample location 5

Table A2-1: Full list of stream aquatic macroinvertebrate taxa recorded.

Order	Family / Taxon	Autumn 2017					Spring 2018				
		1	2	3	4	5	1	2	3	4	5
Gastropoda	Ancylidae		3					1			
Isopoda	Asellidae	32	19	491	430	59	79	8	76	75	37
Ephemeroptera	Baetidae		2							4	4
Trichoptera	Beraeidae	1									
Diptera	Ceratopogonidae	1					1	7	1		
Diptera	Chironomidae	10	125	224	18	1	1450	7	246	31	87
Diptera	Dixidae	2									1
Tricladida	Dugesiiidae								9		
Coleoptera	Dytiscidae		1								
Coleoptera	Elmidae	1	173	81		1	18	287			2
Diptera	Empididae		5	1				24		6	6
Arhynchobdellida	Erpobdellidae	1		6	1					1	1
Amphipoda	Gammaridae	666	412	596	623	177	811	1300	52	402	1501
Rhynchobdellida	Glossiphoniidae	1		6			2		1		1
Trichoptera	Glossosomatidae		39	130	1			3			
Coleoptera	Hydraenidae		1								
Gastropoda	Hydrobiidae		5	2		2	1	14			
Coleoptera	Hydrophilidae				1		3			1	
Trichoptera	Leptoceridae		1								
Trichoptera	Limnephilidae	3	3	2	3	2	385	156	44	32	31
Gastropoda	Lymnaeidae				1		1	1		2	
Hemiptera	Mesoveliidae						1				
Plecoptera	Nemouridae	2					17	62		6	
Oligochaeta	Oligochaeta		174	687	20	23				2	1
Gastropoda	Physidae									4	
Tricladida	Planariidae								30	10	16
Gastropoda	Planorbidae		3	29							

Order	Family / Taxon	Autumn 2017					Spring 2018				
		1	2	3	4	5	1	2	3	4	5
Trichoptera	Polycentropodidae	2	1					4			
Diptera	Psychodidae		5		3	3			1	2	5
Trichoptera	Psychomyiidae		8								
Diptera	Ptychopteridae	183	5				138		1		
Coleoptera	Scirtidae	25					97				
Trichoptera	Sericostomatidae						16				
Diptera	Simuliidae							2		3	18
Veneroida	Sphaeriidae	161	17	13			255	47		2	1
Diptera	Syrphidae						1				
Diptera	Tipulidae		2	1				4			4

13 Appendix 3: Summaries of Relevant Policy, Legislation and Other Instruments

13.1 This section briefly summarises the legislation, policy and related issues that are relevant to the main text of the report. The following text does not constitute legal or planning advice.

National Planning Policy Framework (England)

13.2 The Government published the National Planning Policy Framework (NPPF) on 24 July 2018. Text excerpts from the NPPF are shown where they may be relevant to planning applications and biodiversity including protected sites, habitats and species.

13.3 The Government sets out the three objectives for sustainable development (economy, social and environmental) at paragraphs 8-10 to be delivered through the plan preparation and implementation level and 'are not criteria against which every decision can or should be judged.' At paragraph 8c) the planning system's environmental objective refers to 'protecting and enhancing our natural, built and historic environment' and to 'helping to improve biodiversity'

13.4 In conserving and enhancing the natural environment, the NPPF (Paragraph 170) states that 'planning policies and decisions should contribute to and enhance the natural and local environment' by:

- Protecting and enhancing...sites of biodiversity value... '(in a manner commensurate with their statutory status or identified quality in the development plan)'.
- Recognising the wider benefits from natural capital and ecosystem services including trees and woodland.
- Minimising impacts on and providing net gains in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures.
- Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability.

13.5 In respect of protected sites, at paragraph 171, the NPPF requires local planning authorities to distinguish, at the plan level, '...between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value...take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries.'

13.6 Paragraph 174 refers to how plans should aim to protect and enhance biodiversity. Plans should: 'identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity [a footnote refers to ODPM Circular 06/2005 for further guidance in respect of statutory obligations for biodiversity in the planning system], wildlife corridors and stepping stones that connect them and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation;' and to 'promote the conservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.'

13.7 Paragraph 175 advises that, when determining planning applications, '...local planning authorities should apply the following principles:

- a. if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;

- b. development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments) should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;
- c. development resulting in the loss or deterioration of irreplaceable habitats, (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and
- d. development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity.'

13.8 In paragraph 176, the following should be given the same protection as habitats sites¹⁰:

- i. potential Special Protection Areas and possible Special Areas of Conservation
- ii. listed or proposed Ramsar sites; and
- iii. sites identified, or required, as compensatory measures for adverse effects on habitats sites, potential Special Protection Areas, possible Special Areas of Conservation, and listed or proposed Ramsar sites.'

13.9 In paragraph 177 the NPPF refers back to sustainable development in relation to appropriate assessment and states: 'the presumption in favour of sustainable development does not apply where development requiring appropriate assessment because of its potential impact on a habitats site is being planned or determined.'

13.10 In paragraph 178, the NPPF refers to planning policies and decisions taking account of ground conditions and risks arising from land instability and contamination at sites. In relation to risks associated with land remediation account is to be taken of 'potential impacts on the natural environment' that arise from land remediation.

13.11 In paragraph 180 the NPPF states that planning policies and decisions should ensure that development is appropriate to the location and take into account likely effects (including cumulative) on the natural environment and , in doing so, they 'should limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'

Government Circular ODPM 06/2005 Biodiversity and Geological Conservation (England only)

13.12 Paragraph 98 of Government Circular 06/2005 advises that "the presence of a protected species is a material consideration when a planning authority is considering a development proposal that, if carried out, would be likely to result in harm to the species or its habitat. Local authorities should consult Natural England before granting planning permission. They should consider attaching appropriate planning conditions or entering into planning obligations under which the developer would take steps to secure the long-term protection of the species. They should also advise developers that they must comply with any statutory species' protection provisions affecting the site concerned..."

13.13 Paragraph 99 of Government Circular 06/2005¹¹ advises that "it is essential that the presence or otherwise of protected species, and the extent that they may be affected by the proposed development, is established before the planning permission is granted, otherwise all relevant

¹⁰ Habitats sites are defined in the glossary as 'Any site which would be included within the definition at regulation 8 of the Conservation of Habitats and Species Regulations 2017 (as amended) for the purpose of those regulations, including candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation, Special Protection Areas and any relevant Marine Sites.'

¹¹ ODPM Circular 06/2005. *Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and their Impacts within the Planning System* (2005). HMSO Norwich.

material considerations may not have been addressed in making the decision. The need to ensure ecological surveys are carried out should therefore only be left to coverage under planning conditions in exceptional circumstances, with the result that the surveys are carried out after planning permission has been granted”.

Standing Advice (GOV.UK - England only)

- 13.14 The GOV.UK website provides information regarding protected species and sites in relation to development proposals: ‘Local planning authorities should take advice from Natural England or the Environment Agency about planning applications for developments that may affect protected species.’ GOV.UK advises that ‘some species have standing advice which you can use to help with planning decisions. For others you should contact Natural England or the Environment Agency for an individual response.’
- 13.15 The standing advice (originally from Natural England and now held and updated on GOV.UK¹²) provides advice to planners on deciding if there is a ‘reasonable likelihood’ of protected species being present. It also provides advice on survey and mitigation requirements.
- 13.16 When determining an application for development that is covered by standing advice, in accordance with guidance in Government Circular 06/2005, Local planning authorities are required to take the standing advice into account. In paragraph 82 of the aforementioned Circular, it is stated that: ‘The standing advice will be a material consideration in the determination of the planning application in the same way as any advice received from a statutory consultee...it is up to the planning authority to decide the weight to be attached to the standing advice, in the same way as it would decide the weight to be attached to a response from a statutory consultee.’

Natural Environment and Rural Communities (NERC) Act 2006 – Habitats and species of principal importance (England)

- 13.17 The Natural Environment and Rural Communities (NERC) Act came into force on 1st October 2006. Section 41 (S41) of the Act require the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with Natural England as required by the Act. In accordance with the Act the Secretary of State keeps this list under review and will publish a revised list if necessary, in consultation with Natural England.
- 13.18 The S41 list is used to guide decision-makers such as public bodies, including local authorities and utilities companies, in implementing their duty under Section 40 of the NERC Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions, including development control and planning. This is commonly referred to as the ‘Biodiversity Duty.’
- 13.19 Guidance for public authorities on implementing the Biodiversity Duty¹³ has been published by Defra. One of the key messages in this document is that ‘conserving biodiversity includes restoring and enhancing species populations and habitats, as well as protecting them.’ In England the administration of the planning system and licensing schemes are highlighted as having a ‘profound influence on biodiversity conservation.’ Local authorities are required to take measures to “promote the preservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species. The guidance states that ‘the duty aims to raise the profile and visibility of biodiversity, clarify existing commitments with regard to biodiversity, and to make it a natural and integral part of policy and decision making.’
- 13.20 In 2007, the UK Biodiversity Action Plan (BAP) Partnership published an updated list of priority UK species and habitats covering terrestrial, freshwater and marine biodiversity to focus conservation action for rarer species and habitats in the UK. The UK Post-2010 Biodiversity Framework¹⁴, which covers the period from 2011 to 2020, now succeeds the UK BAP. The UK priority list contained

¹² <https://www.gov.uk/protected-species-and-sites-how-to-review-planning-proposals#standing-advice-for-protected-species>

¹³ Defra, 2007. *Guidance for Public Authorities on Implementing The Biodiversity Duty*. (<http://www.defra.gov.uk/publications/files/pb12585-pa-guid-english-070516.pdf>)

¹⁴ JNCC and Defra (on behalf of the Four Countries' Biodiversity Group). 2012. *UK Post-2010 Biodiversity Framework*. July 2012. (<http://jncc.defra.gov.uk/page-6189>)

1150 species and 65 habitats requiring special protection and has been used as a reference to draw up the lists of species and habitats of principal importance in England.

- 13.21 In England, there are 56 habitats of principal importance and 943 species of principal importance on the S41 list. These are all the habitats and species found in England that were identified as requiring action in the UK BAP and which continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework.

European protected species (Animals)

- 13.22 The Conservation of Habitats and Species Regulations 2017 (as amended) consolidates various amendments that have been made to the 2010 and original (1994) Regulations which transposed the EC Habitats Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Council Directive 92/43/EEC) into national law.
- 13.23 “European protected species” (EPS) of animal are those which are shown on Schedule 2 of the Conservation of Habitats and Species Regulations 2010 (as amended). They are subject to the provisions of Regulation 43 of those Regulations. All EPS are also protected under the Wildlife and Countryside Act 1981 (as amended). Taken together, these pieces of legislation make it an offence to:
- a. Intentionally or deliberately capture, injure or kill any wild animal included amongst these species
 - b. Possess or control any live or dead specimens or any part of, or anything derived from a these species
 - c. deliberately disturb wild animals of any such species
 - d. deliberately take or destroy the eggs of such an animal, or
 - e. intentionally, deliberately or recklessly damage or destroy a breeding site or resting place of such an animal, or obstruct access to such a place
- 13.24 For the purposes of paragraph (c), disturbance of animals includes in particular any disturbance which is likely—
- a. to impair their ability—
 - i. to survive, to breed or reproduce, or to rear or nurture their young, or
 - ii. in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
 - b. to affect significantly the local distribution or abundance of the species to which they belong.
- 13.25 Although the law provides strict protection to these species, it also allows this protection to be set aside (derogated) through the issuing of licences. The licences in England are currently determined by Natural England (NE) for development works and by Natural Resources Wales in Wales. In accordance with the requirements of the Regulations (2010), a licence can only be issued where the following requirements are satisfied:
- a. The proposal is necessary ‘to preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment’
 - b. ‘There is no satisfactory alternative’
 - c. The proposals ‘will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

Definition of breeding sites and resting places

- 13.26 Guidance for all European Protected Species of animal, including bats and great crested newt, regarding the definition of breeding and of breeding and resting places is provided by The European Council (EC) which has prepared specific guidance in respect of the interpretation of

various Articles of the EC Habitats Directive.¹⁵ Section II.3.4.b) provides definitions and examples of both breeding and resting places at paragraphs 57 and 59 respectively. This guidance states that ‘The provision in Article 12(1)(d) [of the EC Habitats Directive] should therefore be understood as aiming to safeguard the ecological functionality of breeding sites and resting places.’ Further the guidance states: ‘It thus follows from Article 12(1)(d) that such breeding sites and resting places also need to be protected when they are not being used, but where there is a reasonably high probability that the species concerned will return to these sites and places. If for example a certain cave is used every year by a number of bats for hibernation (because the species has the habit of returning to the same winter roost every year), the functionality of this cave as a hibernating site should be protected in summer as well so that the bats can re-use it in winter. On the other hand, if a certain cave is used only occasionally for breeding or resting purposes, it is very likely that the site does not qualify as a breeding site or resting place.’

Competent authorities

- 13.27 Under Regulation 7 of the Conservation of Habitats and Species Regulations 2017 (as amended) a “competent authority” includes “any Minister of the Crown..., government department, statutory undertaker, public body of any description or person holding a public office.
- 13.28 In accordance with Regulation 9, “a competent authority must exercise their functions which are relevant to nature conservation, including marine conservation, so as to secure compliance with the requirements of the [Habitats and Birds] Directives. This means for instance that when considering development proposals a competent authority should consider whether EPS or European Protected Sites are to be affected by those works and, if so, must show that they have given consideration as to whether derogation requirements can be met.

Birds

- 13.29 All nesting birds are protected under Section 1 of the Wildlife and Countryside Act 1981 (as amended) which makes it an offence to intentionally kill, injure or take any wild bird or take, damage or destroy its nest whilst in use or being built, or take or destroy its eggs. In addition to this, for some rarer species (listed on Schedule 1 of the Act), it is an offence to disturb them whilst they are nest building or at or near a nest with eggs or young, or to disturb the dependent young of such a bird.
- 13.30 The Conservation of Habitats and Species Regulations 2017 (as amended) places duties on competent authorities (including Local Authorities and National Park Authorities) in relation to wild bird habitat. These provisions relate back to Articles 1, 2 and 3 of the EC Directive on the conservation of wild birds (2009/147/EC, ‘Birds Directive’¹⁶) (Regulation 10 (3)) requires that the objective is the ‘preservation, maintenance and re-establishment of a sufficient diversity and area of habitat for wild birds in the United Kingdom, including by means of the upkeep, management and creation of such habitat, as appropriate, having regard to the requirements of Article 2 of the new Wild Birds Directive...’ Regulation 10 (7) states: ‘In considering which measures may be appropriate for the purpose of security or contributing to the objective in [Regulation 10 (3)] Paragraph 3, appropriate account must be taken of economic and recreational requirements’.
- 13.31 In relation to the duties placed on competent authorities under the 2017 Regulations, Regulation 10 (8) states: ‘So far as lies within their powers, a competent authority in exercising any function [including in relation to town and country planning] in or in relation to the United Kingdom must use all reasonable endeavours to avoid any pollution or deterioration of habitats of wild birds (except habitats beyond the outer limits of the area to which the new Wild Birds Directive applies).’

Badger

- 13.32 Badger is protected under the Protection of Badgers Act 1992. It is not permitted to wilfully kill, injure, take, possess or cruelly ill-treat a badger, or to attempt to do so; or to intentionally or

¹⁵ Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC. (February 2007), EC.

¹⁶ 2009/147/EC Birds Directive (30 November 2009. European Parliament and the Council of the European Union.

recklessly interfere with a sett. Sett interference includes disturbing badgers whilst they are occupying a sett, as well as damaging or destroying a sett or obstructing access to it. A badger sett is defined in the legislation as “a structure or place, which displays signs indicating current use by a badger”.

- 13.33 ODPM Circular 06/2005¹⁷ provides further guidance on statutory obligations towards badger within the planning system. Of particular note is paragraph 124, which states that “The likelihood of disturbing a badger sett, or adversely affecting badgers’ foraging territory, or links between them, or significantly increasing the likelihood of road or rail casualties amongst badger populations, are capable of being material considerations in planning decisions.”
- 13.34 Natural England provides Standing Advice¹⁸, which is capable of being a material consideration in planning decisions. Natural England recommends mitigation to avoid impacts on badger setts, which includes maintaining or creating new foraging areas and maintaining or creating access (commuting routes) between setts and foraging/watering areas.

Reptiles

- 13.35 All native reptile species receive legal protection in Great Britain under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Viviparous lizard, slow-worm, grass snake and adder are protected against killing, injuring and unlicensed trade only. Sand lizard and smooth snake receive additional protection as “European Protected species” under the provisions of the Conservation of Habitats and Species Regulations 2017 (as amended) and are fully protected under the Wildlife and Countryside Act 1981 (as amended).
- 13.36 All six native species of reptile are included as ‘species of principal importance’ for the purpose of conserving biodiversity under Section 41 (England) of the NERC Act 2006 and Section 7 of the Environment (Wales) Act 2016.
- 13.37 Current Natural England Guidelines for Developers¹⁹ states that ‘where it is predictable that reptiles are likely to be killed or injured by activities such as site clearance, this could legally constitute intentional killing or injuring.’ Further the guidance states: ‘Normally prohibited activities may not be illegal if ‘the act was the incidental result of a lawful operation and could not reasonably have been avoided’. Natural England ‘would expect reasonable avoidance to include measures such as altering development layouts to avoid key areas, as well as capture and exclusion of reptiles.’
- 13.38 The Natural England Guidelines for Developers state that ‘planning must incorporate two aims where reptiles are present:
- To protect reptiles from any harm that might arise during development work;
 - To ensure that sufficient quality, quantity and connectivity of habitat is provided to accommodate the reptile population, either on-site or at an alternative site, with no net loss of local reptile conservation status.’

Water vole

- 13.39 Water vole is protected under the Wildlife and Countryside Act 1981 (as amended). This makes it an offence to kill, injure or take any water vole, damage, destroy or obstruct access to any place of shelter or protection that the animals are using, or disturb voles while they are using such a place. Water vole is listed as a Species of Principal Importance under the provisions of the NERC Act 2006 in England and under the provisions of the Environment (Wales) Act 2016.

¹⁷ ODPM Circular 06/2005. *Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and their Impacts within the Planning System* (2005). HMSO Norwich.

¹⁸ <http://www.naturalengland.org.uk/ourwork/planningdevelopment/spatialplanning/standingadvice/specieslinks.aspx>

¹⁹ English Nature, 2004. *Reptiles: guidelines for developers*. English Nature, Peterborough.
<http://publications.naturalengland.org.uk/publication/76006?category=31018>

White-clawed crayfish

- 13.40 The white-clawed crayfish is scheduled under the Wildlife and Countryside Act 1981 (as amended), listed under the EC Habitats Directive (Annexe II and V) and is on the IUCN Red Data List for endangered and threatened species. It is also a Species of Principal Importance under the provisions of the NERC Act 2006 and the provisions of the Environment (Wales) Act 2016.
- 13.41 Under the Wildlife and Countryside Act 1981 (as amended) it is illegal to take or sell white-clawed crayfish. Whilst it is not an offence under the Act to disturb or kill white-clawed crayfish or to damage or destroy their habitat, both Natural England and the Environment Agency recommend that anyone carrying out any form of management or development work on suitable watercourses take into account the conservation of this species.
- 13.42 Signal crayfish and several other invasive non-native crayfish species are listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). Strictly speaking, this makes it an offence to return to the wild any signal crayfish, even if inadvertently captured. Any signal crayfish or other non-native crayfish captured should be humanely destroyed (once their identification has been confirmed by a suitably qualified and experienced ecologist).

Wild mammals in general

- 13.43 The Wild Mammals (Protection) Act 1996 (as amended) makes provision for the protection of wild mammals from certain cruel acts, making it an offence for any person to intentionally cause suffering to any wild mammal. In the context of development sites, for example, this may apply to rabbits in their burrows.

Invasive non-native species

- 13.44 An invasive non-native species is any non-native animal or plant that has the ability to spread causing damage to the environment.
- 13.45 Under the Wildlife and Countryside Act 1981 (as amended) it is an offence to release, or to allow to escape into the wild, any animal which is not ordinarily resident in and is not a regular visitor to Great Britain in a wild state or is listed under Schedule 9 of the Act.
- 13.46 It is an offence to plant or otherwise cause to grow in the wild invasive non-native plants listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

Hedgerows

- 13.47 Article 10 of the Habitats Directive²⁰ requires that 'Member States shall endeavour...to encourage the management of features of the landscape which are of major importance for wild fauna and flora. Such features are those which, by virtue of their linear and continuous structure...or their function as stepping stones...are essential for the migration, dispersal and genetic exchange of wild species'. Examples given in the Directive include traditional field boundary systems (such as hedgerows).
- 13.48 The aim of the Hedgerow Regulations 1997²¹, according to guidance produced by the Department of the Environment²², is "to protect important hedgerows in the countryside by controlling their removal through a system of notification. In summary, the guidance states that the system is concerned with the removal of hedgerows, either in whole or in part, and covers any act which results in the destruction of a hedgerow. The procedure in the Regulations is triggered only when land managers or utility operators want to remove a hedgerow. The system is in favour of protecting and retaining 'important' hedgerows.

²⁰ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

²¹ Statutory Instrument 1997 No. 1160 – The Hedgerow Regulations 1997. HMSO: London

²² The Hedgerow Regulations 1997: a guide to the law and good practice, HMSO: London

- 13.49 The Hedgerow Regulations set out criteria that must be used by the local planning authority in determining which hedgerows are 'important'. The criteria relate to the value of hedgerows from an archaeological, historical, wildlife and landscape perspective.

14 Appendix 4: Target Notes

No.	Description
1	Belt of dense planted trees around perimeter of Begbroke Science Park. Ca. 5 m wide and 7 m tall. Containing: hazel <i>Corylus avellana</i> , wayfaring tree <i>Viburnum opulus</i> , field maple <i>Acer campestre</i> , dogwood <i>Cornus sanguinea</i> , ash <i>Fraxinus excelsior</i> , blackthorn <i>Prunus spinosa</i> , and osier willow <i>Salix viminalis</i> .
2	Stream. Rowel Brook. Moderately fast flowing, gravel or silt bottom, meanders. Channel ca. 0.5 to 1.5 m deep. Water ca. 0.1 to 0.5 m. Width 1–1.5 m. Very limited or marginal vegetation visible (mainly pendulous sedge <i>Carex pendula</i>). Forms site boundary to north west, where north bank runs along multiple private gardens. Abundant ad-hoc bank stabilisation along north bank and informal access bridges to gardens.
3	Woodland strip along stream. Generally dominated by pedunculate oak <i>Quercus robur</i> with understory of hazel <i>Corylus avellana</i> and hawthorn <i>Crataegus monogyna</i> , and field layer of bramble <i>Rubus fruticosus</i> agg. and ivy <i>Hedera helix</i> . Ash <i>Fraxinus excelsior</i> and sycamore <i>Acer pseudoplatanus</i> present in some areas, and crack willow <i>Salix fragilis</i> close to the stream. Stands of tall ruderals (e.g. great willowherb <i>Epilobium hirsutum</i>) and bramble on southern edge.
4	Large patch of variegated yellow archangel <i>Lamium galeobdolon</i> ssp. <i>argentatum</i> growing in woodland adjacent to stream, presumably this has escaped from adjacent gardens. Also rose-of-Sharon <i>Hypericum calycinum</i> . Perhaps from adjacent gardens, or possibly planted.
5	Old access road to Science Park. Flanked by amenity grassland and two heavily trimmed species-poor hedges (dominated by ivy) and informal rows of semi-mature walnut trees <i>Juglans regia</i> .
6	Vegetated earth mounds screening hot heap composting facility. Supports semi-improved neutral grassland and tall ruderal vegetation.
7	Mixed plantation woodland, including semi-mature Scots pine <i>Pinus sylvestris</i> , birch <i>Betula pendula</i> , and Italian alder <i>Alnus cordata</i> .
8	Small stream which emerges from culvert under railway line and flows northwest into Rowel Brook. Fool's-water-cress <i>Apium nodiflorum</i> abundant in some areas.
9	Semi-natural broad-leaved woodland along small stream dominated by pedunculate oak <i>Quercus robur</i> , hazel <i>Corylus avellana</i> and alder <i>Alnus glutinosa</i> . Some wood avens <i>Geum urbanum</i> and false brome <i>Brachypodium sylvaticum</i> in the field layer.
10	Small area of swamp around pond with common reed <i>Phragmites australis</i> and lesser pond sedge <i>Carex acutiformis</i> .
11	Residential property with prefabricated buildings outside Site, surrounded by tall fences/hedgerows.
12	Rough semi-improved neutral grassland, scrub and tall ruderal vegetation outside, but surrounded by, the Site. With common nettle <i>Urtica dioica</i> , hemlock <i>Conium maculatum</i> , and some scrub (especially hawthorn <i>Crataegus monogyna</i>). Understood to have been formerly used as a landfill site and subsequently for agricultural research. Appeared to have recently been flail mown to ground level in September 2018.

13	Ditch. Wet in January 2018 with some flow west to east. Depth ca. 40 cm, width ca. 1 m. Containing abundant aquatic plants including water-cress <i>Nasturtium officinale</i> , fool's-water-cress <i>Apium nodiflorum</i> , sweet-grass <i>Glyceria</i> sp. and creeping bent <i>Agrostis stolonifera</i> . Dry and grass dominated by July 2018.
14	Small triangular field dominated by dense hawthorn <i>Crataegus monogyna</i> scrub, with some tussocky poor semi-improved grassland (dominated by cock's-foot <i>Dactylis glomerata</i>) and tall ruderals (common nettle <i>Urtica dioica</i>) around edges. Also creeping bent <i>Agrostis stolonifera</i> , hogweed <i>Heracleum sphondylium</i> , a St. John's-wort <i>Hypericum</i> sp., hairy tare <i>Vicia hirsuta</i> , curled dock <i>Rumex crispus</i> , a forget-me-not <i>Myosotis</i> sp., hairy bitter-cress <i>Cardamine hirsuta</i> , and rough-stalked feather-moss <i>Brachythecium rutabulum</i> and dog rose <i>Rosa canina</i> .
15	Area of short improved grassland behind tall fence, with poultry and other animal shelters. Used for deer rearing.
16	Large mature hybrid black poplar <i>Populus x canadensis</i> close to site boundary.
17	Yarnton Lane. Unsurfaced byway between Sandy Lane and A44 Woodstock Road. Deep ditches on both sides and mature hedgerows with abundant oak <i>Quercus robur</i> , willow <i>Salix</i> species and alder <i>Alnus glutinosa</i> trees.
18	Meadow. Poor semi-improved grassland with abundant false oat-grass <i>Arrhenatherum elatius</i> . Partially flooded in January 2018. Dry in May 2018.
19	Stand of spotted variegated yellow archangel <i>Lamiatstrum galeobdolon</i> ssp. <i>argentatum</i> growing on ditch bank.
20	Defunct hedgerow. Ditch adjacent containing lesser pond sedge <i>Carex riparia</i> , water cress <i>Nasturtium aquaticum</i> , water mint <i>Mentha aquatica</i> , soft rush <i>Juncus effusus</i> , and reed-mace <i>Typha latifolia</i> . Tufted hair-grass <i>Deschampsia cespitosa</i> adjacent. Dry in September 2018.
21	Large damp meadow, dominated by Italian rye-grass <i>Lolium multiflorum</i> in May 2018. Field to south dominated by tall fescue <i>Schedonorus arundinaceus</i> .
22	Area of impenetrable bramble <i>Rubus fruticosus</i> agg. scrub.
23	Damp semi-improved neutral grassland, dominated by false oat-grass <i>Arrhenatherum elatius</i> , with some creeping bent <i>Agrostis stolonifera</i> , cocksfoot <i>Dactylis glomerata</i> , common nettle <i>Urtica dioica</i> , hogweed <i>Heracleum sphondylium</i> , meadowsweet <i>Filipendula ulmaria</i> and cleavers <i>Galium aparine</i> . Extensive dense bramble <i>Rubus fruticosus</i> agg. scrub towards edges.
24	Ditch with standing water in winter and aquatic vegetation, including greater pond sedge <i>Carex riparia</i> , lesser pond sedge <i>Carex acutiformis</i> , tufted hair-grass <i>Deschampsia cespitosa</i> and floating sweet-grass <i>Glyceria fluitans</i> .
25	Small stream flowing around canal lock. Adjacent swamp – see target Note 26.
26	Small area of swamp dominated by reed sweet-grass <i>Glyceria maxima</i> and creeping bent <i>Agrostis stolonifera</i> .
27	Poor semi-improved grassland in south-west of Science Park (and similar in north).
28	Bed of rose-of-Sharon <i>Hypericum calycinum</i> , ornamental shrub with a line of mature hybrid black poplars <i>Populus x canadensis</i> .

29	Area of amenity grassland with mature black pine <i>Pinus nigra</i> and Scots pine <i>Pinus sylvestris</i> , and several apple trees <i>Malus pumila</i> .
30	Area of semi-improved neutral grassland dominated by red fescue <i>Festuca rubra</i> with abundant forbs and ephemeral species. This grassland has colonised bare sandy ground following demolition of buildings here.
31	Amenity grass verge with mature field maple <i>Acer campestre</i> and pedunculate oak <i>Quercus robur</i> .
32	Short-mown lawn adjacent to farmhouse, contains various grass, forb and bryophyte species including common bent <i>Agrostis capillaris</i> , red fescue <i>Festuca rubra</i> , yarrow <i>Achillea millefolium</i> daisy <i>Bellis perennis</i> , common cat's-ear <i>Hypochaeris radicata</i> and springy turf-moss <i>Rhytidiadelphus squarrosus</i> . Because of this species richness, this grassland is classed as semi-improved neutral grassland in the Phase 1 habitat survey.

15 Appendix 5: Botanical Data

Field A

Table A5-1: Botanical data collected in May 2018 from 5 quadrats within field A, damp good semi-improved grassland in the north-east of the Site. See Figure 4 for quadrat locations. FEP: Farm Environment Plan (Natural England 2010), LM: indicator species for lowland meadows.

Scientific Name	Common Name	Frequency (% cover range)	FEP Frequency	FEP Indicators
<i>Arrhenatherum elatius</i>	False meadow-grass	V (30-70)	Frequent	
<i>Filipendula ulmaria</i>	Meadowsweet	IV (3-40)	Frequent	LM
<i>Galium aparine</i>	Cleavers	IV (3-15)	Frequent	
<i>Urtica dioica</i>	Common nettle	IV (2-10)	Frequent	
<i>Geranium dissectum</i>	Cut-leaved crane's-bill	III (1-2)	Frequent	
<i>Festuca rubra</i>	Red fescue	III (2-30)	Frequent	
<i>Deschampsia cespitosa</i>	Tufted hair-grass	II (5-5)	Occasional	
<i>Dactylis glomerata</i>	Cock's-foot	II (10-15)	Occasional	
<i>Poa pratensis</i>	Annual meadow-grass	II (10-15)	Occasional	
<i>Convolvulus arvensis</i>	Field bindweed	II (2-3)	Occasional	
<i>Angelica sylvestris</i>	Wild angelica	II (2-5)	Occasional	
<i>Humulus lupulus</i>	Hop	I (5-5)	Rare	
<i>Ranunculus acris</i>	Meadow buttercup	I (2-2)	Rare	SI
<i>Rumex crispus</i>	Curled dock	I (3-3)	Rare	
<i>Heracleum sphondylium</i>	Hogweed	I (5-5)	Rare	
<i>Alopecurus pratensis</i>	Meadow foxtail	I (3-3)	Rare	
<i>Ranunculus repens</i>	Creeping buttercup	0	N/A	
<i>Carduus crispus</i>	Wetted thistle	0	N/A	
<i>Vicia sativa</i>	Common vetch	0	N/A	
Average number of species per quadrat (and range)			7.6 (6-9)	

Field B

Table A5-2: Botanical data collected in May 2018 from 5 quadrats within field B, poor semi-improved grassland in the north-east of the Site. See Figure 4 for quadrat locations. FEP: Farm Environment Plan (Natural England 2010), LM: indicator species for lowland meadows.

Scientific	Common	Frequency (and % cover range)	FEP Frequency	FEP Indicators
<i>Poa pratensis</i>	Smooth meadow-grass	V (5-20)	Frequent	
<i>Holcus lanatus</i>	Yorkshire fog	V (3-15)	Frequent	
<i>Lolium multiflorum</i>	Italian ryegrass	V (2-80)	Frequent	
<i>Senecio jacobaea</i>	Common ragwort	IV (2-2)	Frequent	
<i>Festuca arundinacea</i>	Tall fescue	III (2-3)	Frequent	
<i>Epilobium tetragonum</i>	Square-stalked willowherb	II (1-1)	Occasional	
<i>Bromus sterilis</i>	Barren brome	I (1-1)	Rare	
<i>Epilobium parviflorum</i>	Hoary willowherb	I (1-1)	Rare	
<i>Rumex crispus</i>	Curled dock	I (1-1)	Rare	
<i>Lysimachia nummularia</i>	Creeping jenny	I (2-2)	Rare	
<i>Cerastium fontanum</i>	Common mouse-ear	0	N/A	

<i>Senecio erucifolius</i>	Hoary ragwort	0	N/A	
<i>Arrhenatherum elatius</i>	false oat-grass	0	N/A	
<i>Bromus hordaceus</i>	Soft brome	0	N/A	
<i>Sonchus oleraceus</i>	Smooth sow-thistle	0	N/A	
<i>Leontodon autumnalis</i>	Autumn hawkbit	0	N/A	LM
Average number of species per quadrat (and range)			5.6 (5–6)	

Field C

Table A5-3: Botanical data collected in May 2018 from 5 quadrats within field C, poor semi-improved grassland in the north-east of the Site. See Figure 4 for quadrat locations. FEP: Farm Environment Plan (Natural England 2010), SI: indicator species for semi-improved grassland.

Scientific	Common	Frequency (and % cover range)	FEP Frequency	FEP Indicators
<i>Festuca arundinacea</i>	Tall fescue	V (10-95)	Frequent	
<i>Holcus lanatus</i>	Yorkshire fog	V (5-85)	Frequent	
<i>Poa pratensis</i>	Smooth meadow-grass	II (2-5)	Frequent	
<i>Epilobium tetragonum</i>	Square-stalked willowherb	I (1-1)	Rare	
<i>Geranium dissectum</i>	Cut-leaved willowherb	I (10-10)	Rare	
<i>Rumex crispus</i>	Curled dock	I (1-1)	Rare	
<i>Potentilla reptans</i>	Rumex crispus	0	N/A	
<i>Angelica sylvestris</i>	Wild angelica	0	N/A	
<i>Heracleum sphondylium</i>	Hogweed	0	N/A	
<i>Ranunculus repens</i>	Creeping buttercup	0	N/A	
<i>Dactylis glomerata</i>	Cock's-foot	0	N/A	
<i>Deschampsia cespitosa</i>	Tufted hair-grass	0	N/A	
<i>Senecio jacobaea</i>	Common ragwort	0	N/A	
<i>Plantago lanceolata</i>	Ribwort plantain	0	N/A	SI
<i>Lolium multiflorum</i>	Italian ryegrass	0	N/A	
Average number of species per quadrat (and range)			3 (2–4)	

Field D

Table A5-4: Botanical data collected in May 2018 from 5 quadrats within field D, damp good semi-improved grassland in the east of the Site. See Figure 4 for quadrat locations. FRP: Farm Environment Plan (Natural England 2010), LM: indicator species for lowland meadows, SI: indicator species for semi-improved grassland.

Scientific	Common	Frequency (and % cover range)	FEP Frequency	FEP Indicators
<i>Arrhenatherum elatius</i>	False oat-grass	V (20-40)	Frequent	
<i>Holcus lanatus</i>	Yorkshire fog	V (20-30)	Frequent	
<i>Poa pratensis</i>	Cock's-foot	V (5-15)	Frequent	
<i>Alopecurus pratensis</i>	Meadow foxtail	IV (5-5)	Frequent	
<i>Geranium dissectum</i>	Common nettle	IV (2-5)	Frequent	
<i>Heracleum sphondylium</i>	Cow parsley	IV (2-10)	Frequent	
<i>Dactylis glomerata</i>	Cock's-foot	IV (5-20)	Frequent	
<i>Festuca rubra</i>	Red fescue	III (5-20)	Frequent	
<i>Rumex acetosa</i>	Lady's bedstraw	III (3-5)	Frequent	LM
<i>Ranunculus repens</i>	Creeping buttercup	III (3-5)	Frequent	

<i>Veronica chamaedrys</i>	Germander speedwell	II (10-10)	Occasional	SI
<i>Stellaria graminea</i>	Lesser stitchwort	I (2-2)	Rare	
<i>Urtica dioica</i>	Common nettle	I (2-2)	Rare	
<i>Cerastium fontanum</i>	Common mouse-ear	I (2-2)	Rare	
<i>Taraxacum officinalis</i> agg.	Dandelion	I (1-1)	Rare	
<i>Anthriscus sylvestris</i>	Cow parsley	0	N/A	
<i>Galium verum</i>	Lady's-bedstraw	0	N/A	
<i>Tragopogon pratensis</i>	Goat's-beard	0	N/A	LM
<i>Rumex obtusifolius</i>	Broad-leaved dock	0	N/A	
<i>Ranunculus acris</i>	Meadow buttercup	0	N/A	SI
<i>Cirsium arvense</i>	Creeping thistle	0	N/A	
<i>Sanguisorba officinalis</i>	Greater burnet	0	N/A	LM
<i>Leucanthemum vulgare</i>	Oxeye daisy	0	N/A	LM
<i>Ajuga reptans</i>	Bugle	0	N/A	LM
<i>Trifolium repens</i>	White clover	0	N/A	
<i>Lathyrus pratensis</i>	Meadow vetchling	0	N/A	LM
<i>Juncus effusus</i>	Soft rush	0	N/A	
<i>Rumex crispus</i>	Curled dock	0	N/A	
<i>Vicia tetrasperma</i>	Smooth tare	0	N/A	
<i>Common vetch</i>	<i>Vicia sativa</i>	0	N/A	
<i>Potentilla reptans</i>	Creeping cinqfoil	0	N/A	
Average number of species per quadrat (and range)			9.2 (6–13)	

Field E

Table A5-5: Botanical data collected from two quadrats in May 2018 from field E, poor semi-improved grassland in the east of the Site. See Figure 4 for quadrat locations. Relative Abundance is based on the DAFOR Scale (D: dominant, A: abundant, F: frequent, O: occasional; R: rare). FEP: Farm Environment Plan (Natural England 2010), LM: indicator species for lowland meadows.

Scientific	Common	Relative Abundance	FEP Indicators
<i>Arrhenatherum elatius</i>	False oat-grass	D	
<i>Rubus fruticosus</i> agg.	Bramble	A	
<i>Urtica dioica</i>	Common nettle	F	
<i>Agrostis stolonifera</i>	Creeping bent	F	
<i>Dactylis glomerata</i>	Cock's-foot	F	
<i>Fraxinus excelsior</i> (seedling)	Ash (seedling)	R	
<i>Cirsium arvense</i>	Creeping thistle	R	
<i>Crepis capillaris</i>	Smooth hawk's-beard	R	
<i>Senecio jacobaea</i>	Common ragwort	R	
<i>Vicia cracca</i>	Tufted vetch	R	
Average number of species per quadrat			6 (5–7)

Good Semi-Improved grassland at Begbroke Science Park (source: BSG Ecology, 2015)

- 15.1 Table A5-6: Botanical data collected in July 2015, based on one 2 m x 2 m quadrat and reported in BSG Ecology (2015). This is an area of recently disturbed sandy soil now developing into grassland. See Figure 4 for location. Relative Abundance is based on the DAFOR Scale (D: dominant, A: abundant, F: frequent, O: occasional; R: rare). FEP: Farm Environment Plan (Natural England 2010), LM: indicator species for lowland meadows.

Common Name	Scientific Name	DAFOR Abundance	FEP Indicators
Black medick	<i>Medicago lupulina</i>	A	SI
Smooth hawk's-beard	<i>Crepis capillaris</i>	F	
Smooth meadow-grass	<i>Poa pratensis</i>	F	
Red clover	<i>Trifolium pratense</i>	F	SI
Rat's-tail fescue	<i>Vulpia myuros</i>	F	
Fern grass	<i>Catapodium rigidum</i>	O	
Bristly ox-tongue	<i>Helminthotheca echioides</i>	O	
Rough hawkbit	<i>Leontodon hispidus</i>	O	LM
Buck's-horn plantain	<i>Plantago coronopus</i>	O	
Ribwort plantain	<i>Plantago lanceolata</i>	O	
Greater plantain	<i>Plantago major</i>	O	
Dandelion	<i>Taraxacum agg.</i>	O	
Hop trefoil	<i>Trifolium campestre</i>	O	
Scentless mayweed	<i>Tripleurospermum inodorum</i>	O	
Canadian fleabane	<i>Conyza canadensis</i>	R	
Weld	<i>Reseda luteola</i>	R	
Number of species per quadrat			18

Poor semi-improved neutral grassland in north of Science Park (source: BSG Ecology, 2015)

- 15.2 *Table A5-7: Botanical data collected in July 2015, based on eight 2 m x 2 m quadrats reported in BSG Ecology (2015). Relative Abundance is based on the DAFOR Scale (D: dominant, A: abundant, F: frequent, O: occasional; R: rare). The abundance of highland bent Agrostis castellana suggests there has been previous seeding with an agricultural or amenity grass mix.*

Common Name	Scientific Name	DAFOR Abundance	FEP Indicators
Common bent	<i>Agrostis capillaris</i>	A	
Highland bent	<i>Agrostis castellana</i>	F	
Red fescue	<i>Festuca rubra</i>	F	
Yorkshire fog	<i>Holcus lanatus</i>	O	
Perennial rye-grass	<i>Lolium perenne</i>	O	
White clover	<i>Trifolium repens</i>	O	
Creeping bent	<i>Agrostis stolonifera</i>	R	
Common mouse-ear	<i>Cerastium fontanum</i>	R	
Field bindweed	<i>Convolvulus arvensis</i>	R	
Cock's-foot	<i>Dactylis glomerata</i>	R	
Cut-leaved crane's-bill	<i>Geranium dissectum</i>	R	
Prickly lettuce	<i>Lactuca serriola</i>	R	
Common ragwort	<i>Senecio jacobaea</i>	R	
Average number of species per quadrat (and range)			8.43 (4–18)

Poor semi-improved neutral grassland in south-west of Science Park

- 15.3 *Table A5-8: Botanical data collected in July 2015, based on two 2 m x 2 m quadrats reported in BSG Ecology (2015). Relative Abundance is based on the DAFOR Scale (D: dominant, A:*

abundant, F: frequent, O: occasional; R: rare). The abundance of highland bent *Agrostis castellana* suggests there has been previous seeding with an agricultural or amenity grass mix.

Common Name	Scientific Name	DAFOR Abundance	FEP Indicators
Red fescue	<i>Festuca rubra</i>	A	
Highland bent	<i>Agrostis castellana</i>	F	
Common bent	<i>Agrostis capillaris</i>	F	
Dandelion	<i>Taraxacum officinalis</i>	O	
Lesser trefoil	<i>Trifolium dubium</i>	O	
Common mouse-ear	<i>Cerastium fontanum</i>	R	
Hawthorn seedling	<i>Crataegus monogyna</i>	R	
Tall fescue	<i>Schedonorus arundinaceus</i>	R	
Common ragwort	<i>Senecio jacobaea</i>	R	
Autumn hawkbit	<i>Leontodon autumnalis</i>	R	
White clover	<i>Trifolium repens</i>	R	
Average number of species per quadrat (and range)			6 (4–8)

16 Appendix 6: Hedgerow Data

Table A6-1: Hedgerow data.

ID	Schedule 3 woody species	Woody Species per 30 m	Important	Justification/Notes	Species-rich
1	Fe, Up, Rc, Lv, Cm, Ps, VI, Rhc, Ac, Sn, Pa	7	Important	7 woody species.	Species-rich
2	Rc, Cm, Ca, Ps, Rhc, VI, Ac	6		6 woody species and 3 features, but <30 years old (planted around 2011).	Species-rich
3	Cm, Fe, Sxf	2			
4	Up, Sn, Ps, Ap, fe, Rhc, Rc, Ca, Ms	7	Important	7 woody species.	Species-rich
5	Cm, Sn, Ia, Up, Fe	5	Important	4 woody species and adjacent to public right of way.	Species-rich
6	Rc, Cm, Ca, Ps, Rhc, VI, Ac	6			Species-rich
7	Fe, Cm, Ps, Rhc, Ca, Sn	4		Adjacent to residential property.	
8	Sxf, Fe, Cm, Sn, Up, Rc, Ac, Fs	5	Important	5 woody species and 4 features.	Species-rich
9	Fe, Cm, Ca, Rhc, Sn, Sxf, Ac, Up, Qr, Rc	8	Important	7 woody species.	Species-rich
10	Cm, Ms, Ac, Sn, Qr	5	Important	4 woody species and adjacent to public right of way.	Species-rich
11	Ac, Cm, Cs, Up, Ps, Sn	5			Species-rich
12	Fe, Rc, Rhc, Cm, Up, Ps, Sn	4			
13	Ac, Ca, Ps	3			
14	Up, Sn, Fe, Ac, Ca	3			
15	Fe, Ac, Rhc, Sn, C, Ps, Up, Qr	6			Species-rich
16	Cm, Ps, Qr, Up, Rc, Fe, Rhc,	7	Important	7 woody species	Species-rich
17	Cm	1		Adjacent to residential property.	
18	Fe, PS, Cm, Rc, Ac, Sn	4			
19	Cm, Ca, VI, Rhc, Rc, Ps	6			Species-rich
20	Ee, Cm, Ac, Qr, Ps, Fe,	4			
21	Cm, Ca, Cs, Ee, Qr, VI, Ac, Ia,Ps	7		Adjacent to residential property.	Species-rich
22	Up, Cm, Ac, Qr, Rc, Ps, Ca	5			Species-rich

ID	Schedule 3 woody species	Woody Species per 30 m	Important	Justification/Notes	Species-rich
23	Cm, Ac, Qr, Sxcap,	4	Important	4 woody species and adjacent to public right of way.	
24	Cm, Rc, Ac, Qr, Up	4	Important	4 woody species and adjacent to public right of way.	
25	Ps, Cm, Ac, Sn, Ca, Qr, Cs, Sxcap, Up, Fe, Rhc, Jr	8	Important	7 woody species	Species-rich
26	Ac, Cm, Fe, Up, Rc	4			
27	Ps, Ca, Fe, Cm, Ac	4		Adjacent to public right of way.	
28	Up, Ac, Ps, Cm, Ca, Fe, Qr	5			Species-rich
29	Cm, Ac, Sn, laq, Ps, Ee	4			
30	PS, Sn, Sxf, Sxcap, Cm, Ac, Qr,	5			Species-rich
31	Cm, Sxf, Fe, Qr, Sxcap, Ps, Rc	7	Important	7 woody species	Species-rich
32	Cm, Fe, Sn, Ac	3			
33	Ac, Ps, Cm, Qr, Ca, Sn	6	Important	6 woody species and 3 features	Species-rich
34	Ca, Cm, Ps, Sn, Up, Fe, Ee, Ac, Cs	7	Important	7 woody species	Species-rich
34	Cm, Sn, Ac, Sxf	4			
35	Qr, Fe, Ca, Cm, Ms, Sxcap, Cs	7	Important	7 woody species	Species-rich
36	Ac, Fe, Ps, Cm, Up, Cs, Rc, Qr, Sxf, Vo	7	Important	7 woody species	Species-rich
37	Cm, Qr, Up, Sn, Sxcap, Rc, Fe, Vo	6	Important	6 woody species and 3 features	Species-rich
38	Cm, Ca, Cs, Qr, Fe, Rc, Rhc, Sxf	4			
39	Ca, Cm, Fe, Qr, Cs, Ps, Rc, la, Sn	6	Important	6 woody species and 3 features	Species-rich
40	Ac, Cm, Fe, Qr, Ca, Sxcap, Ps, Ac	6	Important	6 woody species and 3 features	Species-rich
41	Sxcap, Ca, Rc, Cm, Qr, Sxf, Ps, Ac	6	Important	6 woody species and 3 features	Species-rich
42	Ac, Cm, Ca, Sn, Sxf, Ag, Ps, Ms, Fe, Qr, Rc	9	Important	7 woody species	Species-rich
43	Cm, Sxf, Sxv, Ag, Qr, Ps, Sn, Cl, Rc	6	Important	6 woody species and 3 features	Species-rich
44	Ac, Cm, Sxf, Sn, Lp, Ag, Sxcap, Up, Qr, Ps, la, Ms, Rc	7.7	Important	7 woody species	Species-rich
45	Cm, Fe, Rc, Sn, Ac, Ca, Qr, Ma	7	Important	7 woody species	Species-rich
46	Ca, Sn, Rc, Sn, Cm, Qr, Ac, lq, Ps, Lv, Sxcap, Ca, Sxf, Up	8	Important	7 woody species	Species-rich
47	Sxf, Ps, Up, Sn, Cm, Fe, Rc, Ms, la, Cs,	7.5	Important	7 woody species	Species-rich
48	Cm, Ac, Ca, Rc, Fe, Ag, Rc, Ps, Qr, Sxf, Sn	7	Important	7 woody species	Species-rich

ID	Schedule 3 woody species	Woody Species per 30 m	Important	Justification/Notes	Species-rich																						
49	Sxcap, Ug, Sn, Fe, Rc, Cm, Up, Qr, Cs, Ia	10	Important	7 woody species	Species-rich																						
50	Rc, Ug, Sxf, Up, Cm, Cs, Sn, Fe, Ia, Ac, Rc, Ca	7.33	Important	7 woody species	Species-rich																						
51	Cm, Ac, Ca, Rc, Fe, Qr, Sxf, Sn, Up, Sxcap, Sn, Lv	7	Important	7 woody species	Species-rich																						
52	Cm, Ac, Fe, Up, Ms, Ag, Lv, Ee, Sn, Sxcap, Cs, Qr	5.67	Important	5 woody species and 4 features	Species-rich																						
53	Cm, Sn, Ac, Sxf	4																									
<p>Abbreviations used for woody species:</p> <table> <tbody> <tr> <td>Ac field maple <i>Acer campestre</i></td> <td>Ps blackthorn <i>Prunus spinosa</i></td> </tr> <tr> <td>Ag alder <i>Alnus glutinosa</i></td> <td>Qr pedunculate oak <i>Quercus robur</i></td> </tr> <tr> <td>Cm hawthorn <i>Crataegus monogyna</i></td> <td>Rc dog rose <i>Rosa canina</i></td> </tr> <tr> <td>Cs dogwood <i>Cornus sanguinea</i></td> <td>Rca buckthorn <i>Rhamnus cathartica</i></td> </tr> <tr> <td>Ee spindle <i>Euonymus europaeus</i></td> <td>Sn elder <i>Sambucus nigra</i></td> </tr> <tr> <td>Fe ash <i>Fraxinus excelsior</i></td> <td>Sxcap goat willow <i>Salix caprea</i></td> </tr> <tr> <td>Ia holly <i>Ilex aquifolium</i></td> <td>Sxf crack willow <i>Salix fragilis</i></td> </tr> <tr> <td>Lv wild privet <i>Ligustrum vulgare</i></td> <td>Ug wych elm <i>Ulmus glabra</i></td> </tr> <tr> <td>Lp honeysuckle <i>Lonicera periclymenum</i></td> <td>Up English elm <i>Ulmus procera</i></td> </tr> <tr> <td>Ms crab apple <i>Malus sylvestris</i></td> <td>Vi guelder rose <i>Viburnum lantana</i></td> </tr> <tr> <td>Pa wild cherry <i>Prunus avium</i></td> <td>Vo wayfaring tree <i>Viburnum opulus</i></td> </tr> </tbody> </table>						Ac field maple <i>Acer campestre</i>	Ps blackthorn <i>Prunus spinosa</i>	Ag alder <i>Alnus glutinosa</i>	Qr pedunculate oak <i>Quercus robur</i>	Cm hawthorn <i>Crataegus monogyna</i>	Rc dog rose <i>Rosa canina</i>	Cs dogwood <i>Cornus sanguinea</i>	Rca buckthorn <i>Rhamnus cathartica</i>	Ee spindle <i>Euonymus europaeus</i>	Sn elder <i>Sambucus nigra</i>	Fe ash <i>Fraxinus excelsior</i>	Sxcap goat willow <i>Salix caprea</i>	Ia holly <i>Ilex aquifolium</i>	Sxf crack willow <i>Salix fragilis</i>	Lv wild privet <i>Ligustrum vulgare</i>	Ug wych elm <i>Ulmus glabra</i>	Lp honeysuckle <i>Lonicera periclymenum</i>	Up English elm <i>Ulmus procera</i>	Ms crab apple <i>Malus sylvestris</i>	Vi guelder rose <i>Viburnum lantana</i>	Pa wild cherry <i>Prunus avium</i>	Vo wayfaring tree <i>Viburnum opulus</i>
Ac field maple <i>Acer campestre</i>	Ps blackthorn <i>Prunus spinosa</i>																										
Ag alder <i>Alnus glutinosa</i>	Qr pedunculate oak <i>Quercus robur</i>																										
Cm hawthorn <i>Crataegus monogyna</i>	Rc dog rose <i>Rosa canina</i>																										
Cs dogwood <i>Cornus sanguinea</i>	Rca buckthorn <i>Rhamnus cathartica</i>																										
Ee spindle <i>Euonymus europaeus</i>	Sn elder <i>Sambucus nigra</i>																										
Fe ash <i>Fraxinus excelsior</i>	Sxcap goat willow <i>Salix caprea</i>																										
Ia holly <i>Ilex aquifolium</i>	Sxf crack willow <i>Salix fragilis</i>																										
Lv wild privet <i>Ligustrum vulgare</i>	Ug wych elm <i>Ulmus glabra</i>																										
Lp honeysuckle <i>Lonicera periclymenum</i>	Up English elm <i>Ulmus procera</i>																										
Ms crab apple <i>Malus sylvestris</i>	Vi guelder rose <i>Viburnum lantana</i>																										
Pa wild cherry <i>Prunus avium</i>	Vo wayfaring tree <i>Viburnum opulus</i>																										

From: Charlotte Watkins <Charlotte.Watkins@Cherwell-DC.gov.uk>
Sent: 20 October 2022 09:51
To: Kai Hayes <k.hayes@bsg-ecology.com>
Subject: RE: Consultation regarding ecology surveys at Begbroke PR8 site

Dear Kai

The scope seems appropriate to me although I do not know this site particularly well. As long as anything omitted (such as Otter) is justified within your reports then I would not anticipate any issues with scope.

Kind regards

Charlotte

Dr Charlotte Watkins
Ecology Officer
Tel: 01295 227912
Email: Charlotte.Watkins@Cherwell-DC.gov.uk
Communities Directorate
Cherwell District Council
www.cherwell.gov.uk

My usual working hours are: Monday-Thursday mornings.

From: Kai Hayes <k.hayes@bsg-ecology.com>
Sent: 19 October 2022 15:06
To: Charlotte Watkins <Charlotte.Watkins@Cherwell-DC.gov.uk>
Cc: Tom Flynn <t.flynn@bsg-ecology.com>
Subject: RE: Consultation regarding ecology surveys at Begbroke PR8 site

You don't often get email from k.hayes@bsg-ecology.com. [Learn why this is important](#)

CAUTION: This email originated from outside of the Council. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Dear Charlotte,

Please could you confirm whether you are happy with the scope of the ecological surveys undertaken for the Begbroke PR8 site, as detailed below?

Kind regards,

□ □ □ □ □ □ □ □
Ecologist

□ □ □ □ □ □ □ □
Phone: 01865 883833 | **Mobile:** 07496 624340

From: Kai Hayes
Sent: 30 May 2022 16:21
To: Charlotte.Watkins@Cherwell-DC.gov.uk
Subject: RE: Consultation regarding ecology surveys at Begbroke PR8 site

Dear Charlotte,

Further to my previous email would you be able to confirm that you are happy with the proposed scope of the surveys for the Begbroke PR8 site, as detailed below?

Thank you,

□ □ □ □ □ □ □ □
Ecologist

□ □ □ □ □ □ □ □
Phone: 01865 883833 | Mobile: 07904518471

From: Kai Hayes
Sent: 13 May 2022 10:21
To: Charlotte.Watkins@Cherwell-DC.gov.uk
Cc: Tom Flynn <t.flynn@bsg-ecology.com>
Subject: Consultation regarding ecology surveys at Begbroke PR8 site

Dear Charlotte,

I'm writing to you regarding proposed update ecology surveys at the Begbroke PR8 site. A planning application is intended to be submitted in the summer of 2023. Initial baseline surveys were carried out in 2018, and updated in 2021, and further ecology surveys are expected to take place throughout 2022.

The table below summarises our proposed scope for these update ecology surveys:

Task	Scope/Method	Timing of survey(s)
Ecology desk study	Initial data obtained from TVERC in Dec 2017. Data search updated in October 2021 to inform 2022 surveys.	N/A
Phase 1 habitat survey of tip area	The tip area, recently acquired by Oxford University, is the only part of the site not covered by the 2021 Phase 1 habitat survey update. We will undertake an extended Phase 1 habitat survey of this area based on standard industry guidance at the optimal period of the year.	1 x visit in June
Botanical condition assessment of grassland areas	In order to provide strong evidence to underpin the biodiversity net gain calculation, we will carry out a condition assessment of the grassland fields at the site (mainly east of the railway line, but also including the tip area), based on Natural England's condition assessment criteria.	1 x visit in June
Breeding bird characterisation survey	We will carry out three survey visits, timed approximately monthly, to characterise the breeding bird assemblage at the site and produce indicative breeding territory maps. This is our standard approach to providing baseline information on breeding birds. The survey timing relates to the period of peak bird breeding activity.	3 x visits, April, May and June
Wintering bird survey	We have carried out three survey visits, in December 2021 and in January and February 22. There is no significant use of the site by wintering waterfowl.	3 x visits, Dec, Jan Feb

Task	Scope/Method	Timing of survey(s)
Ecology desk study	Initial data obtained from TVERC in Dec 2017. Data search updated in October 2021 to inform 2022 surveys.	N/A
Reptile survey	We will carry out a targeted survey of the habitats suitable for reptiles at the site which were surveyed in 2018 (e.g., semi-improved neutral grassland, field margins and scrub). This will involve one visit to lay artificial reptile shelters (squares of roofing felt) and seven visits to check these to determine the presence or absence of these species. The survey will be based on standard industry guidance and standing advice from Natural England.	8 x visits March to June
Great crested newt survey	Following the eDNA surveys in 2018 and 2021, this species is likely to be absent from all but one pond at the site: the ornamental pond at the science park. We will confirm the population size in this pond based on the industry standard method for population size class assessment which involves six overnight survey visits using a torchlight search and bottle trapping.	6 x overnight visits March to June
Bat activity survey – walked transects	We will carry out monthly walked transects after dusk using appropriate ultrasonic bat detectors for the period April–October to obtain updated information on the use of the site by bats. The same two transect routes as employed in 2018 will be used.	7 x visits, monthly at dusk or dawn between April and October
Bat activity survey – automated detector survey	We will also deploy four static bat detectors (each deployed for five days per month) over this period. This level of survey effort and timing is based on standard industry guidance.	7 x 5-night deployments, monthly between April and October
Bat roost emergence survey at science park	We will carry out dusk and dawn bat emergence and re-entry surveys of the farmhouse and attached buildings based on industry guidance. Based on our 2018 and 2021 work we have assumed that three dawn or dusk visits with seven surveyors will be required to adequately cover the main building, plus up to two visits with two surveyors to cover the stone structure at Parker’s Farm.	Up to 3 x visits at dawn or dusk between May and August
Bat roost emergence survey at tip site	The poplar trees along the eastern boundary of the tip have some suitability to support roosting bats due to the presence of cracks and holes in some of the trunks. Based on standard industry guidance, we will carry out a dusk and a dawn survey to determine the level of use by bats. Each visit will involve two surveyors, each using a thermal imaging camera. These trees are not considered safe to climb.	2 x visits dawn or dusk between May and August
Water vole survey	Two survey visits will be carried out (one in spring and one in autumn), based on standard industry guidance. The survey will cover Rowel Brook (and the small connected stream to the south) and selected ditches, and will involve bank side searches for field signs.	2 x visits, in April-May and October

Task	Scope/Method	Timing of survey(s)
Ecology desk study	Initial data obtained from TVERC in Dec 2017. Data search updated in October 2021 to inform 2022 surveys.	N/A
Badger survey	We will carry out a detailed update badger survey of the tip area to map individual sett entrance holes. We will classify all setts and sett entrances, based on the level of activity associated with them. If, following the survey, any further surveys are required (such as bait marking surveys to identify separate badger groups), these could then be carried out later in 2022. A general update badger survey of the wider site was carried out in 2021.	1x visit in April
Dormouse survey	We will carry out a survey of hedgerows and other suitable habitat (e.g., suitable areas of woodland and scrub) that could be affected by the development for the presence of this species using nest tubes, placed out in April and monitored monthly by a licensed surveyor until the end of September. Survey effort and timing will follow current standard industry guidance. Based on the 2018 survey, we estimate between 150 and 200 nest tubes will be required.	6 visits, monthly April to September 2022
Terrestrial invertebrate survey	We have carried out a winter search for brown hairstreak eggs in February 2022. Due to the limited value for invertebrates of habitats that will be directly affected by the development (the majority of development areas are currently under intensive arable farming), we consider that further invertebrate surveys are not appropriate.	1 visit, February 2022
Aquatic invertebrate survey	Baseline survey to inform an assessment of the need for WFD and to have a baseline in case of future pollution incidents. The survey will include 3 samples along Rowel Brook in the spring and autumn. We will identify all sampled invertebrates to family level via microscopy to allow characterisation of the invertebrate assemblage and the biological water quality of the Brook. We will store samples and if WFD compliance assessment is required the samples can be reanalysed to species level.	2 x visits, in April and October 2022

Are you able to confirm that you are happy with the scope of the above surveys for this site and for a planning application to be submitted in the summer of 2023?

Regards and thanks

Dr [redacted] (F [redacted])
Principal Ecologist

[redacted]
Phone: 01865 883833 | Mobile: 07827 815617

Kai Hayes
Ecologist



Worton Park, Worton, Oxford,
Oxfordshire, OX29 4SX

t: 01865 883833 | m: 07904518471 | www.bsg-ecology.com

BSG Ecology Ltd | Offices in Oxford, Derbyshire, Newport, Newcastle-upon-Tyne, Swansea and Cambridge
Registered in: England and Wales No. 12142513 | Registered address: Merlin House, No1 Langstone Business
Park, Newport, NP18 2HJ

From: Charlotte Watkins <Charlotte.Watkins@Cherwell-DC.gov.uk>
Sent: Thursday, May 20, 2021 10:33 PM
To: Tom Flynn <t.flynn@bsg-ecology.com>
Cc: Oliver Kemp <o.kemp@bsg-ecology.com>
Subject: RE: Consultation regarding scope of update ecology surveys for PR8 site

Hello

Thank you for your email.

I have had little involvement with the Partial Review sites and PR8 to date but having looked at the scope attached I cannot see any obvious issues with this plan. The proposed update surveys and justifications all look reasonable.

The planning Officer dealing with development briefs may also need to see this scope therefore I will send this on with these comments.

Kind regards

Charlotte

Dr Charlotte Watkins

Ecology Officer

Tel: 01295 227912

Email: Charlotte.Watkins@Cherwell-DC.gov.uk

www.cherwell.gov.uk

My usual working hours are: Monday and Wednesday mornings.

Coronavirus (COVID-19): In response to the latest Government guidance and until further notice, the Planning Service has been set up to work remotely, from home. Customers are asked not to come to Bodicote House but instead to phone or email the Planning Service on 01295 227006: planning@cherwell-dc.gov.uk. For the latest information about how the Planning Service is impacted by COVID-19, please check the website: www.cherwell-dc.gov.uk

From: Tom Flynn <t.flynn@bsg-ecology.com>
Sent: 12 May 2021 12:16
To: Charlotte Watkins <Charlotte.Watkins@Cherwell-DC.gov.uk>
Cc: Oliver Kemp <o.kemp@bsg-ecology.com>
Subject: Consultation regarding scope of update ecology surveys for PR8 site

Hi Charlotte,

I am keen to discuss the scope of the proposed update surveys at the Begbroke PR8 site.

If you could comment on the attached scope that would be very helpful. I will be away 17 to 21 May, but my colleague Oliver Kemp (copied in and available on 07585 138747) would be happy to discuss the matter in my absence.

Regards and thanks
Tom

Dr [redacted] **F** [redacted]
Principal Ecologist

[redacted]
Phone: 01865 883833 | **Mobile:** 07827 815617

Begbroke PR8

Scope of 2021 Ecology Update Surveys

Tom Flynn, BSG Ecology 19.03.21

	Significant update survey proposed.
	Update survey likely to be limited to a walkover.
	No update survey necessary.

Task	2017-2018 Survey scope	Key Results	Proposed 2021 Update Surveys
Ecology Desk Study	Search for: international sites 10km, other statutory sites 5km, Ancient Woodland 3km, non-statutory sites 2km, protected and notable species 2km, ponds 500m.	Cherwell Valley CTA overlaps east of site, Rushy Meadow SSSI adjacent to north of site, Oxford Meadows SAC 1.8km south.	Repeat of desk study to identify any additional species record or new designated sites.
Extended Phase 1 habitat survey	Standard survey of whole site.	Arable habitats dominate the site. Some semi-improved grassland in north east. Also hedgerows, ponds, Rowel Brook and mature trees.	Update Phase 1 habitat survey to be carried out in May to July 2021. To include condition assessment or biodiversity calculation.
Hedgerow survey	Hedgerow Regulations assessment of whole site.	53 hedgerows identified, of which 37 species-rich and 30 important under <i>Wildlife and Landscape</i> criteria.	Hedgerows to be assessed using Natural England condition assessment criteria (to feed into biodiversity calculation).
Botanical survey	Survey of grassland fields in NE.	Some semi-improved grassland (MG1 community) present.	Walkover of grassland areas by an experienced botanist to determine any significant change to habitat. No further surveys if no such change, on the basis that without significant habitat change, plant populations and vegetation communities would be unlikely to have changed significantly.
Badger survey	Standard survey of whole site.	Setts at centre, north-west, and east of site.	Re-survey of the site. Full badger survey.
Bat assessment of buildings	Standard survey of all buildings on site.	Bat potential at Science Park, and Parkers farm to the east.	Repeat of assessment of buildings to be directly affected by the development.
Bat emergence survey of buildings	Standard surveys of all buildings with bat potential on site.	Pipistrelle and soprano pipistrelle roosts at the science park.	Survey of any buildings with bat potential to be directly affected by the development.
Bat assessment of trees	Standard ground level surveys of trees in development areas.	Nine trees identified with suitability.	Repeat of assessment of trees to be directly affected by the development.
Bat inspection of trees	Endoscope inspection of trees with bat suitability in development areas.		Repeat inspection of trees to be directly affected by the development.
Bat activity surveys	Two transects surveyed monthly April to Oct. Three automated detectors deployed for five nights monthly April to October.	At least 10 bat species recorded, including very small numbers of rarer species, lesser	Walkover to determine any significant change to habitat. No further surveys if no such change, on the basis that without significant habitat or habitat connectivity changes, the bat

		horseshoe and barbastelle.	assemblage would be unlikely to have changed significantly.
Dormouse survey	170 dormouse tubes deployed in suitable hedgerows, checked monthly June to Sept.	No evidence of this species was found.	Walkover to determine any significant change to habitat. No further surveys if no such change, on the basis that without significant habitat or habitat connectivity changes, dormouse is unlikely to have become established at the site.
Water vole survey	Standard survey of the on-site sections of the Rowel brook and suitable ditches.	Present on Rowel Brook. Known presence in Oxford Canal.	Single update survey visit.
Otter survey		Not recorded on site, although likely occasionally present. Known presence of Oxford canal.	
Breeding bird characterization survey	Site-wide transect, surveyed April, May and June.	Typical assemblage for the (mainly farmland) habitats present.	Walkover to determine any significant change to habitat. No further surveys if no such change on the basis that without significant habitat change, the bird assemblage would be unlikely to have changed significantly.
Wintering bird survey	Not surveyed, due to limited habitat suitability at the site, lack of wetland sites in proximity, and lack of significant desk study records on to adjacent to the site.	N/A	Walkover to determine any significant change to habitat. No further surveys if no such change, on the basis that the site is of limited suitability for these species, and without significant habitat change, this is unlikely to have changed.
Great crested HSI assessment	Standard assessment of all accessible ponds within 500m.	Six ponds within the site and seven within 500m of the site. Variable suitability for great crested newts.	Re-assessment of on-site ponds and off-site ponds where accessible.
Great crested newt eDNA survey	Standard survey of all accessible ponds within 250m.	Present in an ornamental pond at the science park.	Re-survey of on-site ponds.
Great crested newt population assessment	Six survey visits on the single pond (at Begbroke Science Park) having a positive eDNA result.	Small population.	For ponds in which there is no change in the presence/absence status, no further survey is necessary. The only pond with this species is an ornamental pond of low suitability, with a very low population size in 2018, and without significant habitat change, this population is unlikely to have changed significantly. If new presence is of this species is detected in ponds, the need for population assessment will be considered (based on distance from proposed development and on surrounding habitats).
Great crested newt terrestrial survey	Survey of suitable on-site habitat in proximity to an off-site pond to which access was not available. 40 carpet sites deployed, in addition to the 20 reptile mats deployed for the reptile survey in this area.	No great crested newts recorded in this part of the site.	Walkover to determine any significant change to habitat. No further surveys if no such change, on the basis that without significant habitat change, the distribution of this species would be unlikely to have changed significantly.

Reptile survey	Survey of suitable habitats at the site using 100 survey mats.	Slow worm, grass snake and common lizard present. Mainly recorded in fields at north-east of site, and near Parkers Farm east of the science park.	Walkover to determine any significant change to habitat. No further surveys if no such change, on the basis that without significant habitat change, reptile populations would be unlikely to have changed significantly.
Crayfish survey	Manual and torchlight survey of Rowel Brook (Oct 2017).	White-clawed crayfish not recorded. American signal crayfish present.	Given presence of American signal crayfish, no realistic potential for establishment of white-clawed crayfish. Update survey not necessary.
Macroinvertebrate sampling of streams	Kick-sampling of five locations on Rowel Brook and tributary, in Oct 2017 and April 2018.	Results indicate moderate water quality.	Walkover to determine any significant change to habitat. No further surveys if no such change.
Terrestrial invertebrate survey	Not considered necessary, given the intensive agricultural use of the majority of the site and the retention of the higher-value habitats (e.g. the semi-improved grassland in the north-east of the site).	N/A	Walkover to determine any significant change to habitat. No further surveys if no such change.

□□□ **A**□□□□**d**□□□□□□□□**r**□□□□**N**□□□□□

□□r□□□□N□□□□□

Based on 2018 Survey, updated in 2021 and 2022. Target note locations are shown on Figure 2.

N□□□	N□□□□
1	Belt of dense planted trees around perimeter of Begbroke Science Park. Ca. 5 m wide and 7 m tall. Containing: hazel <i>Corylus avellana</i> , wayfaring tree <i>Viburnum opulus</i> , field maple <i>Acer campestre</i> , dogwood <i>Cornus sanguinea</i> , ash <i>Fraxinus excelsior</i> , blackthorn <i>Prunus spinosa</i> , and osier willow <i>Salix viminalis</i> . Sparse ground vegetation.
2	Stream. Rowel Brook. Moderately fast flowing, gravel or silt bottom, meanders. Channel ca. 0.5 to 1.5 m deep. Water ca. 0.1 to 0.5 m. Width 1–1.5 m. Very limited or marginal vegetation visible (mainly pendulous sedge <i>Carex pendula</i>). Forms site boundary to north west, where north bank runs along multiple private gardens. Abundant ad-hoc bank stabilisation along north bank and informal access bridges to gardens.
3	Woodland strip along stream. Generally dominated by pedunculate oak <i>Quercus robur</i> with understory of hazel <i>Corylus avellana</i> and hawthorn <i>Crataegus monogyna</i> , and field layer of bramble <i>Rubus fruticosus</i> agg. and ivy <i>Hedera helix</i> . Ash <i>Fraxinus excelsior</i> and sycamore <i>Acer pseudoplatanus</i> present in some areas, and crack willow <i>Salix fragilis</i> close to the stream. Stands of tall ruderals (e.g., great willowherb <i>Epilobium hirsutum</i>) and bramble on southern edge. Woodland strip very narrow on northern site for the brook from much of its length (i.e., canopy overhang only)
4	Large patch of variegated yellow archangel <i>Lamiastrum galeobdolon</i> ssp. <i>argentatum</i> growing in woodland adjacent to stream, presumably this has escaped from adjacent gardens. Also rose-of-Sharon <i>Hypericum calycinum</i> . Perhaps from adjacent gardens, or possibly planted. No spread evident in 2022.
5	Old access road to Science Park. Flanked by amenity grassland and two heavily trimmed species-poor hedges (dominated by hawthorn with abundant ivy <i>Hedera helix</i>) and informal rows of semi-mature trees including walnut <i>Juglans regia</i> and willow <i>Salix</i> sp.
6	Vegetated earth mounds screening hot heap composting facility. Supports semi-improved neutral grassland and tall ruderal vegetation, including bristly ox-tongue <i>Helminthotheca echioides</i> .
7	Mixed plantation woodland, including semi-mature Scots pine <i>Pinus sylvestris</i> , birch <i>Betula pendula</i> , and Italian alder <i>Alnus cordata</i> . Little understorey and no woodland ground flora noted.
8	Small stream which emerges from culvert under railway line and flows northwest into Rowel Brook. Fool's-water-cress <i>Apium nodiflorum</i> abundant in some areas. Significant shading by adjacent oak <i>Quercus robur</i> and hazel <i>Corylus avellana</i> canopy.
9	Semi-natural broad-leaved woodland along small stream dominated by pedunculate oak <i>Quercus robur</i> , hazel <i>Corylus avellana</i> and alder <i>Alnus glutinosa</i> . Some wood avens <i>Geum urbanum</i> and false brome <i>Brachypodium sylvaticum</i> in the field layer.
10	Area of swamp which dominates a pond with common reed <i>Phragmites australis</i> and lesser pond sedge <i>Carex acutiformis</i> .
11	Residential property with prefabricated buildings outside Site, surrounded by tall fences/hedgerows. Outside the Site.

12	Rough semi-improved neutral grassland, scrub and tall ruderal vegetation on the former landfill site in the centre of the Site. With common nettle <i>Urtica dioica</i> , hemlock <i>Conium maculatum</i> , and some scrub (especially hawthorn <i>Crataegus monogyna</i>).
13	Ditch. Wet outside summer period. Depth variable, to ca. 40 cm, width ca. 1 m. Containing abundant aquatic plants including water-cress <i>Nasturtium officinale</i> , fool's-water-cress <i>Apium nodiflorum</i> , sweet-grass <i>Glyceria</i> sp. and creeping bent <i>Agrostis stolonifera</i> . Dry and grass dominated during summer period.
14	Small triangular field dominated by dense hawthorn <i>Crataegus monogyna</i> scrub, with some tussocky semi-improved grassland (dominated by cock's-foot <i>Dactylis glomerata</i>) and tall ruderals (common nettle <i>Urtica dioica</i>) around edges. Also creeping bent <i>Agrostis stolonifera</i> , hogweed <i>Heracleum sphondylium</i> , a St. John's-wort <i>Hypericum</i> sp., hairy tare <i>Vicia hirsuta</i> , curled dock <i>Rumex crispus</i> , a forget-me-not <i>Myosotis</i> sp., hairy bitter-cress <i>Cardamine hirsuta</i> , and rough-stalked feather-moss <i>Brachythecium rutabulum</i> and dog rose <i>Rosa canina</i> .
15	Area of short improved grassland behind tall fence, with poultry and other animal shelters. Used for deer rearing. Close mown/grazed and dominated by agricultural grasses and white clover.
16	Large mature hybrid black poplar <i>Populus x canadensis</i> close to site boundary but outside Site.
17	Yarnton Lane. Unsurfaced byway between Sandy Lane and A44 Woodstock Road. Deep ditches on both sides and mature hedgerows with abundant oak <i>Quercus robur</i> , willow <i>Salix</i> species and alder <i>Alnus glutinosa</i> trees.
18	Meadow. Poor semi-improved grassland with abundant false oat-grass <i>Arrhenatherum elatius</i> . Partially flooded in January 2018. Dry in May 2018.
19	Stand of spotted variegated yellow archangel <i>Lamiatstrum galeobdolon</i> ssp. <i>argentatum</i> growing on ditch bank.
20	Defunct hedgerow. Ditch adjacent containing lesser pond sedge <i>Carex riparia</i> , water cress <i>Nasturtium aquaticum</i> , water mint <i>Mentha aquatica</i> , soft rush <i>Juncus effusus</i> , and reedmace <i>Typha latifolia</i> . Tufted hair-grass <i>Deschampsia cespitosa</i> adjacent. Dry in September 2018.
21	Large damp meadow, various grasses and herbs, including species indicating disturbance. See habitat description for more details.
22	Area of impenetrable bramble <i>Rubus fruticosus</i> agg. scrub.
23	Damp semi-improved neutral grassland, dominated by false oat-grass <i>Arrhenatherum elatius</i> , with some creeping bent <i>Agrostis stolonifera</i> , cocksfoot <i>Dactylis glomerata</i> , common nettle <i>Urtica dioica</i> , hogweed <i>Heracleum sphondylium</i> , meadowsweet <i>Filipendula ulmaria</i> and cleavers <i>Galium aparine</i> . Extensive dense bramble <i>Rubus fruticosus</i> agg. scrub in encroaching (dominating) the grassland.
24	Ditch between arable field and hedgerow, close to Oxford Canal with standing water in winter and aquatic vegetation, including greater pond sedge <i>Carex riparia</i> , lesser pond sedge <i>Carex acutiformis</i> , tufted hair-grass <i>Deschampsia cespitosa</i> and floating sweet-grass <i>Glyceria fluitans</i> . Dominated by greater willowherb <i>Epilobium hirsutum</i> .
25	Small artificial stream flowing around canal lock. Adjacent swamp – see target Note 26.
26	Small area of swamp dominated by reed sweet-grass <i>Glyceria maxima</i> and creeping bent <i>Agrostis stolonifera</i> . Mature crack willows present.
27	Semi-improved grassland in south-west of Science Park.

28	Planted bed of rose-of-Sharon <i>Hypericum calycinum</i> , ornamental shrub, with a line of mature hybrid black poplars <i>Populus x canadensis</i> . Begbroke Science Park.
29	Area of former amenity grassland with mature black pine <i>Pinus nigra</i> and Scots pine <i>Pinus sylvestris</i> , and several apple trees <i>Malus pumila</i> , now a cleared construction site for new buildings at the Science Park.
30	Area of former semi-improved neutral grassland dominated by red fescue <i>Festuca rubra</i> with abundant forbs and ephemeral species. This grassland had colonised bare sandy ground following demolition of buildings here. Now part of a cleared construction site.
31	Amenity grass verge with mature field maple <i>Acer campestre</i> and pedunculate oak <i>Quercus robur</i> .
32	Short-mown lawn adjacent to farmhouse, contains various grass, forb and bryophyte species including common bent <i>Agrostis capillaris</i> , red fescue <i>Festuca rubra</i> , yarrow <i>Achillea millefolium</i> daisy <i>Bellis perennis</i> , common cat's-ear <i>Hypochaeris radicata</i> and springy turf-moss <i>Rhytidiadelphus squarrosus</i> . Because of this species richness, this grassland is classed as semi-improved neutral grassland in the Phase 1 habitat survey.

□

Table A4-1. Plant species list for Field A

Table A4-1. Plant species list for Field A

Table A4-1. Plant species list for Field A

Common Name	Latin Name	DAFRA Code
False oat-grass	<i>Arrhenatherum elatius</i>	D
Bramble	<i>Rubus fruticosus</i>	F
Common nettle	<i>Urtica dioica</i>	F
Meadow foxtail	<i>Alopecurus pratensis</i>	O
Creeping thistle	<i>Cirsium arvense</i>	O
Field bindweed	<i>Convolvulus arvensis</i>	O
Hedge bindweed	<i>Convolvulus arvensis</i>	O
Tufted hair-grass	<i>Deschampsia cespitosa</i>	O
Greater willowherb	<i>Epilobium hirsutum</i>	O
A horsetail	<i>Equisetum sp.</i>	O
Red fescue	<i>Festuca rubra</i>	O
Meadowsweet	<i>Filipendula ulmaria</i>	O
Cleavers	<i>Galium aparine</i>	O
Creeping buttercup	<i>Ranunculus repens</i>	O
Curled dock	<i>Rumex crispus</i>	O
Garlic mustard	<i>Alliaria petiolata</i>	R
Wild angelica	<i>Angelica sylvestris</i>	R
Common knapweed	<i>Centaurea nigra</i>	R
Cock's-foot	<i>Dactylis glomerata</i>	R
Hogweed	<i>Heracleum sphondylium</i>	R
Yorkshire fog	<i>Holcus lanatus</i>	R
Meadow vetchling	<i>Lathyrus pratensis</i>	R
Meadow buttercup	<i>Ranunculus repens</i>	R
Broadleaved dock	<i>Rumex obtusifolius</i>	R
Smooth sow-thistle	<i>Sonchus oleraceus</i>	R

Table A4-2. Plant species list for Field D

Common Name	Latin Name	DAFRA Code
False oat-grass	<i>Arrhenatherum elatius</i>	A
Yorkshire fog	<i>Holcus lanatus</i>	A
Creeping bent	<i>Agrostis stolonifera</i>	F
Meadow foxtail	<i>Alopecurus pratensis</i>	F
Cock's-foot	<i>Dactylis glomerata</i>	F
Creeping buttercup	<i>Ranunculus repens</i>	F
Soft brome	<i>Bromus hordaceus</i>	O
Cut-leaved crane's-bill	<i>Geranium dissectum</i>	O
White clover	<i>Trifolium repens</i>	O

Cow parsley	<i>Anthriscus sylvestris</i>	R
Crested dog's-tail	<i>Cynosurus cristata</i>	R
Lady's bedstraw	<i>Galium verum</i>	R
Hogweed	<i>Heracleum sphondylium</i>	R
Hard rush	<i>Juncus inflexus</i>	R
Meadow vetchling	<i>Lathyrus pratensis</i>	R
Ox-eye daisy	<i>Leucanthemum vulgare</i>	R
Bird's-foot trefoil	<i>Lotus corniculatus</i>	R
Ribwort plantain	<i>Plantago lanceolata</i>	R
Meadow buttercup	<i>Ranunculus repens</i>	R
Yellow rattle	<i>Rhinanthus minor</i>	R
Common sorrel	<i>Rumex acetosa</i>	R
Broad leaved dock	<i>Rumex obtusifolius</i>	R
Greater burnet	<i>Sanguisorba officinalis</i>	R
Hoary ragwort	<i>Senecio erucifolia</i>	R
Field sow-thistle	<i>Sonchus arvensis</i>	R
Lesser stitchwort	<i>Stellaria graminea</i>	R
Dandelion	<i>Taraxacum officinalis</i>	R
Lesser trefoil	<i>Trifolium dubium</i>	R
Red clover	<i>Trifolium pratense</i>	R
Germander speedwell	<i>Veronica chamaedrys</i>	R
Common vetch	<i>Vicia sativa</i>	R
Smooth tare	<i>Vicia tetrasperma</i>	R

Table A4-3. Plant species list for Field E

Field E		
Common Name	Latin Name	DAF R A d
Yorkshire fog	<i>Holcus lanatus</i>	A
False oat-grass	<i>Arrhenatherum elatius</i>	D
Creeping thistle	<i>Cirsium repens</i>	O
Hedge bindweed	<i>Convolvulus sepium</i>	O
Red fescue	<i>Festuca rubra</i>	O
Meadow vetchling	<i>Lathyrus pratensis</i>	O
Smooth meadow-grass	<i>Poa pratensis</i>	O
Dewberry	<i>Rubus caesius</i>	O
Smooth tare	<i>Vicia tetrasperma</i>	O
Urtica dioica	<i>Common nettle</i>	R
Curled dock	<i>Rumex crispus</i>	R

Table A4-4. Plant species list for Field F

Field F		
Common Name	Latin Name	DAF R A d
Common nettle	<i>Urtica dioica</i>	A
False oat-grass	<i>Arrhenatherum elatius</i>	D
Cow parsley	<i>Anthriscus sylvestris</i>	F

Field bindweed	<i>Calystegia arvensis</i>	F
Cock's-foot	<i>Dactylis glomerata</i>	F
Hemlock	<i>Conium maculatum</i>	O
Red fescue	<i>Festuca rubra</i>	O
Creeping cinquefoil	<i>Potentilla reptans</i>	O
Meadow fescue	<i>Schedonorus pratensis</i>	O
Horseradish	<i>Amoracia rusticana</i>	R
Wetted thistle	<i>Carduus crispus</i>	R
Spear thistle	<i>Cirsium vulgare</i>	R
Senecio jacobaea	Common ragwort	R
Cleavers	<i>Galium aparine</i>	R
Ground ivy	<i>Glechoma hederacea</i>	R
Hogweed	<i>Heracleum spondylium</i>	R
Smooth meadow-grass	<i>Poa pratensis</i>	R
Comfrey	<i>Symphytum officinale</i>	R
Goat's-beard	<i>Tragopogon pratensis</i>	R

Field B

Table A4-5. Plant species list for Field B

Field B		
Common Name	Scientific Name	DAF R/A
Yorkshire fog	<i>Holcus lanatus</i>	D
Silverweed	<i>Potentilla anserina</i>	A
Tall fescue	<i>Schedonorus arundinacea</i>	A
False oat-grass	<i>Arrhenatherum elatius</i>	O
Smooth meadow-grass	<i>Poa pratensis</i>	O
Perforate St John's wort	Sweet vernal grass	O
Garlic mustard	<i>Alliaria petiolata</i>	R
Wild angelica	<i>Angelica sylvestris</i>	R
Lesser burdock	<i>Arctium minus</i>	R
Wintercress	<i>Barbarea vulgaris</i>	R
Soft brome	<i>Bromus hordeaceus</i>	R
Field bindweed	<i>Calystegia arvensis</i>	R
Hairy sedge	<i>Carex hirta</i>	R
Creeping thistle	<i>Cirsium arvense</i>	R
Spear thistle	<i>Cirsium vulgare</i>	R
Cock's-foot	<i>Dactylis glomerata</i>	R
Tufted hair-grass	<i>Deschampsia cespitosa</i>	R
Broad-leaved willowherb	<i>Epilobium montanum</i>	R
A horsetail	<i>Equisetum sp.</i>	R
Cleavers	<i>Galium aparine</i>	R
Ox-eye daisy	<i>Leucanthemum vulgare</i>	R
Creeping cinquefoil	<i>Potentilla reptans</i>	R
Self-heal	<i>Prunella vulgaris</i>	R

Common fleabane	<i>Pullicaria dysenterica</i>	R
Meadow buttercup	<i>Ranunculus arvensis</i>	R
Creeping buttercup	<i>Ranunculus repens</i>	R
Bramble	<i>Rubus fruticosus</i> agg.	R
Curled dock	<i>Rumex crispus</i>	R
Water figwort	<i>Scrophularia aquatica</i>	R
Hoary ragwort	<i>Senecio erucifolia</i>	R
Hedge woundwort	<i>Stachys sylvatica</i>	R
Dandelion	<i>Taraxacum officinalis</i>	R
Common nettle	<i>Urtica dioica</i>	R
Germander speedwell	<i>Veronica chamaedrys</i>	R

Table A4-6. Plant species list for Field C

Field C		
Common Name	Scientific Name	DAF/R/A
Tall fescue	<i>Schedonorus arundinacea</i>	D
Yorkshire fog	<i>Holcus lanatus</i>	F
Wild angelica	<i>Angelica sylvestris</i>	R
Soft brome	<i>Bromus hordaceus</i>	R
False fox sedge	<i>Carex otrubae</i>	R
Common mouse-ear	<i>Cerastium fontanum</i>	R
Meadowsweet	<i>Filipendula ulmaria</i>	R
Cut-leaved crane's-bill	<i>Geranium dissectum</i>	R
Cat's-ear	<i>Hypochaeris radicata</i>	R
Meadow vetchling	<i>Lathyrus pratensis</i>	R
Creeping buttercup	<i>Ranunculus repens</i>	R
Meadow buttercup	<i>Ranunculus repens</i>	R
Yellow rattle	<i>Rhinanthus minor</i>	R
Curled dock	<i>Rumex crispus</i>	R
Dandelion	<i>Taraxacum officinale</i>	R
Lesser trefoil	<i>Trifolium dubium</i>	R
Red clover	<i>Trifolium repens</i>	R
Tufted vetch	<i>Vicia cracca</i>	R
Smooth tare	<i>Vicia tetrasperma</i>	R

Improved grassland in the south-west of the Site

Table A4-8. Plant species list for improved grassland in the south-west of the Site.

Improved grassland in the south-west of the Site		
Common Name	Scientific Name	DAF/R/A
Perennial rye-grass	<i>Lolium perenne</i>	A
Creeping buttercup	<i>Ranunculus repens</i>	F
Poa pratensis	<i>Smooth meadow-grass</i>	F
White clover	<i>Trifolium repens</i>	F
Cock's-foot	<i>Dactylis glomerata</i>	O

Table A5-1: Habitat condition assessment information for Fields A, D, E and F, based on Natural England (2023) guidance

Table A5-1: Habitat condition assessment information for Fields A, D, E and F, based on Natural England (2023) guidance

Table A5-1: Habitat condition assessment information for Fields A, D, E and F, based on Natural England (2023) guidance

Field	Field A	Field D	Field E	Field F	Field F
Field A	Clearly <i>Arrhenatherum</i> neutral grassland.	A range of neutral indicator species present, although at low cover.	Clearly <i>Arrhenatherum</i> neutral grassland.	Clearly <i>Arrhenatherum</i> neutral grassland, although heavily grass dominated with allow cover of forbs.	A range of neutral indicator species are present.
Field D	Uniform tall sward. No signs of management in recent years.	Uniform tall sward. Assume manged by one annual cut.	Uniform tall sward.	Uniform tall sward.	Uniformly short mown
Field E					
Field F	Bramble patches occupy >5% of the field.	Neither present.	Neither present on grassland (central area of scrub mapped separately as scrub habitat).		Neither present.
Field F			Common nettle cover is ca. 10%.	Common nettle cover is estimated to be 5-10%.	
Field F	Varies between 3 and 5 across 5 quadrats.	Varies between 5 and 8 across 5 quadrats.	Varies between 3 and 6 across 5 quadrats	Varies between 3 and 4 across 5 quadrats	Varied between 5 and 8 across 5 quadrats.
Field F	3	4	3	3	4
Field F	Moderate	Moderate	Moderate	Moderate	Moderate

Table A5-2: Habitat condition assessment information for Fields B and C based on Natural England (2023) guidance

Table A5-2: Habitat condition assessment information for Fields B and C based on Natural England (2023) guidance

Field	Field B	Field C
Field B	Varies between 4 and 7 across 5 quadrats.	Varies between 3 and 5 across 5 quadrats.
Field C		
Field B		
Field C	Bare and wheel-rutted areas present.	
Field B		

A

Table A6-1: Hedgerow data.

ID	Species	Number of species	Importance	Notes	Assessment	Criteria	Overall Rating
001	Fe, Up, Rc, Lv, Cm, Ps, Vl, Rhc, Ac, Sn, Pa	7	Important	7 woody species.	Species-rich	A1-D2. No trees in hedgerow so E1 and E2 N/A.	Good
002	Rc, Cm, Ca, Ps, Rhc, Vl, Ac	6		6 woody species and 3 features, but <30 years old (planted around 2011).	Species-rich	A1-D2. No trees in hedgerow so E1 and E2 N/A.	Good
003	Cm, Fe, Sxf	2	-	-	-	Fails C2 and D2. No trees in hedgerow so E1 and E2 N/A.	Good
004	Up, Sn, Ps, Ap, fe, Rhc, Rc, Ca, Ms	7	Important	7 woody species.	Species-rich	Passes all criteria A1-E2.	Good
005	Cm, Sn, Ia, Up, Fe	5	Important	4 woody species and adjacent to public right of way.	Species-rich	Fails C2 and D2. No trees in hedgerow so E1 and E2 N/A.	Good
006	Rc, Cm, Ca, Ps, Rhc, Vl, Ac	6	-	-	Species-rich	Fails A1, A2, C1. No trees in hedgerow so E1 and E2 N/A.	Moderate
007	Fe, Cm, Ps, Rhc, Ca, Sn	4	-	Adjacent to residential property.	-	Fails B2, C1, C2, D2. No trees in hedgerow so ignore E1 and E2 N/A.	Moderate
008	Sxf, Fe, Cm, Sn, Up, Rc, Ac, Fs	5	Important	5 woody species and 4 features.	Species-rich	Fails D2 only. Passes E1 and E2.	Good
009	Fe, Cm, Ca, Rhc, Sn, Sxf, Ac, Up, Qr, Rc	8	Important	7 woody species.	Species-rich	Passes all criteria A1-E2.	Good
010	Cm, Ms, Ac, Sn, Qr	5	Important	4 woody species and adjacent to public right of way.	Species-rich	Fails B1, B2, C2, D2. No trees in hedgerow so E1 and E2 N/A.	Moderate
011	Ac, Cm, Cs, Up, Ps, Sn	5	-	-	Species-rich	Passes all criteria A1-E2.	Good
012	Fe, Rc, Rhc, Cm, Up, Ps, Sn	4	-	-	-	Passes A1-D2. E1 and E2 are N/A.	Good
013	Ac, Ca, Ps	3	-	-	-	Only fails B2. Passes E1 and E2	Good
014	Up, Sn, Fe, Ac, Ca	3	-	-	-	Fails B1 and B2, C2, D2. No trees in hedgerow so E1 and E2 N/A.	Moderate
015	Fe, Ac, Rhc, Sn, C, Ps, Up, Qr	6	-	-	Species-rich	Fails B1 and B2. Passes E1 and E2	Moderate
016	Cm, Ps, Qr, Up, Rc, Fe, Rhc,	7	Important	7 woody species	Species-rich	Passes all criteria A1-E2	Good
017	Cm	1	-	Adjacent to residential property.	-	Fails B1, C1, C2. ignore E1 and E2 are N.A.	Moderate
018	Fe, PS, Cm, Rc, Ac, Sn	4	-	-	-	Passes A1-D2. No trees in hedgerow so E1 and E2 N/A.	Good
019	Cm, Ca, Vl, Rhc, Rc, Ps	6			Species-rich	Passes B2. No trees in hedgerow so E1 and E2 N/A.	Good
020	Ee, Cm, Ac, Qr, Ps, Fe,	4	-	-	-	Fails B1, C1, C2, D2. Passes E1 and E2	Moderate

ID	Species	Count	Importance	Notes	Assessment	Criteria	Outcome
001	Cm, Ca, Cs, Ee, Qr, Vl, Ac, Ia, Ps	7		Adjacent to residential property.	Species-rich	Fails B1, B2, C1. E1 and E2 are N/A.	Moderate
002	Up, Cm, Ac, Qr, Rc, Ps, Ca	5	-	-	Species-rich	Passes A1-D2. E1 and E2 are N/A.	Condition
003	Cm, Ac, Qr, Sxcap,	4	Important	4 woody species and adjacent to public right of way.	-	Fails C1 and C2. E1 and E2 are N/A.	Moderate
004	Cm, Rc, Ac, Qr, Up	4	Important	4 woody species and adjacent to public right of way.	-	Fails C1 and C2. E1 and E2 are N/A.	Moderate
005	Ps, Cm, Ac, Sn, Ca, Qr, Cs, Sxcap, Up, Fe, Rhc, Jr	8	Important	7 woody species	Species-rich	Fails C2. E1 and E2 are N/A.	Good
006	Ac, Cm, Fe, Up, Rc	4	-	-	-	Passes A1-D2. E1 and E2 are N/A.	Good
007	Ps, Ca, Fe, Cm, Ac	4	-	Adjacent to public right of way.	-	Fails B1, C2 and E1.	Moderate
008	Up, Ac, Ps, Cm, Ca, Fe, Qr	5	-	-	Species-rich	Passes all criteria A1-E2.	Good
009	Cm, Ac, Sn, Ia, Ps, Ee	4	-	-	-	Fails B1, B2, C2. E1 and E2 are N/A.	Moderate
010	PS, Sn, Sxf, Sxcap, Cm, Ac, Qr,	5	-	-	Species-rich	Fails B1, B2, C1, C2, D2, E1.	Poor
011	Cm, Sxf, Fe, Qr, Sxcap, Ps, Rc	7	Important	7 woody species	Species-rich	Fails C2. Passes E1 and E2.	Good
012	Cm, Fe, Sn, Ac	3				Fails D2. E1 and E2 are N/A.	Good
013	Ac, Ps, Cm, Qr, Ca, Sn	6	Important	6 woody species and 3 features	Species-rich	Fails B1, C2. Passes E1 and E2.	Good
014	Ca, Cm, Ps, Sn, Up, Fe, Ee, Ac, Cs	7	Important	7 woody species	Species-rich	Fails C2. Passes E1 and E2.	Good
015	Qr, Fe, Ca, Cm, Ms, Sxcap, Cs	7	Important	7 woody species	Species-rich	Fails A2, B1, B2, C1, D1. Passes E1 and E2.	Moderate
016	Ac, Fe, Ps, Cm, Up, Cs, Rc, Qr, Sxf, Vo	7	Important	7 woody species	Species-rich	Fails E1 only.	Good
017	Cm, Qr, Up, Sn, Sxcap, Rc, Fe, Vo	6	Important	6 woody species and 3 features	Species-rich	Passes A1-E2.	Good
018	Cm, Ca, Cs, Qr, Fe, Rc, Rhc, Sxf	4	-	-	-	Fails B2 and E1.	Good
019	Ca, Cm, Fe, Qr, Cs, Ps, Rc, Ia, Sn	6	Important	6 woody species and 3 features	Species-rich	Passes A1-E2.	Good
020	Ac, Cm, Fe, Qr, Ca, Sxcap, Ps, Ac	6	Important	6 woody species and 3 features	Species-rich	Passes A1-E2.	Good
021	Sxcap, Ca, Rc, Cm, Qr, Sxf, Ps, Ac	6	Important	6 woody species and 3 features	Species-rich	Fails C2 and E2.	Good
022	Ac, Cm, Ca, Sn, Sxf, Ag, Ps, Ms, Fe, Qr, Rc	9	Important	7 woody species	Species-rich	Passes A1-E2.	Good
023	Cm, Sxf, Sxv, Ag, Qr, Ps, Sn, Cl, Rc	6	Important	6 woody species and 3 features	Species-rich	Fails C2. Passes E1 and E2.	Good

ID	Ac, Cm, Sxf, Sn, Lp, Ag, Sxcap, Up, Qr, Ps, Ia, Ms, Rc	7.7	Important	7 woody species	Species-rich	Fail B1 and B2, C2, E2.	Moderate
	Cm, Fe, Rc, Sn, Ac, Ca, Qr, Ma	7	Important	7 woody species	Species-rich	Fails C1 and E2.	Good
	Ca, Sn, Rc, Sn, Cm, Qr, Ac, Iq, Ps, Lv, Sxcap, Ca, Sxf, Up	8	Important	7 woody species	Species-rich	Fails B2, C2, E1 and E2.	Moderate
	Sxf, Ps, Up, Sn, Cm, Fe, Rc, Ms, Ia, Cs,	7.5	Important	7 woody species	Species-rich	Fails B2, C2, and E1.	Moderate
	Cm, Ac, Ca, Rc, Fe, Ag, Rc, Ps, Qr, Sxf, Sn	7	Important	7 woody species	Species-rich	Fails E2.	Good
	Sxcap, Ug, Sn, Fe, Rc, Cm, Up, Qr, Cs, Ia	10	Important	7 woody species	Species-rich	Fails E2.	Good
	Rc, Ug, Sxf, Up, Cm, Cs, Sn, Fe, Ia, Ac, Rc, Ca	7.33	Important	7 woody species	Species-rich	Fails B1, C2, E2.	Moderate
	Cm, Ac, Ca, Rc, Fe, Qr, Sxf, Sn, Up, Sxcap, Sn, Lv	7	Important	7 woody species	Species-rich	Fails B1, C2. Passes E and E2.	Good
	Cm, Ac, Fe, Up, Ms, Ag, Lv, Ee, Sn, Sxcap, Cs, Qr	5.67	Important	5 woody species and 4 features	Species-rich	Fails B2, C1, E1 and E2.	Moderate
	Cm, Sn, Ac, Sxf	4	-	-	-	Passes A1-D2. E1 and E2 are N/A.	Good
	Sn, Cm, Ca, Ac, Fe, Rc, Qr, Ps	5	Important	6 woody species and 3 features	Species - rich	Fails C2. Passes E1 and E2.	Good
A <input type="checkbox"/> field maple <i>Acer campestre</i> A <input type="checkbox"/> alder <i>Alnus glutinosa</i> <input type="checkbox"/> hawthorn <i>Crataegus monogyna</i> <input type="checkbox"/> dogwood <i>Cornus sanguinea</i> <input type="checkbox"/> spindle <i>Euonymus europaeus</i> F <input type="checkbox"/> ash <i>Fraxinus excelsior</i> L <input type="checkbox"/> holly <i>Ilex aquifolium</i> L <input type="checkbox"/> wild privet <i>Ligustrum vulgare</i> L <input type="checkbox"/> honeysuckle <i>Lonicera periclymenum</i> M <input type="checkbox"/> crab apple <i>Malus sylvestris</i> <input type="checkbox"/> wild cherry <i>Prunus avium</i>					<input type="checkbox"/> blackthorn <i>Prunus spinosa</i> <input type="checkbox"/> pedunculate oak <i>Quercus robur</i> R <input type="checkbox"/> dog rose <i>Rosa canina</i> R <input type="checkbox"/> buckthorn <i>Rhamnus cathartica</i> <input type="checkbox"/> elder <i>Sambucus nigra</i> <input type="checkbox"/> goat willow <i>Salix caprea</i> <input type="checkbox"/> crack willow <i>Salix fragilis</i> <input type="checkbox"/> wych elm <i>Ulmus glabra</i> <input type="checkbox"/> English elm <i>Ulmus procera</i> <input type="checkbox"/> guelder rose <i>Viburnum lantana</i>		

Table A7-1: Results of great crested newt habitat suitability assessment.

For further details of criteria and HIS calculation see ARG UK (2010).

Criteria	Habitat ID									
	1	2	3	4	5	6	7	8	9	10
1. Location	1	1	1	1	1	1	1	1	1	1
2. Pond area	0.4	0.05	0.05	0.2	0.05	0.2	0.8	0.6	0.9	0.1
3. Pond drying	0.9	0.1	0.1	0.9	0.1	0.5	0.9	1	1	1
4. Water	1	0.33	0.33	0.67	0.67	0.67	1	1	1	0.67
5. Shade	1	0.2	0.2	1	1	0.6	1	1	1	1
6. Fowl	1	1	1	1	1	1	1	1	1	1
7. Fish	1	1	1	0.33	1	1	0.67	1	1	1
8. Ponds	0.92	0.92	0.92	0.92	0.82	0.82	0.92	0.95	0.92	0.82
9. Terrestrial	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	1
10. Macrophytes	0.8	0.4	0.4	0.6	0.4	0.4				
Overall HIS	0.84	0.39	0.39	0.66	0.49	0.62	0.89	0.91	0.94	0.75
Suitability Class	E	P	P	A	P	A	E	E	E	G

¹ Suitability classes: E: excellent; G: good; A: average; BA: below average; P: poor.

Appendix A

Table A8-1 Bat roost suitability of trees. See Figure 6b for tree locations.

ID	Location	Tree Species	Roost Description	Suitability
1	S of Begbroke Science Park	Walnut	Small knot hole on SE side. 3.5 m from ground.	Low
2	S of Begbroke Science Park	Walnut	Peeling bark on south side, ground level to 1.5 m.	Low
3	S of Begbroke Science Park	Crack willow	Several small and 1 medium woodpecker hole on north side. Dead wood and fungus above. Considered to have Low-Moderate potential, but classified here as Moderate on a precautionary basis. Unsafe to climb due to fungus.	Moderate
4	Parker's Farm	Italian alder	Bark damage on east side, ca 3 m in length. Some woodpecker damage near top of this. Could develop into a PRF.	Low
5	N of Begbroke Science Park	Crab apple	Openings at base right near ground, no upward holes. Stump section 3 to 4 m tall. Endoscope inspection on 28/09/21 found no evidence of bats and confirmed low suitability due to level of draught exposure.	Low
6	N of Begbroke Science Park	Crab apple	Openings at base of stump. Endoscope inspection on 28/09/21 found no evidence of bats and confirmed Low suitability due to level of draught exposure.	Moderate
7	N of Begbroke Science Park	Oak	No visible features. No clear view of all of the crown due to branches. Poor roosting habitat.	Low
8	South of Site	Oak	Some dead wood and broken branches. Small areas of flaky bark. Poor roosting habitat.	Low
9	South of Site	Ash	Split along 3 m of SE side of trunk. Limited value to bats.	Moderate
10	College Farm, SW of Site (off-site)	Hybrid black poplar	Medium hole at 2.5 m on east side of trunk. Endoscope inspection on 28/09/21 found no evidence of bats and confirmed Low suitability.	Moderate
11	Tip site	Hybrid black poplar	Several woodpecker holes on east side.	Moderate
12	Tip site	Hybrid black poplar	Woodpecker hole half way up stem on east side.	Low
13	S of Site	Ash	Heavy ivy growth, making parts of stem/main branches not visible.	Low
14	S of Site	Oak	Small woodpecker hole present on north side.	Low
15	S of Site	Ash	Parts of crown obscured by ivy. Low potential on a precautionary basis.	Low
16	S of Site	Crack willows & ash	Line of trees with some ivy. No visible features. Neg to Low on a precautionary basis.	Low
17	S of Site	Ash	Two small woodpecker holes facing downwards on branch on north side. One blocked knot hole on east side.	Low
18	S of Site	Crack willow	Pollarded crack willow. Large mature stump with some holes/cracks present but likely too congested with young growth to allow access by bats.	Low
19	S of Site	Ash	Two small woodpecker holes on north side.	Low

20	S of Site	Ash	Main trunk is broken open. Likely to open for bats and open above.	Low
21	S of Site	Oak	Dead limbs. Woodpecker hole facing downwards in dead limb pointing east.	Moderate
22	S of Site	Oak	Pollarded. Many holes on north-east side. Bark contorted into potential roost feature towards stop of main stem.	High
23	S of Site	Crack willow	Pollarded. Trunk split open to east, crack extending much of trunk. Potential roost feature.	High
24	S of Site	Crack willow	Pollarded. Potential roost feature (small crack at 2 m height) on north-east side.	Low
25	S of Site	Crack willow	Pollarded. Cavity on north-west side. Potential roost feature. Low potential because cluttered by brambles.	Low
26	Parkers Farm	Italian alder	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
27	Parkers Farm	Italian alder	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
28	Parkers Farm	Scots pine	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
29	Parkers Farm	Scots pine	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
30	Parkers Farm	Scots pine	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
31	Parkers Farm	Scots pine	Ivy-clad trunk. Some dead wood and peeling bark visible.	Low
32	Parkers Farm	Italian alder	Some small holes visible.	Low
33	Parkers Farm	Sycamore	Wound in low west-facing branch.	Low
34	Parkers Farm	Scots pine	Ivy-clad trunk. Some peelign bark.	Low
35	Parkers Farm	Italian alder	Strip of bark missing on east side. Some woodpecker / rot holes.	Low
36	Parkers Farm	Scots pine	Ivt-clad trunk. No features noted, but much of stem not visible.	Low
37	Tip Site	Hybrid poplar	Small hole(3cm dia) 2m high on E side.	Moderate
38	Tip Site	Hybrid poplar	Small crack and ghole on lateral branch in west side of canopy. Downward facing hole (4cm dia) on lateral branch on E side.	Low
39	Tip Site	Hybrid poplar	2 WP holes on E side of trunk. Torn limbs in canopy.	Moderate
40	Tip Site	Hybrid poplar	Small WP hole (ca 3cm dia) on east side. Torn limbs in canopy.	Low
41	Tip Site	Hybrid poplar	Downward facing hole (4cm dia) in west facing limb.	Low
42	Tip Site	Hybrid poplar	Broken branches in canopy. Limited cover for bats.	Low
43	Tip Site	Hybrid poplar	5m high stump.	Low
44	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
45	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
46	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
47	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
48	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
49	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
50	Tip Site	Hybrid poplar	7m tall broken stem. Ivy-clad trunk. No features noted, but much of stem not visible.	Low

51	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
52	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
53	Tip Site	Hybrid poplar	5m tall broken stem. Ivy-clad trunk. No features noted, but much of stem not visible.	Low
54	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
55	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
56	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
57	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
58	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
59	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
60	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
61	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
62	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
63	Tip Site	Hybrid poplar	2 large WP holes on east side ca. 10m height.	Moderate
64	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
65	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
66	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
67	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
68	Tip Site	Hybrid poplar	Ivy-clad trunk. No features noted, but much of stem not visible.	Low
69	Science Park		Western facing knot hole approx 60 cm with a cavity going upwards into the center of the tree trunk.	Low
70	Science Park		South facing knot hole approx 4 m high. Very exposed as the tree had no branches. Peeling bark is present but these features would collect rainwater.	Low

□□□ **A** □□□□□ **d** □□□□□ **A** □□□□□□ **I** □□□□□ **r** □□□□□ **r** □□□□□ **D** □□□□□

□□□ □ **r** □

L □□□□□□□□□□	
□ r d □ r □	F □ □ □ □ □
Amphipoda	Gammaridae
Coleoptera	Dytiscidae
Coleoptera	Elmidae
Coleoptera	Scirtidae
Diptera	Asilidae
Diptera	Dixidae
Diptera	Chironomidae
Diptera	Limoniinae
Diptera	Ptychopteridae
Hemiptera	Veliidae
Plecoptera	Nemouridae
Rhynchobdellida	Glossiphoniidae
Sphaeriida	Sphaeriidae
Trichoptera	Limnephilidae
Trombidiformes	Hydrachnidia
Trichoptera	Psychomyiidae
Tricladida	Planariidae

L □□□□□□□□□□	
□ r d □ r □	F □ □ □ □ □
Amphipoda	Gammaridae
Coleoptera	Elmidae
Diptera	Chironomidae
Diptera	Limoniinae
Diptera	Pediciidae
Ephemeroptera	Baetidae
Ephemeroptera	Spp.
Ephemeroptera	Leptophlebiidae
Hemiptera	Veliidae
Isopoda	Asellidae
Littorinimorpha	Hydrobiidae,
Sphaeriida	Sphaeriidae
Trichoptera	Polycentropodidae
Trichoptera	Glossosomatidae

L □□□□□□□□□□	
□ r d □ r □	F □ □ □ □ □
Amphipoda	Gammaridae
Coleoptera	Elmidae
Diptera	Chironomidae
Isopoda	Asellidae
Oligochaeta	Spp.
Sphaeriida	Sphaeriidae
Tricladida	Planariidae
Trichoptera	Glossosomatidae
Trichoptera	Limnephilidae
Trombidiformes	Hydrachnidia
Rhynchobdellida	Glossiphoniidae

A □□□□ □□

L □□□□□□□□□□	
□ r d □ r □	F □ □ □ □ □
Amphipoda	Gammaridae

Coleoptera	Scirtidae
Coleoptera	Elmidae
Diptera	Ptychopteridae
Diptera	Dixidae
Diptera	Chironomidae
Diptera	Psychodidae
Isopoda	Asellidae
Sphaeriida	Sphaeriidae
Tricladida	Planariidae
Trichoptera	Limnephilidae

L	
rd	F
Amphipoda	Gammaridae
Coleoptera	Elmidae
Diptera	Chironomidae
Isopoda	Asellidae
Oligochaeta	Spp.
Sphaeriida	Sphaeriidae
Trichoptera	Glossosomatidae
Tricladida	Planariidae
Trichoptera	Limnephilidae
Trombidiformes	Hydrachnida
Rhynchobdellida	Glossiphoniidae